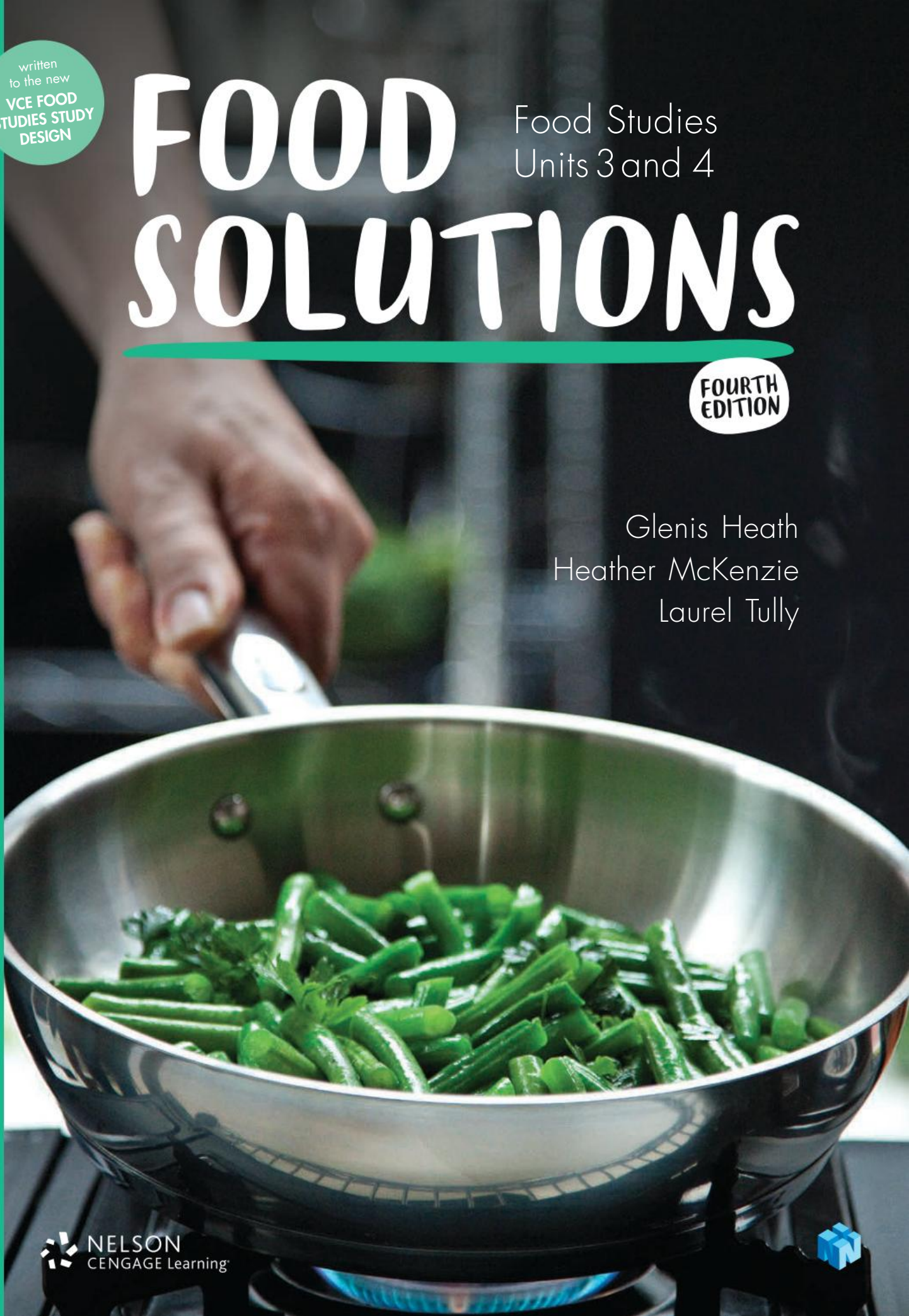
written to the new VCE FOOD STUDIES STUDY DESIGN

FOOD SOLUTIONS

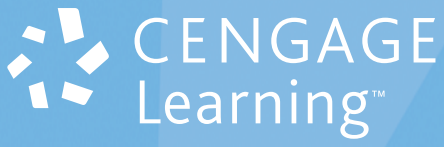
Food Studies
Units 3 and 4

FOURTH EDITION

Glenis Heath
Heather McKenzie
Laurel Tully



NELSON CENGAGE Learning



COPYRIGHT NOTICE

Copyright in this work is owned by Cengage Learning Australia ("the work"). A condition of purchase of this electronic version of the work is that you agree to respect the copyright in the work, abide by the Copyright Act 1968 and specifically agree not to transfer, sell, assign, misuse, copy or transmit an electronic or other version of the work to any third party.

Please note: This product is accompanied by a licence (single user, network or adoption) governing the terms and conditions of its use.

This is a legal agreement between the you, (the "Customer") and Cengage Learning Australia Pty Limited (ABN 14 058 280 149) (the "Licensor") which provides the terms and conditions of this non-exclusive licence and the limited warranty for the Product. Use of the Product indicates an acknowledgement that the Customer has read and agreed to be bound by the terms and conditions of this Agreement. If you do not agree to these terms and conditions, return the Product to the place of purchase within 15 days of the date of purchase (with proof of purchase) for a full refund

1. **Licence Grant**
   You do not receive title to the Product. Copyright in the Product (which includes all images, photographs, video, animations, audio, music and text incorporated in the Product, including all of the accompanying printed material) is owned by the Licensor and/or its suppliers and is protected by Australian copyright laws. The Licensor grants you a non-exclusive licence to use the Product subject to the restrictions and terms set out in this Agreement.

2. **A Licence allows you to:**
   Use the Product on your computer. The Customer represents that they shall in no way place the Product in the public domain or in any way compromise our copyright in the Material. You agree to take reasonable steps to protect our copyright.

3. **You may not:**
   Alter, modify, translate, reverse engineer, decompile, or adapt the software or create derivative works based on the Product. Make further copies by any means technological, electronic, digital whatsoever without the written permission of the Licensor. Rent or transfer all or any part of your rights under this Agreement. Remove or alter any copyright or other proprietary notice or label attached to the software.

4. **Termination**
   Any failure to comply with the terms and conditions of this agreement will result in the automatic termination of this licence. Upon termination of this licence for any reason, the Customer must destroy or return to the Licensor all copies of the software and accompanying documentation.

5. **Warranties**
   To the extent permitted by law, the Licensor's liability for any breach of the warranty or any term implied by law into this licence is limited to the lowest cost of replacing the goods, acquiring equivalent goods or having the goods repaired.

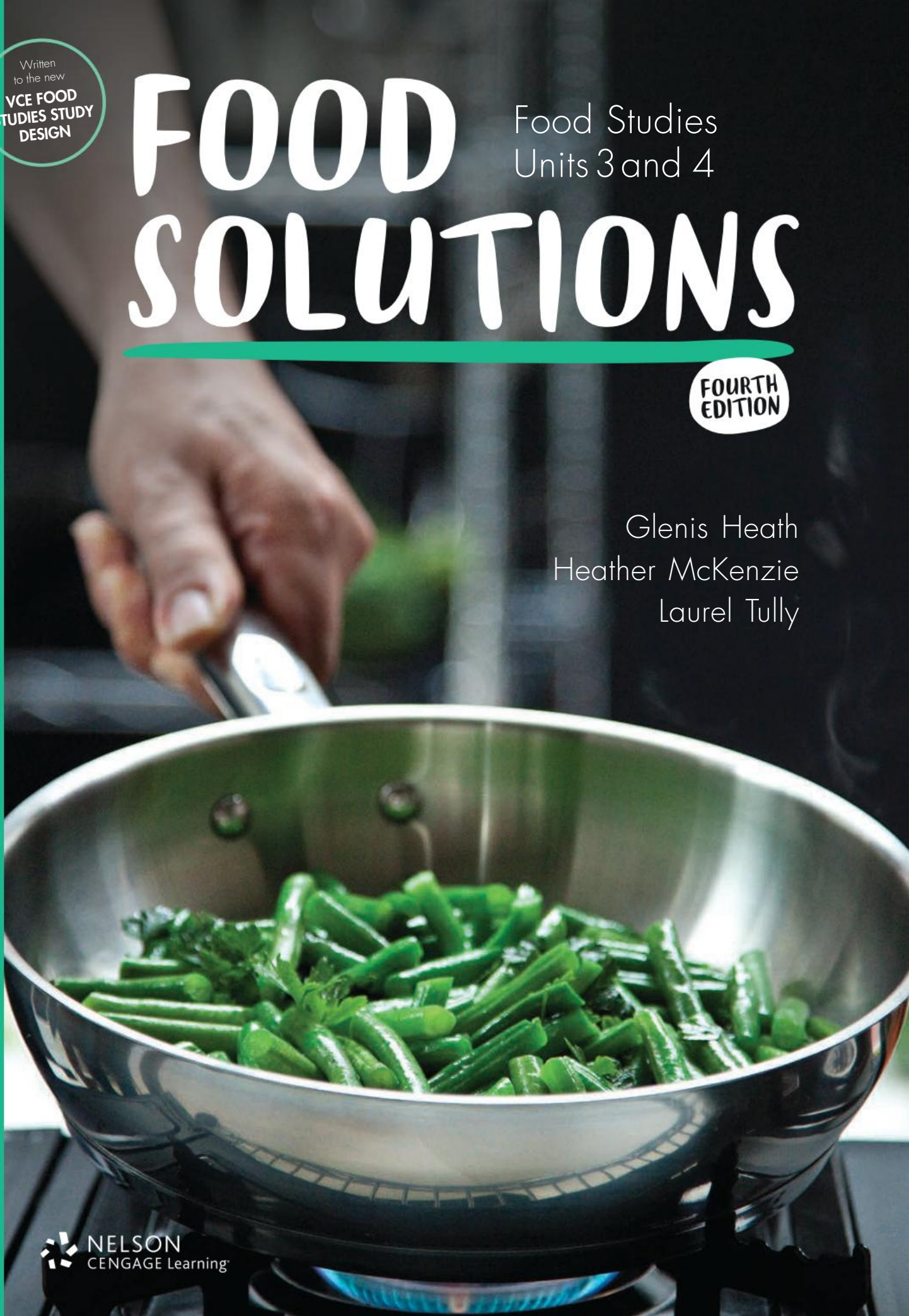
Written to the new **VCE FOOD STUDIES STUDY DESIGN**

FOOD SOLUTIONS

Food Studies
Units 3 and 4

FOURTH EDITION

Glenis Heath
Heather McKenzie
Laurel Tully



NELSON CENGAGE Learning

NELSON
CENGAGE Learning

Food Solutions: Food Studies Units 3 & 4
4th Edition
Glenis Heath
Heather McKenzie
Laurel Tully

Associate publishing editor: Sam Bonwick
Project editor: Ainsley Ryan
Editor: Carolyn Glascodine
Proofreader: Ingrid De Baets
Indexer: Max McMaster
Senior image and permissions researcher: Kait Jordan
Text design: Kim Ferguson
Cover image: Neil Hargreaves/group n.b. photography
Production controller: Erin Dowling
Typeset by: Cenveo Publisher Services

Any URLs contained in this publication were checked for currency during the production process. Note, however, that the publisher cannot vouch for the ongoing currency of URLs.

Acknowledgements

The publisher would like to thank:

Hayley Allen and Lucy Billing, NelsonNet resources authors
Mark Fergus, photographer and stylist
Melanie Vandegraaff of Red Courgette, chef and stylist
Rhonda Fergus, photo shoot production
Cedar Hospitality Supplies, provider of tableware
Belgrave Heights Christian School

The photographs appearing on the recipe pages of *Food Solutions: Food Studies Units 3 & 4*, along with other selected photographs, were shot on-location at Belgrave Heights Christian School's Hospitality Trade Training Centre.

Text © 2016 Glenis Heath, Heather McKenzie and Laurel Tully
Design and illustrations © 2016 Cengage Learning Australia Pty Limited

Copyright Notice

This Work is copyright. No part of this Work may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without prior written permission of the Publisher. Except as permitted under the *Copyright Act 1968*, for example any fair dealing for the purposes of private study, research, criticism or review, subject to certain limitations. These limitations include: Restricting the copying to a maximum of one chapter or 10% of this book, whichever is greater; providing an appropriate notice and warning with the copies of the Work disseminated; taking all reasonable steps to limit access to these copies to people authorised to receive these copies; ensuring you hold the appropriate Licences issued by the Copyright Agency Limited ("CAL"), supply a remuneration notice to CAL and pay any required fees. For details of CAL licences and remuneration notices please contact CAL at Level 15, 233 Castlereagh Street, Sydney NSW 2000,
Tel: (02) 9394 7600, Fax: (02) 9394 7601
Email: info@copyright.com.au
Website: www.copyright.com.au

For product information and technology assistance,
in Australia call **1300 790 853**;
in New Zealand call **0800 449 725**

For permission to use material from this text or product, please email **aust.permissions@cengage.com**

National Library of Australia Cataloguing-in-Publication Data

Heath, Glenis, 1945– author.
Food solutions : food studies units 3 & 4 student book / Glenis Heath, Heather McKenzie, Laurel Tully.

4th edition.
9780170378482 (paperback)
For secondary school age.

Food industry and trade--Study and teaching (Secondary)
Food industry and trade--Australia.
Food--Textbooks.

McKenzie, Heather, 1957– author.
Tully, Laurel, 1946– author.

664

Cengage Learning Australia
Level 7, 80 Dorcas Street
South Melbourne, Victoria Australia 3205

Cengage Learning New Zealand
Unit 4B Rosedale Office Park
331 Rosedale Road, Albany, North Shore 0632, NZ

For learning solutions, visit **cengage.com.au**

Printed in China by China Translation & Printing Services.
1 2 3 4 5 6 7 20 19 18 17 16

CONTENTS

About this book VI

1 EATING AND DIGESTING FOOD 3

What is food and why do we eat it? 4
Satiety 4
Appreciating food 5
The senses 5
Digestion 8
Macronutrients 12
Preparing for exams 19

2 THE AUSTRALIAN DIETARY GUIDELINES 21

The health of Australians 22
The Australian Dietary Guidelines 23
Different dietary requirements across the life span 32
Food allergies and intolerances 35
Preparing for exams 39

3 FOOD POISONING 41

Safe food 42
Food spoilage 42
Food poisoning 42
How bacteria reproduce 44
Preventative practices for a safe food supply 46
Preparing for exams 51

4 COOKING FOOD 53

Why do we cook food? 54
How food is cooked 54
Techniques for cooking foods 57
Preparing for exams 63

5 THE SCIENCE OF FOOD 65

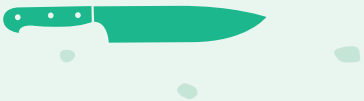
Properties of food 66
Processes that cause changes during food preparation and cooking 67
The pH scale 67
Enzymes 69
Aeration 70
Protein 72
Sugar 82
Starch 84
Fats and oils 88
Preparing for exams 91

6 AUSTRALIAN EATING PATTERNS 93

Patterns of eating in Australia 94
Social factors that influence food choices 100
Preparing for exams 107

7 FOOD AND SOCIETY 109

The social and emotional role of food 110
The development of body image 114
Restrictive dieting 116
Comfort eating 119
Preparing for exams 121



8 FOOD AND THE MEDIA 123

The role of the media in shaping food information 124
Marketing 124
News reportage 133
Popular culture 135
Social media 137
Preparing for exams 145

9 TODAY'S FOOD CONSUMERS 147

What is a food system? 148
Australia's present-day food system 148
Overconsumption of food 151
Sedentary behaviour 159
Establishing healthy diets in children 162
Preparing for exams 167

10 GLOBAL FOOD SECURITY 169

Feeding an increasing world population 170
What is food security? 170
The four pillars of food security 176
Solutions to global food insecurity 176
Preparing for exams 185

11 ETHICAL FOOD PRODUCTION 187

Ethical principles for Australian consumers 188
Consumer concern about animal welfare 188
Sustainable food production 196
Fair trade 202
Preparing for exams 207

12 FOOD PRODUCTION AND THE ENVIRONMENT 209

Farming practices and sustainability 210
Biosecurity, climate change and loss of biodiversity as risks to sustainability 224
Preparing for exams 233

13 DEVELOPMENTS IN SUSTAINABLE FARMING 235

Challenges for Australian agriculture 236
Genetically modified food production 236
Low-impact farming 242
Organic food production 245
Preparing for exams 251

14 ENVIRONMENTAL SUSTAINABILITY IN FOOD PROCESSING 253

The impact of food processing on the environment 254
Food packaging and the environment 259
Food transportation 266
Food waste 268
Preparing for exams 273

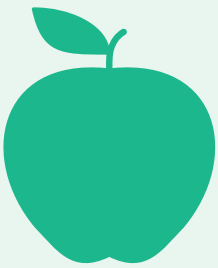
15 BECOMING AN INFORMED FOOD CONSUMER 275

Contemporary contexts in which we learn about food 276
Individual and family responses to food information 276
Community responses to food information 279
The research underpinning the Australian Dietary Guidelines 283
Principles of research 283
Food fads and fad diets 287
Analysing claims made by weight-loss or nutrient supplement companies 289
Practical ways to apply the Australian Dietary Guidelines in everyday life 295
Preparing for exams 299

16 FOOD LABELLING 301

Food labelling in Australia and New Zealand 302
Nutrition content claims and health claims 308
Advantages of accurate food labelling information 310
Identifying the halo effect 312
Preparing for exams 315

Recipes 317
Recipe index 401
Index 403



ABOUT THIS BOOK

The fourth edition of this market-leading series has been rewritten specifically for the new VCE Food Studies Study Design and follows units 3 and 4 of the study.

The highly experienced author team has added exciting new dishes to complement existing much-loved recipes.

Featuring fully updated case studies and activities, designed to increase students' understanding and awareness of the issues surrounding food supply and consumption, *Food Solutions* builds a foundation of learning for students to live healthier lives and pursue further training and employment in food-related industries.

Infographic

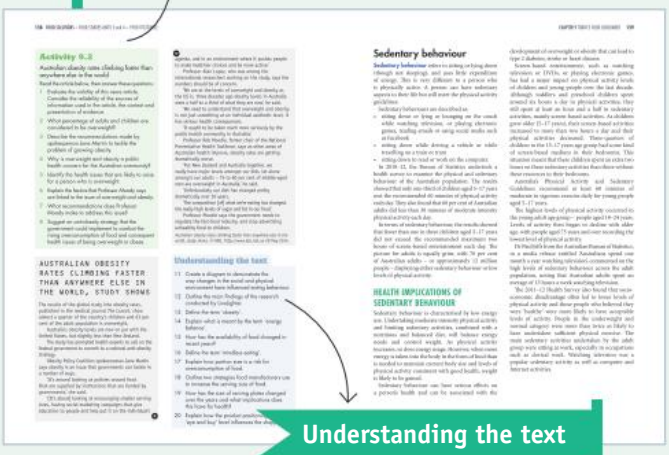
Visually engaging infographics scaffold key information contained within the chapter.

Key terms

Key terms in each chapter are highlighted.

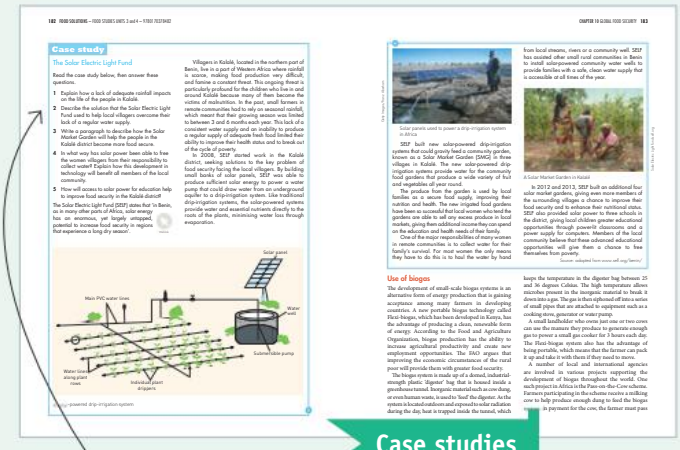
Activities

A range of practical and theoretical exercises address and reinforce learning outcomes.



Understanding the text

These sections are checkpoints for students' learning and appear at regular intervals throughout the text.

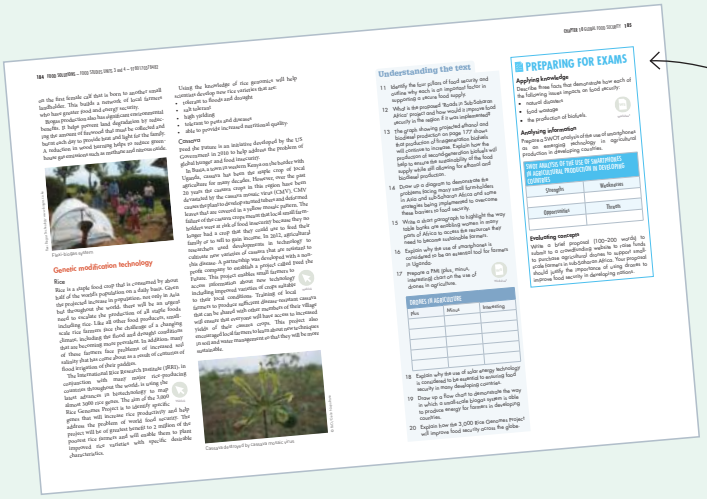


Case studies

These include real-life examples that broaden student understanding and link to the wider context of food production, distribution and manufacturing.

Recipes

Extensively tried and tested for completion within practical sessions and included at the end of the book. The recipes incorporate a broad range of food preparation processes and cooking techniques, thereby developing and reinforcing students' key skills and knowledge.



Preparing for exams

These sections appear at the end of each chapter to challenge students to apply, analyse and evaluate the information in the preceding chapter.

NelsonNet

Food Solutions is a premium Cengage title and is fully supported by the NelsonNet platform.

NELSONNETBOOK

The NelsonNetBook is your digital textbook. Readable online and offline on desktops, laptops and tablets, it reproduces the student text in digital form. With annotations and reviewing tools, and the ability to add and customise your book, NelsonNetBook is accessible immediately via access codes. Please note that any notations made to the NelsonNetBook will expire two years after the access code is activated.

NELSONNET RESOURCES

Access to NelsonNet also provides students with additional web-based materials such as worksheets, videos and bonus recipes.

WEBLINKS

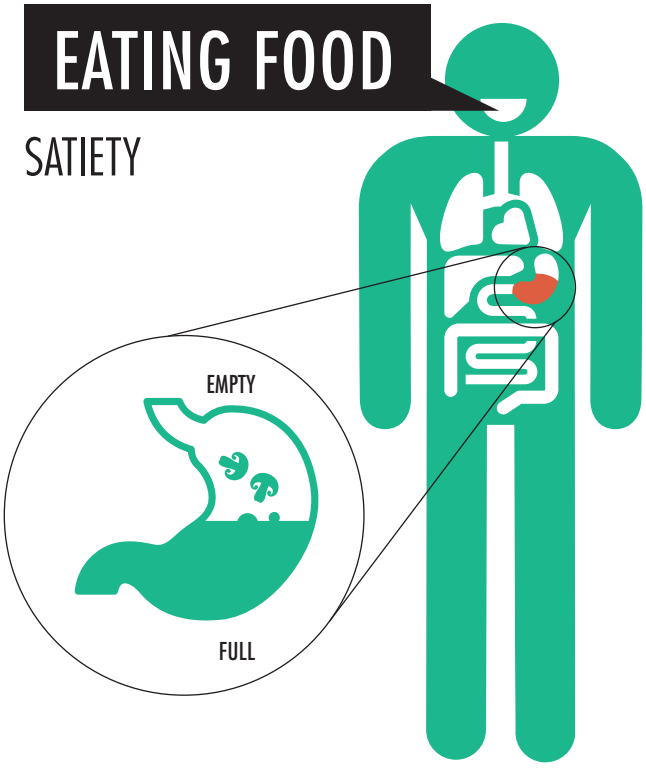
Students and teachers can link directly to external websites referred to in *Food Solutions* via the free, unprotected weblinks site located at **http://foodsolutions.nelsonnet.com.au**.

DISCLAIMER

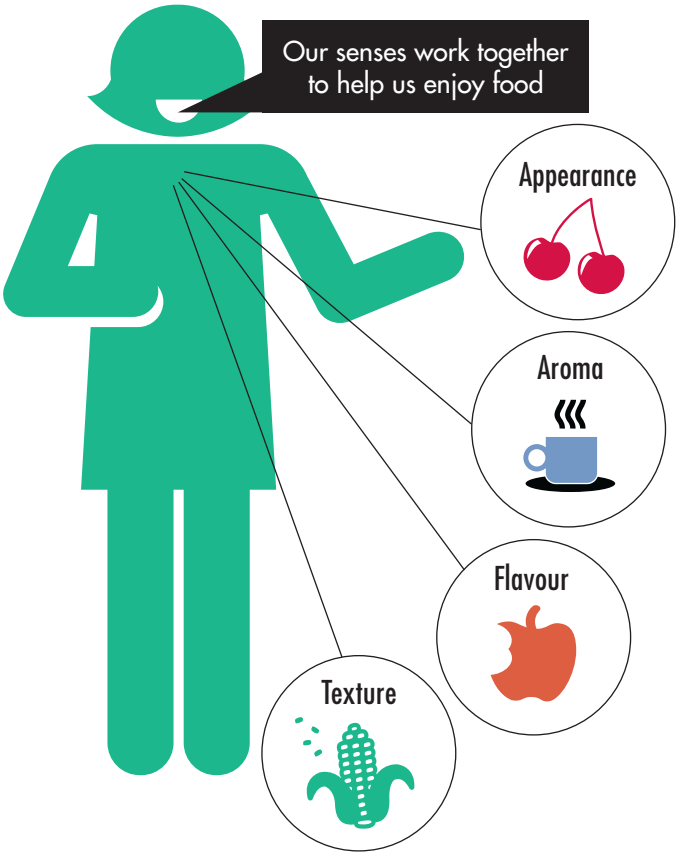
Please note that complimentary access to NelsonNet and the NelsonNetBook is only available to teachers who use the accompanying student textbook as a core educational resource in their classroom. Contact your Education Consultant for information about access codes and conditions.

EATING FOOD

SATIETY



SENSORY APPRECIATION OF FOOD – THE ENJOYMENT OF FOOD



FOODS WITH A HIGH LEVEL OF SATIETY

- Meat
- Fish
- Poultry
- Dairy foods
- Pasta
- Long-grain rice
- Multigrain bread
- Soya beans
- Kidney beans
- Lentils

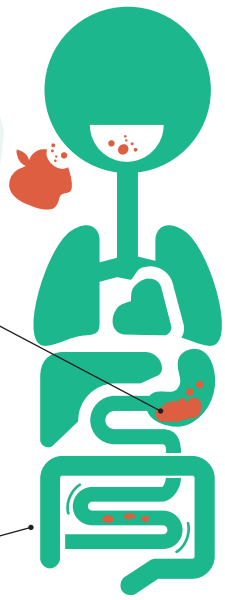
FOODS WITH A LOW LEVEL OF SATIETY

- Snack foods
- Pastries
- Sweet biscuits

1

EATING AND DIGESTING FOOD

DIGESTING FOOD

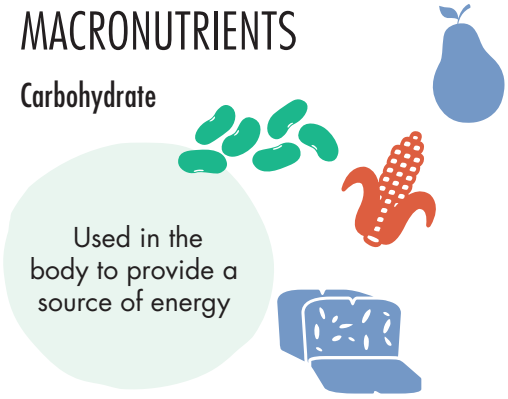


TYPES OF DIGESTION

Chemical
The breakdown of food using chemicals such as enzymes and acids

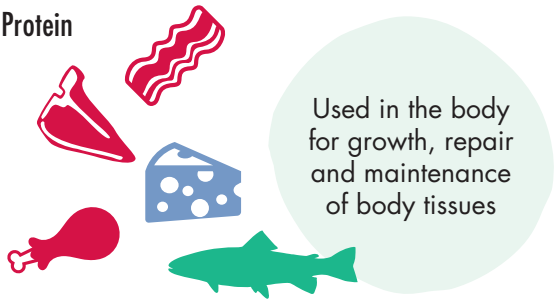
Mechanical
The use of force to break down food such as chewing or the squashing movement of the intestines

MACRONUTRIENTS



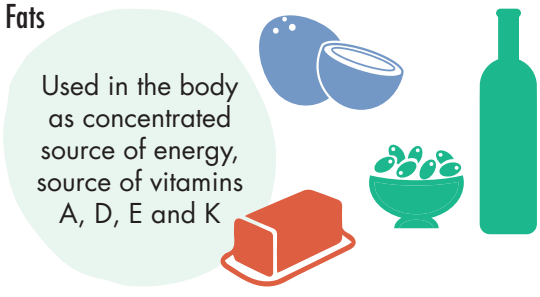
Carbohydrate

Used in the body to provide a source of energy



Protein

Used in the body for growth, repair and maintenance of body tissues



Fats

Used in the body as concentrated source of energy, source of vitamins A, D, E and K

KEY TERMS

Appetite is the desire for food.

Chemical digestion is the breakdown of food using chemicals such as enzymes and acids.

Digestion is the process by which food is broken down into substances that can be absorbed and utilised by the body.

Enzymatic hydrolysis is a chemical digestive process that breaks down food by breaking the bonds that hold together the molecular 'building blocks' within the food.

Flavour is a combination of the taste and aroma of food.

Glycaemic index (GI) is a measure of how fast and how much a food raises blood glucose levels.

Hunger is the drive to satisfy the need for food.

Macronutrients are the essential nutrients required by the body in large amounts.

Mechanical digestion is the use of physical force to break down food, such as chewing or the squashing movement of the intestines.

Satiety is a state or feeling of fullness after eating food.

Saturated fats contain the maximum amount of hydrogen.

Sensory appreciation of food is the information humans get from their senses about food and how they interpret that information.

Sensory properties of food are the characteristics of foods as they are perceived by the senses – sight, smell, taste, touch and hearing.

Trans fats are created artificially by a process called hydrogenation.

Unsaturated fats can be monounsaturated or polyunsaturated fats.

What is food and why do we eat it?

The basic need for food comes from the body's requirement for the nutrients found in food to ensure our survival. Food contains nutrients that provide energy, promote the growth and repair of tissues, and regulate body processes. This is referred to as the physiological function of food.

We choose and eat food for many reasons other than survival. Our appetite, the desire for food, is conditioned by factors that influence our food choices.

Hunger and appetite are two reasons for eating food but they are not the same thing.

WHAT IS HUNGER?

Hunger is the drive to satisfy the need for food. Your body lets you know when you are running low on fuel and this is the sensation of hunger. Hunger instinctively protects the body from exhausting energy reserves.

Hunger is the result of chemical changes in the body. When glucose levels in the bloodstream are low – they fluctuate naturally several hours after eating – the body produces hunger pangs to let you know it is time to eat and restore the blood glucose levels. The sensation of hunger occurs after the food from the previous meal has been digested and absorbed. Hunger is controlled by a small gland at the base of the brain called the hypothalamus, which also regulates appetite, thirst and body fluids.

WHAT IS APPETITE?

Appetite is defined as the desire for food, even when the body is not hungry. Appetite, or appetite conditioning, may be explained as a conditioned response to food; that is, it can be triggered by the sight of appealing food, the aroma of food, or even the mention of food in conversation. For example, when you sit down to eat pizza for dinner, the sight and aroma of the pizza causes a sensory response. This results in stimuli that cause you to salivate (your mouth waters); simultaneously, a tingling sensation occurs in the pit of the stomach that strongly encourages you to continue to eat pizza. Unlike hunger, if appetite is not satisfied, it will eventually go away.

Do we usually eat because we are hungry or do we eat for pleasure? The answer, of course, is that we often do both! We often eat even when we aren't hungry, enticed by the tantalising aromas and the visual appeal of food even when that empty feeling has long passed. Initially, feeling comfortably full is a pleasant feeling. However, if we continue to eat, we can start to feel bloated and, in extreme cases, nauseous.

Satiety

Satiety is the state of fullness after eating and when there is no further desire for food. Foods differ in their ability to give us a sense of satiety. This is the result of the nutrients they contain and the way in which they are processed and prepared. The foods that provide

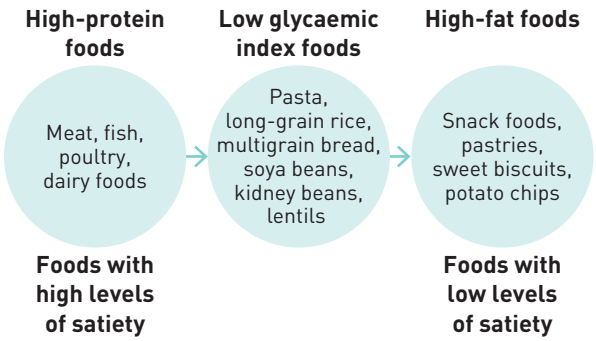
HUNGER	APPETITE
iStock.com/vikif	iStock.com/Aslan Alphan
If you are hungry, one or two slices of pizza will satisfy your hunger. Some components of the pizza will be converted to glucose and absorbed into the bloodstream, which raises the blood sugar levels and stops hunger pangs.	It is your appetite that causes you to reach for another slice and then another and perhaps another. Your appetite is conditioned by the appearance, aroma, flavour and texture of the pizza, and encourages you to eat more, even after your hunger is satisfied.

The differences between hunger and appetite

the greatest level of satiety are high-protein foods such as meat, fish, poultry and dairy products.

The group of foods next most likely to satisfy hunger are high-carbohydrate foods, especially those with a low **glycaemic index (GI)** – the glycaemic index is a measure of how fast and how much a food raises blood glucose levels. These high-carbohydrate, low-GI foods delay the onset of hunger because they break down slowly during digestion. Foods with a low GI include wholemeal pasta, wholegrain bread, soya beans, kidney beans and lentils.

Foods with a high fat content do not satisfy hunger as well as those of protein or carbohydrate origin. One of the main dangers for the modern consumer is that we are often enticed by advertising to select processed foods or fast foods, which are energy dense rather than nutrient dense. These foods often have a high fat and/or high sugar content and can provide more energy than is needed and don't satisfy hunger for long.



Satiety levels of food

Appreciating food

As humans, our choice of food is strongly influenced by our senses or **sensory appreciation of food**; that is, the information we get from our senses about food and how we interpret that information.

The look, feel and even sound of food can change the way it tastes, and all our senses work together with our memory in the enjoyment of food. Food manufacturers, chefs and cooks are aware that consumers choose foods with their eyes first, then with their ears and fingers, and lastly with their nose and tongue. In fact, understanding the **sensory properties of food**, that is the characteristics of foods as they are perceived by the senses of sight, smell, taste, touch and hearing, enables us to describe and explain to others why we enjoy or dislike particular foods. Being able to identify the characteristics of a recipe that need to be altered to improve the appeal of a food product is a useful skill for a cook, chef or food scientist. When we are eating food, our sense organs work together to determine our response to everything we eat.

The senses

APPEARANCE

Looking at food, using our sense of sight to observe the appearance of food is the way most humans first assess food. It doesn't matter how good the food tastes, if it is not visually appealing, most people are reluctant to eat it.

Colour plays a major part in the perception of food. We expect yellow cordial to have a lemon flavour, and strawberry-flavoured foods to be pink or reddish in colour. The colour of food also serves as a useful guide for judging its quality, and indicates any deterioration or spoilage, the degree of ripeness or the level of cooking.

We use our eyes to assess the shape and size of food. This is a very important consideration for primary producers of fresh fruit and vegetables, for example, as most consumers today will choose unblemished, even-sized produce.

We consider a variety of colours and textures when planning meals to ensure sensory appeal.

iStock.com/dluxum

Colourful fruit and vegetables have appealing sensory properties.

AROMA

Aroma refers to the smell or 'bouquet' of food. The smell of food is created by the many chemicals in food. We can only identify four or five basic flavours, but we can detect thousands of different aromas. Many different chemicals are responsible for the aromas we associate with particular foods. We detect the chemicals from food as they escape into the air, and

then are inhaled by the nose to reach the olfactory cells. Our senses of taste and smell work together to distinguish the sometimes minute differences between food, for example between the aroma of ripe and unripe strawberries.

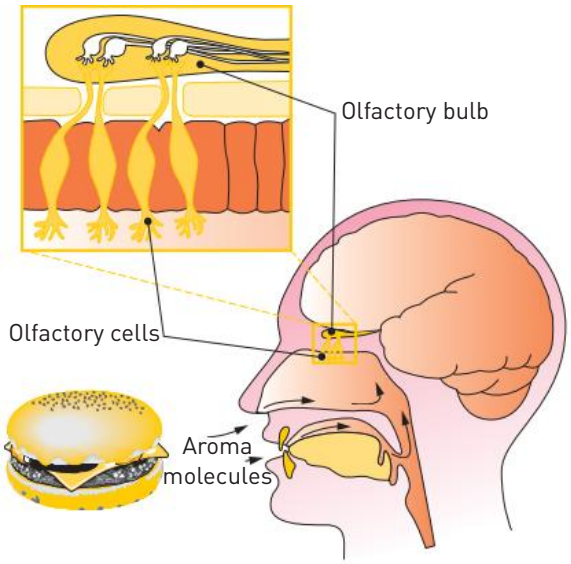
When foods are heated, the aromas are often accentuated because the chemicals are more volatile. This explains why hot foods have a stronger aroma than cold foods. Our sense of smell also helps us judge the safety of foods because 'off' flavours are often obvious to the nose. As our senses of smell and taste are so closely linked, if we hold our nose while eating or if we have a cold, it is difficult to identify the exact flavour of foods.

FLAVOUR

Flavour is a combination of the taste and aroma of food. Flavour is the total sensory impression formed when food is eaten. The ability to detect an array of flavours and aromas varies between people and influences an individual's likes and dislikes of particular foods. Some people find strong flavours, such as curry, overpowering, whereas others really enjoy the spiciness, full flavour and aroma of these dishes. The salty taste of ingredients such as olives, fish sauce and feta cheese is very appealing to some, while others find their flavour too strong.

Taste sensations begin when the papillae or taste buds on the tongue are stimulated. As food is placed into the mouth, the water in saliva begins to dissolve the flavour chemicals. At the same time, the olfactory cells in the nose detect the aromas of the food, and the nerve endings in the skin within the mouth detect the food's temperature. The taste buds are concentrated on the tongue and detect specific tastes such as sweet, sour, salty and bitter.

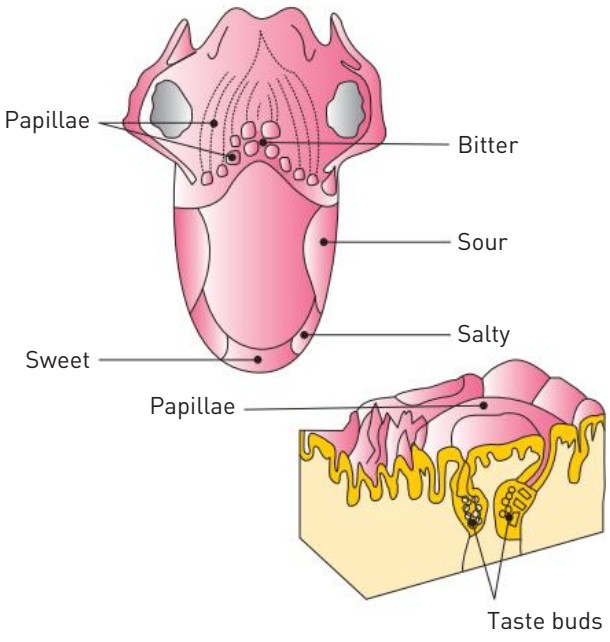
There is a fifth taste associated with Japanese and Chinese cuisine – umami. This taste is sometimes referred to as savoury, delicious, more-ish or meaty. The umami flavour is not detected in a specific taste zone on the tongue; rather the flavour is detected by a combination of taste zones. Many centuries ago, Japanese cooks discovered that the use of stock made from seaweed produced a delicious meaty flavour, which they loved. Umami occurs in other foods such as tomatoes, parmesan cheese and salami. Some cooks and food manufacturers use monosodium glutamate (MSG) to create the umami taste.



Olfactory cells allow us to appreciate the aroma of food.

Alamy Stock Photo/Bon Appetit

Cooking meat on a barbecue creates delicious aromas.



Taste zones of the tongue

TEXTURE

Texture is the tactile sense or the way the food feels in the mouth. We can use our eyes and describe the appearance of the surface of food; we can feel the physical structure of food with our hands, and our tongue and skin inside the mouth experiences the mouthfeel of food. We feel the effervescence of a carbonated soft drink, an astringent sensation from unripe bananas, the pungency of wasabi or fresh chilli and the cooling of menthol from a peppermint lolly. We determine the ripeness of fruit by gently squeezing it, and when chewing food we can feel if it is smooth, crunchy, firm, moist, lumpy or hard.

The temperature of food is felt in the mouth – the coldness of ice-cream or the heat of a hot chocolate drink is important to our enjoyment of particular foods.

The texture of food is sensed when it is chewed. The food can feel chewy and cohesive like chewing gum, or sticky like honey, or give a feeling of mouth-coating like peanut butter. The sound of food being eaten also links with texture – the crisp, crunchy sound of potato chips is well known.

Shutterstock.com/Nitr

Effervescence or the bubbling effect of a soft drink

ENJOYMENT OF FOOD

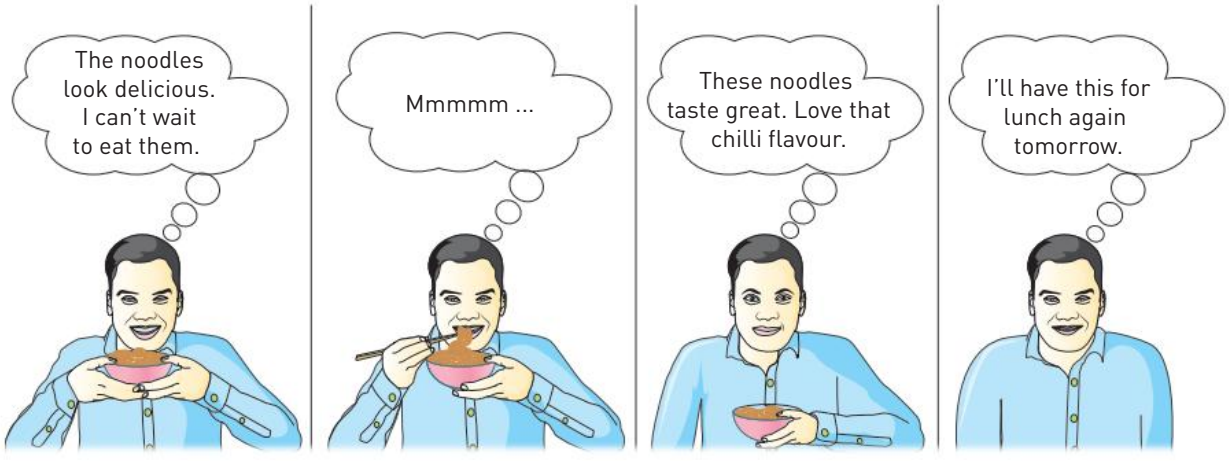
Food is more than just nutrients and a means of satisfying hunger. While it must meet the body's physiological demands, it must also satisfy certain psychological and social needs.

Looking at food before it is eaten

You may see food in a market or supermarket, in a picture in a recipe book, in a TV advertisement or on a plate. This is the first stage in the enjoyment of food and it engages all your senses. You begin to make a visual judgement about the food: What will it taste like? Does it look appetising? You might imagine the sound of food when it is being prepared, such as the sound of a steak sizzling on a barbecue or the snap of fresh beans. Your sense of smell will also begin to work and will soon combine with your sense of taste to provide the expectations of a full flavour sensation. The aroma of fresh bread baking in a local bakery makes your mouth begin to water and entices you to buy the bread.

Putting food in your mouth

The next stage is to transfer the food to your mouth. This may be done with a knife and fork or spoon, or fingers or chopsticks. At this point, you begin to physically interact with the food and can make judgements about its flavour, texture and temperature.



The senses at work when eating

Chewing and swallowing food

The food inside your mouth is now being chewed and swallowed. The flavour is being sensed by the taste buds on the tongue and the different tastes can be distinguished. Mouthfeel can now be determined as you chew and move the food around in your mouth in preparation for swallowing.

Choosing this food again

If eating this food was enjoyable and satisfying, you will probably choose to eat it again or recommend it to others. A positive experience will also be imprinted in the memory.

Understanding the text

1. Draw a diagram to demonstrate the factors associated with the sensation of hunger.
2. What is appetite and how does it influence the amount of food we eat?
3. How does hunger differ from appetite?
4. Explain what is meant by satiety.
5. Explain why the appearance of food influences our enjoyment of what we are about to eat.
6. Describe how we smell the different aromas of food. How does temperature affect the aroma of food?
7. Explain how we detect the flavour of food.
8. How is the umami taste different from the four major taste sensations?
9. Explain how we determine the texture of food.
10. List the four main stages in eating food.

Digestion

Digestion is the process by which food is broken down into substances that can be absorbed and used by the body for energy, for growth and to repair and build new tissue. During this process the large particles in food are broken down into smaller components that can be readily absorbed into the bloodstream.

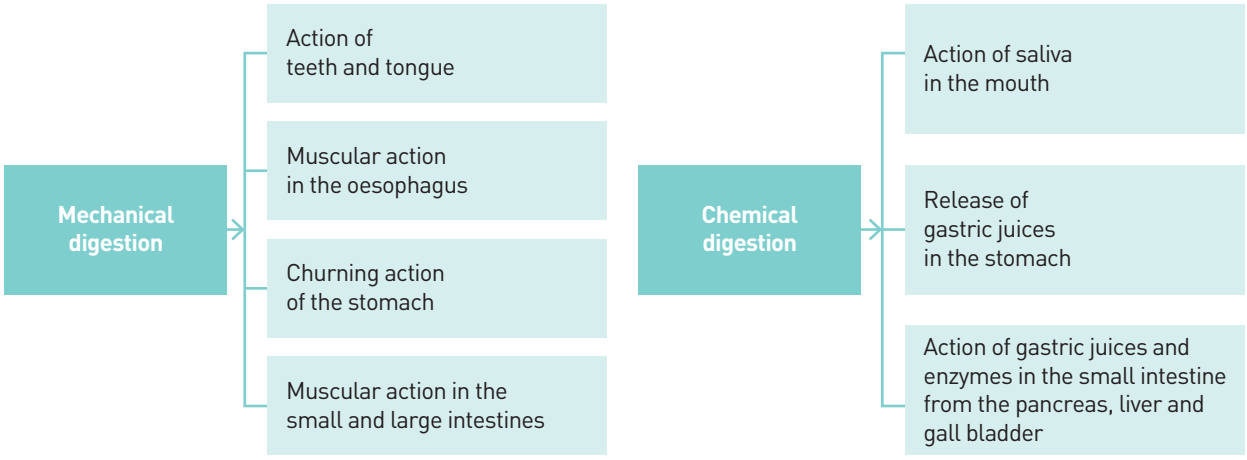
Digesting food involves both mechanical processes and chemical processes.

MECHANICAL DIGESTION

Mechanical digestion is the use of physical force, such as chewing or the churning or squashing movements of the stomach or intestines, to break down food. This mechanical process begins in the mouth as the teeth tear, cut and grind the food into smaller pieces that can be swallowed without choking. The muscular walls of the oesophagus, stomach and intestines continue the mechanical processes by pushing food along and churning and breaking it into smaller particles.

CHEMICAL DIGESTION

Chemical digestion is the breakdown of food using chemicals such as enzymes and acids. Chemical processes occur at every point in the digestive system, beginning when food is first seen or smelt. The sensory properties of appearance and aroma set off nerve impulses from the eyes and nose. These nerve impulses then trigger the release of enzymes that will eventually break down food and release the nutrients contained in the food.

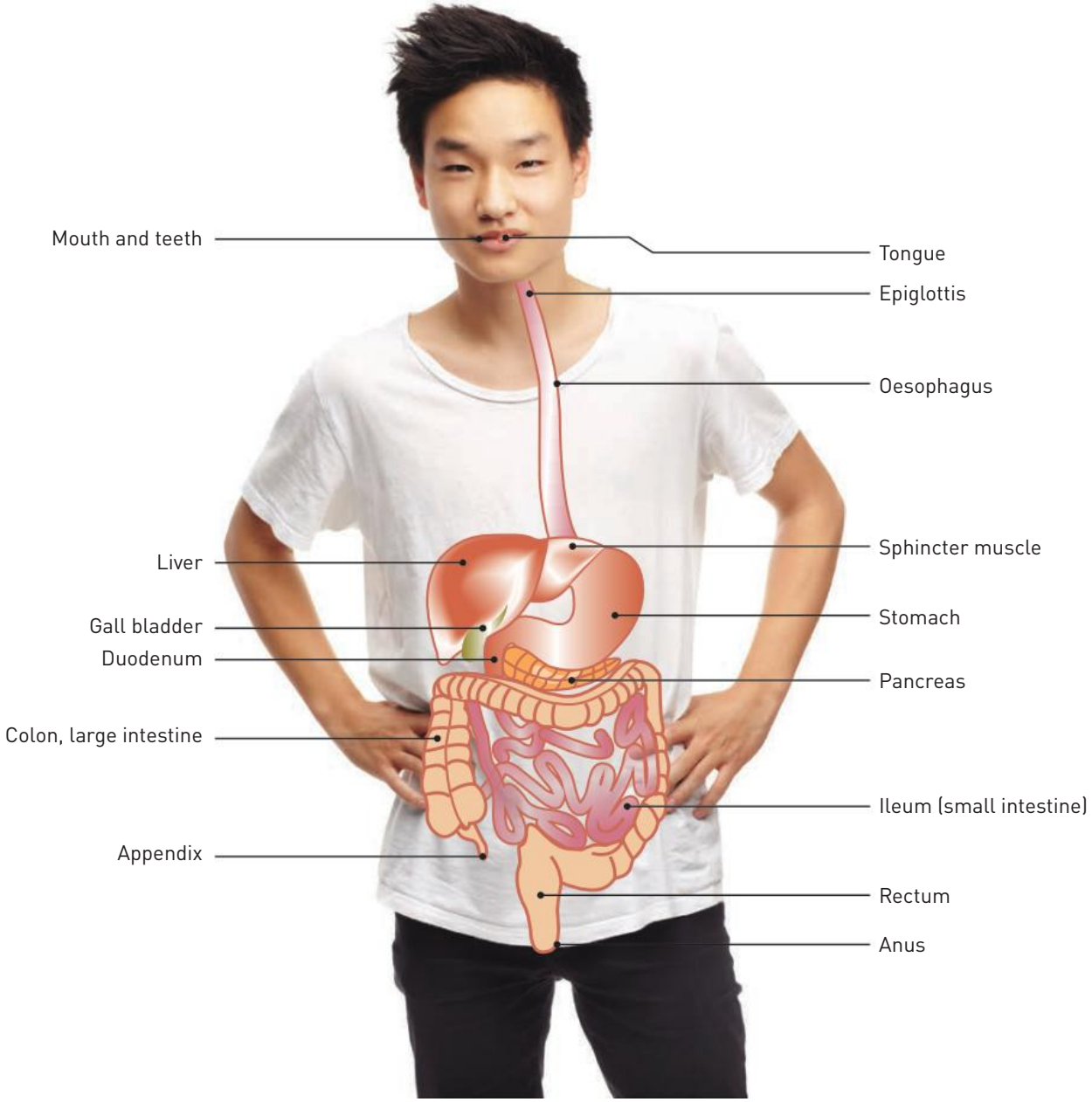


The mechanical and chemical processes of digestion

Chemical digestion is often referred to as **enzymatic hydrolysis** or a chemical process, such as the release of enzymes, that breaks down food by breaking the bonds that hold the molecular 'building blocks' within the food together.

THE DIGESTIVE PROCESS

The digestive system



iStock.com/PeopleImages

The digestive system

BODY PART	FUNCTION	DIGESTIVE ACTION
Looking at and smelling food		
Eyes and nose	Digestion begins with the eyes and ears sending messages to the brain, which sends messages to other body parts. These parts of the body respond to the sight or appearance of food and to the aroma or smell of food, creating a sensory appreciation of the food to be eaten. This sends signals to the brain that enjoyable food is about to be placed in the mouth.	The response to this message causes: • the mouth to water – saliva is produced • the stomach to contract causing hunger pangs • intestinal glands to start the production of digestive chemicals.
Tasting and chewing		
Mouth, teeth and tongue	When food is placed in the mouth both mechanical and chemical digestive processes take place. The teeth bite off pieces of food and chew the food into manageable pieces. The tongue helps to move the food around in the mouth. The salivary glands release saliva, containing an enzyme called salivary amylase. The tongue helps to push the food towards the sphincter, which opens to allow food to pass into the oesophagus.	In the mouth the smaller portions of food combine with the saliva to form a 'mushy' bundle called a bolus, which can easily slide down the throat. Enzymes in the salivary amylase begin to digest the carbohydrates in the food. The food then enters the oesophagus through a muscular valve called the sphincter that opens and allows the food to be swallowed. The epiglottis prevents food from entering the windpipe and channels food down the oesophagus.
Swallowing food		
Oesophagus	As food enters the oesophagus, its passage is assisted by a 'rush' of saliva. The bolus (small, soft ball of food) then passes down the oesophagus.	The oesophagus is ringed with muscles that contract and relax to form wavelike motions called peristalsis. The bolus is pushed towards the stomach. A muscular valve at the base of the oesophagus opens to allow the food to enter the stomach.
Digesting food		
Stomach	The bolus enters the stomach. The walls of the stomach are strong and muscular. They contract with sufficient force to further break down the food as glands in the stomach release a mixture of gastric juices made up of enzymes and acid.	The stomach wall churns the bolus and the wavelike contractions squeeze the thick mass along to the first section of the small intestine – the duodenum. A liquefied mass called chyme is produced. The stomach juices containing pepsin begin the chemical digestion of proteins into amino acids. Hydrochloric acid helps destroy bacteria.
The small intestine		
The small intestine is made up of three parts:	Once in the duodenum, the first section of the small intestine, pancreatic fluid containing digestive enzymes is released.	Enzymatic hydrolysis is a chemical digestive process that breaks down food by breaking the bonds that hold the molecular 'building blocks' within the food together. In enzymatic hydrolysis, reactions occur when an enzyme incorporates a water molecule across the bond, allowing it to break.

BODY PART	FUNCTION	DIGESTIVE ACTION
• the duodenum • the jejunum • the ileum.	Bile is also released from the gall bladder. Food is squeezed into the lower parts of the small intestine, the jejunum and the ileum.	Nutrients are absorbed in the jejunum and ileum. The intestinal epithelial cells of the small intestine secrete: • sucrase to break down sucrose to glucose • lactase to break down lactose to glucose and galactose • maltase to break maltose to glucose.
Pancreas Gall bladder Liver	The pancreas secretes both digestive juices and insulin. Insulin helps to regulate the amount of sugar in the blood. • The liver produces bile, which is secreted into the duodenum where it emulsifies fat.	The pancreas, gall bladder and liver all secrete important enzymes into the small intestine to aid digestion. Pancreatic lipase digests fats producing fatty acids and glycerol. The pancreatic enzyme protease splits the proteins into separate amino acids. These nutrients are then absorbed for energy or used as building blocks for new tissue. Specialised cells in the intestinal walls collect sugars, amino acids, fatty acids and glycerol.
The end of the digestive process		
Large intestine or colon Appendix	Once the nutrients have been absorbed, the indigestible remainder of food moves on to the large intestine. Bacteria break down some of the fibre. The appendix is found at the junction of the small and large intestine.	Water is absorbed from the waste and the remains are bundled together. The resulting faeces are removed from the body through the anus by muscular contractions. The appendix acts a reservoir for beneficial bacteria. These bacteria assist the digestive system to recover from infection and diarrhoea.

THE MICROBIOLOGY OF THE INTESTINAL TRACT

Weblink

The microbiology of the intestinal tract refers to the microbes or microscopic living organisms such as bacteria that live in the small and large intestine of all human beings. The intestinal tract is a complex ecosystem and contains over 400 species and over 100 trillion individual bacteria called microflora. The large intestine is densely populated with a microbial ecosystem; however, the small intestine is home to a smaller quantity and fewer species of these microflora.

These microflora or bacteria perform many important and useful metabolic and fermentation activities in the intestine. They improve digestion and the absorption of short-chain fatty acids and assist with the synthesis of vitamins B and K. They are particularly important in aiding the digestion of lactose, reducing diarrhoea in lactose-intolerant people. The microflora also improve the body's resistance to infections through their ability to repress the growth of harmful microorganisms or pathogenic bacteria.

Microflora also assist with the digestion of fibre by fermenting indigestible carbohydrates such as pectin, cellulose and hemicellulose; they also collect the energy from these otherwise indigestible products. Without intestinal microflora, the human body would be unable to use some of these undigested carbohydrates.

The importance of probiotics and prebiotics in the intestinal tract

In recent years, health professionals have identified two groups of functional ingredients that can be added to traditional foods to give them functional properties to assist with digestive and bowel health. These ingredients are known as probiotics and prebiotics and they help to optimise the health of the digestive system by adding to and supporting the natural microflora present in the intestine.

Probiotics are live microbial food supplements such as the *Bifidobacterium* and *Lactobacillus* bacterial species, or foods that have naturally occurring live bacteria such as fermented foods. When probiotics are added to foods, or fermented foods are eaten, they have significant health benefits for the consumer. Many diseases and antibiotics can have a negative impact on intestinal flora and cause a disturbance in the balance of microorganisms in the intestine. This may in turn affect people's health and ability to digest food and absorb nutrients. Probiotics are often referred to as 'good bacteria' because they are said to restore the balance of these important bacteria or microflora in the intestinal tract.

One of the most widely recognised probiotic foods is yoghurt, especially yoghurt that has live cultures such as acidophilus, bifidus and lactobacillus casei cultures added to it. Other examples of probiotic foods include fermented cabbage dishes such as kimchi and sauerkraut, fermented soybean foods such as miso, and kefir, a type of fermented cow, goat or sheep's milk.

Understanding the text

11 Explain the term 'digestion' and outline the differences between mechanical and chemical digestion.

12 What is enzymatic hydrolysis?

13 Describe the digestive actions that occur when the brain receives the signals from the nose and eyes on seeing and smelling food.

14 Outline the role of the teeth, tongue and saliva in digestion after food is placed in the mouth.

15 Explain how food is assisted in its passage down the oesophagus.

16 Outline the chemical actions that take place when food enters the stomach.

17 Describe the changes that occur to the following sugars in the small intestine:
- sucrose
- lactose
- maltose.

18 Explain the role of the liver in the digestive process.

19 Describe what happens to any indigestible matter once it enters the large intestine.

20 Explain the roles of the microflora in the intestinal tract.

Prebiotic components are compounds in food products or those that are added to food products that are non-digestible. Prebiotic components feed bacteria by stimulating the growth or activity of naturally occurring colonic bacteria, thereby improving health. Defined as dietary fibre, resistant starches and non-starch polysaccharides are two substances that can be metabolised by colonic bacteria to allow the bacteria to grow. To be classified as a prebiotic substance, components must not be broken down or absorbed in the small intestine. They act as a substrate to allow beneficial colonic bacteria to grow and consequently improve the ratio of beneficial colonic microflora.

Probably the most widely recognised prebiotic substance used in food manufacture today is Hi-maize, a food ingredient with high levels of resistant starch; that is, a starch that resists digestion in the small intestine.

Macronutrients

Macronutrients are the essential nutrients that our bodies need in large amounts. These nutrients all supply the body with energy, promote growth and the repair of tissues, and regulate body processes. There are three macronutrients: carbohydrates, protein and fat.

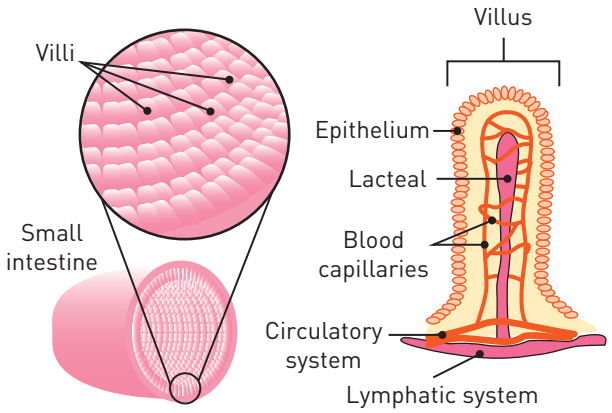
ABSORPTION AND USE OF MACRONUTRIENTS

The absorption of nutrients occurs along the whole length of the small intestine, which is approximately 8 metres long. Food slowly passes along the small intestine, taking about 2–3 hours before it reaches the large intestine. This allows plenty of time for the absorption of nutrients to take place.

The walls of the small intestine are lined with thousands of tiny finger-like projections called villi. These villi create a large surface for the tiny units of each nutrient to pass through into either the bloodstream or the lymphatic system.

Role of villi

The surface of each villus is surrounded by a wall of single cells that allow nutrients to pass through. Within each villus is a network of blood capillaries, linking to veins and an artery. Glucose is absorbed through the blood capillaries and circulated throughout the bloodstream. In the centre of each villus is the lacteal. The lacteal is surrounded by tiny blood capillaries, which are connected to larger blood vessels. Fats are



Villi in the small intestine

Cross-section of a villus in the wall of the small intestine

absorbed into the lacteal, which is connected to the lymphatic system.

When villi are damaged, nutrients cannot be absorbed properly. People with coeliac disease are intolerant to gluten and have trouble absorbing nutrients. The gluten irritates the villi, causing them to shrink and flatten so they are less effective in absorbing the nutrients.

CARBOHYDRATES

Carbohydrates contain the elements of carbon, hydrogen and oxygen. The complex metabolism of the body requires a source of energy in order to function, and carbohydrates are the body's preferred fuel source. Foods that contain carbohydrates include breakfast cereals, rice, pasta, legumes, corn, potatoes, fruit, yoghurt, sugar, biscuits, cakes and lollies.

They contribute 16 kilojoules of energy per gram of carbohydrate. It is recommended that 45–65 per cent of our daily energy intake is derived from carbohydrates.

Shutterstock.com/Martin Rettenberger

Carbohydrate foods contribute 16 kilojoules of energy per gram.

Glycaemic index

The glycaemic index or GI is based on how rapidly the carbohydrate is digested and absorbed into the bloodstream.

Weblink

Carbohydrate foods are compared with glucose or white bread as a reference food and given a score of 100. The glycaemic index then compares foods that have the same amount of carbohydrate gram for gram.

Carbohydrates that break down quickly during digestion have a higher GI; that is, foods that release their glucose into the blood quickly, rate more than 70. Foods in this category include baked potatoes.

Carbohydrates that break down slowly, such as oats, release glucose gradually into the bloodstream. Low-GI foods prolong digestion because of their slow breakdown and will help give a sensation of feeling full or of satiety.

Types of carbohydrates

Monosaccharides

These single units of sugar are the base unit from which other carbohydrates are built. They have a sweet taste and are referred to as single sugars. Monosaccharides come in a number of forms. **Glucose** is the form of carbohydrate the body uses as energy and is found in onions, unripe potatoes and sweet fruits. **Fructose** is a simple sugar found in fruit, plant juices and honey. **Galactose** is found in the milk of mammals such as cows, goats and sheep.

Disaccharides

These are formed when two monosaccharides join together. These are often called double sugars and have a sweet taste and readily dissolve in water.

Sucrose is formed from 1 unit of glucose plus 1 unit of fructose and is found in fruits, vegetables and cane sugar. **Lactose** is formed from 1 unit of glucose plus 1 unit of galactose and is found in milk. **Maltose** or malt sugar is formed from 2 units of glucose joined together and is formed when barley is malted in the brewing process.

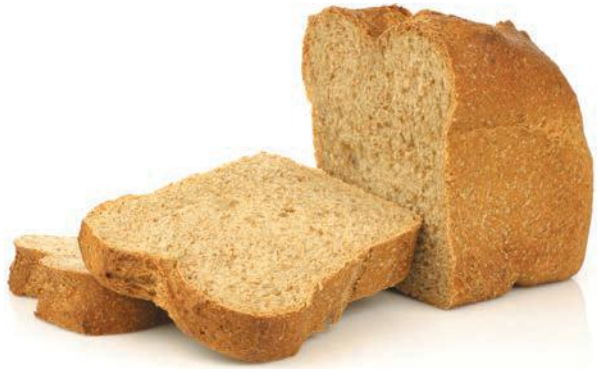
Polysaccharides

Polysaccharides are carbohydrates made from many sugar units and are known as starches. These form during photosynthesis in plants from a varying number of monosaccharide units joined together in a chain. Polysaccharides are tasteless, readily dissolve in water and are converted to glucose during digestion. Starches are found mainly in cereals and starchy vegetables such as potatoes.

LOW-GI FOODS (54 OR LESS)	MEDIUM-GI FOODS (55–69)	HIGH-GI FOODS (70 AND ABOVE)
Wholegrain bread	Orange juice	Potatoes
Pasta	Honey	White bread
Sweet potato	Long-grain rice	Short-grain rice
Peas	Wholemeal bread	Watermelon
Dried beans and lentils		
Porridge		

Shutterstock.com/Oliver Hoffmann

Honey contains the simple sugar fructose.



Shutterstock.com/Peter Zijlstra

Wholemeal bread contains insoluble fibre.

Fibre

Fibre is another form of carbohydrate and is only found in plant food. It is not digested in the stomach or small intestine but is broken down by bacteria in the large intestine.

- **Soluble fibre** includes pectin and gums, which are found mainly in plant cells. This fibre provides bulk to the digestive system and is completely broken down by bacteria in the large intestine. Good sources of soluble fibre include oats, legumes, fruit and vegetables.
- **Insoluble fibre** includes cellulose and lignin, which make up the structural part of plants. Insoluble fibre provides bulk to the diet and keeps the bowels regular. Sources include wholegrains and wholemeal breads and cereals, wheat and rice bran, fruit and vegetables with the skin on, nuts and seeds.
- **Resistant starch** resists digestion and promotes the growth of healthy bacteria. Although it is not considered a traditional fibre, it acts in a similar way. It resists digestion in the small intestine and is therefore valuable for bowel health. Foods containing resistant starch include baked beans, firm bananas, legumes, unprocessed cereals and grains. The resistant starch Hi-maize can also be added to some breads and breakfast foods.

Absorption and use of carbohydrates

Carbohydrate is the body's main supplier of energy. Sugars and starches are broken down to glucose during digestion. The glucose is absorbed into the blood capillaries and transported by the bloodstream to cells in other parts of the body.

The pancreas secretes a hormone called insulin, which helps the glucose to move from the bloodstream into the cells. Once inside the cell, the glucose is 'burned' along with oxygen to produce energy – glucose + oxygen → energy + CO_2 + water.

Any excess glucose is converted to glycogen and stored in the liver and muscle tissue. It can be used to supplement blood glucose levels during extended physical activity.

PROTEIN

The body requires protein throughout its life cycle, for growth and maintenance and repair of body cells. Protein is also required to produce enzymes, antibodies, haemoglobin and hormones.

Proteins are made up of simple units in chain formation called amino acids and contain the elements of carbon, oxygen, hydrogen and nitrogen. Amino acids are often referred to as the building blocks of life. The number and type of amino acids in the different types of protein chain vary considerably. The pattern of amino acids that form in the protein molecule determines the shape of that molecule and

consequently its physical properties and the type of protein food. Each amino acid has its own chemical name and there are approximately 20 different types.

Eight amino acids cannot be produced by the body – these are called essential amino acids. The remainder can be produced by the body – these are called non-essential amino acids.

The main function of protein is for growth, maintenance and repair of body cells, but if there is too much protein in the diet it can be converted to kilojoules and used as energy, or if not used it will be stored as body fat. If there is insufficient carbohydrate and fat in the diet, protein can also be used as an energy supply. In this case it is referred to as a secondary source of energy. About 10 per cent of the body's energy comes from protein.

The nutritional value of protein is measured by the quantity of the essential amino acids it provides.

Protein requirements

We require about 40 to 50 grams of protein daily. During periods of growth, during infancy, childhood, adolescence and pregnancy and lactation, greater amounts of protein are required in relation to body weight.

The amount of protein we require in our diet depends on our weight, age, stage of the life cycle and health.

Pregnancy
- 1 gram per kilogram of body weight

↓

Lactation
- 1.1 gram per kilogram of body weight

↓

Infant 0–6 months
- 1.43 grams per kilogram of body weight

↓

Adolescence
- **Boy** – 0.94 grams per kilogram of body weight
- **Girl** – 0.87 grams per kilogram of body weight

↓

Adult women
- 0.75 grams per kilogram of body weight
- 70 + years – 0.94 grams per kilogram of body weight

↓

Adult men
- 0.84 grams per kilogram of body weight
- 70 + years – 0.94 grams per kilogram of body weight

Protein requirements across a human's life span

Types of proteins

Complete proteins come mainly from animal sources and contain all the essential amino acids. They are said to be of high biological value because they contain the amino acids required for growth and repair. Sources of complete proteins include meat, fish, eggs, cheese, milk and yoghurt. A small number of plant foods contain complete proteins, including soya bean products, quinoa and amaranth, a leafy green consumed in Asia and the Mediterranean.

iStock.com/redmal

Sources of complete protein

Incomplete proteins come mainly from plant sources and lack one or more of the essential amino acids. They are said to be of low biological value because they do not contain all the essential amino acids required for growth and repair. Sources of these proteins include cereals such as wheat, oats and rye, pulses such as peas and beans, and lentils and nuts.

All the essential amino acids will be supplied in a diet that includes a range and variety of these proteins eaten together.

iStock.com/egal

Pulses are a good source of incomplete protein.

Absorption and use of protein

Proteins are broken down into amino acids during digestion. The amino acids are absorbed into the blood capillaries where they dissolve in the blood and are carried to the liver for storage.

These amino acids are the building blocks for protein synthesis for the creation of new tissue, cells and hair. Amino acids are also the precursors in the creation of body chemicals, such as enzymes and hormones.

FATS

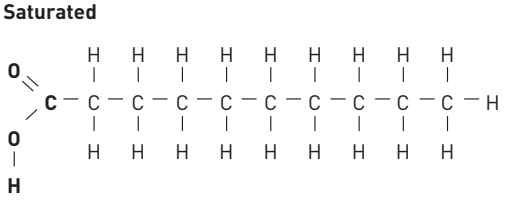
Fats and oils have the same chemical elements as carbohydrates – carbon, hydrogen and oxygen – but the structure varies, so the foods have different properties. The elements are linked together to form fatty acids and glycerol. Fats and oils can be classified according to:

- their source – animal or vegetable
- the way in which they are distributed throughout foods – visible or invisible
- their chemical composition – saturated or unsaturated
- their state at room temperature – liquid or solid.

Dietary fats contain 37 kilojoules per gram and are considered to be very energy dense. Fats and oils also transport vitamins A, D, E and K around the body.

Types of fat

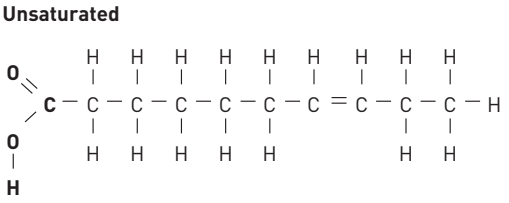
Saturated fats contain the maximum amount of hydrogen. A fatty acid is a long carbon chain with hydrogen atoms attached. When each carbon chain and oxygen atom has its full complement of hydrogen atoms, it is said to be saturated. Saturated fatty acids are predominantly present in fats that are solid at room temperature, and are mainly of animal origin. They tend to increase low-density lipoproteins (LDL), which increases the risk of heart disease. The main food sources of saturated fats include milk, butter and fats on meats. Coconut oil and palm oil are exceptions, because they are saturated fats of plant origin and are solid at room temperature.



In saturated fats, all oxygen and carbon atoms are saturated by hydrogen.

The chemical structure of saturated fats

Unsaturated fats can be monounsaturated or polyunsaturated fats. These fats do not contain the maximum amount of hydrogen, because each carbon chain does not have the full number of hydrogen atoms attached. Double bonds exist between the carbon atoms so the fatty acid is said to be unsaturated. Unsaturated fatty acids are mostly present in plant and vegetable oils. These fats can help to decrease cholesterol. Unsaturated fats are found mainly in peanut, olive, maize and canola oils, nuts, seeds and soy products.



In unsaturated fats, not all carbon atoms are saturated by hydrogen.

The chemical structure of unsaturated fats

Trans fats are created artificially through a process called hydrogenation. Liquid oil is converted to a solid fat with a maximum amount of the carbon chain and oxygen atoms filled with hydrogen. Like saturated fats, they are considered to be more harmful to health because they increase the level of bad (LDL) cholesterol and lower the level of high-density lipoproteins (HDL) or good cholesterol. Trans fats are thought to increase the risk of coronary heart disease. The main food sources of trans fats are pastries, cakes, biscuits, deep-fried foods and processed foods.

Absorption and use of fats

During digestion, fats are broken down to fatty acids and glycerol. These fatty acids and glycerol are absorbed into the lacteal or inner section of the villi in the small intestine. In the lacteal, they recombine to form fats, which mix with lymphatic fluid. They then move around the body in the lymphatic system, and join the blood circulation as insoluble fat. They are converted to soluble fat in the liver.

Activity 1.1

Trans fats, but not saturated fats, are the problem

Read the article below, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. Outline the difference in the health risks associated with consuming saturated and trans fats.
3. What is the percentage of energy recommended by national guidelines for saturated fats and trans fats?
4. List the sources of saturated fats.
5. What ingredients are used to produce trans fats?
6. How are trans fats produced?
7. What foods are manufactured using these fats?
8. Explain why the researchers undertook this study.
9. Outline the key finding of the study in relation to trans fats and coronary heart disease (CHD).
10. Explain why it may be necessary to review the Dietary Guidelines for Australians in the future in light of this research.

TRANS FATS, BUT NOT SATURATED FATS, ARE THE PROBLEM

Saturated fats are not associated with an increased risk of death, heart disease, stroke, or type 2 diabetes, finds a Canadian study published in *The British Medical Journal* (BMJ) this week. However, the findings show that trans fats are associated with greater risk of death and coronary heart disease.

The study confirms previous suggestions that industrially produced trans fats might increase the risk of coronary heart disease and calls for a careful review of dietary guidelines for these nutrients.

Guidelines currently recommend that saturated fats are limited to less than 10%, and trans fats to less than 1% of energy to reduce risk of heart disease and stroke.

Saturated fats come mainly from animal products, such as butter, cow's milk, meat, salmon and egg yolks, and some plant products such as chocolate and palm oils. Trans unsaturated fats (trans fats) are mainly produced industrially from plant oils (a process known as hydrogenation) for use in margarine, snack foods and packaged baked goods.

Contrary to prevailing dietary advice, a recent evidence review found no excess cardiovascular risk associated with intake of saturated fat. In contrast, research suggests that industrial trans fats may increase the risk of coronary heart disease.

To help clarify these controversies, researchers in Canada analysed the results of observational studies assessing the association between saturated and/or trans fats and health outcomes in adults.

The team found no clear association between higher intake of saturated fats and all cause mortality, coronary heart disease (CHD), cardiovascular disease (CVD), ischemic stroke or type 2 diabetes, but could not, with confidence, rule out increased risk for CHD death. The team did not find evidence that diets higher in saturated fat reduce cardiovascular risk.

However, consumption of industrial trans fats was associated with a 34% increase in all cause mortality, a 28% increased risk of CHD mortality, and a 21% increase in the risk of CHD.

AUSTRALIAN FOOD NEWS ausfoodnews.com.au, 12 August 2015

Understanding the text

21 Briefly explain where the absorption of nutrients takes place during digestion and how long this process takes.

22 Explain how the structure of the villi assists the process of absorption of nutrients.

23 Describe what happens when the villi are damaged and how this impacts on the absorption process.

24 What contribution to energy do carbohydrates make?

25 Explain the term 'glycaemic index' and its impact on satiety.

26 Draw a diagram like the one below to summarise the key information about types of carbohydrates.

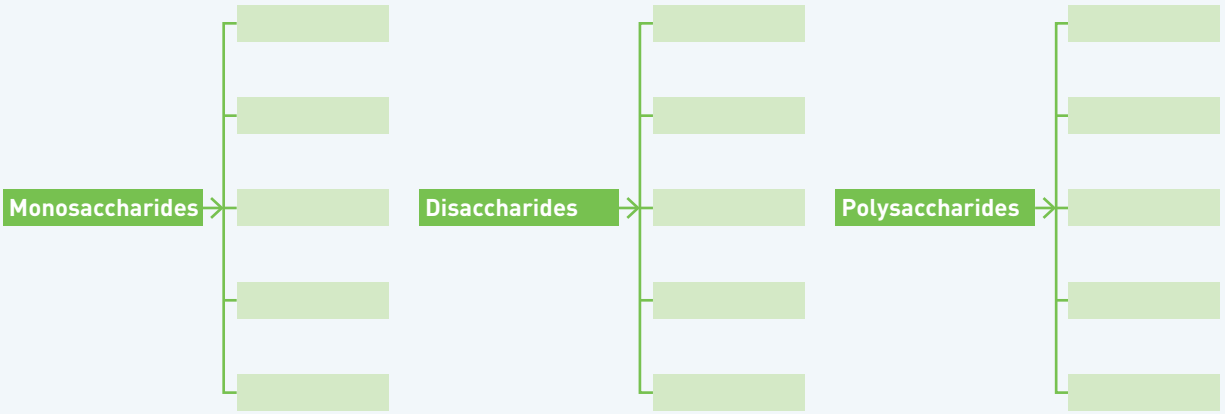
27 Outline why resistant starch is valuable in the digestive process.

28 Explain why protein is a valuable macronutrient for the body.

29 Complete the following table to demonstrate your understanding of types of proteins.

PROTEIN TYPE	CHEMICAL MAKE-UP	FOOD SOURCES
Complete		
Incomplete		

30 Explain the chemical make-up of saturated fats. List four sources of saturated fats.



PREPARING FOR EXAMS

Applying knowledge

Draw a flow chart to demonstrate the passage of food through the digestive tract.

Analysing information

Analyse each of the following macronutrients and describe the way they are absorbed and used in the body.

- Carbohydrates
- Proteins
- Fats

Evaluating concepts

Rank the importance of hunger, appetite, satiety and the senses in determining an individual's food intake. Justify your ranking.

AUSTRALIAN DIETARY GUIDELINES

GUIDELINE #1

Achieve and maintain a healthy weight, be physically active and choose nutritious food and drink to meet your energy needs

Enjoy a wide variety of nutritious foods from grains, lean meats, vegetables, legumes, fruit and dairy

GUIDELINE #2

GUIDELINE #3

Limit intake of foods containing saturated fat, added salt, added sugars and alcohol

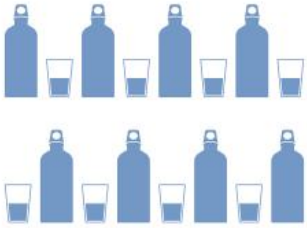
Encourage, support and promote breastfeeding

GUIDELINE #4

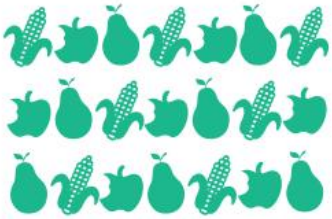
GUIDELINE #5

Care for your food; prepare and store it safely

AUSTRALIAN GUIDE TO HEALTHY EATING

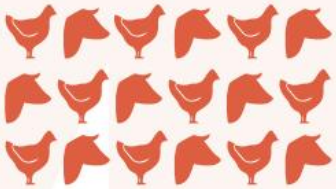


Drink plenty of water



Eat a wide variety of vegetables and fruit

Go for grains, particularly wholegrains



Choose lean meat, poultry and eggs and/or plant-based alternatives

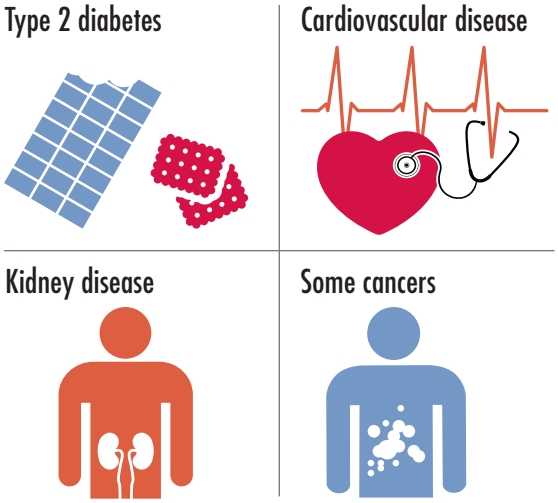
Use small amounts of unsaturated fats/oils and spreads

Limit foods high in fats, added sugars and salt

ENERGY REQUIREMENTS

Age	Male	Female
12–15 years	10900 kJ	9550 kJ
16–18 years	12900 kJ	10200 kJ
19–50 years	11550 kJ	9300 kJ
51–70 years	10450 kJ	8800 kJ
Adults over 70 years	9450 kJ	8300 kJ

DIET-RELATED DISEASES



2

THE AUSTRALIAN DIETARY GUIDELINES

KEY TERMS

Australian Dietary Guidelines were developed to guide and promote good nutrition and health, and reduce diet-related disease.

Australian Guide to Healthy Eating is a practical, pictorial guide for food selection.

Discretionary food choices are of food and drink that do not necessarily provide nutrients the body needs.

Energy is required in the body for metabolic processes, physiological functions, muscular activity, heat production, and growth and synthesis of new tissue.

Energy-dense foods are foods that are high in energy, usually because of their high fat and sugar content.

Food allergy is an abnormal immunological reaction to food caused by a foreign substance, usually protein, and can be life-threatening.

Food intolerance is a chemical reaction to particular foods; it is not an immune response, so is not a true allergy.

Kilojoule (kJ) is a unit for measuring energy intake or expenditure.

Lifestyle diseases include diseases such as obesity, type 2 diabetes and cardiovascular disease.

Obesity is carrying excess body weight in the form of fat.

The health of Australians

In 1992, the federal government developed Australia's Food and Nutrition Policy in order to improve the country's knowledge and skills of food and nutrition. The **Australian Dietary Guidelines** were developed by Australian government food and nutrition experts to guide and promote good nutrition and health, and to reduce diet-related diseases. These guidelines give advice on healthy food choices and their contribution to a healthy lifestyle in order to reduce the risk of diet-related diseases or lifestyle diseases. **Lifestyle diseases** are diseases such as obesity, type 2 diabetes and cardiovascular disease.

Weblink

In February 2013, the National Health and Medical Research Council (NHMRC) launched a review of the Dietary Guidelines and published an updated version in order to provide scientific advice for healthier Australian diets. The updated Dietary Guidelines are evidence based and focus on food choices rather than nutrients, and provide a comprehensive approach to the promotion of healthy eating.

The updated **Australian Guide to Healthy Eating** is a pictorial food model developed by the Australian Government as a practical guide, with a visual representation of the proportions of each food group that should be consumed daily (Dietary Guideline 2).

THE AUSTRALIAN DIET

According to the Dietary Guidelines, most Australians need to eat more:

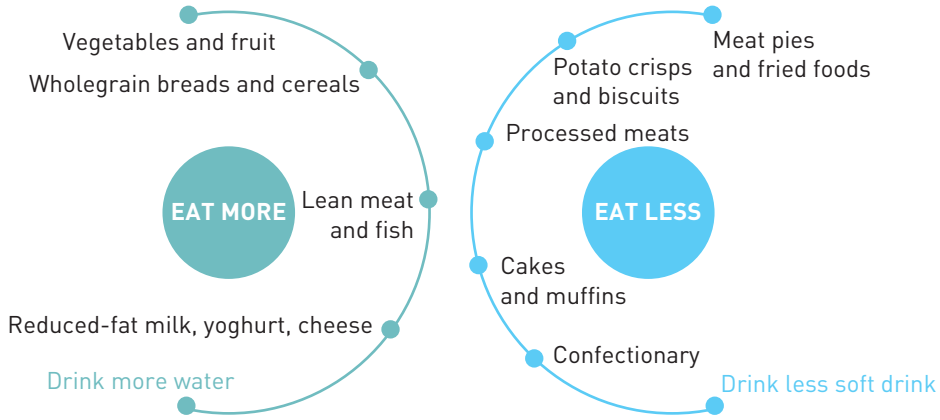
- vegetables and fruit, particularly green, orange and red vegetables, such as broccoli, carrots, capsicum and sweet potatoes, and leafy vegetables like spinach, and legumes/beans such as lentils
- grain (cereal) foods, particularly wholegrain cereals like wholemeal breads, wholegrain/high-fibre breakfast cereals, oats, wholegrain rice and pasta
- reduced-fat milk, yoghurt and cheese varieties (reduced-fat milks are not suitable for children under the age of 2 years as a main milk drink)
- lean meats and poultry, fish, eggs, nuts and seeds and legumes/beans (except many Australian men would benefit from eating less red meat)
- water instead of soft drinks, cordials, energy drinks, sports drinks and sweetened fruit juices and/or alcoholic drinks.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

The Dietary Guidelines also state that most Australians need to eat less:

- meat pies, sausage rolls and fried hot chips
- potato crisps, savoury snacks, biscuits and crackers
- processed meats like salami, bacon and sausages
- cakes, muffins, sweet biscuits and muesli bars
- confectionary (lollies) and chocolate
- ice-cream and desserts
- cream and butter
- jam and honey
- soft drinks, cordial, energy drinks and sports drinks
- wine, beer and spirits.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013



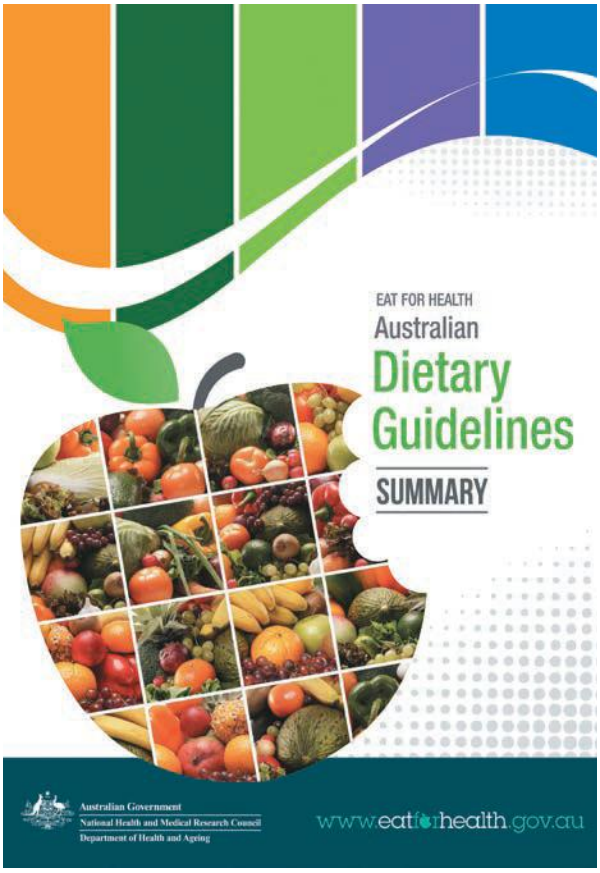
Foods to eat more of and foods to eat less of

DIET-RELATED OR LIFESTYLE DISEASES

Poor nutrition is often associated with ill health and a diet too high in **energy-dense foods**. These are foods that are high in **kilojoules** – a unit for measuring **energy** intake or expenditure of foods – usually because of their high fat and sugar content.

The Australian Dietary Guidelines promote a diet containing nutritious foods; that is, foods that make a substantial contribution towards providing a range of nutrients and have an appropriate nutrient density. Good nutrition contributes to a healthy weight, quality of life and wellbeing, resistance to infection and protection against chronic diseases and premature death.

In their 2010 research on premature mortality from chronic disease, the Australian Institute of Health and Welfare found that lifestyle and diet-related or chronic diseases such as cardiovascular disease, type 2 diabetes and some forms of cancer are major causes of death and disability among Australians. These diseases are responsible for one-third of all premature deaths in Australia, many of which are influenced by overweight and obesity.



National Health and Medical Research Council

The Australian Dietary Guidelines summary

The Australian Dietary Guidelines

Dietary recommendations such as the Australian Dietary Guidelines can be effective in encouraging people to consume the right types of food and focus on the amounts of each food consumed. Over consumption, even of nutritious foods, can lead to excessive energy intake compared to the individual's energy needs and lead to an increase in body weight.

The *Eat For Health Program* was developed by the Australian Government Department of Health as a vehicle for promoting the Dietary Guidelines. Its aim is to encourage good health and wellbeing within the Australian population and the program has used the latest scientific evidence to develop public health nutrition guidelines. The program also offers practical information to help Australians determine the food that they should eat each day according to their age, gender, body size, activity levels and other factors such as pregnancy and breastfeeding.

Guideline 1

To achieve and maintain a healthy weight, be physically active and choose amounts of nutritious food and drinks to meet your energy needs.

Guideline 2

Enjoy a wide variety of nutritious foods from these five food groups every day.

Guideline 3

Limit intake of foods containing saturated fat, added salt, added sugars and alcohol.

Guideline 4

Encourage, support and promote breastfeeding

Guideline 5

Care for your food; prepare and store it safely.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

DIETARY GUIDELINE 1

To achieve and maintain a healthy weight, be physically active and choose amounts of nutritious food and drinks to meet your energy needs.

- Children and adolescents should eat sufficient nutritious foods to grow and develop normally. They should be physically active every day and their growth should be checked regularly.
- Older people should eat nutritious foods and keep physically active to help maintain muscle strength and a healthy weight.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Guideline 1 encourages people to maintain a healthy weight and to be physically active, choosing amounts of nutritious food and drinks to meet the body's energy needs.

Evidence suggests that a healthy weight reduces the risk of chronic disease, including cardiovascular disease, type 2 diabetes and some cancers. Unhealthy weight refers to being underweight, overweight or obese.

Obesity is carrying excess body weight in the form of fat. For adults, obesity is defined as having a body mass index (BMI) of over 30 or a waist measurement of more than 89 centimetres for women or 102 centimetres for men.

If a nutritious dietary intake is adopted and weight is lost, combined with an active lifestyle, obesity-related conditions are preventable.

There is increasing scientific evidence that the consumption of certain foods is associated with the risk of excess weight gain, while other foods are associated with a reduced risk of weight gain. Fat is a concentrated source of energy so it has a large influence on energy intake. Sugar and sugar-sweetened soft drinks are associated with weight gain in adults and children. Evidence suggests that vegetables and fruit reduce the risk of weight gain. Portion size has also been shown to have a direct relationship to weight gain.

Tips for a healthy weight

- Enjoy a healthy breakfast.
- Eat slowly and savour every mouthful.
- Listen to your body. Stop when, or even before, you feel full.
- Don't shop when you're hungry – and use a list.
- Plan healthy, quick and easy meals for busy days.
- Make meal times special occasions for the whole family. And turn off the TV!
- When eating out, make healthy choices. For example, choose grilled or steamed foods and avoid creamy sauces.
- Choose water instead of soft drink, cordial, fruit drinks, vitamin waters, energy drinks, sports drinks or alcoholic drinks.
- When hungry, fill up with fruit and vegetables.
- Don't spend a long time sitting down. Turn off the computer!
- Be physically active every day in as many ways as you can. Go for a walk, play active games, go for a ride, start a vegetable garden. Get the kids involved too.
- Find a friend or family member to help support you to eat healthily and be active.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Activity 2.1

Weblink

Quiz: Are you eating for health?

1. Access the website of the *Australian Dietary Guidelines – Summary*. Take the quiz on page 6: Are you eating for health?
2. Once you have completed the quiz, remember to rate yourself.
3. Evaluating your diet – if your score was 4–6 points or below, suggest ways you could improve your diet. Use the *Australian Guide to Healthy Eating* as a guide.

National Health and Medical Research Council

Quiz: Are you eating for health?

National Health and Medical Research Council

Australian Guide to Healthy Eating

DIETARY GUIDELINE 2

Enjoy a wide variety of nutritious foods from these five food groups every day.

- Plenty of vegetables, including different types and colours, and legumes/beans
- Fruit
- Grain (cereals) foods, mostly wholegrain and/or high cereal fibre varieties, such as bread, cereals, rice, pasta, noodles, polenta, couscous, oats, quinoa and barley
- Lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans
- Milk, yoghurt, cheese and/or alternatives, mostly reduced fat (reduced-fat milks are not suitable for children under 2 years)
- And drink plenty of water.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

This guideline encourages the consumption of a wide variety of nutritious foods from the five food groups every day.

Evidence suggests that dietary patterns that include a wide variety of foods from the five food groups will promote health and wellbeing. The key to eating well is to eat a variety of foods from the five food groups. These five food groups make up the plate or main circle on the Australian Guide to Healthy Eating.

The five food groups

The five food groups are:

- vegetables and legumes
- fruit
- grains – mostly wholegrains
- lean meat, poultry and fish
- milk and milk alternatives.

The Australian Guide to Healthy Eating

This guide is a food selection model for consumers to assist them in planning, selecting and consuming adequate proportions of foods from the five food groups. It has been incorporated into the Australian Dietary Guidelines and represents Guideline 2 – *Enjoy a wide variety of nutritious foods from these five groups every day ... and drink plenty of water.*

Weblink

The guide has been designed as a visual model, showing a circle divided into five wedges, each representing one of the five food groups; the size of each wedge reflects the proportion of each food group that should be consumed daily. The model converts the scientific knowledge on food composition and nutritional requirements for good health and wellbeing into a practical guide. The appropriate serving sizes can be applied by using the details in Guideline 2.

In addition to the five groups, consumers are advised to consume plenty of water, and include small amounts of monounsaturated and polyunsaturated fats in their diets. They are also advised to only consume small amounts of foods such as soft drinks, sweets such as lollies and chocolates, alcohol, full-cream dairy products, baked goods such as cakes and doughnuts, processed meats and high-energy takeaway foods.

Vegetables

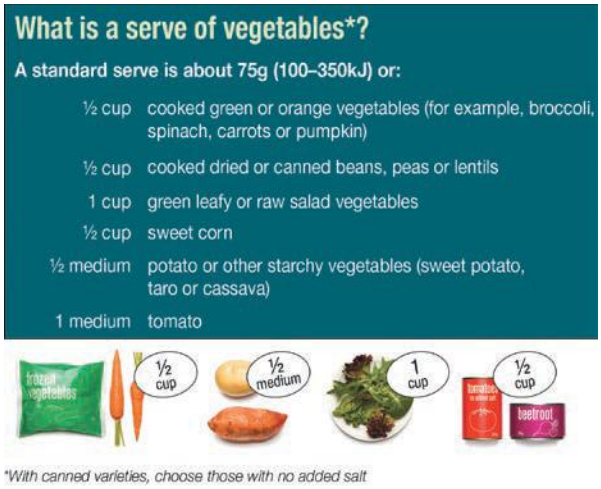
Eating plenty of vegetables is associated with a reduced risk of weight gain and consequently cardiovascular disease and type 2 diabetes. Vegetables contain vitamins, minerals and dietary fibre, and most are low in kilojoules.

Evidence suggests that it is important to eat a variety of vegetables, particularly those of different colours and structures. Colours such as green from broccoli and spinach, orange from carrots and pumpkin, and yellow and red from capsicums and tomatoes should be included. A range of vegetable types, such as leaves and roots, beans, lentils, stems, seeds and chickpeas, should also be included. An important message is to limit the intake of fried vegetables such as potato chips.

MINIMUM RECOMMENDED NUMBER OF SERVES OF VEGETABLES PER DAY

	SERVES PER DAY		
	19–50 years	51–70 years	70+ years
Men	6	5½	5
Women	5	5	5
Pregnant women	5	–	–
Breastfeeding women	7½	–	–

	SERVES PER DAY				
	2–3 years	4–8 years	9–11 years	12–13 years	14–18 years
Boys	2½	4½	5	5½	5½
Girls	2½	4½	5	5	5



Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

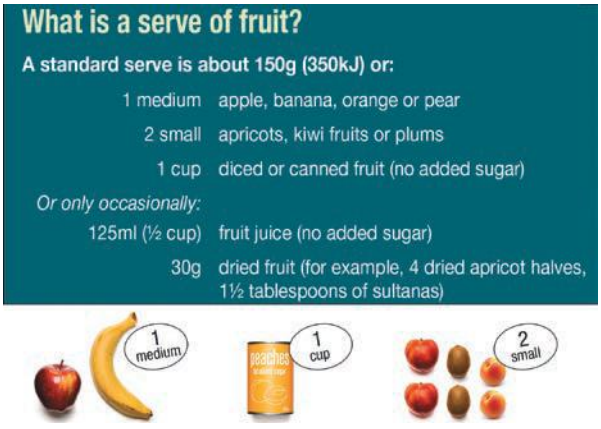
Fruit

Evidence suggests that including fruit in the diet each day may reduce the risk of chronic diseases such as heart disease and some cancers. Fruit is a good source of vitamin C and folate, and it also provides potassium, dietary fibre and carbohydrates. The edible skins are particularly high in dietary fibre. Research shows Australians eat only about half the recommended amount of fruit. It is recommended that at least two serves of fruit from a wide variety of fruit types be consumed daily. Many people drink too much fruit juice, which provides kilojoules but no dietary fibre, and may leave acidic residue on the teeth, increasing the risk of dental decay by eroding the tooth enamel.

MINIMUM RECOMMENDED NUMBER OF SERVES OF FRUIT PER DAY

	SERVES PER DAY		
	19–50 years	51–70 years	70+ years
Men	2	2	2
Women	2	2	2
Pregnant women	2	–	–
Breastfeeding women	2	–	–

	SERVES PER DAY				
	2–3 years	4–8 years	9–11 years	12–13 years	14–18 years
Boys	1	1½	2	2	2
Girls	1		2	2	2



Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

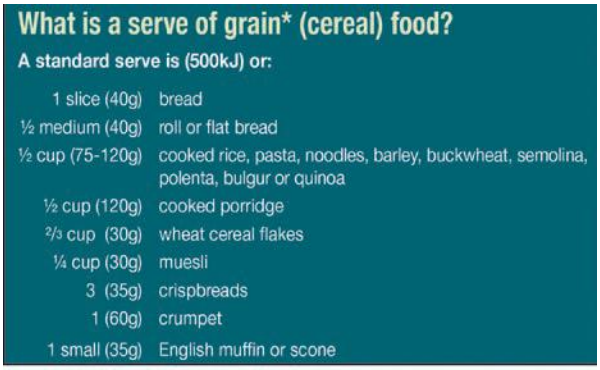
Wholegrain cereals

It is recommended that people eat grain (cereal) foods, such as wheat, oats, rice, barley, millet and corn, and choose mostly wholegrain and/or high cereal fibre varieties. Wholegrain products are valuable for the key nutrients they contain such as starch (carbohydrate), protein, dietary fibre, B group vitamins, vitamin E, iron, zinc and magnesium and phosphorus. Health experts suggest that consumption of cereal foods is associated with a reduced risk of cardiovascular disease, type 2 diabetes and excess weight gain and obesity. The dietary fibre contained in cereals also reduces the risk of colorectal cancer in adults.

MINIMUM RECOMMENDED NUMBER OF SERVES OF GRAIN (CEREAL) FOODS PER DAY, MOSTLY WHOLEGRAIN AND/OR HIGH CEREAL FIBRE VARIETIES

	SERVES PER DAY		
	19–50 years	51–70 years	70+ years
Men	6	6	4½
Women	6	4	3
Pregnant women	8½	–	–
Breastfeeding women	9	–	–

	SERVES PER DAY				
	2–3 years	4–8 years	9–11 years	12–13 years	14–18 years
Boys	4	4	5	6	7
Girls	4	4	4	5	7



Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Understanding the text

1. Draw a diagram to demonstrate the major causes of death and disability among Australians.
2. Why were the Australian Dietary Guidelines developed?
3. What is meant by 'energy-dense foods'? Explain why these foods are a problem if eaten in excess.
4. What is obesity and how is it defined?
5. Write a short comment to include on a health blog about the importance of maintaining a healthy weight. Include five tips for healthy eating that consumers could follow to ensure they achieve a healthy weight.
6. Explain why the Australian Guide to Healthy Eating is a valuable tool for Australians.
7. Why is it important to include plenty of vegetables in the diet?
8. Explain why it is important to limit the consumption of fruit juice.
9. Draw up a diagram to identify the nutrients found in cereals.
10. Explain how eating grain (cereal) foods can improve long-term health.

Meat, fish, eggs and/or plant-based alternatives

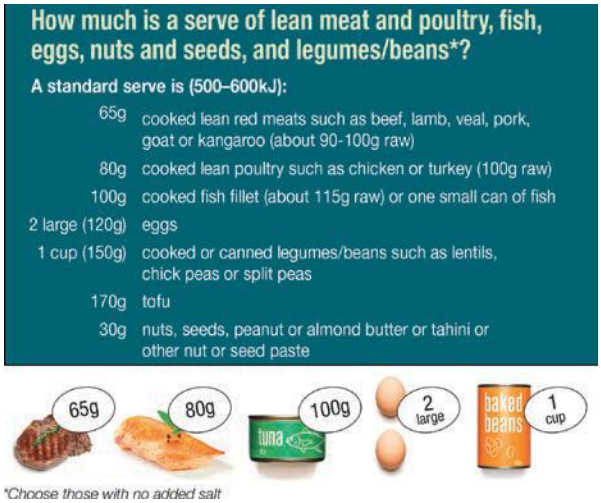
It is recommended that people choose lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans. These foods are an important part of the Australian cuisine, culture and lifestyle, but should be chosen carefully.

Lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans are protein rich, but some also supply important nutrients such as iron, iodine, zinc, vitamin B_{12} and essential fatty acids such as omega-3. Processed and cured meats such as sliced ham, bacon and sausages should not be eaten as substitutes for unprocessed meats as they are high in salt and saturated fat. The consumption of fish has been shown to reduce the risk of cardiovascular disease, and nuts are believed to lower cholesterol.

MINIMUM RECOMMENDED NUMBER OF SERVES OF LEAN MEATS AND POULTRY, FISH, EGGS, TOFU, NUTS AND SEEDS, AND LEGUMES/BEANS PER DAY

	SERVES PER DAY		
	19–50 years	51–70 years	70+ years
Men	3	2½	2½
Women	2½	2	2
Pregnant women	3½	–	–
Breastfeeding women	2½	–	–

	SERVES PER DAY				
	2–3 years	4–8 years	9–11 years	12–13 years	14–18 years
Boys	1	1½	2½	2½	2½
Girls	1	1½	2½	2½	2½



Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Milk, yoghurt and cheese and/or alternatives

Milk, yoghurt and cheese are rich sources of calcium, minerals, protein and vitamins including B_{12}. Studies show that consumption of these foods can protect against heart disease and stroke, and reduce the risk of high blood pressure, some cancers, and type 2 diabetes, and contribute to stronger bones. It is, however, important to choose low-fat varieties of these foods as full-fat varieties are high in saturated fat.

MINIMUM RECOMMENDED NUMBER OF SERVES OF MILK, YOGHURT AND CHEESE AND/OR ALTERNATIVES PER DAY, MOSTLY REDUCED FAT

	SERVES PER DAY		
	19–50 years	51–70 years	70+ years
Men	2½	2½	3½
Women	2½	4	4
Pregnant women	2½	–	–
Breastfeeding women	2½	–	–

	SERVES PER DAY				
	2–3 years	4–8 years	9–11 years	12–13 years	14–18 years
Boys	1½	2	2½	3½	3½
Girls	1½	½	3	3½	3½

Water

It is recommended that water should be chosen instead of soft drinks and drinks with added sugar or alcohol. Australia has an excellent water supply, it is inexpensive, safe and, when fluoridated, assists developing bones and teeth. Health studies show that drinks with added sugars have high kilojoule levels and increase the risk of excessive weight gain and increase the risk of dental cavities.

DIETARY GUIDELINE 3

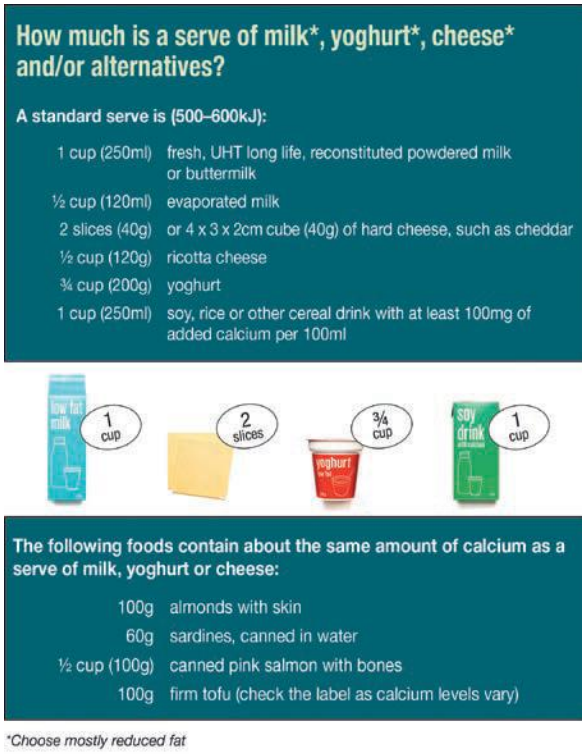
Limit intake of foods containing saturated fat, added salt, added sugars and alcohol.

a Limit intake of foods high in saturated fat such as many biscuits, cakes, pastries, pies, processed meats, commercial burgers, pizza, fried foods, potato chips, crisps and other savoury snacks.
- Replace high-fat foods containing saturated fats such as butter, cream, cooking margarine, coconut and palm oil with foods containing polyunsaturated and monounsaturated fats such as oils, spreads, nut butters/pastes and avocado.
- Low-fat diets are not suitable for children under the age of 2 years.

b Limit intake of foods and drinks containing added salt.
- Check labels for lower sodium options among similar foods.
- Do not add salt to foods in cooking or at the table.

c Limit intake of foods and drinks containing added sugars such as sugar-sweetened soft drinks and cordials, fruit drinks, vitamin waters, and energy and sports drinks.

d If you choose to drink alcohol, limit your intake. For women who are pregnant, planning a pregnancy or breastfeeding, not drinking alcohol is the safest option.



Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Foods outside the circle – discretionary choices

The foods and drinks that appear in the bottom right-hand corner of the Australian Guide to Healthy Eating are known as discretionary foods. **Discretionary food choices** are food and drinks, such as those high in energy, saturated fats, sugar, salt/or alcohol, that do not necessarily provide nutrients the body needs.

Foods in this section include sweet biscuits, cakes, desserts and pastries, processed meats and sausages, lollies, chocolate, pies, commercially fried foods, potato chips, salty snack foods, cream and butter and spreads, soft drinks, sports and energy drinks and alcoholic drinks. Many of these foods have low levels of essential nutrients and can contribute many kilojoules and displace other more nutritious foods. Most Australians consume too many of these foods instead of choosing foods from within the five food groups inside the circle.

Consumption of these foods and drinks that are high in saturated fat and contain added sugars and salt may be associated with an added risk of obesity and other chronic diseases such as heart disease, stroke, type 2 diabetes and some forms of cancer.

What is a serve of discretionary choices?

A serve of Discretionary choices provides about 500-600 kilojoule:

2 scoops (75g)	ice-cream
2 slices (50-60g)	processed meats, salami or mettwurst
1½ thick or 2 thin (50-70g)	regular sausages
½ snack-size packet (30g)	salty crackers or crisps
2-3 (35g)	sweet plain biscuits
1 (40g)	doughnut
1 slice (40g)	plain cake/small cake-type muffin
5-6 (40g)	sugar confectionary/small lollies
1 tblsp (60g)	jam or honey
½ bar (25g)	chocolate
2 tblsp (40g)	cream
1 tblsp (20g)	butter
1 can (375ml)	soft drink (sugar-sweetened)
¼ pie or pastie (60g)	commercial meat pie or pastie (individual size)
12 (60g)	fried hot chips
200ml	wine (2 standard drinks; but note this is often 1 glass for many Australian wines)
60ml	spirits (2 standard drinks)
600ml	light beer (1½ standard drinks)
400ml	standard beer (1½ standard drinks)

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Fats

All fats are high in kilojoules, but saturated and trans fats increase the risk of heart disease. These fats, which include butter, cream, coconut and palm oils, should be replaced by monounsaturated fats, for example olive oil, canola oil or oil from nuts such as cashew nuts and almonds, and polyunsaturated fats from oily fish, nuts such as Brazil nuts, and seeds, corn, safflower or soy oil.

Foods such as butter, cream, biscuits, cakes, pies, hamburgers, untrimmed meat, fried foods, pizza, potato crisps and full-cream milk and cheese all contain saturated fats. These foods should be replaced where possible with those that contain unsaturated fats. These fats are found in foods including nuts, avocados, fish, lean meat, poultry and eggs.

Shutterstock.com/Valentyn Volkov

Avocados are a good source of unsaturated fats.

Plant foods, including sunflower seeds, safflower seeds, soya beans and sesame seeds, contain mainly polyunsaturated fats. The best sources of monounsaturated fats include canola seeds, most varieties of nuts, rice bran and olives.

Shutterstock.com/Subbotina Anna

Olives are a good source of monounsaturated fats.

Sugar

Sugars occur naturally in fruit, vegetables and milk, but these are not the problem; it is the sugar added to drinks and foods to sweeten or preserve them that we must be wary of. Added sugars are energy dense but nutrient poor, and increase the kilojoule content

of the diet. They also reduce the percentage of foods consumed that are nutrient dense and come from the five food groups. Evidence shows that sugar-sweetened drinks increase the risk of excess body fat and weight gain, as well as tooth decay. The excess fat that surrounds key organs in the body, such as the heart and liver, is known as 'toxic fat'.

Artificially sweetened drinks, such as those containing aspartame, have little to no kilojoules, but are still a concern because they are acidic and may erode the tooth enamel.

Shutterstock.com/M. Unal Ozmen

Canned soft drinks are high in sugar.

Salt

Many Australians eat too much salt. Most of the sodium we eat comes from processed foods because salt is used in food processing to enhance the flavour of foods and to preserve them. It is important to cut down on sodium intake because as there is strong evidence that a diet high in salt increases blood pressure, which increases the risk of heart disease and stroke.

Shutterstock.com/Moving Moment

Potato crisps are high in salt.

DIETARY GUIDELINE 4

Encourage, support and promote breastfeeding.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Breastfeeding is encouraged for at least the first 6 months of a baby's life because breast milk is an ideal food for the growth and development of an infant, and provides many benefits for both mother and baby. Breast milk provides a unique mix of nutrients and substances that reduce the risk of infections and allergies such as asthma and eczema. Research shows that breastfeeding babies can reduce the risk of high blood pressure in childhood, and the risk of becoming obese in childhood, adolescence and adulthood. Lowering the risk of obesity will, in turn, reduce the risk of type 2 diabetes and stroke later in life.

DIETARY GUIDELINE 5

Care for your food; prepare and store it safely.

Source: *Australian Dietary Guidelines – Summary*, National Health and Medical Research Council, 2013

Although the Australian food supply is reliable, safe and nutritious, food poisoning can occur. Foods can become contaminated when they are not stored at the correct temperature, when raw and cooked foods are not separated, when tools and hands are unhygienic and when food handlers prepare food while unwell. Food must be prepared and stored safely.

For more details on food poisoning, see chapter 3 Food Poisoning.

Understanding the text

11 Why is it important to include lean meat and fish in the diet?

12 Explain why it is important to limit the amount of processed meat such as ham and bacon in the diet.

13 Draw up a mind map to demonstrate the value of including dairy products in the diet.

14 What are discretionary foods and why is it important to limit the serves of these foods?

15 List two examples of both monounsaturated fats and polyunsaturated fats.

16 Why are 'added sugars' considered to be a problem in the diet?

17 Explain what is meant by the term 'toxic fat'.

18 Outline the main benefit of reducing salt in the diet.

19 Why is breastfeeding considered to be important for the first six months of a baby's life?

20 Explain why the National Health and Medical Research Council has included Dietary Guideline 5.

Different dietary requirements across the life span

Although it would seem logical that two people who eat the same meals for breakfast, lunch and dinner would produce the same amount of energy, this is really most unlikely. Each person's energy requirement is unique to them. There are, however, a number of factors that influence the amount of energy each person requires.

The Basal Metabolic Rate (BMR) or the amount of energy the body requires to function will vary according to a person's build. The greater the size and the more muscle rather than fat a person has, the higher their BMR will be.

- Generally, the younger a person is, the more energy they require.
- Gender determines energy needs (males have a higher BMR than females).
- Children and adolescents who are growing rapidly have a higher BMR. Pregnant women, too, have an increased need for energy.
- People involved in heavy manual labour or athletes with intense training schedules also have an increased need for energy.

FOOD NEEDS AT VARIOUS STAGES OF THE LIFE SPAN

Regardless of our age, we all need the same nutrients to fulfil three main functions in the body:

- the growth and repair of body tissue
- the production of energy
- the maintenance of body processes and the prevention of disease.

As we grow and develop, the proportion of the nutrients we require changes depending on a number of factors, such as our age, gender, state of health, degree of physical activity and physical stature. Each life stage has specific dietary considerations.

Infancy and early childhood

The first two years of a baby's life are the most rapid period of growth that occurs in the life span after birth. Consequently, the nutritional requirements are the highest level required at any time during the life span. During the first six months of life, infants double their weight. By the time they reach 12 months, they have tripled their birth weight. One of the most important features of this period of life is that, although infants' nutritional needs are extremely high, their small body size means that they can only consume a small amount of food at any one time. Because they grow so rapidly at this stage, infants require a diet high in energy, protein and calcium to sustain the growth of bones and soft tissue.

iStock.com/marctranvn

Infancy is a period of rapid growth.

Childhood

From approximately two years to 11 years of age, children continue to increase in weight and height, but do so less rapidly than during their first two years. Therefore, only a gradual increase in nutrients is required during this stage and most foods consumed should be nutrient dense. Nutritional requirements during childhood can vary from child to child and will depend to a large degree on their level of activity.

Adolescence

From approximately 13 to 19 years of age, another period of rapid growth occurs, and young people grow significantly until they reach their adult height. Adolescence is also often a period of intense physical activity, so nutritional intake needs to provide a wide variety of nutrient-dense foods that will supply the energy, protein, vitamins and minerals needed to sustain the rapid growth and active lifestyle typical of this age group. It is also important for adolescents to consume a diet high in calcium and to exercise regularly. This enables peak bone mass formation and reduces the likelihood of osteoporosis in later life.

Adulthood

For adults, a well-balanced diet is needed to provide adequate nutrients for the maintenance and repair of all tissues in the body, as well as to repair damaged

iStock.com/DragonImages

Children continue to grow in weight and height during childhood.

tissues and to provide energy for physical activity. It is important for adults to consume a well-balanced diet that contains adequate amounts of protein, vitamins and minerals, and dietary fibre. As many adults lead a fairly sedentary lifestyle, energy-dense foods should be limited so that the energy in foods consumed does not exceed the energy expended in the form of exercise. Women continue to need a diet high in calcium, particularly as they reach menopause.

iStock.com/PeopleImages

Adolescence is also characterised by rapid growth.

Shutterstock.com/Rawpixel.com

Growth slows in adulthood but a well-balanced diet is still required.

Pregnancy

During pregnancy, there is a need to increase the intake of a number of nutrients, particularly protein, Vitamin C, B group vitamins, folate, calcium and iron. The increase in these nutrients is necessary to build new foetal tissue and maternal tissues including the growth of the placenta, as well as increasing tissue in the mother, including breast tissue. A diet high in folate is particularly important in the month before conception and for the first three months of pregnancy to reduce the likelihood of spina bifida and other neural tube defects in the baby. An increase in iron, vitamin C and B group vitamins is necessary for the increased blood supply. Additional calcium is required in pregnancy to provide for maximum bone growth and formation of tooth buds in the developing foetus. Extra energy supplies should come from nutrient-dense foods, and pregnant women should increase their serves of cereal foods, mostly wholegrain, from

Shutterstock.com/wavebreakmedia

A number of additional nutrients are required during pregnancy.

6 serves to 8½ serves per day. They also need to increase their protein foods by one serve a day from 2½ serves a day to 3½.

Lactation

During breastfeeding, mothers need a significant amount of nutrients and energy to cope with the demands of milk production. They need to eat and drink regularly and increase fluid intake by 750–1000 millilitres a day above basic needs.

Although energy is not a nutrient, it is required for metabolic processes and the physiological process of milk production. This extra energy should come from nutrient-dense foods. An additional requirement of the micronutrients calcium, folate, iodine and zinc are required during lactation and should also be supplied by nutrient-dense foods. Breastfeeding women should add extra serves of cereal foods, particularly wholegrain, from six serves to nine serves.

Late adulthood

One of the most serious health concerns of older Australians is that of increasing weight as they age, as energy needs reduce by 15–20 per cent. Therefore, during the later years of adulthood it is important to make sure that the diet is nutrient dense rather than energy dense and that older people continue to be active. People in late adulthood still need to consume a well-balanced diet containing protein, vitamins, minerals and carbohydrate with a low GI to enable the growth and repair of tissues and maintenance of all body systems. However, these nutrients are required in smaller amounts than at other stages of life and therefore smaller, regular meals are important.

Shutterstock.com/Halfpoint

In late adulthood, a broad range of nutrients are still required but in smaller amounts.

Gender

When puberty begins, there is a difference in the growth and development of males and females. Males generally tend to have a larger body size, broader shoulders, greater muscle mass and height, and therefore weigh more than females. This difference in body structure requires different amounts of energy. **Energy** is required in the body for metabolic processes, physiological functions, muscular activity, heat production, and growth and synthesis of new tissue. The figures in the following table represent average requirements for the Australian population. Energy needs for individuals vary depending on activity levels, body composition, state of health, age, weight and height.

The average amount of kilojoules required daily**		
Age	Male	Female
12–15 years	8 200–9 900 kJ	7 400–8 200 kJ
16–18 years	10 300–10 900 kJ	8 400–8 500 kJ
19–30 years	10 300* kJ	8 400^ kJ
31–50 years	9 900* kJ	8 000^ kJ
51–70 years	9 100* kJ	7 600^ kJ
Adults over 70 years	8 300* kJ	7 200^ kJ

** Based on a sedentary person.

* estimated energy intake for male 180cm tall, 71.3kg

^ estimated energy intake for female 170cm tall, 63.6kg

Based on material provided by the National Health and Medical Research Council. Used with permission from Nutrition Australia.

Physical activity

Physical activity is defined as body movements (light, moderate or vigorous) that causes the muscles to work and uses more energy than the person would be using if resting.

Low levels of physical activity are a major risk factor for a number of lifestyle diseases. People who have insufficient physical activity are at greater risk of becoming obese and therefore of developing cardiovascular disease and type 2 diabetes.

Australia's Physical Activity and Sedentary Behaviour Guidelines recommend that Australians must be active on most days of the week. For extra fitness, Australians should undertake some vigorous activities such as muscle strengthening at least twice a week and minimise sedentary activities.

iStock.com/ImageDB; iStock.com/emholk; Shutterstock.com/Artem and Olga Sapegin; Shutterstock.com/wavebreakmedia.

Sedentary activities include sitting and watching TV or lying down. These activities use very little energy.

Light activities include walking around school, walking to the shops or a leisurely walk in the park.

Moderate activities require some effort, such as gentle swimming, a social game of tennis or walking briskly.

Vigorous activities make you puff, such as jogging, aerobics, football or running to catch the train.

Types of physical activity

Activity levels can be ranked according to the amount of energy expended. The greater the amount of energy expended and the greater the number of physical activities the person engages in, the higher the activity level. Lower ranked sedentary activities use less energy than the more highly ranked strenuous activities. A healthy diet and physical activity are important to balance energy input and output according to the body's needs and to avoid weight gain.

Understanding the text

21 Identify the three main uses of food in the human body.

22 Why are the nutritional requirements the highest for an infant than at any other stage of the life span?

23 How do energy needs during childhood differ from those during adolescence?

24 Explain how the sedentary lifestyle of some adults can influence their energy needs.

25 Draw up a mind map to demonstrate the nutritional needs during pregnancy and for lactation.

26 Why is it important during later adulthood to consume a well-balanced diet, but with smaller amounts of food than at other stages of the life span?

27 Explain how the body uses its supply of energy.

28 Describe how gender has an impact on energy requirements.

29 How can activity levels be ranked?

30 Give an example of a vigorous activity and explain why it requires more energy.

Food allergies and intolerances

Recent data from the Australian Bureau of Statistics showed that almost 4 million Australians indicated they were allergic or intolerant to some type of food. The most common form of food allergy reported was to peanuts, while the most common food intolerance was to gluten and dairy.

FOOD ALLERGIES

A **food allergy** is an abnormal immunological reaction to food caused by a foreign substance, usually protein. Food allergies can cause an anaphylactic reaction and as a result are life-threatening. The foreign substance enters the bloodstream and an antibody is produced to fight it. Each time the foreign substance enters the body again, more antibodies are produced. Therefore, some food allergies can become more severe with more frequent exposure.

Foods associated with allergies

Foods that can cause allergies in some people include fish, shellfish, nuts, eggs and dairy foods. The implications for people who suffer from a food allergy are significant because they must make sure their food is not contaminated with even a hint of the food to which they are allergic. For example, a person who has an allergy to peanuts will suffer a severe reaction if they use an implement or storage container that has touched or held a food such as peanuts or peanut butter if it has not been thoroughly cleaned. People with a severe food allergy must read the ingredients list on all processed foods and even restaurant menus extremely carefully.

iStock.com/RedHelga

Shutterstock.com/COLOA Studio

Peanuts and prawns can cause allergies.

Allergy symptoms and management

The reaction caused by a food allergy is usually physical and occurs within an hour of exposure to the food. In most cases a food allergy is evident by symptoms such as hives, rashes, asthma, stomach pain or diarrhoea. In mild cases, a headache or swelling of the face or eyelids may occur. In extreme cases, even a small exposure can be life-threatening. The safest approach for people with a food allergy is to avoid any contact with this food.

If contact with a food to which they are allergic occurs, this can result in anaphylactic shock. Anaphylactic shock is a severe allergic reaction. In some people it can be caused by eating peanuts or other nuts, and needs urgent medical attention. Within minutes of exposure to this allergen, the person can have potentially life-threatening symptoms that may include difficulty breathing, swelling of the tongue and throat, and loss of consciousness. Sufferers need to carry an EpiPen or auto-injector containing life-saving adrenaline, and have an Anaphylaxis Action Plan. Family, friends, carers and work colleagues need to know how to use these aids in case of emergency.

FOOD INTOLERANCES

Food intolerance is a chemical reaction in the body to particular foods; it is not an immune response and so is not a true allergy. This reaction occurs in some people after eating or drinking certain foods. Food intolerance is much more common than food allergies. The reactions are similar to a food allergy, but are generally not life-threatening.

Foods associated with food intolerances

There is a wide range of foods to which some people are allergic, including chocolate, milk, wheat, mint, garlic, mushrooms, certain fruits, such as oranges, strawberries, pineapple and tomatoes, and fruit drinks containing preservatives.

Symptoms of food intolerance

The reactions to particular foods may occur soon after eating or may be delayed up to 48 hours after exposure to the food. Symptoms include skin rashes and hives, bloating and diarrhoea, and migraine. The severity of the symptoms usually decreases as the quantity of the food consumed decreases.

Some people are born with a condition that makes it impossible for them to metabolise a particular food or nutrient. They may lack the enzyme or be unable to produce the enzyme in sufficient amounts to digest certain foods or nutrients. Consequently, they develop diarrhoea if they eat that food. Food intolerance can also occur when someone does not have the biochemical mechanisms required to transport the enzyme or the nutrient involved around the body.

There are various food intolerances that are relatively common in our society. They include gluten intolerance and lactose intolerance.

Coeliac disease or gluten intolerance

Coeliac disease or gluten intolerance is a disease of the small intestine – the part of the digestive system responsible for absorbing nutrients. In a person who suffers from coeliac disease, the lining of the small intestine is damaged by gluten. People who suffer from coeliac disease are unable to absorb the protein gluten. Coeliac disease occurs in one in 2500 people. It is generally diagnosed during childhood, although the symptoms can occasionally occur in adults. The main symptoms of coeliac disease are diarrhoea and the failure of young children to gain weight as normal.

Foods associated with coeliac disease

Gluten occurs in wheat, rye, oats, triticale and barley. These cereals are widely used in food processing and therefore gluten is found in a range of commonly eaten foods such as breads, pizza, cereals, cakes, biscuits and pies. It is also a common thickener in processed foods. The removal of gluten from the diet allows the lining of the intestine to return to normal. However, the diet must be free of gluten rather than just low in gluten, and it must be maintained throughout life.

Symptoms of coeliac disease

The first symptoms of coeliac disease are caused when the villi in the intestine become inflamed and damaged. The villi are the finger-like folds that project into the small intestine and increase the surface area to a size equivalent to a tennis court. Damage to the villi prevents the absorption of other nutrients, leading to a state of severe malnutrition. In untreated coeliac disease, these villi are damaged by gluten and become flat and inflamed so that the area available for absorption of nutrients is reduced to the size of a card table. Because of this, unabsorbed food passes along the large intestine and out in the bowel motions. Diarrhoea can be severe and the abdomen may be bloated or distended by gas and undigested food.

Alternative foods for people with coeliac disease

Sources	Food products
Corn (maize)	Cornflour Polenta Pure corn chips Taco shells
Rice	Rice flour Rice pasta Rice cakes Rice crackers Puffed rice Rice noodles Rice bran Baby rice cereal
Buckwheat	Buckwheat flour
Soy	Soy bran
Lentils	Lentil flour
Sago	Sago flour
Tapioca	Tapioca flour
Arrowroot	Arrowroot flour
Potato	Potato flour

Lactose intolerance

Milk and other dairy products contain a sugar called lactose. For lactose to be digested by the body, it must first be broken down in the small intestine by the enzyme lactase. The level of lactase in the body declines after the person is weaned off an all-milk diet; in many people lactose cannot be absorbed by the body and passes through to the colon unchanged. If this occurs, bacteria within the colon cause the lactose to ferment and produce carbon dioxide, which may cause the bowel to retain water and produce symptoms of diarrhoea, bloating and abdominal pain.

This condition is called lactose intolerance. It is rare for Caucasians to develop lactose intolerance; however, it is quite common among people from Asia, Africa, the Middle East and Mediterranean countries, and among Indigenous Australians. Today, food manufacturers have developed milk with a reduced level of lactose for people who suffer from lactose intolerance. It is important for suffers to check the labels of processed products carefully for ingredients such as milk solids, whey and milk sugar.

Dlibrary

Lactose-free milk has been developed for people who are lactose intolerant.

Activity 2.2

Comparing gluten-free and wheat-based chocolate biscuits

Worksheets

Aim: To compare the physical, sensory and chemical properties of gluten-free chocolate biscuits with similar chocolate biscuits made from wheat

Method

1. Have samples of the following types of chocolate biscuits available for the comparison: Woolworths Free From Gluten Double Choc Biscuits and similar wheat-based chocolate wafer biscuits, for example Tim Tams.
2. Taste-test each type of biscuit and record your results in a table similar to the one that follows.
3. List the ingredients used to make each biscuit.
4. Note the cost of each biscuit.
5. Examine the method of packaging of each type of biscuit.

Results

	WOOLWORTHS FREE FROM GLUTEN DOUBLE CHOC BISCUITS	WHEAT-BASED CHOCOLATE WAFER BISCUITS
Appearance		
Aroma		
Flavour		
Texture		
Chocolate coating		
Ingredients		
Number of biscuits per packet		
Cost		

Analysis

1. Which biscuit had the most appealing sensory properties? Explain your decision, considering the chocolate coating and the biscuit.
2. Compare the ingredients used to produce each biscuit. Which ingredients have been used in place of wheat-based flour in the gluten-free biscuits?
3. Which biscuit represented the best value for money? Explain your answer.

Conclusion

Would the Woolworths Free From Gluten Double Choc Biscuits be a suitable substitute for someone suffering with coeliac disease? Justify your decision.

Christodoulou

Woolworths Free From Gluten Double Choc Biscuits

FODMAP intolerance

FODMAP is an acronym that stands for fermentable oligosaccharides, disaccharides, monosaccharides and polyols. It describes a group of, short-chain carbohydrates including lactose, fructose, fructans, galactans and polyols that may be poorly absorbed in the small intestine of some people.

This group of FODMAP carbohydrates are found in everyday foods. As FODMAP foods move along the digestive tract to the large intestine (colon), they draw water into the colon. These short-chain carbohydrates are then rapidly fermented (digested) by naturally occurring gut bacteria and this produces gas and other by-products.

Foods associated with FODMAP

High FODMAP foods include vegetables high in fructans, such as asparagus, beetroot and onions, and legumes such as baked beans and lentils, which are high in galacto-oligo-saccharides. Other high FODMAP foods include dairy foods such as milk and yoghurt, which are high in lactose; fruits that are high in fructose, such as apples and pears; and fruits containing polyols, such as apricots, cherries and plums.

Symptoms of intolerance to FODMAP foods

Each person has an individual threshold for tolerating FODMAP foods and some foods may pose more of a problem than others. Many people with digestive disorders, such as irritable bowel syndrome (IBS), find that FODMAP foods trigger symptoms including abdominal pain, cramping, bloating, excess gas, constipation and/or diarrhoea.

Understanding the text

31 What is a food allergy? List the most common types of food allergies.

32 Explain why food allergies are such an important health issue for someone who has this condition.

33 What procedures would you undertake if a friend who was allergic to peanuts had trouble breathing?

34 Explain how a food intolerance differs from a food allergy.

35 What is coeliac disease? Explain why a person suffering from coeliac disease must maintain a gluten-free diet for life.

36 List four foods that someone with coeliac disease must avoid.

37 What is lactose intolerance? How does this condition affect people who suffer from lactose intolerance?

38 Explain the meaning of the term 'FODMAP intolerance'.

39 Draw up a diagram to illustrate the types of foods linked to FODMAP intolerance.

40 Describe the effects of FODMAP intolerance on someone who has this condition.

PREPARING FOR EXAMS

Applying knowledge

Distinguish between food allergies and food intolerances.

Analysing information

Identify the similarities and differences between the Australian Dietary Guidelines and the Australian Guide to Healthy Eating.

What do you now understand about the Australian Dietary Guidelines and the Australian Guide to Healthy Eating?

Evaluating concepts

Explain why babies, adolescents and older adults have different energy requirements.

FOOD SPOILAGE

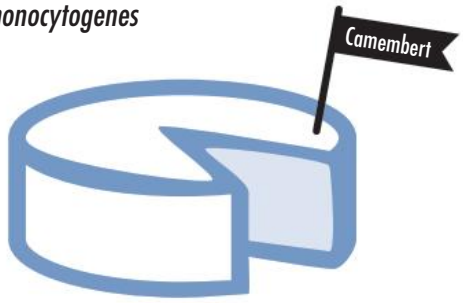
Is a reduction in the food quality identified by deterioration in the physical, chemical and/or sensory properties

FOOD POISONING

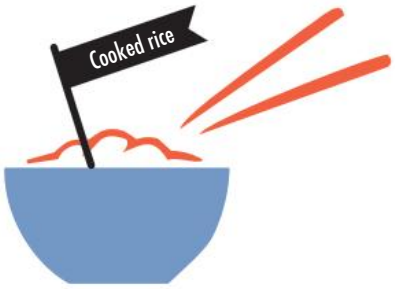
An illness caused by consuming foods contaminated by bacteria, toxins or viruses

EXAMPLES OF FOOD POISONING

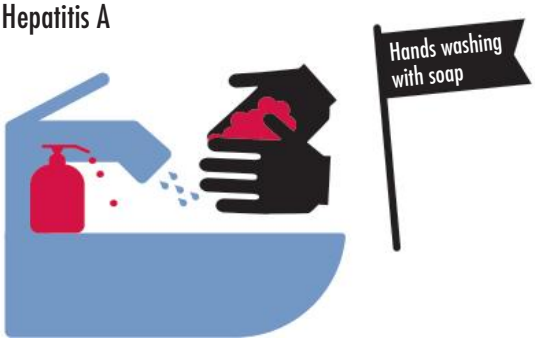
Listeria monocytogenes



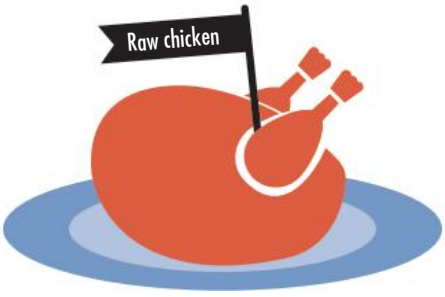
Bacillus cereus



Hepatitis A



Salmonella



3

FOOD POISONING

CONDITIONS FOR THE GROWTH OF BACTERIA

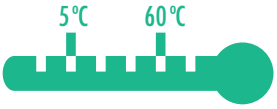
Low-acid environment

pH

Many require oxygen

A moist environment

The correct temperature between 5 °C and 60 °C



Sufficient time to grow

An appropriate food supply

PREVENTING FOOD POISONING

Personal hygiene

Design and cleanliness of premises

Garbage disposal

Pest control

Food purchased from reputable suppliers

Storage

KEY TERMS

Bacteria are single-cell microorganisms that can cause food poisoning when they are consumed live in food, or through the toxins they produce once they are ingested.

Cross-contamination involves the transfer of harmful bacteria from uncooked or raw food to food that has already been cooked or prepared.

Food poisoning is an illness caused by consuming foods contaminated by bacteria, toxins or a virus.

Food spoilage is a reduction in a food's quality identified by deterioration in its physical, chemical and/or sensory properties.

Viruses are minute microorganisms that are even smaller than bacteria.

Safe food

Food is safe only if there is no risk of harm to humans when they consume it. Although Australia has one of the safest food supplies in the world, there is still a high incidence of food-borne illness in the community.

According to data released in 2015 by the Food Safety Information Council, 4.1 million cases of food poisoning occur in Australia every year, costing an estimated $1.25 billion annually. More than 1 million people visit the doctor as a result of food poisoning and 32 000 people are hospitalised each year. Tragically, more than 90 people die each year as victims of a food-poisoning incident.

There are several reasons for the high incidence and reporting of food-borne illness:

- changing patterns of food consumption leading to more meals being eaten away from home
- greater diversity of food available
- emergence of new food-borne pathogens
- increase in the group of the population most at risk – elderly people are now a greater proportion of the total population
- better diagnosis and food testing
- enhanced surveillance and greater awareness of the incidence through the media.

Food spoilage

Food spoilage is a reduction in a food's quality, identified by deterioration in its physical, chemical and/or sensory properties. When the physical, sensory or chemical properties of a food, such as its nutrient content, colour, flavour, texture or appearance, begin to deteriorate or reduce in quality, the food is said to have spoilt. This means it is usually unpleasant to eat.

Food spoilage can be caused by several factors, including the action of naturally occurring enzymes in the food, or moulds or yeast, which can 'attack' the food. There will be clear changes in the physical appearance, texture, odour, colour or flavour of food that has spoilt. However, while the food may be less pleasant to eat, it will not generally be poisonous or cause any physical harm if consumed.

Some of the most common forms of food spoilage include:

- biscuits that have absorbed moisture from the air and become soft
- bread and cake that have become stale because they have lost moisture
- mould on cheese, jam, bread or citrus fruit
- milk that has developed a sour flavour and odour
- fruit that has become bruised and overripe
- vegetables that have become limp.

Food poisoning

Food poisoning is an illness caused by consuming food contaminated by bacteria, toxins or a virus. Food that can cause food poisoning may appear harmless and its physical properties of appearance, aroma, flavour and texture may be normal.

MICROORGANISMS THAT CAUSE FOOD POISONING

There are three groups of microorganisms that are closely linked to food poisoning and can make us very ill.

1 **Bacteria** are microscopic organisms. Bacteria that are linked to food poisoning are found in the faeces, mouth, nose and ears of all human as well as in infected sores. The bacteria that are most commonly linked to food poisoning are *Salmonella*, *Listeria monocytogenes* and *Campylobacter*. Most reported cases of food poisoning are caused by bacterial contamination.
2 Toxins are produced by some microorganisms including *Bacillus cereus*, *Clostridium perfringens* and *Staphylococcus aureus*. Toxins can survive cooking, even though the bacteria that produced them are killed.
3 **Viruses** are minute microorganisms that are even smaller than bacteria. Viruses don't grow in food but only a miniscule amount of a virus needs to be present in food to make us ill. Food-borne viruses include hepatitis A, norovirus and rotavirus.

BACTERIAL FOOD POISONING

Salmonella

How is food contaminated?

Salmonella causes an infection when food that contains the live bacteria from contaminated food products, water or hands is eaten.

What foods can be contaminated?

Raw meat, poultry, sausages, dried egg powder, mayonnaise

What is the effect of this food poisoning bacterium?

Salmonella is responsible for approximately 70 per cent of all food poisoning cases. It can be fatal in the elderly, the sick and the very young. Symptoms including nausea, diarrhoea, fever, headache and abdominal cramps can develop 12–72 hours after infection. The illness usually lasts 4–7 days.

Listeria monocytogenes

How is food contaminated?

Listeria infection is caused by eating food that contains *Listeria monocytogenes* bacteria. These bacteria are widespread in the environment and are able to grow in extreme conditions, including refrigeration, and can survive the pasteurisation process. They can contaminate certain high-risk foods that have not been prepared or stored hygienically or cooked thoroughly.

What foods can be contaminated?

Milk products, including soft cheeses such as brie, camembert and feta

What is the effect of this food-poisoning bacterium?

Listeria infection causes the food-borne disease *listerosis*, and can result in death. It can cause pregnant women to miscarry or lead to stillbirth. It can also affect people who have a weakened immune system, including the elderly.

TOXINS THAT CAUSE FOOD POISONING

Bacillus cereus

How is food contaminated?

Bacillus cereus is a spore-forming bacterium that produces toxins that cause food poisoning. These bacteria are normally found in the soil, but form spores and so are easily distributed in air and dust. The spores produce a tough protective coating that allows them to remain dormant for a long time. The tough external coating also means the spores are resistant to high temperatures and can therefore survive cooking.

What foods can be contaminated?

Cereals, especially boiled rice that has been left to cool at room temperature before use, and vegetables that are high in starch such as potatoes

What is the effect of this food-poisoning toxin?

Symptoms of *Bacillus cereus* infection include nausea, vomiting and diarrhoea, but are generally mild and only last about 24 hours.

VIRUSES THAT CAUSE FOOD POISONING

Hepatitis A

How is food contaminated?

Hepatitis A is usually transferred from the faeces of an infected person and contaminates food, drinks or food-handling equipment through poor personal hygiene practices. It can also be spread through contact with contaminated water. The virus can survive on the hands for several hours and resist removal by detergents. It is also able to survive in food kept at room temperature for a considerable length of time.

What foods can be contaminated?

Hepatitis A can contaminate fresh food that uses water in its production, such as fruit and vegetables, and frozen foods. Contaminated shellfish have also been linked to hepatitis A infections.

What is the effect of this food poisoning virus?

The main symptom of hepatitis A is a viral infection of the liver. It usually appears about 4 weeks after infection. The most common symptoms are fever, nausea, abdominal pain, dark urine and jaundice.

Activity 3.1

Salmonella food poisoning on the rise

Read the article below, then answer these questions:

1. Outline the increase in the incidence of salmonella food poisoning in both Victoria and Queensland in recent years.
2. Explain the difference between the microorganisms that cause salmonella food poisoning and those linked to hepatitis A food poisoning.
3. Outline three factors identified in the article that are linked to food poisoning.
4. Explain why microbial contamination presents as the highest risk for food poisoning.
5. List three food sources of salmonella bacteria identified in the article.
6. Research a recent incident of food poisoning that was a result of either salmonella poisoning or hepatitis A poisoning.
7. List five key points from the article that you find of interest.

FOOD-BORNE ILLNESS IN AUSTRALIA FALLING EXCEPT SALMONELLA, WHICH IS INCREASING

Despite more than 4 million Australians getting sick from contaminated food each year, the overall national rate of food poisoning is falling.

Except, that is, when it comes to salmonella.

A glance at Victoria's Department of Health figures for example, shows a 50 per cent increase in salmonella poisoning since 2012.

Queensland has seen a doubling of salmonella poisoning cases in the past 12 months.

Salmonella can be found in soil and water, and multiplies rapidly if food is not handled properly, including washing and refrigeration.

It is one of the reasons the independent Fresh Produce Safety Centre Australia New Zealand has released new guidelines for everyone involved in food to try to lift standards.

The case of hepatitis A in frozen berries imported by Patties Foods focused attention on food safety and experts agree it was preventable.

'It made 30 people ill. It could have had significantly greater impact if it wasn't nipped in the bud as it was,' said Richard Bennett, technology manager for the Fresh Produce Safety Centre and the Fresh Produce Marketing Australia New Zealand.

'Salmonella certainly, according to Department of Health, is one of the few areas of food-borne illness that's increasing.

'Overall, despite more coverage, food-borne illness is declining, from 4.3 million cases a year in 2000 to 4.1 million cases in 2010.

'Our supply chains have become more complex, our meal solutions have become a lot more complex. It's not just chops and three veg as it used to be.

'Shelf life is stretched to the limit.

'It's across all food items, and Australian consumers can expect to fall ill from food contamination every four or five years on average due to contaminated food.'

On its first anniversary, the Australian Fresh Produce Safety Centre Australia, New Zealand in Sydney has launched new guidelines to make growing and handling food safer.

'Our aim was to reinvigorate the safety, to give it greater focus, make information available to industry.

'The public perception of the main risk is pesticide or chemical contamination, but the main threat is microbial contamination,' said Joseph Ekman, technical director of the private fruit company, grower and distributor Fresh Produce Group.

'We're seeing an increased compliance on chemical use, and growers are more diligent,' he said. 'The main threat is microbial contamination because it can grow and multiply through the supply chain.'

'While salmonella bacteria are most commonly associated with livestock and chickens, they have also been responsible for food safety outbreaks associated with fresh produce,' says the new Food Safety Guideline.

'Large numbers of salmonella bacteria are shed in the faeces of infected humans and other animals both before and after symptoms of disease.

'In most cases, gastroenteritis symptoms are relatively mild, including cramps, nausea and diarrhoea, although severe disease and even septicaemia can occur in susceptible individuals.'

Food-borne illness in Australia falling except salmonella which is increasing, by Sarina Locke, © ABC, http://www.abc.net.au 13 August 2015

How bacteria reproduce

Food poisoning is usually caused by bacteria. Bacteria are single-cell microorganisms that can cause food poisoning if they are consumed live in food, or through the toxins they produce once ingested.

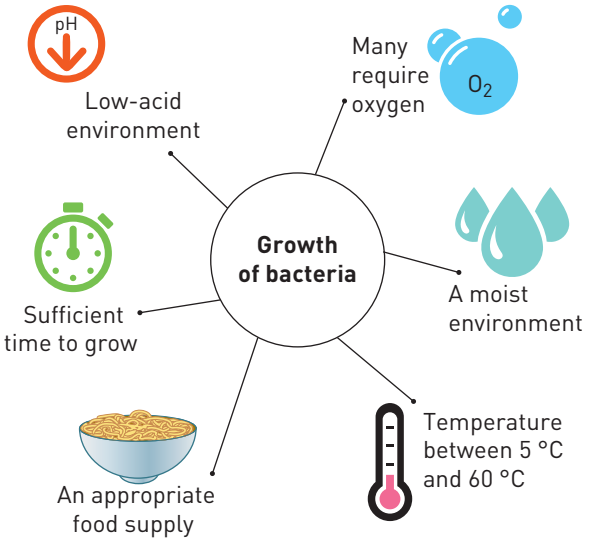
CONDITIONS REQUIRED FOR THE GROWTH OF BACTERIA

Bacteria are living organisms that grow best under specific conditions. To optimise their growth, bacteria need:

- a moist environment
- a temperature between 5 °C and 60 °C

- sufficient time to grow
- an appropriate food supply
- a low-acid environment.

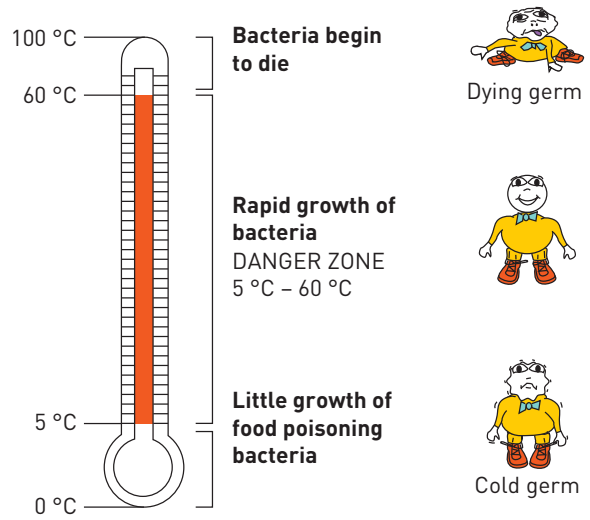
Many bacteria also require oxygen for growth.



Conditions required for the growth of bacteria

Temperature control

Most bacteria will grow, provided they have enough food and moisture, and if the temperature is between 5 °C and 60 °C. This temperature range is called the 'danger zone'. Bacteria can be inhibited from growing if they are too cold; that is, if food is kept in the refrigerator – or if they are too hot, by cooked food being kept in a heated environment.



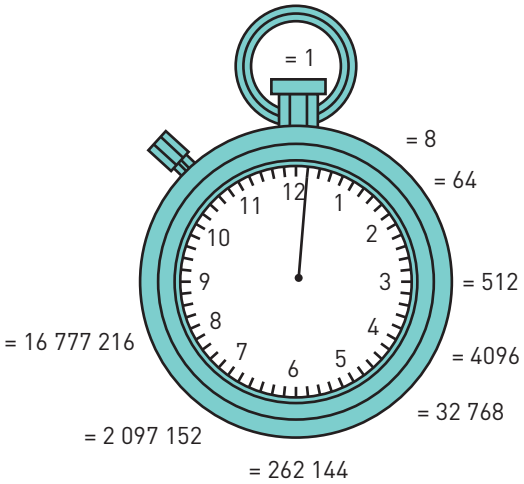
Danger zone

Moisture

Bacteria need moisture to be able to carry out their normal cell functions and to be able to divide and multiply. In a food preparation area, bacteria can grow in any moist environment, such as on wet dishcloths and damp tea towels, in water left lying in the sink or in equipment and utensils that haven't been dried properly.

Time

Given ideal conditions, one bacterium can reproduce itself by splitting into two and dividing every 20 minutes. This process of division is called 'binary fission'. Therefore, one bacterium can multiply to produce approximately 17 million bacteria within eight hours.



Rate of reproduction of bacteria over an eight-hour period

Food supply

Bacteria grow much more quickly in some foods. These foods are called 'high-risk foods' because they are the foods most likely to cause food poisoning. Foods that are high in protein or starch and contain moisture allow bacteria to grow more quickly.

By contrast, food-poisoning bacteria do not easily grow in foods that are acidic or high in fat. Foods that have a high concentration of sugar, salt or vinegar also inhibit the growth of disease-causing bacteria.

High-risk foods include foods such as milk and milk products such as soft cheeses and cream, meat, fish, poultry, raw eggs and egg products, cooked pasta and rice, coconut, gelatine, ice-cream and pastries.

Cooked rice | Milk

Soft cheese | Raw chicken

Shutterstock.com/Elena Eliseeva; Shutterstock.com/Gts; Shutterstock.com/Mycolis; iStock.com/YinYang.

High-risk foods for food poisoning

Low-risk foods are foods such as margarine, butter, cooking oil, citrus fruit, vinegar, salted fish, jams and most vegetables.

Low-acid environment

Bacteria require a low-acid environment to flourish; that is, a pH above 4.6, such as for protein-based foods, and are less likely to grow in highly acidic foods such as fruit, vinegars, jams and most vegetables.

Oxygen supply

Many bacteria need oxygen for survival and in order to reproduce. Food preservation techniques such as canning, bottling, dehydration and vacuum packaging rely on the removal of oxygen to extend the shelf life of foods.

Understanding the text

1. Outline three effects of food poisoning on the community.
2. Briefly describe the three main causes of food spoilage.
3. Explain the difference between food spoilage and food poisoning.
4. Draw a diagram of the main types of bacteria that cause food poisoning and identify the foods they contaminate.
5. Explain how cereal-based dishes such as fried rice can lead to food-poisoning incidents.
6. How does hepatitis A cause food poisoning? What effect does hepatitis A have on the body?
7. List four important conditions required for the growth of bacteria.
8. Why is the presence of moisture an important condition for bacteria to reproduce?
9. Describe the best method of keeping food out of the 'danger zone' and explain why this method is an important food safety consideration.
10. Explain why some foods are a high risk for food poisoning and others are considered to be low-risk foods.

Preventative practices for a safe food supply

PREVENTING FOOD POISONING

Food is very easily contaminated, so it is essential to establish rigorous food safety practices to minimise the risk of food poisoning. An effective food safety program covers a wide range of areas; for example, personal hygiene, the design and cleanliness of food premises including garbage and pest control, the purchase and storage of food supplies, safe food-handling practices, and measures to avoid cross-contamination.

Personal hygiene

The first step in the preparation of safe food is ensuring that anyone handling food follows sound personal hygiene practices:

- Wash hands thoroughly before handling or preparing food, particularly after using the toilet, blowing your nose or coughing, handling raw food, eating, smoking, touching pets, or handling money or rubbish.
- Do not wear rings or any other jewellery.
- Keep fingernails short and do not wear nail polish or nail extensions when handling food.
- Wear a clean apron or other protective clothing.
- Tie hair back or wear a hat or hairnet to prevent loose strands of hair contaminating food products.
- Sanitise cuts and cover with a clean, waterproof dressing.

Design of premises

In the food industry, best-practice procedures ensure that the premises where food is prepared, stored and sold are well designed and maintained in a clean and sanitary manner. These procedures help to protect food and make sure that it is free from contamination. The main considerations for food manufacturers or food retailers are:

- establishment of logical workflow – efficient movement from raw ingredients to finished product. This includes the safety of staff at each workstation
- separate areas for the preparation of raw and cooked food
- appropriate facilities to enable staff to maintain a high level of personal hygiene. An example is foot-operated or magic-eye washbasins
- provision of workstations designed for easy cleaning and maintenance
- adequate supply of hot and cold water
- temperature control for refrigeration, cooking and food display
- adequate lighting, ventilation and exhaust facilities
- appropriate pest control methods and garbage disposal.

Cleanliness of premises

One of the most common causes of food contamination is poor cleanliness of the premises and the equipment used in food preparation. It is essential that premises and equipment are cleaned when changing from the preparation of one type of food to another, as well as at the end of each food preparation cycle. One of the most important rules to remember is 'Clean as you go'.

Cleaning must cover all areas of the food preparation area, including the walls and floors, all fixtures and fittings such as benches, and all food preparation equipment, including stoves and mixers, and all crockery and cutlery.

It is essential to use detergent or a chemical sanitiser and very hot water (above 82° C) to make sure all bacteria are destroyed.

imagefolk/Cultura

Cleaning in a commercial kitchen

Garbage

It is important to remove garbage regularly because it can contaminate food, smell bad and attract pests. Good practice in this area involves:

- ensuring garbage containers are fly-proof and rodent-proof, and do not leak or absorb liquids
- using containers that are easily cleaned and have tight-fitting lids
- removing garbage and waste from food-handling areas and workstations as often as necessary – at least daily
- keeping garbage containers in good repair and cleaning them away from food preparation areas
- cleaning garbage storage areas regularly.

Pest control

Pests such as insects and rodents can spoil food products by damaging the food itself or the package surrounding the food. Insects may not eat large quantities of the food, but once damaged, microbial growth is more likely to occur. Insects such as weevils spoil cereals and dried fruit by eating holes in the packaging material, leaving their faeces and body parts in the food and producing 'off' odours in the food. Rats and mice damage and contaminate food by gnawing and chewing and making body contact with the product and contaminating it with their faeces. They will eat anything, but prefer meat, fruit, vegetables and bakery goods.

Three strategies can be used to prevent insect and rodent infestation:

1 **Build them out** – Seal all unnecessary gaps around fittings, in walls and floors of the building, and ensure there is adequate space for cleaning.
2 **Starve them out** – Store food correctly, clean up all spills immediately, and clean food preparation areas effectively so there is no source of food for the pests.
3 **Chase them out** – If pests enter the premises, baits can be used. These are toxic and should be handled and stored carefully to avoid contaminating food.

iStock.com/ ottoflick

Pest control will help prevent food contamination.

Purchasing food

Contamination of food supplies can sometimes occur at the point of manufacture or processing, or in the transportation of food. It is therefore essential to purchase food only from reputable suppliers who implement correct food handling and storage procedures. To ensure the food you purchase is safe and free from contamination:

- check the use-by or best-before date
- examine the food for any sign of contamination, such as a rancid smell or mould
- look for signs of damage on packaging and cans
- ensure that frozen foods remain frozen and do not show signs of thawing
- check that the food is transported in a registered food transport vehicle that is kept hygienically clean and that the food is transported at the correct temperature.

Storage

Storing food correctly is one of the key factors in preventing food poisoning. Shelf life is the period of time in which the quality of a food product remains satisfactory after processing and purchase. The shelf life of food will vary depending on the physical and chemical properties of the food and the methods of processing, packaging, distribution and storage.

Fresh foods or 'perishable' foods, including liquid milk, yoghurt, fresh meats, fish, poultry and fresh fruit and vegetables, are fragile and so their shelf life is short, particularly if there is poor temperature control during storage. These foods must be stored in refrigerated conditions to slow down changes that cause food to spoil and prevent growth of bacteria.

Refrigeration

Refrigeration is the cooling of foods to below 5 °C. This reduction in temperature delays the deterioration of food and slows down the microorganism growth and enzyme activity. The lower the temperature, the slower the chemical changes in food and the slower the microbial growth. Refrigeration does not kill the microorganisms; once the food has been returned to room temperature, they will be reactivated and can continue to reproduce. Cover all cooked foods and store them on a shelf above uncooked foods. This minimises the risk of food-poisoning organisms being transferred from uncooked to cooked foods through dripping of moisture.

Tips for storing food safely

- Store perishable food such as meat, fresh milk and fresh fruit and vegetables in the refrigerator below 5 °C.
- Separate cooked food and raw food in the refrigerator.
- Store raw food on a lower shelf so that juices cannot drip onto cooked food.
- Cover all food placed in the refrigerator.
- Store poultry separately from fresh meat and other protein foods to avoid cross-contamination.
- Make sure all foods that have a strong odour are firmly covered.

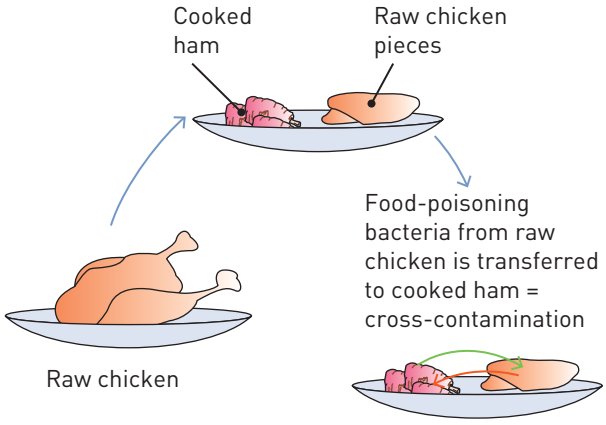
- Cool hot food for 20–30 minutes before placing in the refrigerator to avoid affecting the holding temperature of the refrigerator.
- Store frozen foods below –18 °C.
- Store non-perishable foods such as flour, sugar, canned and dry packaged food in a cool, dry place and above floor level.
- Check the seals on cans and do not store cans that are misshapen, swollen or dented because these are signs that they may have become contaminated.
- Check that all food is clearly labelled and includes a use-by or best-before date.
- Rotate all food in the refrigerator, freezer or pantry so that food is used on a 'first in, first out' system.
- Do not store cleaning materials near food.

PREVENTING CROSS-CONTAMINATION

One of the most common causes of food poisoning is through the cross-contamination of food. **Cross-contamination** of food involves the transfer of harmful bacteria from uncooked or raw food to food that has already been cooked or prepared. Cooking kills most of the harmful bacteria present in food. However, if raw food comes into contact with food that has been cooked, bacteria may be transferred to the cooked food.

Major risks in cross-contamination

- **Storing raw and cooked ingredients together** – Processed or prepared foods should be stored in sealed containers above raw foods. Raw vegetables that contain microorganisms that might cause food poisoning should also be stored separately in refrigerated areas.
- **Raw food such as chicken** – Cutting raw foods such as chicken on a chopping board can deposit salmonella bacteria in cracks or crevices on the board. Salmonella can then be transferred to a high-risk food, such as cooked meat, if another food is prepared on the same board and the board is not washed between food preparation tasks. The use of coloured boards for particular food types in commercial food preparation kitchens is one way in which health authorities have tried to overcome the problem of cross-contamination; for example, white boards for dairy products, red for raw meats and green for fruit and vegetables.
- **The sink** – Bacteria can transfer from one food to another when rinsed in the sink if the sink is not carefully cleaned between uses.
- **Double dipping** – Using a spoon to taste food and then using the same spoon to mix or stir the food allows bacteria present in the mouth to be transferred to the food that is being prepared. Equally dangerous is using one spoon to taste one food and then another product.
- **Tea towels** – These should only be used to dry dishes. They should not be used to dry dishes and then to wipe chopping boards, hands or benches or to cover food.

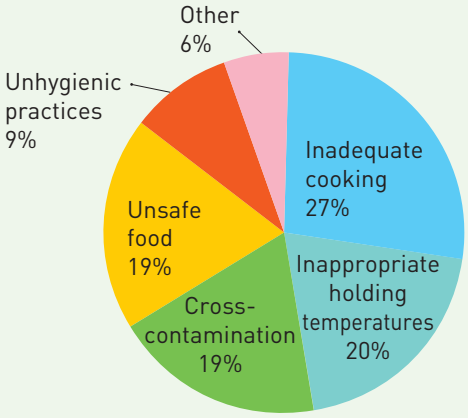


How cross-contamination can occur

Activity 3.2

Causes of food-borne illness in Australia

Look at the graph below and answer the questions that follow.



Causes of food-borne illness in Australia

1. List five unhygienic personal practices that may account for 9 per cent of food-borne illnesses.
2. Explain how each of the following foods may become unsafe:
   - fresh chicken
   - uncooked salad vegetables
   - cooked rice
   - beef and vegetable casserole left on the bench to cool after cooking.
3. Explain how cross-contamination can be prevented when preparing food.
4. Correct holding temperatures are critical when storing cooked food. What safe holding temperatures are necessary for keeping lasagne hot, ready for serving?
5. What temperature is necessary to store the lasagne safely in the refrigerator for reheating later?

Activity 3.3

Worksheets

Examining food poisoning

More than 4 million cases of food-borne illness occur in Australia each year. Many of these could be prevented with safe storage and preparation of food and sound hygiene practices. Read the information in these news items and answer the questions that follow each item.

NEWS ITEM 1

A restaurant was fined after a council environmental health officer carrying out an inspection found containers of raw chicken and pork stored on the floor, uncovered food exposed to potential contamination and other food stored in plastic shopping bags.

1. Describe the symptoms someone might suffer if they had eaten food from this restaurant.
2. Explain how the raw chicken and pork should be stored safely.

NEWS ITEM 2

A mayonnaise spread made at an inner-city restaurant was found to contain salmonella strains that led to one death and 106 people becoming infected with gastroenteritis. The spread was made from oil, raw eggs and garlic flakes, and was used on the restaurant's pork bun rolls and chicken rolls. The pork buns rolls were prepared with one pair of tongs used to pick up the different ingredients. The buns were stored at room temperature during summer.

1. Identify the ingredient in the mayonnaise that is likely to cause the food poisoning outbreak. Explain why this is a high-risk ingredient.
2. What safety precautions would need to be put in place when serving and storing the prepared rolls?

NEWS ITEM 3

Eleven people contracted food poisoning at a charitable event in Victoria from meat-filled pancakes that were not cooked thoroughly. Nor were they stored and transported at correct temperatures.

1. Outline the risk factors involved in preparing and cooking pancakes at a charitable event.
2. Describe how the ingredients for the pancakes should have been transported to make sure they were safe to consume.

NEWS ITEM 4

Six people at a party in Victoria suffered food poisoning from either undercooked chicken or cross-contamination of ready-to-eat foods from raw chicken.

1. Which bacteria are likely to have been the main cause of this incident of food poisoning?
2. Describe how the bacteria would have been able to multiply.
3. How could cross-contamination have been prevented when serving chicken at the party in Victoria?

Understanding the text

11 Explain how well-designed food premises can help to prevent food spoilage and food contamination.

12 Outline two safe practices in handling garbage.

13 Explain why it is important for food premises to take strict pest control measures.

14 List four ways to check that food is safe to purchase.

15 Explain what is meant by the term 'shelf life'. Why do shelf-stable foods have a prolonged shelf life?

16 How does refrigeration minimise the likelihood of food contamination?

17 How does the principle of stock rotation operate in a food business?

18 Draw a knowledge map to summarise the main safe food-handling practices.

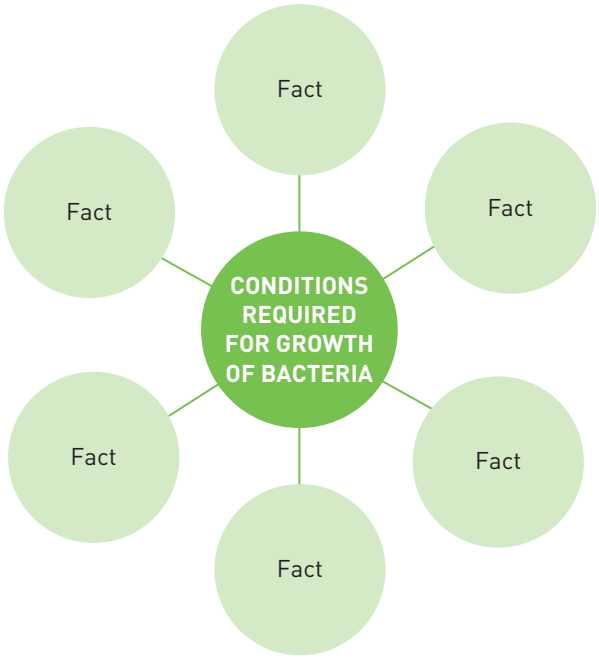
19 What is meant by the term 'cross-contamination'?

20 Outline three of the main causes of cross-contamination of food.

PREPARING FOR EXAMS

Applying knowledge

Complete the diagram below to demonstrate the conditions required for the growth of bacteria.



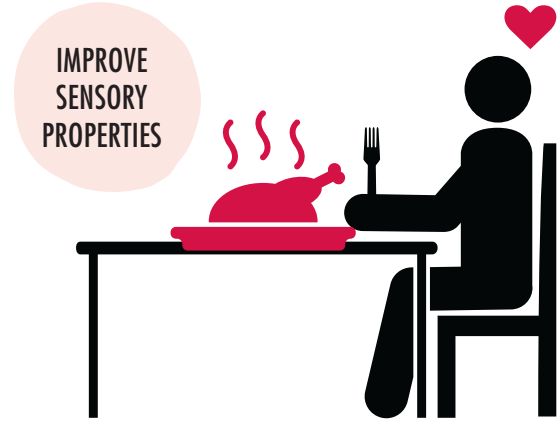
Analysing information

Inadequate cooking leads to 27 per cent of food-borne illness in Australia. Explain why inadequate cooking of food leads to so many cases of food-borne illness.

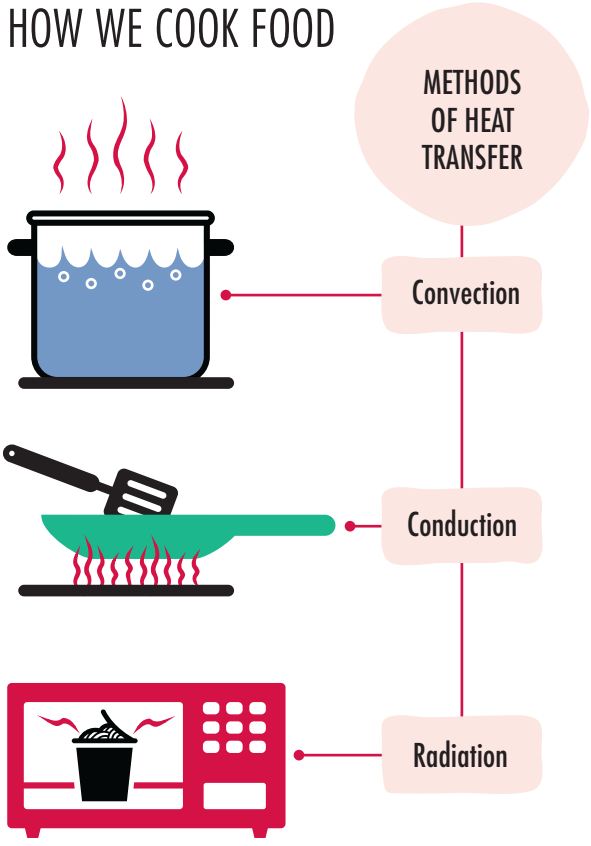
Evaluating concepts

Rank the factors involved in preventing cross-contamination in food from 'most important' to 'least important'. Justify the ranking you give to each of the factors.

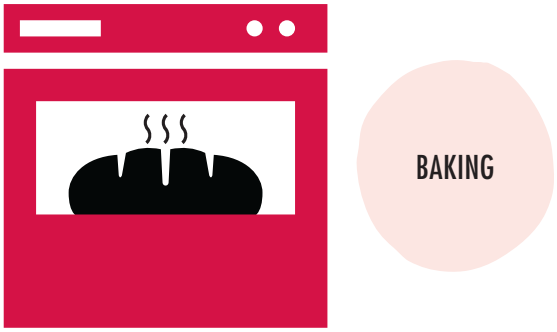
WHY WE COOK FOOD

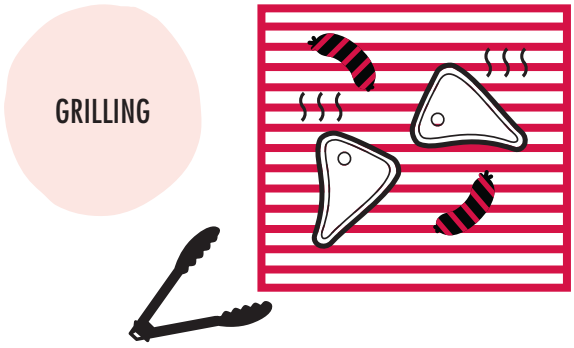


HOW WE COOK FOOD



DRY METHODS OF COOKING

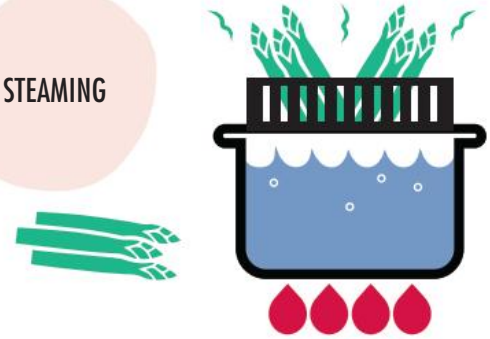




MOIST METHODS OF COOKING

BOILING

STEAMING



BLANCHING

STEWING

POACHING

4 COOKING FOOD

KEY TERMS

Baking is the cooking of food in an oven without the addition of fat or oil.

Blanching is a method of partly cooking food by plunging it briefly into boiling water.

Boiling is cooking food in water at 100 °C.

Conduction occurs when heat is transferred from one molecule to another by collision or movement.

Convection occurs when the molecules in liquids or gases move from a warmer area to a cooler one.

Cooking is the application of heat to ingredients to cause physical and chemical changes.

Frying is cooking food by total or part immersion in fat or oil that is heated to temperatures between 150 °C and 220 °C.

Grilling is a fast, dry method of cooking that uses intense heat radiated by an electrical element, a gas flame, glowing charcoal or an open wood fire.

Poaching is a method of cooking delicate foods in liquid at a temperature just below simmering point (85 °C).

Radiation is the transmission of heat energy in the form of rays, as occurs during grilling and microwaving.

Roasting is the cooking of food in an oven using an amount of fat or oil.

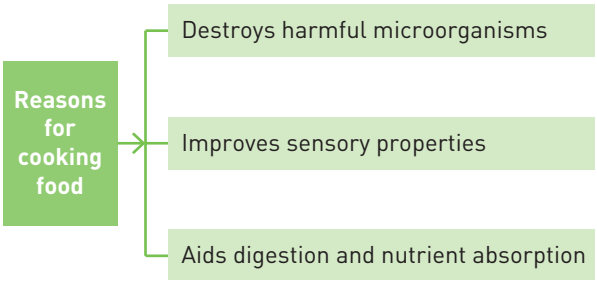
Simmering is cooking food at a temperature of 85 °C.

Steaming is cooking food in the steam from boiling water.

Stewing is a long, slow method of simmering food in a small amount of liquid.

Why do we cook food?

The aim of all methods of food preparation is to produce food that is palatable, appetising and attractive – food that people will want to eat. Cooking involves the transfer of energy from a heat source to food and makes it more enjoyable to eat. On the other hand, some foods are more appealing when eaten raw, such as salad vegetables.



Reasons for cooking food

Cooking destroys harmful microorganisms in food and some of the enzymes that cause food to spoil, and so it extends the life of the product.

The physical and chemical changes in food that take place during cooking make eating, digesting and absorbing nutrients easier and more efficient. For example, there is a lot less chewing required to eat cooked meat because the muscle fibres have been tenderised, and in cooked vegetables the cellulose has been softened.

The sensory properties of food are usually improved during cooking. When we think about the appearance of food, cooking can brighten the colour of vegetables or create a golden crust, for example on the outside of potatoes that have been fried. The aromas that are released when onions and garlic are sautéed and bread is baked are very enticing and increase the flow of digestive juices. The flavour of other foods is greatly enhanced during cooking; for example, when potatoes are cooked, the starch is softened, which makes them taste better. Using a range of cooking methods produces a variety of textures within a meal and makes eating more interesting.

How food is cooked

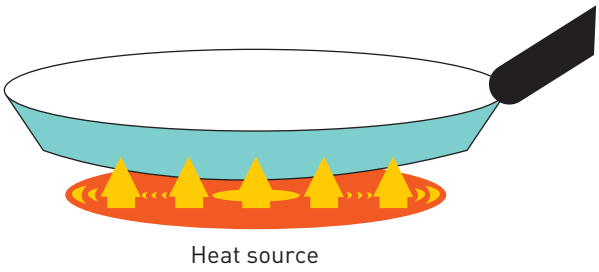
Cooking is the application of heat to ingredients to cause physical and chemical change. Energy is transferred from a heat source to food to alter its properties. Techniques or cooking methods, such as **boiling, baking and frying,** achieve their results by using the different mediums of water, air and oil, and draw on different principles of heat transfer to cook foods. There are three methods of transferring heat to food: **conduction, convection and radiation.**

CONDUCTION	CONVECTION	RADIATION
Direct contact with heat passing through two materials	Heat transferred by the movement of fluids or air against a colder material	Heat transferred by electromagnetic waves
Sautéing Pan-frying	Dry methods: • baking/roasting • deep-frying Moist methods: • boiling • simmering • steaming • poaching • braising • stewing • water bath or bain-marie	Grilling Barbecuing Microwaving
Steak touching frying pan, frying pan touching electric or gas burner	Hot air or oil moving around the outside of food Hot water moving around and touching the outside of food	• Infrared radiation from an electric element or charcoal in a grill or barbecue • Electromagnetic radiation in a microwave oven

CONDUCTION

Conduction is the process of cooking food by direct heat. Conduction of heat occurs when energy is moved from one particle to another by collision or movement. Heat is conducted through the base of a frying pan by direct contact with the gas flame or the electric element of the cooktop. As the heat is absorbed on the surface of the food, it is also transferred by conduction to the inside of the food, cooking it through.

Frying pans are made of metal, which is a very good conductor of heat and so enables quick transfer of heat to the food. From a safety perspective, the spoons and handles of some cooking utensils are made of wood or plastic because these materials are poor conductors of heat and remain cool to the touch during the cooking process.

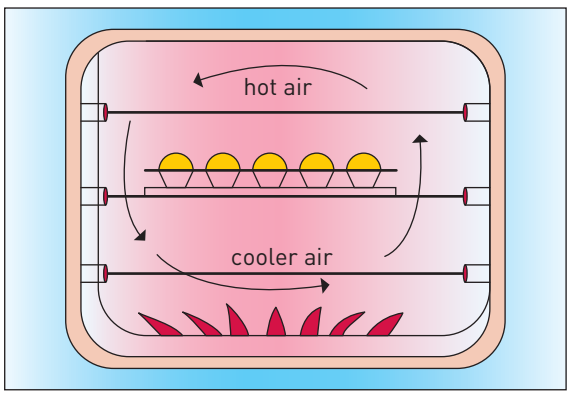


The metal base of a frying pan conducts heat.

CONVECTION

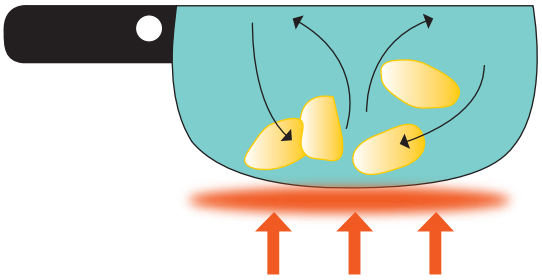
Convection is the transfer of heat in liquids and air, which is brought about when the molecules move from a warmer area to a cooler area. The circulating hot liquid or air against the cold food causes the two materials to undergo conduction to transfer the heat.

When baking or roasting, the hot air in the oven transfers the heat. Convection currents are formed as the air in the oven is heated, the hot air rises and forces the colder air at the top to flow down the sides of the oven, creating a current. In a traditional oven, the top is the hottest zone and the bottom of the oven is always cooler. In fan-forced ovens, a fan is used to distribute the heat evenly throughout the oven. The high temperatures of dry methods of cooking allow for chemical reactions to occur. These include the Maillard reaction, dextrinisation and/or caramelisation, and they develop the flavours, aromas and golden-brown colours.



Convection currents in a traditional oven

Moist methods of cooking, such as boiling, simmering and steaming, involve water as the material that transfers heat via conduction. For example, when boiling potatoes, the hot water in the saucepan moves against the surface of the cold potatoes. As the water molecules absorb energy from the heat source, they heat up and rise, then sink again when they cool off.



Convection currents in a liquid

Activity 4.1

Testing your oven

Oven temperatures can become uneven over time, so it is advisable to check whether there are any hot spots to make sure your food is baked evenly. Complete this activity to check the temperature of your oven to see if it is accurate and reliable when baking; this will minimise poor results during production work.

Aim: To check the evenness of heat in your oven

Equipment

- oven tray
- baking paper
- a slice of white bread

Worksheet

Method

1. Preheat oven to 180 °C.
2. Cover an oven tray with baking paper.
3. Remove the crusts from a slice of white bread, and cut the bread into 2-centimetre cubes.
4. Spread the cubes of bread over the oven tray and bake for 10 minutes in the preheated oven.

5 The bread should be evenly browned if the oven temperature is accurate and even. If the bread has browned unevenly and looks patchy, this indicates that your oven temperature is incorrect. You may need to have the oven serviced by a technician.

Results

Using the colour variation on your cubes of bread, sketch a diagram of the heat zones in your oven, shading the hottest area in the darkest colour and the coolest in the lightest colour.

Analysis

Was the oven temperature even? If you were cooking a tray of biscuits in your oven, would you need to turn the tray halfway through the cooking time? Explain your answer.

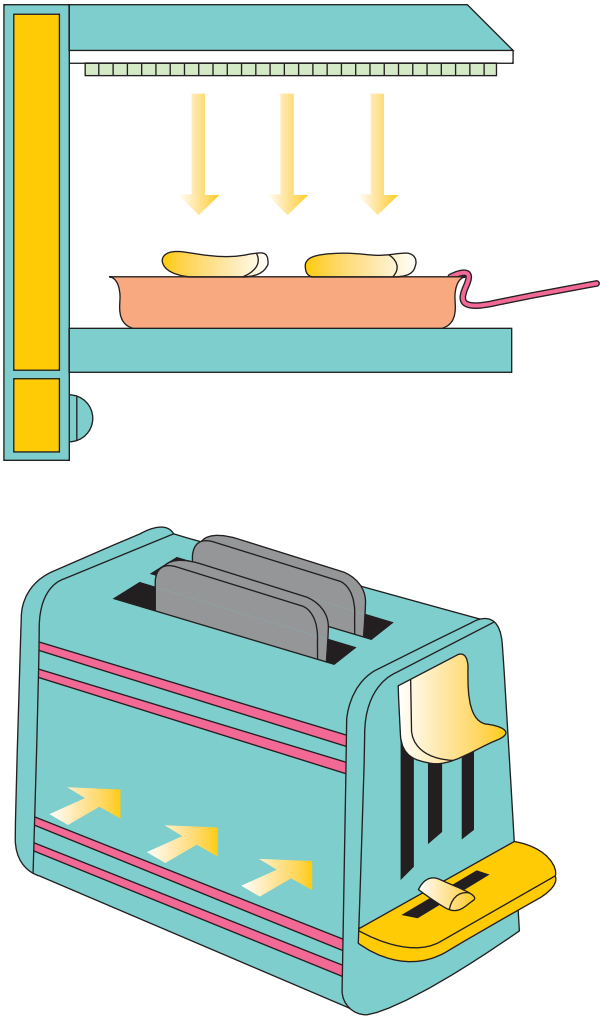
Conclusion

When cooking in the oven you tested, what will you need to take into account when baking in this oven in the future?

RADIATION

Radiation is the transmission of energy by wave motion in the form of electromagnetic waves. In cooking, we use infrared radiation to grill, barbecue or toast food and electromagnetic radiation when heating food in the microwave oven. The heat energy can be reflected or absorbed by the food.

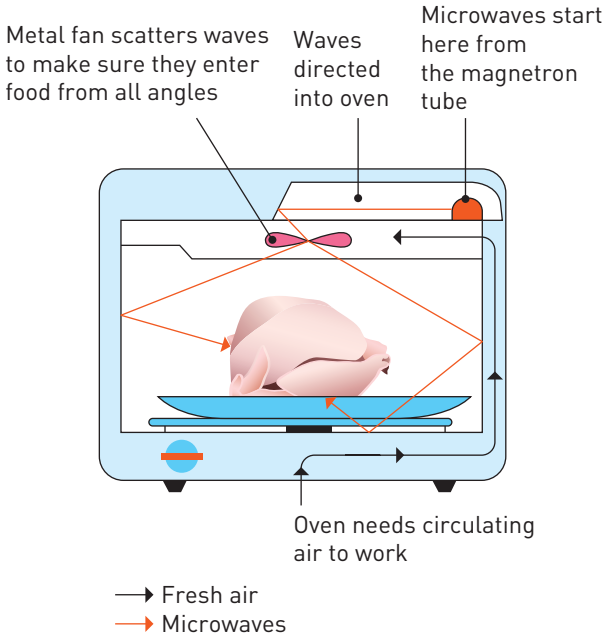
When the waves fall on food they cause the molecules in food to vibrate, which causes the food to heat up and subsequently cook. The food does not come into contact with the heat source, but the waves are absorbed on the surface and the food is cooked by conduction of heat through the food. Radiation is used when food is cooked under a grill or in a toaster.



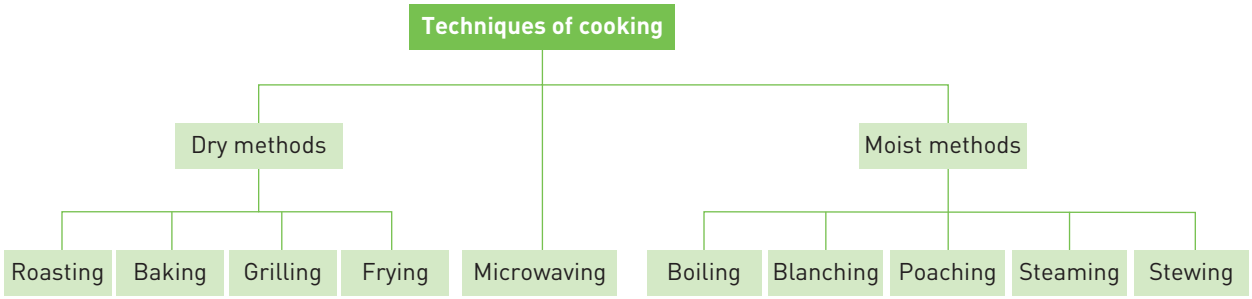
Transfer of heat by radiation in a griller and a toaster

Microwave cooking

In microwave cooking, energy is transferred to the food by electromagnetic radiation. The microwave oven contains a magnetron, which converts electricity to microwaves by rapidly switching electromagnets on and off to set up a wave pattern. The microwaves are channelled into the oven space by the waveguide, but as they cannot penetrate the metal lining of the oven, they bounce off the sides of the oven and return to the magnetron for recharging. A fan called a 'mode stirrer' and the turntable ensure even distribution of the microwaves throughout the oven.



How a microwave oven works



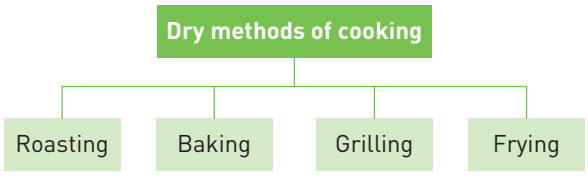
Techniques for cooking food

Techniques for cooking foods

All methods of cooking food depend on the principles of the transfer of heat. The heating method doesn't change the temperature of chemical reactions such as the Maillard reaction, caramelisation and denaturation; however, the rate of heat transfer differs. For example, the time to cook a porterhouse steak will vary depending on whether it is pan-fried, roasted or grilled. The main methods are:

- **Dry methods** – These include roasting, baking, grilling and frying at high temperatures. Heat is transferred to the surface of the food by convection or radiation. The interior is cooked by heat conducted through the food.
- **Moist methods** – These include boiling, blanching, poaching, stewing, steaming and pressure cooking. Water or steam is used as the cooking medium. Temperatures are lower than for dry methods of cooking because heat is transferred by convection currents in the cooking liquid. The heat from the liquid penetrates the food and cooks by convection and then conduction.

DRY METHODS



Dry methods of cooking food

Roasting

Roasting is a method of cooking food in an oven using a small amount of fat or oil. The heat for oven roasting is provided by a combination of convection heat from the air currents circulating through the oven and heat radiating from the oven walls.

Foods suitable for roasting include red meat such as beef and lamb, white meats such as chicken and pork, and vegetables such as potatoes, carrots, pumpkin, eggplants and zucchini.

iStock.com/hiphoto

Roasting is a dry technique used for cooking meat and some vegetables.

Baking

Baking follows a similar principle to oven roasting, with heat provided by a combination of convection heat and radiating heat. However, baked food is cooked without the addition of fat or oil. The products best suited to baking are those that must not come into direct contact with liquids. Cakes, breads, biscuits and pastries are all baked using convection heat.

Foods suitable for baking include fish, fruit such as apples, egg custards and lasagne, and flour products such as breads, cakes, biscuits and pastry.

Safety practices for roasting and baking

- Take care when lighting a gas oven – if the oven does not light immediately, turn it off for a few minutes to allow the gas to disperse before trying again.
- Avoid burns by using oven mitts to handle hot baking trays. Never use a damp tea towel, as the heat from the tray can turn the water into steam, causing a serious burn.

- Always open the oven door completely, so that it does not close on your hand.
- Do not leave the oven door open after removing food from the oven, as someone may bump into it.
- Always check that the oven racks are in the correct position before turning the oven on as they become very hot quite quickly and can cause a serious burn.

Shutterstock.com/Viktor1

Foil protects the tender flesh of fish during baking.

Grilling

Grilling is a fast, dry method of cooking that uses intense heat radiated by an electrical element, gas flame, glowing charcoal or open wood fire. The surface of the food is cooked by dry radiant heat and the interior is cooked by conduction. This is a very quick method of cooking food and is suitable for foods that are tender or require a short cooking time. Meats require searing quickly on both sides to seal the outside and prevent the loss of meat juices.

Foods suitable for grilling include tender cuts of meat such as fillet steak, lamb chops, chicken fillets and kebabs, fish, and vegetables such as tomatoes, mushrooms, capsicum and corn.

Safety practices for grilling

- If using a separate grill, always leave the grill door open while the grill is on to avoid a build-up of heat in the grill, which can lead to spontaneous combustion.
- The door of a combination cooker/grill should be closed during cooking as these ovens are designed with special fans and air vents to avoid a build-up of heat.
- Turn food with tongs rather than a fork – the fork can pierce the meat and cause the meat juices and fat to spatter through the grill.
- Always check that the grill is turned off when you have finished using it.

Frying

In **frying**, food is cooked by total or part immersion in fat or oil, which is heated to temperatures between 150 °C and 220 °C. Frying is a dry method of cooking because no water is involved. Convection currents heat the fat or oil as it moves over the outer surfaces of food, and conduction transfers the heat from the hot fat or oil to the food. Frying gives foods a crisp, flavoursome, brown crust due to the Maillard reaction and caramelisation.

Foods must be dry and free from moisture to prevent spitting of hot fat and to ensure a protective crust forms quickly on contact with the hot oil, sealing the exterior of the food. This formation of a protective layer prevents further penetration of fat or oil into the food and traps the juices and flavours inside.

Coating foods before deep-frying helps to protect the food from drying out, produces even browning and a crisp texture, and adds flavour. The coating also helps to reduce the amount of fat or oil absorbed by the food, holds the shape of the food and prevents moisture loss. Foods may be coated with flour, breadcrumbs or batter. Some foods may be covered in wrappers, such as won tons or spring rolls, while others are covered in pastry, such as samosas.

Deep-fried foods must be drained carefully, first by shaking in a sieve-like basket and then draining on absorbent paper.

Smoke point

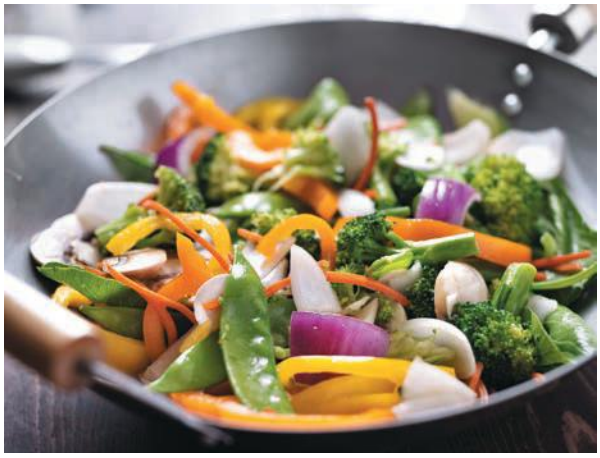
'Smoke point' is the temperature at which fats and oils begin to burn or denature or break down. As the fat overheats, a bluish haze will begin to appear, giving off acrid fumes and leaving foods with an unpleasant flavour. This temperature, at which fat or oil has become dangerously hot and is ready to burst into flames, is called the 'flash point'.

Animal fats such as clarified butter, lard and dripping have a smoke point of about 190 °C. Natural butter, with the milk solids and salts retained, has a smoke point of 110 °C.

Vegetable oils such as canola, cottonseed, grapeseed and peanut oil have a smoke point of about 230 °C; rice bran oil has one of the highest smoke points at 254 °C, making it an excellent deep-frying oil. Monounsaturated oils are an excellent medium for deep-frying because they do not contain cholesterol and are therefore better for our health than saturated animal fats.

Methods of frying

- **Dry-frying** – This uses only the fat that runs from the food as it is heated. Bacon is usually cooked by this method.
- **Shallow-frying** – This uses small quantities of fat or oil to cover the base of the pan. It lubricates the food, prevents it from sticking, and adds flavour and aroma while cooking.
- **Stir-frying** – A little oil is heated in a wok and the food is stirred and lifted during the short, hot cooking process.
- **Deep-frying** – Food is totally submerged in preheated fat or oil. The oil or fat is heated to a temperature twice that of boiling water and so the food cooks quickly, forming a brown crust all over and a crisp texture.



Shutterstock.com/Joshua Resnick

Stir-frying is a quick and healthy technique for cooking vegetables.

Foods suitable for frying include tender cuts of meat such as pork chops, sausages and schnitzel, and vegetables such as potatoes, mushrooms, onions and eggplant. Other foods such as eggs, omelettes, pancakes, fritters and pikelets can be shallow-fried, while potato chips, doughnuts, spring rolls and won tons can be deep-fried.

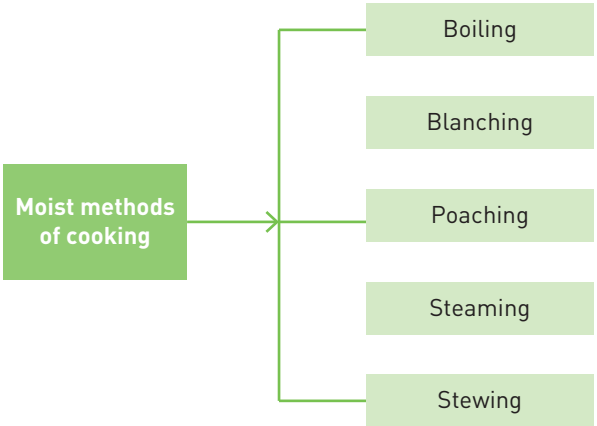
Safety practices for frying

- Take extreme care when frying because hot fat can reach a very high temperature. Use oven mitts to protect your hands.
- Never leave a pan or deep-fryer unattended when cooking because the oil can ignite easily.
- Do not heat beyond the required temperature because this will cause the fat or oil to break down and develop 'off' flavours.
- Keep the pan handle turned to the side to prevent the pan being knocked over.
- Make sure any food placed in hot fat or oil is dry, otherwise there will be spitting.
- If the fat or oil catches alight, do not attempt to extinguish the flame with water. Cover the cooking container with a lid or fire blanket to cut off the supply of oxygen and extinguish the flame.

Understanding the text

1. Outline four reasons for cooking food.
2. Explain how food is cooked by both conduction and convection.
3. Identify the methods of cooking food using radiation and explain how the heat is transferred to food.
4. Explain what is meant by 'dry methods' of cooking and give two examples.
5. What is roasting? List four examples of food suitable for roasting.
6. Explain how baking differs from roasting. Which products are best suited to baking? Give two examples.
7. List two safety practices for roasting or baking and explain why these practices should be followed.
8. Why is grilling described as a fast method of cooking?
9. List two important points to consider when preparing food for frying.
10. Compare the similarities and differences between dry-frying, shallow-frying and deep-frying.

MOIST METHODS



Moist methods of cooking

Boiling

- **Boiling** is cooking food in water at 100 °C. Boiling produces rapid bubbling all over the surface of the pan and evaporation of water as steam. Boiling allows the liquid to come into contact with the whole surface of the food, and heat is therefore transferred to the food quickly and efficiently, with no drying out or browning. Flavourings such as spices, herbs, salt or wine can be added to the liquid to flavour the food. Flavour can also be extracted from meats, fish and vegetables to make stocks, sauces and soups.
- **Blanching** is a method of partly cooking food by plunging it briefly into boiling water. This process is carried out before freezing vegetables to destroy the enzymes that cause discolouration or enzymatic browning. Some vegetables, such as snow peas, are blanched to brighten and soften them slightly before using them in a salad; others, such as tomatoes, are blanched to make it easier to remove their skin. In order to retain its colour and texture, food is 'refreshed' after blanching by plunging it into cold or iced water to retard the cooking process.
- **Simmering** is not true boiling because food is cooked at the lower temperature of 85 °C, and bubbles rise slowly on one side of the pan. This gentle cooking method allows flavours to develop and ingredients to soften, without liquid evaporating.

Foods suitable for boiling include soups and stocks, vegetables such as potatoes and carrots, pulses, rice, pasta, tougher cuts of meat and poultry, and shellfish including prawns and mussels.

- Cooking starchy vegetables such as potatoes causes the starch to swell up and thicken or gelatinise so they are more enjoyable to eat and easier to digest than raw potatoes.
- When cooking rice, the bubbling action of the water keeps the grains in motion and prevents the rice from sticking to the saucepan. Boiling allows gelatinisation of the starch within cereals to occur so the grains become plump and soft.
- Pasta is cooked in boiling water so the starch gelatinises – it increases in weight and softens as it absorbs water. Pasta is done when the texture is 'al dente' or soft to the teeth. Pasta should be cooked in a large volume of rapidly boiling water to prevent it from sticking together. Dry pasta requires a much longer cooking time than fresh pasta.

Poaching

Poaching is a method of cooking delicate foods in liquid at a temperature just below simmering point (85 °C). The surface of the liquid should not bubble, but will appear to tremble. Heat is transferred to the food through the convection currents in the liquid. The food remains tender and moist, but is not damaged by the rough action of boiling. Food may be shallow-poached, with the liquid only partially covering the food, or deep-poached, with the liquid completely covering the food.

Shutterstock.com/Robyn Mackenzie

Poached pears retain their shape.

Food suitable for poaching:

- Fish is ideal to poach because it has little connective tissue, so the coagulation process happens quickly in comparison with other meats.
- A variety of fruits, including peaches, cherries, apricots, apples and pears, are suitable for poaching. The sugar solution in the syrup helps to keep the shape of the fruit.
- Eggs that are poached in an open pan keep their shape and remain firm by the addition of an acid such as lemon juice or vinegar. This helps to reduce the setting point of the protein and so speeds up the process of coagulation.

Steaming

Steaming is cooking food in the steam from boiling water. The food must not come into contact with water, but the steam must be able to circulate freely around it. The boiling point of water occurs at 100 °C and, at that point, the liquid is turned into a gas or vapour and steam is produced.

Heat is transferred to the food in two ways during steaming. First, convection currents carry the heat via the steam from the heat source to the food. Second, condensation transfers the heat from the steam to the surface. When the steam touches the food, it condenses; that is, it changes back into water. The energy or latent heat is released again and heats the food.

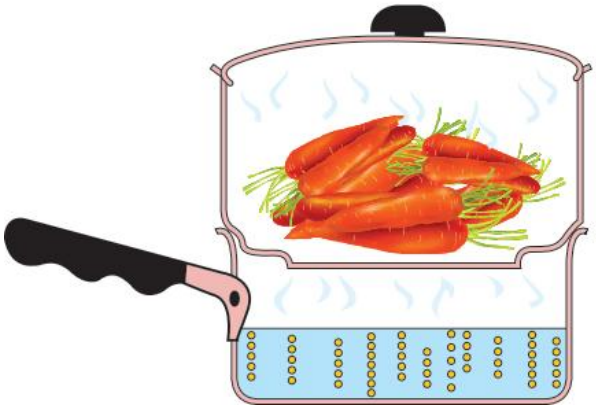
Steaming produces a moist heat that prevents foods from drying out. Foods that are cooked gently without movement from boiling water are less likely to be overcooked. Furthermore, fewer of the water-soluble vitamins are lost during the steaming of vegetables because they do not leach out into the boiling water.

Shutterstock.com/L.F

Food retains its shape when cooked in the moist heat generated in a bamboo steamer.

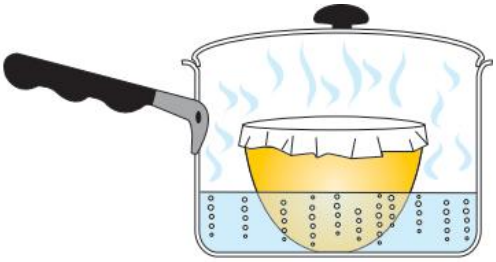
Methods of steaming

- **Graduated or atmospheric steamer** – Boiling water is placed in a pan to create steam, then a series of cooking compartments, such as tiered bamboo steamers or a metal container with a perforated base, are stacked on top of each other to hold the food. The steam rises through the perforations of the container, circulating around the food and cooking it. A tight-fitting lid must be used to prevent the steam escaping.



Cooking food in an atmospheric steamer

- **Sealed container** – Food is placed in a covered basin or lidded steamer bowl and securely covered so that no moisture can enter. The bowl is then placed in a saucepan of boiling water that comes halfway up the bowl. This method is used for making steamed puddings.



Steaming food in a basin

Foods suitable for steaming include vegetables and fish. Fish has very short muscle fibres, very little connective tissue and almost no fat. Steaming enables the fish to be cooked just to the point of coagulating the muscle protein without toughening or drying out the flesh.

Stewing

Stewing is a long, slow method of simmering food in a small amount of liquid. The cooking liquid provides a moist environment to break down the connective tissue or collagen in tough cuts of meat into soluble gelatin. The liquid adds and absorbs flavours throughout cooking and retains the nutrients that have escaped from the food. This liquid forms part of the finished dish and is flavoured with other ingredients to contribute to the overall flavour. In some stews, the thickening occurs at the beginning of the process, often with a roux; in other cases, the ingredients, such as potatoes, thicken the stew as it cooks because the starch absorbs moisture and gelatinises.

Foods suitable for stewing include cheaper cuts of meats, poultry, fish and a variety of fruits, particularly stone fruits.

Safety practices for using the cooktop

- Always remember to turn saucepan handles so that they face away from walkways. This minimises the likelihood that saucepans or frying pans will be knocked and the contents spilt.
- Use an oven mitt when handling hot saucepans and frying pans to minimise the risk of burns. Metal handles on saucepans can become very hot because metal is an excellent conductor of heat.

- Remember to lift the lid from the saucepan or steamer so that the heat escapes away from your face. Steam reaches a higher temperature than boiling water and can cause serious burns.
- Take care when moving saucepans filled with boiling liquids – make sure other people stand well back, as a burn from a boiling liquid can be extremely serious.
- Use a wooden spoon for stirring boiling liquids, such as jams, stews and casseroles because wooden spoons are poor conductors of heat and will remain cool during use.

Cooking in a microwave oven

When the electromagnetic microwaves are absorbed by the food, the molecules of water vibrate at a high speed and in turn knock into protein and fat molecules and transfer energy to them. This vibration of the water, fat and protein molecules produces heat, which cooks the food. Microwaves can penetrate food to a depth of 4–5 centimetres, unlike infrared radiation, which is only absorbed on the surface of the food.

The most suitable foods for cooking in a microwave oven are those that have a high moisture content and cook quickly. Small portions – less than 4 centimetres in thickness – cook more evenly. Foods with a low water content, such as biscuits, are not suitable for cooking in a microwave oven.

The heat produced in a microwave oven enables the protein in food to be denatured or to coagulate, and so become firm as it cooks. However, one disadvantage of microwave cooking is that as food is cooked very quickly, it is easy to overcook some foods. If overcooked, meat in particular is likely to lose excessive fluid and have a dry texture. Another disadvantage of cooking food in a microwave oven is that it does not brown because the surface of the food does not get sufficiently hot to trigger the Maillard reaction, caramelisation or dextrinisation.

Food that is cooked in a microwave oven should be left to stand for the same length of time as the cooking time stated in the recipe to allow the molecules to stop vibrating and finish the cooking process. Some foods will need to be stirred during cooking because this will enable even distribution of heat – although the food may be bubbling around the edge, the heat may not have penetrated the centre, which could still be cold.

Safety practices for cooking in a microwave oven

- Use only microwave-safe containers. Glass, plastic and ceramic materials allow microwaves to pass through them, so they make excellent containers for cooking foods in a microwave oven.

Shutterstock.com/Pavel V Mukhin

Many microwave safe containers include a vent to allow steam to escape.

- Metal surfaces reflect microwaves and therefore metal bowls and aluminium foil containers are unsuitable.
- Only plastic that has been specifically designed for use in a microwave oven should be used. Plasticisers, a component of many plastics, can migrate at high temperatures and contaminate food.
- Plastic containers used for frozen food such as ice-cream and for chilled food such as margarine are generally made from soft plastics, which are not designed to be exposed to high temperatures and may melt if used in a microwave oven.
- If covering food with plastic film, avoid direct contact with food, even if the film is labelled 'microwave safe'. Absorbent kitchen paper can be used as an alternative to prevent spatter.
- Do not turn the microwave oven on unless you have put some food or liquid in it because this will damage the magnetron.
- Remember to turn the microwave oven off at the electricity source before cleaning or moving it.

Understanding the text

11 Explain the difference between boiling and simmering.

12 Describe the process of heat transfer that takes place when food is boiled.

13 What is meant by the term 'blanching' and why is this process often used in food preparation?

14 List three safety practices to observe when boiling, blanching, poaching, steaming or stewing.

15 Explain the process used to poach food and list two advantages of poaching.

16 How is heat transferred to food during steaming?

17 Why is steaming often considered an excellent method of cooking tender portions of food?

18 List three advantages of stewing tough or less tender cuts of meat.

19 How does a microwave oven cook food?

20 Explain why food cooked in a microwave oven does not go brown on the surface.

PREPARING FOR EXAMS

Applying knowledge

Prepare a summary chart of both dry and moist methods of cooking using the following headings:

- Cooking method
- Definition
- Methods of heat transfer
- Foods suitable
- Equipment required
- Safety practices

Worksheet

Analysing information

Prepare a SWOT analysis of microwave cooking.

STRENGTHS	WEAKNESSES
OPPORTUNITIES	**THREATS**

Evaluating concepts

1 Select an ingredient, for example a fruit or vegetable.

2 Select three different cooking methods that can be used to prepare the ingredient.

Worksheet

3 Assess the outcome of each method of cooking on the sensory properties of the selected ingredient.

4 Which method of cooking would you recommend to enhance the properties of the ingredient? Justify your decision.

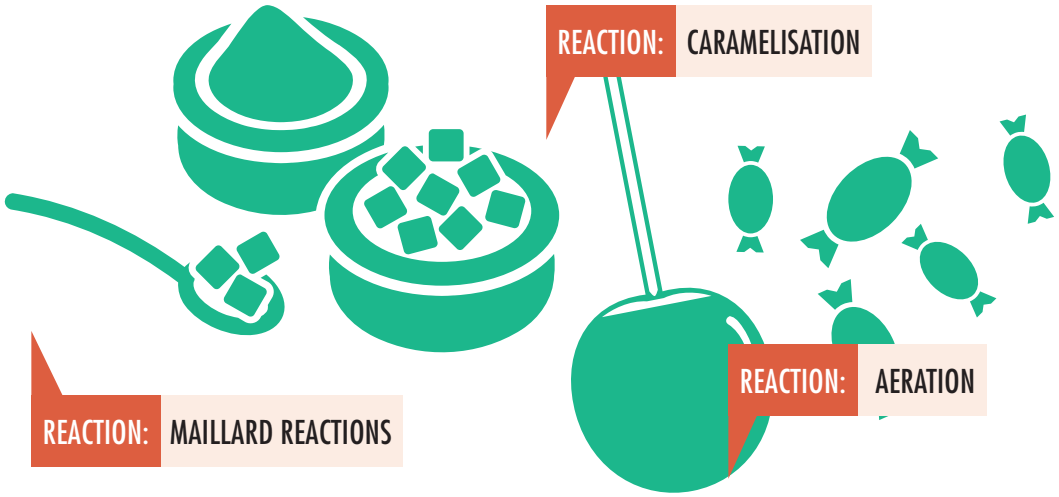
STARCH

Flour
Cornflour
Rice
Potato flour
Rice flour
Pasta

REACTIONS: MAILLARD REACTIONS
DEXTRINISATION
GELATINISATION

SUGAR

Granular
Caster
Raw
Brown
Golden syrup



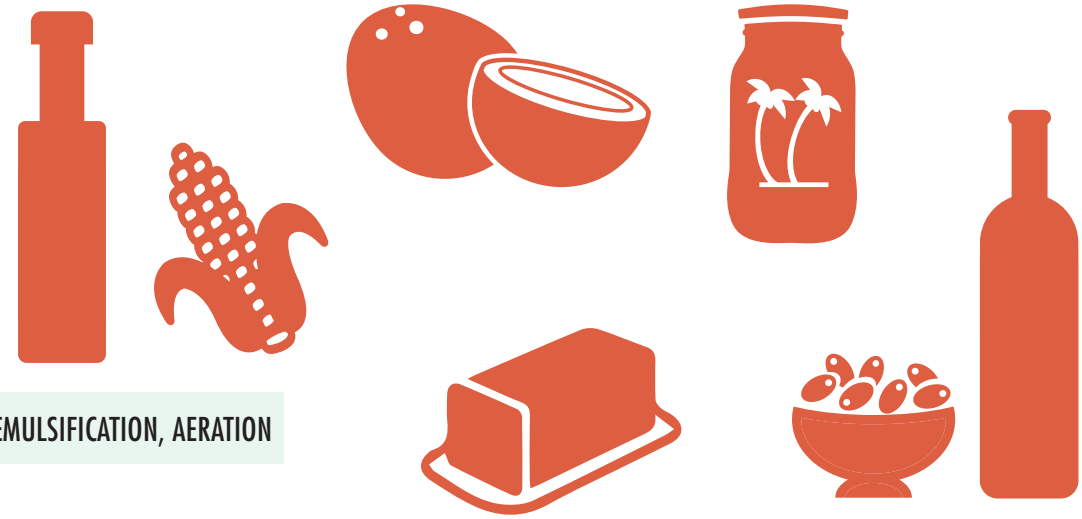
REACTION: CARAMELISATION

REACTION: AERATION

REACTION: MAILLARD REACTIONS

FATS AND OILS

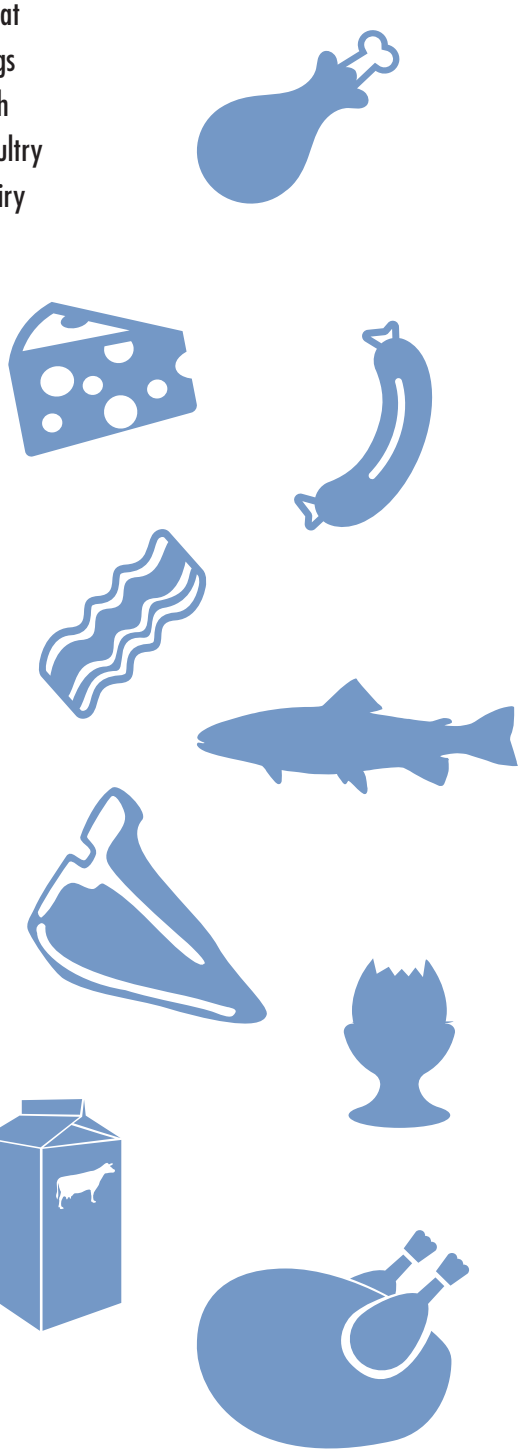
Butter
Canola oil
Lard
Olive oil
Maize oil
Coconut oil



REACTIONS: EMULSIFICATION, AERATION

PROTEIN

Meat
Eggs
Fish
Poultry
Dairy



REACTIONS: DENATURATION , COAGULATION, EMULSIFICATION, AERATION, MAILLARD REACTIONS

5

THE SCIENCE OF FOOD

KEY TERMS

Aeration is the process of incorporating air into food products to increase the volume and create a light, airy texture.

Caramelisation is the process that sugars undergo when heated to high temperatures to develop a golden brown colour.

Coagulation is a form of denaturation and occurs when there is a permanent change in the protein from a liquid into a thick mass as a result of heat or the addition of acids.

Denaturation describes the permanent structural change of the protein molecules in food.

Dextrinisation is the process that occurs when a starch is exposed to dry heat; the starch is broken down to dextrin, resulting in a change in colour to golden brown.

Emulsification is mixing two liquids that don't normally combine evenly, for example water and oil.

Functional properties are the physical and chemical properties of ingredients that impact on food preparation and processing.

Gelatinisation is the process that occurs when starch granules absorb liquid in the presence of heat and thicken the liquid, forming a gel.

Maillard reaction occurs when a protein and sugar or starch are present in the same mixture and dry heat is applied during baking, creating a golden brown crust.

Properties of food

In commercial and domestic food processing and preparation, knowledge of ingredients and their properties is essential to produce high-quality products that will be well received by consumers. Understanding the **functional properties** – that is, the physical and chemical properties of food ingredients and the way they react during preparation and processing – is essential to producing successful products that have the delicious flavour, aroma, texture or visual appeal that we desire. For example:

- Yeast is a biological raising agent that requires a warm temperature to assist enzymatic reactions, which promote fermentation so the dough will rise.
- The mechanical action of beating to aerate egg whites creates a light, airy texture in a sponge cake.
- Chemical reactions, such as the Maillard reaction, dextrinisation and caramelisation, when food is exposed to dry heat, produce an appealing golden brown colour.
- Changing the acidity level in foods, such as adding lemon juice to cut banana when it is used in a fruit salad, prevents enzymatic browning, and adding an acid with the sugar and pectin in fruit forms a gel in jam.
- The proportions of ingredients used in a recipe are important, such as the ratio of butter to flour when making pastry – shortcrust pastry has less butter than puff pastry so has a drier mouth-feel.

iStock.com/Bernilynn

Yeast enables bread doughs to rise.

Mark Fergus Photography

Beating eggs gives sponges a light, airy texture.

iStock.com/Jmichl

Butter gives shortcrust pastry a crisp texture.

Processes that cause changes during food preparation and cooking

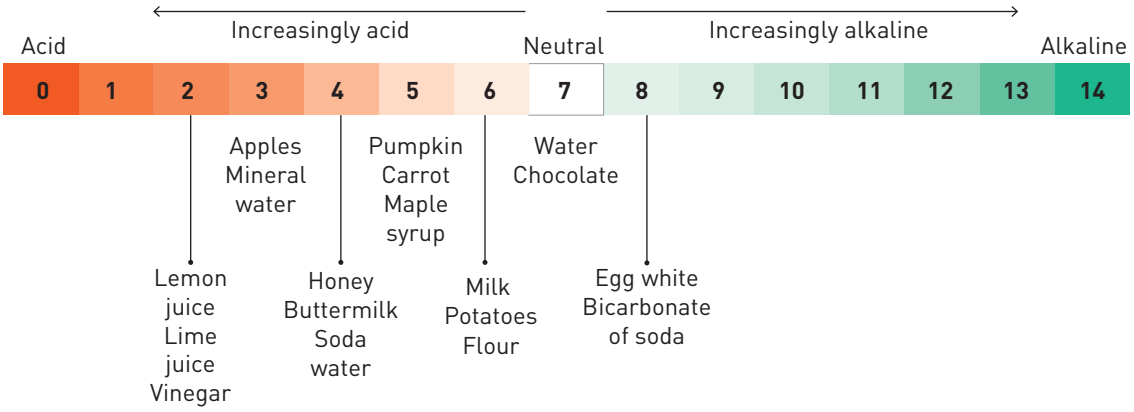
Video

REACTION	DESCRIPTION OF REACTION	FOOD EXAMPLES
Aeration	**Aeration** is the process of incorporating air into food products to increase the volume and create a light, airy texture. Food can be aerated by: • biological ingredients – yeast • chemical ingredients – baking powder, bicarbonate of soda • mechanical actions – sifting, creaming, whisking, beating, folding in ingredients, rubbing in ingredients, steaming.	Bread Cakes Sponge cake Pavlova Soufflé
Caramelisation	**Caramelisation** is when sugar (sucrose) begins to decompose when exposed to high temperatures (190 °C) using dry heat. Hundreds of compounds are generated as the sugar decomposes, resulting in browning and enjoyable aromas such as those of baked goods or roasting coffee.	Gingersnaps Caramel sauce Toffee
Coagulation	**Coagulation** is a form of denaturation that occurs when there is a permanent change in the protein from a liquid into a thick mass as a result of heat or the addition of acids. The denatured proteins form a new structure that retains water – a semi-liquid becomes firm and maintains its shape.	Grilled meat Quiche Boiled egg
Denaturation	**Denaturation** describes the permanent structural change of the protein molecules in food. This can occur by the application of heat, mechanical action or the addition of acids.	Beaten egg whites Poached egg Marinaded meat
Dextrinisation	**Dextrinisation** is the process that occurs when a starch is exposed to dry heat; the starch is broken down into dextrin, resulting in a change in colour to golden brown.	Bread Scones
Emulsification	**Emulsification** is mixing two immiscible liquids (liquids that don't normally combine), for example water and oil. Some proteins act as emulsifying agents and hold the immiscible liquids in suspension.	Mayonnaise Vinaigrette dressing
Gelatinisation	**Gelatinisation** is the process in which starch granules absorb liquid in the presence of heat and thicken the liquid, forming a gel.	Cheese sauce on cauliflower White sauce in lasagne Filling of lemon meringue pie
Maillard reaction	The **Maillard reaction** turns food brown and creates pleasant, volatile, aromatic compounds. It is a reaction between amino acids in protein and sugars or starch. It begins at 154 °C and can be seen when sautéing on the cooktop or baking in the oven.	Cakes Roast meat Biscuits Muffins

The pH scale

The pH scale is used by food scientists when analysing an ingredient or food product to determine if it is an acid or alkali. The 'p' stands for *potenz*, the potential to be, and the 'H' stands for *hydrogen*; pH is measured on a scale of 1 to 14.

Acids occur naturally in some foods and have a pH between 1 and 6. Juice from citrus fruit such as lemons and limes may be added during food preparation or processing to perform a number of functions; for example, they may be included in a marinade to tenderise meat.



pH scale

Most foods fall into the acidic to neutral section of the pH scale, rather than being alkaline. Neutral ingredients are neither acid nor alkaline, so have a pH of 7 – water and chocolate are examples of neutral ingredients, which means they do not react with or cause chemical changes when combined with other ingredients in a recipe.

Alkaline ingredients have a pH between 7 and 14. Bicarbonate of soda and egg white are two examples of alkaline ingredients often used in food products. The pH rating of ingredients has an important impact on the way they function as a natural component in food products. Blue and red litmus papers are used to determine whether the food is an acid or an alkali, and universal indicator paper indicates the pH rating.

ACIDS

Acids are any chemical that releases hydrogen ions when dissolved in water. Edible acids, such as citric and acetic acid, usually taste sour and can be described as having an acidic flavour. Acids turn litmus paper red.

FOOD ACIDS	
ACID	**FOOD SOURCE**
Acetic acid	Vinegar
Benzoic acid	Prunes, cranberries
Citric acid	Citrus fruits such as lemons, limes, oranges, grapefruit and raspberries
Lactic acid	Milk
Malic acid	Apples, apricots, grapes, plums, strawberries and tomatoes
Oxalic acid	Rhubarb, pineapple
Tartaric acid	Grapes

Shutterstock.com/Alexeysun

Lemons contain citric acid.

ALKALIS

Alkalis are the opposite of acids and are sometimes known as 'bases'. They have a low concentration of hydrogen ions when dissolved in water. Their pH values are above 7 and they turn litmus paper blue.

Bicarbonate of soda is the most common alkali used in cooking.

Activity 5.1

Determining the pH levels of foods

Aim: To determine the pH levels of a variety of foods

Equipment

- 8 clear plastic glasses
- blue litmus paper
- red litmus paper
- universal pH paper
- teaspoon measuring spoons
- 1 teaspoon each of:
  - vinegar
  - milk
  - tomato juice
  - tap water
  - bicarbonate of soda
  - orange juice
  - lemon juice
  - egg white

Method

1. Copy the table on the right to record your results.
2. Add 1 teaspoon of bicarbonate of soda to a glass and dissolve in 1 teaspoon of water.
3. Place each of the other ingredients in individual glasses, each with 1 teaspoon of water. Remember to label each glass.
4. Test each sample with the blue litmus paper – if it turns red, this indicates the sample is an acid.
5. Test each sample with the red litmus paper – if it turns blue, this indicates the sample is an alkali.
6. Record the results from the litmus paper tests.
7. Using the universal indicator paper, test each sample for a pH rating to determine the degree of acidity or alkalinity.

Analysis

1. Which foods could be used to sour milk?
2. Which alkali substance would be suitable to use as a raising agent?
3. What is likely to happen when milk is added to hot tomato soup? Why is this reaction likely to occur?
4. Which foods would be suitable to add to a marinade for meat? Why would this product be suitable?

Conclusion

- Acidic ingredients were …
- Alkaline ingredients were …
- Neutral ingredients were …

Worksheets

FOOD SAMPLE	LITMUS PAPER TEST	pH RATING
Vinegar		
Milk		
Tomato juice		
Tap water		
Bicarbonate of soda		
Orange juice		
Lemon juice		
Egg white		

Alkalis have a bitter taste and a slimy mouthfeel. The most common alkali used in food preparation is bicarbonate of soda. It is a white powder and the simplest form of a chemical raising agent.

Enzymes

Enzymes are chemical substances that act as biological catalysts in plants, animals and microorganisms. They bring about and speed up chemical reactions in foods without becoming involved in the reaction, and are valuable when preparing some foods.

Enzymes found in fruits and vegetables

When fruits or vegetables are peeled or cut, enzymes contained in the plant tissue are released. In the presence of oxygen from the air, these enzymes catalyse to form brown pigments called 'melanins'. This process is called 'enzymatic browning'.

To overcome this problem, the cut fruit or vegetable is coated with an antioxidant, which is a chemical compound that prevents oxidation. Common antioxidants are found in the juice from acidic citrus fruit or pineapples. Citric acid from lemon juice is

often used to prevent browning and to slow down the action of the enzymes in cut fruits, such as apples and bananas, in a fruit salad.

Enzymes are also responsible for the ripening of fruit as they convert the starch to sugar, which gives fruit better sensory properties and makes it more palatable. An example of this process is the ripening of a green banana. The astringent 'starchy' flavour and hard texture of green bananas are converted into a deep-yellow banana with a sweet taste and softer texture on ripening. Fruits become softer as the pectin enzymes convert the cell wall 'cement' to a more soluble form.

Enzymes found in some fresh fruits, such as fresh pineapple or papaya, contain the enzyme protase and have the ability to break down proteins. This enzymatic action can be used to tenderise tough cuts of meat by breaking down or denaturing the proteins in the muscle fibres and connective tissue. When using these fruits to marinade, it is important to cut the meat into cubes first so there is greater surface area. This allows better penetration of the enzymes.

Gelatine is a protein substance used for setting jellies served for dessert. Fruits such as pineapple and kiwi fruit contain the enzyme protease, which prevents a gelatine mixture from setting because the protease enzymes break down the gelatine. This problem can be overcome by first cooking and cooling the fruit, as heat deactivates the protease enzymes in the fruit.

iStock.com/Viktar

Enzymes in papaya break down protein.

Understanding the text

1. What is the pH scale?
2. If an ingredient has a pH of 7, what does that mean when it is included in a recipe?
3. Explain the difference between an acid and an alkali.
4. Describe the characteristic properties of an acid.
5. List five ingredients that are classified as an acid.
6. Describe the characteristic properties of an alkali and identify the most common alkali used in food preparation.
7. Define the term 'enzymes'.
8. Describe the process of enzymatic browning in cut fruit and vegetables, and explain how its effect can be minimised.
9. Explain the role enzymes play in developing the sensory properties of fruit.
10. How can enzymes tenderise meat?

Aeration

Aeration is the process of incorporating air into food products to increase the volume and create a light, airy texture. Food can be aerated by:

- biological ingredients such as yeast
- chemical ingredients such as baking powder, bicarbonate of soda
- mechanical actions – sifting, creaming, whisking, beating, folding and rubbing in ingredients. Steam is included here because the change of state from water to steam produces heat energy that can increase the volume of a product, for example in choux pastry.

BIOLOGICAL RAISING AGENT – YEAST

Flour contains an enzyme amylase, which changes some of the starch in flour to a sugar: maltose. This enzymatic reaction in a yeast dough makes the sugar available from within flour to provide some of the 'food' for yeast during fermentation as well as assisting in the browning of the bread during baking. Yeast is like an enzyme machine, breaking down sugars into smaller and simpler molecules. Yeast contains three enzymes:

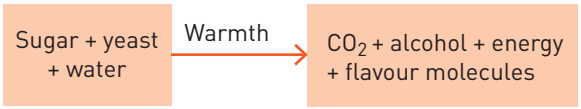
- **maltase** – which changes maltose to glucose
- **sucrase** – also called 'invertase', which changes sucrose to invert sugar, a mixture of glucose and fructose

- **zymase** – which splits up both glucose and invert sugar into carbon dioxide and alcohol.

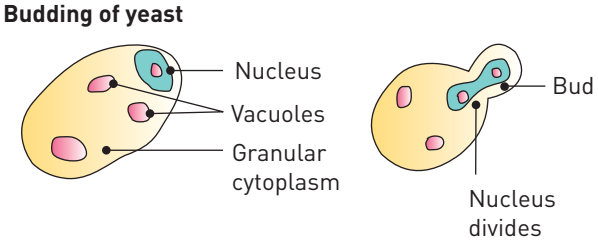
These simple sugars are a very important part of the process of fermentation and the production of carbon dioxide, which enables the yeast dough to rise.

Yeast as an aerating agent

Yeast is a single-cell microorganism. It reproduces by budding and, during this process, yeast converts the carbohydrates, starch and sugar in the yeast dough to a gas, carbon dioxide (CO_2), plus alcohol and water. This process is known as 'fermentation'. Yeast needs food, moisture and warmth in order to ferment and leaven (raise) the bread dough. In breadmaking, the food for the yeast is from the flour and a little sugar; the water in the dough provides the moisture. While the yeast dough is being 'proved' – that is, while fermentation is occurring – the dough must be kept warm at a temperature between 25 °C and 27 °C to allow the yeast to reproduce and increase the volume of the dough. A flour with a high gluten content allows the dough to stretch and capture the bubbles of carbon dioxide without collapsing.



Fermentation process of yeast



Reproduction of yeast cells

CHEMICAL RAISING AGENTS

Alkali as a raising agent

Bicarbonate of soda is a pure white powder, which, when combined with moisture and heated, produces sodium carbonate, steam and carbon dioxide. The carbon dioxide gas is released and leavens the mixture by causing it to froth and expand up and out. The remaining residue is soda, an alkaline substance that gives a sharp, bitter taste and a dark yellow colour. Ingredients that have strong flavours, such as brown sugar, ginger or golden syrup, are needed to mask these unpleasant residue flavours. When bicarbonate of soda is used as an ingredient in biscuit making, it causes the biscuits to spread more, and brown and crisp faster. The resulting biscuits have a rich, dark colour.

Acids as raising agents

Raising agents are used in baked products, such as cakes, biscuits and muffins, to increase the volume of a mixture to create a light, porous texture in the final item. The acid ingredients dissolve when they are moistened, then react with the bicarbonate of soda to produce carbon dioxide gas, which in turn leavens the mixture. Examples of acidic ingredients used in baked products to help them rise can be seen in the diagram below.

Acidic ingredients used in baked products

Chemical raising agents used in baked goods all include an acid, the alkali bicarbonate of soda and a filler such as cornflour. Baking powder is a commercially produced raising agent that can be added to plain flour to increase the volume of baked products. Some of the acids used in combination with bicarbonate of soda in baking powder are:

- **tartaric acid** – Carbon dioxide is released quickly on moistening
- **cream of tartar** – Carbon dioxide is released at low oven temperatures
- **sodium pyrophosphate** – This is very stable and only releases carbon dioxide when the oven reaches a high temperature.

Self-raising flour is a convenient all-purpose flour, with baking powder and salt already added. It is used in a wide range of baked products such as cakes, muffins, biscuits and scones, which are leavened when baked.

MECHANICAL RAISING AGENTS

Sifting, creaming together butter and sugar, whisking, beating, folding, rubbing-in and steaming are all processes that mechanically trap bubbles of air within a cake batter in order to create a light, airy texture in the finished product. Sometimes mechanical and chemical raising agents are combined in the production so that tiny air bubbles can be created and then trapped and held by specific ingredients within the structure of a cake. Examples of mechanical methods of aeration:

- **Sifting** involves passing dry ingredients such as flour through a fine-mesh sieve to incorporate air to make ingredients lighter.
- **Creaming** is beating butter and sugar together until they resemble lightly whipped cream. As the mixture is creamed, air is incorporated, the volume increases and the mixture becomes lighter in colour.
- **Whisking** is the process of using a whisk vigorously to incorporate air into a mixture.
- **Beating** is to stir rapidly in a circular motion with a tool such as a wooden spoon or electric beater to incorporate air.
- **Folding** is the process of gently combining a light, airy mixture into a heavier mixture. A metal spoon or spatula is used in short strokes to prevent loss of air.
- **Rubbing-in** is a method of mixing butter through dry ingredients with fingertips until the mixture resembles fresh breadcrumbs. The fingertips are held above the bowl so air is captured as the mixture is lifted and dropped into the bowl.
- **Steam generation** doesn't mechanically trap air like the other methods mentioned; however, it is a physical process by which air is introduced into food. The high temperature within the oven causes water to quickly change from its liquid form to steam. In this transition phase, a large amount of heat is given off, which contributes to the leavening of products such as cakes, bread and pastries. Many recipes rely on steam generation as part of their leavening, but in reality very few baked products rely on only one method of aeration for lift.

Understanding the text

11 Explain why aeration is important in the production of many food products.

12 Yeast is a biological raising agent. Identify and outline the process it uses to aerate food products.

13 List the three conditions yeast requires in order to grow.

14 Explain how the gluten content of flour can impact on the overall success of yeast as a raising agent.

15 Describe how bicarbonate of soda acts as a raising agent.

16 Why are ingredients such as brown sugar, ginger and golden syrup used in recipes that are leavened with bicarbonate of soda?

17 How do acidic ingredients work with bicarbonate of soda to increase the volume of cakes, biscuits and muffins?

18 List acidic ingredients that could be used in baked products to assist in the leavening process.

19 Select four mechanical methods that can be used to aerate food products. Describe how each method incorporates air to leaven a food product.

20 Explain how steam can aerate baked products.

Protein

Proteins are found in both animal and plant foods. They are sensitive food molecules in raw meat, poultry, fish, eggs, dairy foods, wheat flour and legumes. Heating protein foods, applying mechanical actions such as beating, changing the pH or combining with enzymes can change the shape and behaviour of the protein molecules. When we prepare, manipulate and cook protein foods, we use the active properties of protein to change consistencies and form new structures or frameworks, which result in the textures, shapes and colours of foods we enjoy eating. For example, a raw piece of rump steak is soft, pliable and bright red in colour; during cooking, for example pan-frying, the texture becomes firm, the surface browns and flavours develop as a result of changes to the protein molecules.

WHAT ARE PROTEINS?

Proteins are large molecules made up of smaller units called 'amino acids' and contain the elements of carbon, oxygen, hydrogen and nitrogen. The number and type of amino acids in the different types of protein chain vary considerably. The pattern of amino acids that form in the protein molecule determines the shape of that molecule and consequently its physical properties and the type of protein food. Each amino acid has its own chemical name and there are at least 22 different types.

PROTEIN FOODS	TYPES OF PROTEIN
Meats, fish and gelatine	Collagen – connective tissue Myosin – muscle tissue Elastin – muscle fibre
Dairy products – milk, cheese	Caseinogen – milk curd Lactalbumin – whey of milk Lactoglobulin – whey of milk
Eggs	Ovalbumin – egg white Mucin – egg white Lipovitellin – egg yolk
Wheat Soya beans	Gluten – wheat flour Globulin – legume protein

FUNCTIONAL PROPERTIES OF PROTEINS

When preparing and cooking protein foods, such as meat, poultry, fish, dairy products, eggs and legumes, the protein molecules undergo a permanent structural change known as **denaturation**. It can occur by the application of heat, mechanical actions, a change in pH or exposure to enzymes. As a result of exposure to all or any of these, the protein becomes less elastic and less soluble.

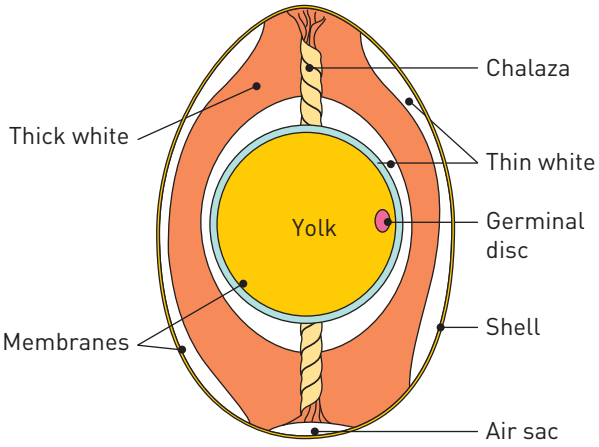
Coagulation is a form of denaturation and occurs when there is a permanent change in the protein from a liquid into a thick mass as a result of heat or the addition of acids. Here are two examples of denaturation of protein in food products:

- During the beating of egg whites for meringue, air bubbles are captured so the liquid becomes light and foamy.
- Including an acid such as vinegar in the water assists in coagulation when poaching an egg.

EGGS

Eggs are a self-contained food that provides many nutrients. A reference to eggs in any recipe usually means hen's eggs. They can be cooked simply by a range of methods or can be incorporated into a wide variety of recipes.

Structure of eggs



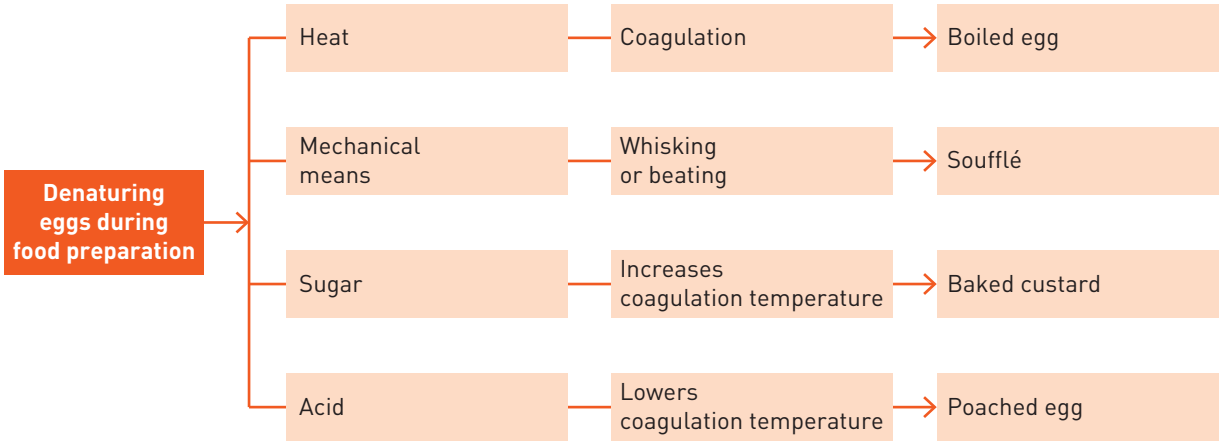
Cross-section of an egg showing its structure

Eggs in food preparation and cooking

Eggs are a valuable ingredient in food preparation because of their versatility and the various functions they perform when combined with other foods. Popular methods of preparing eggs by themselves are boiling, frying, scrambling, poaching and beating for an omelette.

iStock.com/William Mahar

Omelette is a popular method of preparing eggs.



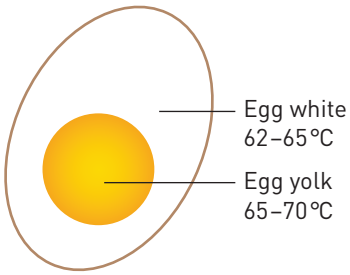
Denaturing eggs during food preparation

Cooking with eggs

In each protein food, including eggs, all the molecules are identical in shape in their raw form. It is possible to denature egg protein in a variety of ways by heating, applying mechanical actions, adding sugar or an acid.

Coagulation of eggs

During cooking, heat is applied to eggs or egg mixtures, causing considerable changes in their physical properties. In its raw state, egg white is a clear liquid with a slimy texture, and egg yolk is a dense yellow colour and is slightly more viscous than the white. When the egg is exposed to heat, the liquid white gradually sets to form a white rubbery mass and the yolk becomes firm. This denaturation of the protein sets the eggs and is termed coagulation. Egg white and egg yolk coagulate at different temperatures: egg white at 62–65 °C and egg yolk at 65–70 °C.



Coagulation temperatures when eggs are cooked

The temperature at which egg protein coagulates or sets is dependent on several factors:

- **Concentration** – In a recipe, the dilution of egg proteins increases the temperature at which the proteins coagulate. For example, a custard made with one whole egg thickens at a lower temperature than one made with only the egg yolk.
- **Acidity** – Adding acid to egg white decreases the pH so the proteins become less stable and more likely to denature. This means small amounts of acid lower the coagulation temperature of most egg proteins. For example, adding vinegar to the water when poaching eggs causes the egg white to set more quickly and to hold its shape.
- **Sugar** – Adding sugar raises the temperature of coagulation of an egg mixture.

Cooking eggs using dry heat

Effect of baking on eggs

When baked products are cooked in the dry heat of an oven, the protein in eggs is an important structure builder. During the baking of a cake mixture, the heat coagulates or sets the egg protein, contributing to the fixed shape and firm structure of the finished product. Often eggs work in conjunction with gluten, the protein in flour, to create the solid structure of baked products, and without them, many would collapse. Egg white is the strongest structural component, followed by the whole egg, then the egg yolk. Products that use the structural function of eggs are cakes, muffins, biscuits and puddings.

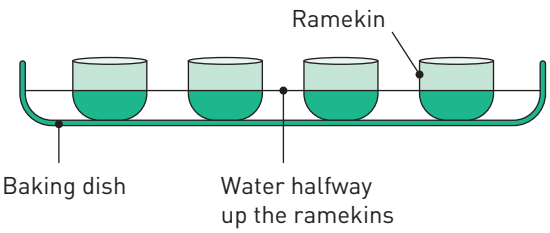
In the final step before baking, pastries and scones are often brushed with an egg glaze. There is a very small amount of glucose in eggs; during baking it combines with the egg proteins, and complex reactions such as the **Maillard reaction** occur, resulting in brown colouration and intense flavour development. In baked products that include eggs, the yellow-orange carotenoids in the yolk contribute to the internal yellow colour in cakes and biscuits.

The Maillard reaction doesn't just depend on temperature. Foods that are more alkaline, such as egg

whites, undergo the Maillard reaction more easily and so browning becomes evident at a low temperature. For example, when cooking meringue, it is baked at a low temperature of 100–110 °C so it can maintain the white, creamy colour. The amount of water and ingredients in a product will also influence the rate of the Maillard reactions.

The egg proteins in baked custards and the filling for quiches gradually denature and coagulate when the mixture is heated in the oven and, in doing so, thicken to form the structure of the products. Without the coagulated egg, the mixtures would remain runny.

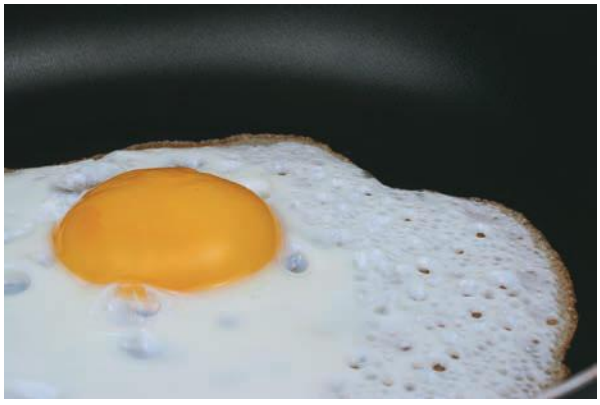
Baked custards are very delicate mixtures and must be cooked with a gentle heat to ensure a smooth, even texture so they are cooked in a water bath within the oven. The water surrounding the baking dish prevents the direct heat coming into contact with the egg, creating a lower baking temperature. This slows down the process of coagulation and prevents curdling of the cooked mixture. The top surface of the baked custard becomes golden brown as the Maillard reaction occur.



A water bath is used for baking egg-based dishes.

Effect of frying on eggs

Frying is another dry cooking method regularly used to cook eggs. The heat is transferred through the frying pan to heat the fat or oil and as soon as the raw egg is added, its physical and chemical properties begin to change. The semi-liquid egg sets into a firm shape as the protein denatures and coagulates, and the base of the egg begins to brown as the Maillard reactions become evident around the edge of the egg white.



Age Fotostock/Blickwinkel/McPHOTO

When frying an egg, the protein denatures rapidly.

Eggs can act as a binding agent to help batter and breadcrumbs adhere to foods that are fried, such as battered fish and schnitzel. The dry heat of frying coagulates the egg, and the crumbs are held within the firm structure. This property is also used to attach nuts and spices onto the surface of cakes and breads. In products such as hamburgers and meatballs, the liquid egg helps to bind ingredients together and makes shaping easier. When the hamburger is cooked, the egg coagulates and forms part of the structure of the product, preventing the hamburger from falling apart.

Cooking eggs using moist heat

Boiling involves cooking food in a liquid at 100 °C. When an egg is boiled, the texture changes from a semi-liquid to a firm, solid mass. The egg white changes from transparent to white and the oval shape is set within the shell as the process of coagulation takes place.

Steaming is used to cook delicate mixtures such as egg custard sauces that are used as a base for ice-cream. Using a double boiler and the gentle heat of steam prevents the egg custard from over-coagulating to produce a smooth, even-textured product. If an egg custard or sauce is overheated, the mixture is said to have 'curdled'. This means the egg protein has over-coagulated and results in 'weeping' or **syneresis**. It is easily recognised because tough bits of the egg protein float in pools of the squeezed-out liquid.

The juice of lemons, limes or oranges combined with eggs, sugar and butter makes a spread that can be used as a topping on bread or as a filling in tartlets. These fruit butters or curds are also cooked over steam, and the thickening process occurs as a result of the eggs coagulating when they are combined with the acid from the citrus fruit and heated.

Effect of acid on eggs

When eggs are poached in hot water, a small amount of acid in the form of vinegar can be added to assist in the denaturation process. The acid decreases the pH of the cooking solution so the proteins in the egg become less stable and more likely to denature. By combining heat and an acid to denature the egg protein during poaching, it coagulates and holds its shape at a lower temperature, making the end product more appealing. However, if the water is allowed to

boil when poaching eggs, the rapid movement of the bubbles in the water causes the delicate egg white to become ragged and misshapen.

When beating egg whites to make meringue, a small amount of cream of tartar, which is an acid, can be added. This addition of acid in the early stages of beating stabilises the egg whites. The process may take a little longer, but the protein network that forms will help prevent over-whipping and is more stable for folding and piping. The meringue will be whiter than if no acid was used. When making pavlova, a small amount of vinegar can be added after the meringue is beaten to help stabilise the mixture and ensure the meringue is white.

Emulsification using eggs

Egg yolks include lecithin and this makes them an effective **emulsifying ingredient**. The yolk has the ability to prevent fat and water from separating. This function is helpful in cake and pancake batters, as well as doughs, because the egg yolks help keep the fats (such as butter) and liquids (such as milk) evenly distributed until baking or cooking. If eggs are too cold or are added too quickly to a creamed mixture of butter and sugar, the emulsion breaks and is said to have 'split' or 'curdled'. Egg yolk is also used in mayonnaise as the emulsifying agent – see Fats and oils on page 88.

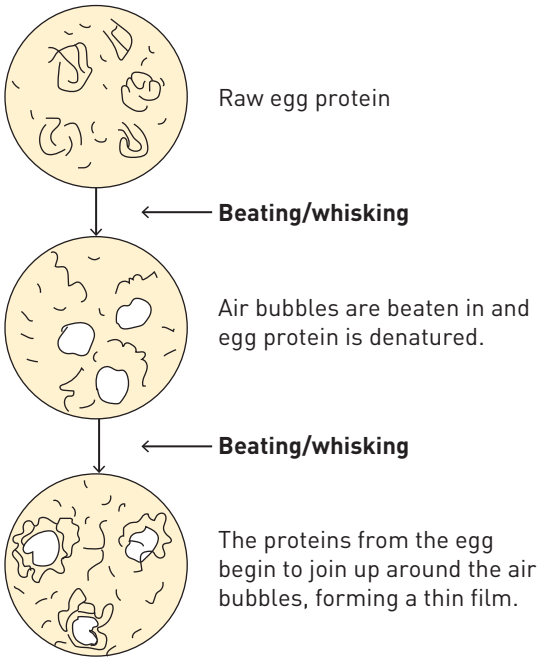
Shutterstock.com/margouillat photo

Lecithin in egg yolks helps create an emulsion.

Aeration of eggs

When mechanical action is applied to egg whites – that is, they are whisked or beaten – the protein is denatured, creating a foam that will aerate a mixture. As the egg white is beaten, the protein is stretched, forming a thin membrane that traps air bubbles. This mesh-like structure stabilises the air bubbles in the foam. Providing protein molecules are not overstretched, the foam will continue to expand when heated, creating extra lightness. A pinch of salt may be added to help create a more stable, stiff foam without influencing the flavour because it helps bring the proteins together. Examples of this form of aeration can be observed when sponges and soufflés are baked, and fluffy omelettes are cooked in a frying pan.

Eggs, either whole, yolks or whites, trap air as they are beaten to create a foam made from millions of bubbles that will increase the volume and create a light texture in a mixture. During whisking or beating, the egg-white protein, ovalbumin, is denatured or partially coagulated. The protein forms an elastic framework around the air bubbles and this trapped air expands when heated in the oven. The expanding bubbles lift the soufflé or cake until the temperature of the mixture is hot enough to set the egg protein. Egg whites can aerate products such as meringues, soufflés and sponge cakes.



Stages in making an egg-white foam

To maximise the foaming properties of egg white when preparing them in the kitchen, it is important to:

- ensure the whites are at room temperature
- ensure the whites contain no trace of egg yolk and therefore no fat
- ensure all utensils are clean and dry
- avoid using plastic utensils because they tend to retain fatty substances and inhibit the foam development.

Overbeating egg whites overstretches the protein molecules and the foam will collapse. Adding sugar

to a beaten egg foam will stabilise the mixture and maximise its volume when baked.

Note that if egg whites have to be measured, 1 egg white is equivalent to 30 millilitres or 1.5 tablespoons.

Shutterstock.com/Charlie Edwards

Egg white is denatured during beating.

Understanding the text

21 Define the term 'denaturation' and describe how it can change the properties of protein foods.

22 Define the term 'coagulation'.

23 Use a flow chart to illustrate the physical changes in egg protein as it begins to coagulate.

24 Explain why you would have to adjust the cooking time when baking a custard made with two egg yolks rather than two whole eggs.

25 Describe the structural role of eggs in a baked product such as a cake.

26 Identify and explain the chemical reaction that occurs in an egg glaze when it is brushed onto pastry before baking.

27 Explain how eggs thicken a custard sauce.

28 Why is vinegar added to the water when poaching an egg?

29 Explain why egg yolk can be described as an emulsifying ingredient.

30 Explain how beating eggs denatures the protein and aerates a mixture.

MEAT

Meat is the flesh of animals and birds that is eaten by humans. It is a rich source of nutrients and an excellent source of protein. Three of the main proteins in meat are:

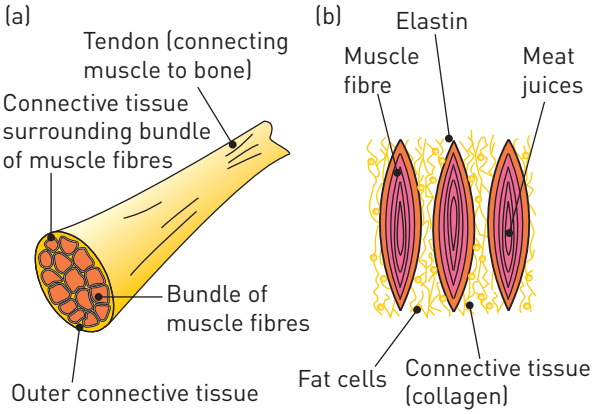
- collagen in the connective tissue
- myosin in the muscle tissue
- elastin in the muscle fibre.

Red meat is flesh from cattle (beef) and sheep (lamb). White meat includes flesh from pigs (pork), calves (veal) and poultry (chicken, turkey and duck). Game is dark meat that may come from rabbits, kangaroos, crocodiles, deer and wild birds.

Structure of meat

Lean meat is composed of bundles of long muscle fibres. Each fibre has a wall of elastin and is filled with water carrying dissolved protein, minerals and extractives. These fibres create the grain of the meat. The bundles of fibres are held together with collagen, which dissolves into gelatin when cooked by moist methods.

Fat is present between the protein fibres in the form of invisible fat or marbling, on the outer surface as adipose tissue, and around internal organs such as the kidneys, where it acts as a protective layer. The older the animal is, the greater the amount of fat.



Structure of meat

What makes meat tender?

The tenderness of a cut of meat depends on the age of the animal and the part of the body from which it comes. The meat from young animals has short, fine fibres, whereas meat from older animals has longer, thicker fibres and more connective tissue. The level of activity of an animal is directly related to the tenderness of its meat. Hard-working muscles of an animal's legs

and neck are highly developed, so there is a greater build-up of connective tissue – the resulting cuts of meat are tougher, darker in colour and have a stronger flavour. The cuts of meat from around the ribs, the back and the rear parts of the animal that move less when the animal is in the pasture have less connective tissue and therefore produce the most tender cuts of meat.

The tenderness of meat is also influenced by the methods of preparation and cooking used, as well as the cut selected. Meat can be partially tenderised mechanically by scoring or pounding, or cutting across the grain. It can also be tenderised by marinating.

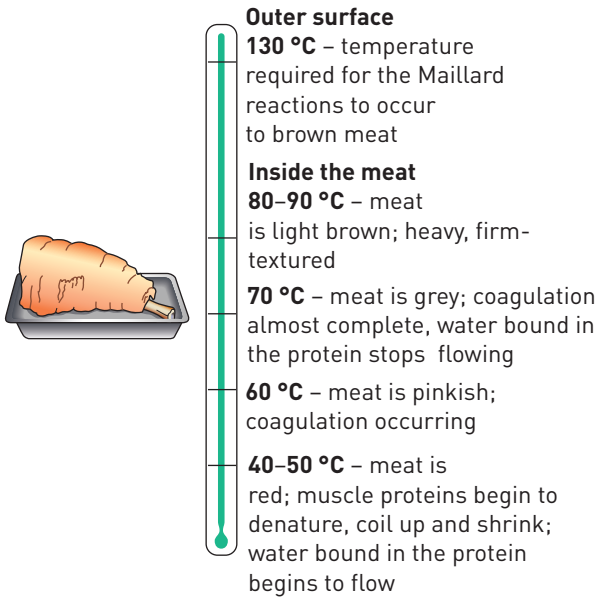
Cooking meat

Cooking meat successfully is all about producing the best colour, texture and flavour. By applying heat, the Maillard reaction produces the meaty aromas and brown colour people enjoy. Denaturation and coagulation of protein occurs so the texture of meat becomes firm and holds its shape. The fat melts, contributing to the flavour and the crisp surface texture. Meat is also cooked to make it safe to eat by destroying any harmful microorganisms and to make it easier to chew and digest.

Changes that occur when meat is cooking

The cooking process changes each main structural component of the meat:

- **Muscle fibre** – During heating, the proteins in the muscle fibre begin to change shape; that is, they denature and coagulate. As the proteins change, there is contraction in the direction of the muscle fibre, resulting in the piece of meat shrinking and becoming firm as some of the water is expelled. The longer the meat is heated, the tougher it becomes, as more protein is denatured. If meat is overcooked, the toughened protein becomes less digestible.
- **Connective tissue** – The protein collagen, which makes up connective tissue, is tough in its raw state and must be cooked sufficiently to convert it to water-soluble gelatin so that it becomes tender enough to bite through.
- **Fat** – Before heat is applied, the fat in meat is solid, either on the edge of a cut of meat or marbled through the muscle fibre. During cooking, the fat melts and acts as a lubricant so that the muscle fibre appears less tough. Fat also contributes to the flavour and aroma of cooked meat.
- **Water** – This is the largest component of meat and has a major influence on the flavour and texture of the cooked meat. When the meat is heated, for example when frying, a little water will flow out of the meat as the proteins begin to denature. However, most of the water remains locked within the proteins, and if the meat is cooked at the correct temperature and for the correct time, it should be juicy and moist to eat. Meat that has been cooked too long will become dry because much of the water has been lost.



Stages in cooking meat

Effect of mechanical action on meat

A meat mallet can be used to pound some meat cuts to break down the tough fibres. This tenderises the meat or makes it thinner so it will cook more quickly. For example, a blade steak can be pounded before coating in egg and breadcrumbs to make a schnitzel. Chuck steak can be pounded before being cut into cubes for use in a rendang curry.

Effect of acids on meat

Acidic ingredients, such as wine, vinegar or lemon juice, are often combined with flavourings to make a marinade for meat and poultry before cooking. The acidic ingredient in the marinade acts as a tenderising agent by breaking down bonds between the proteins in the connective tissue and converting the collagen to gelatin. These acidic ingredients also increase the hydration or water-holding capacity of the muscle fibre – that is, the protein in the meat – which increases softening and tenderising during cooking.

Effect of enzymes on meat

The enzyme papain, an extract from papaya, is a common ingredient in commercial meat tenderisers – it breaks down the bonds between some of the protein molecules in tough meat fibres. It is sold in supermarkets as a white powder mixed with salt, sugar and a range of herbs and spices.

POULTRY

The term 'poultry' includes duck, turkey, chicken, pigeon and goose. Chicken is the most popular type of poultry because it has an appealing flavour, can be prepared and cooked in many different styles, and is economical.

Structure of poultry

Poultry can be cooked as a whole bird, or cut into portions such as thigh fillets, drumsticks, wings, tenderloins, chops and breast fillets. The thigh and leg meat of poultry is from the active muscles of the bird, so these are tougher cuts. They are darker in colour because they require more oxygen to move about, and are higher in fat. Domestic chickens do not fly, so their breast meat is white and tender because there is less connective tissue.

Cooking poultry

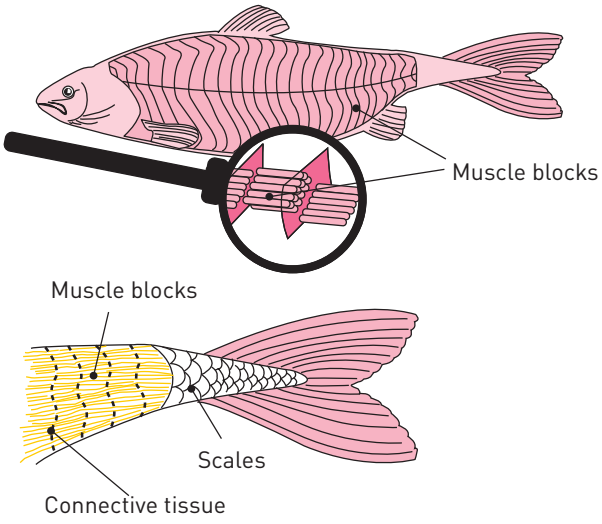
The tender cuts such as tenderloins and breast fillets are best prepared using quick dry methods of cooking such as stir-frying or pan-frying to prevent dryness and toughness. As with red meat, the heat of the cooking process denatures and coagulates the proteins. In their raw state, cuts of poultry have a pinkish colour, are shiny on the surface and soft in texture. As heat is applied, the flesh becomes whiter and firm to touch. Browning on the outside when dry methods of cooking are used is a result of the Maillard reaction. Tougher cuts, such as drumsticks and thighs, have more connective tissue and are best baked or cooked using a wet method such as simmering for a curry or casserole.

SEAFOOD

Fish are aquatic vertebrates; that is, they have a spinal column and are found in fresh water or salt water. Fish are one of the most popular animal foods eaten throughout the world. They are found in most waterways of the globe, from the waters of the Arctic and the Antarctic to tropical streams and oceans.

Structure of seafood

Fish is different from meat and poultry in that the muscles are arranged in layers of short fibres unlike the long fibres that make up the muscle fibres of meat and poultry. These bundles of short fibres are surrounded by very thin sheets of delicate connective tissue. Fish contains very little connective tissue – only about 3 per cent of its body weight in comparison with meat, which contains approximately 15 per cent of connective tissue. The little connective tissue that is present is very fragile and easily converted to gelatin.



Muscle fibres in fish

Fish have different sensory properties depending on the amount of oil in their flesh.

- **Oily fish** – The oil is dispersed throughout a darker coloured flesh and these fish have a strong flavour. Examples of oily fish are salmon, tuna, trout, sardines, mackerel and gemfish.
- **White fish** – These fish have white flesh and a delicate flavour, and the oil is contained in a small sac near the liver. Whiting, flathead, flake, garfish and bream are examples of white fish.

Cooking seafood

The changes in the physical and sensory properties of fish are particularly evident during the cooking process. In its raw state, fish is translucent, firm to the touch, and the juices are clear and watery. When fish is fully cooked, and the proteins have denatured and coagulated, the flesh becomes opaque and begins to separate into flakes and the juices are milky white. Fish cooks quickly and, when cooked, it is very tender, with a tendency to fall apart during cooking. As fish has a low fat content, it is easier to digest than meat or

poultry. Cooking fish whole rather than as fillets helps to keep the flesh moist and has a superior flavour.

Effect of acids on seafood

Fish has only a small amount of connective tissue so is tenderised or softened very quickly when exposed to an acid such as lemon or lime juice. In fact, if fish is marinated in an acidic ingredient for longer than 5 to 10 minutes the raw flesh turns white and the texture becomes firm – in much the same way as the sensory properties of fish are changed during cooking.

Understanding the text

31 What is the grain of meat?

32 Where on animals do the most tender cuts of meat come from, and what are the recommended cooking methods?

33 Explain how connective tissue influences the tenderness of meat.

34 Why are dry methods of cooking suitable for some cuts of meat and moist methods for other cuts of meat?

35 Prepare a summary of the changes that occur during cooking to the main components of meat – muscle fibre, connective tissue, fat and water. Explain how the changes influence the final sensory properties of cooked meat.

36 Explain how mechanical actions and the application of acids affect the tenderness of meat.

37 Discuss the relationship between tenderness and cut in poultry.

38 Describe the changes that occur to poultry when it is cooked.

39 Describe the difference in structure between fish and meat, and explain how this impacts on the cooking time of fish.

40 How does the exposure to ingredients such as lemon juice change the properties of raw seafood?

MILK

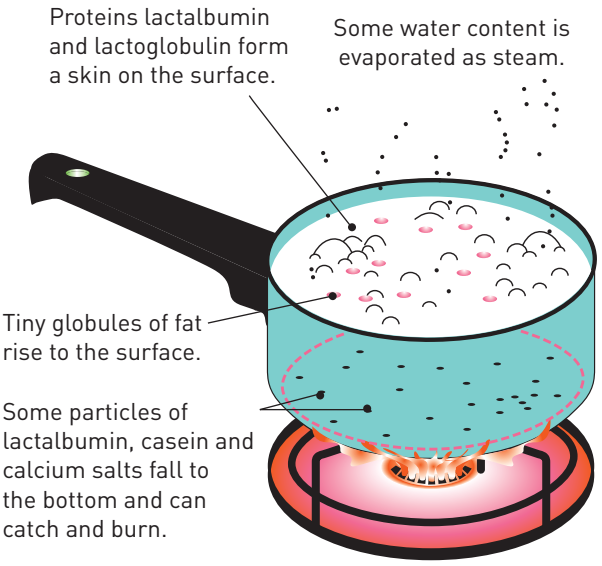
Milk is a liquid produced by mammals to feed their young. It consists mainly of water and a range of nutrients, including various proteins, calcium, milk fat, sugar, vitamins and mineral salts that are suspended in the liquid. There are two main types of protein: those present in the whey of the milk, principally lactoglobulin and lactalbumin, and those present in the curds of the milk, casein. This classification of the proteins in milk is important, particularly in cheesemaking.

Cooking with milk

Boiling milk

When milk is heated in a saucepan, several changes occur. Some of the water in the milk evaporates as steam and the tiny globules of fat begin to rise to the surface, giving a more creamy appearance. When the temperature of the milk reaches boiling point (100 °C), the proteins present on the surface of the milk combine with the fat to form a skin. If the heating continues, the milk may boil over as a result of the pressure of steam forcing its way through the skin.

If milk is warmed over a direct heat, a coating forms on the base and sides of the saucepan. This occurs as the heavy protein particles in the milk fall to the bottom of the saucepan, where they stick and can scorch or burn. This effect is even more obvious in functional milks that have been enriched with additional protein or calcium. To help prevent this, stir the milk during heating, or use a heavy-based, non-stick pan or heat milk in a microwave oven.



The impact of heating on milk

Combining eggs with milk – baking and steaming milk

Custard is a mixture of milk, or milk and cream, with eggs or egg yolks and sugar. There are two basic kinds of custard: one is stirred on top of the stove and the other is baked in the oven.

The consistency of custard depends on the ratio of eggs to milk – the higher the ratio of eggs to milk, the thicker the end product, as more egg protein is available to coagulate. The smooth texture of custard relies on gentle, even heat, ensuring the eggs coagulate or set evenly within the milk at a temperature between 65 °C and 70 °C. Preparing a stirred custard in a double boiler, or cooking the set custard in a water bath, helps to prevent the delicate mixture from curdling or separating. If the custard is overheated, the proteins from the egg and milk begin to over-coagulate to form small lumps and separate from the whey, and the smooth, rich texture is lost.

Effect of acids on milk

Ingredients such as citric acid, for example lemon juice, cause significant change in the sensory properties of milk when they are mixed together. Adding lemon juice to fresh milk will cause the milk to curdle. This means the milk protein, casein, joins together or coagulates to form tiny lumps or clots, thus altering the texture and appearance of the milk. The flavour of milk also becomes sour to taste. The hot dessert lemon delicious is based on the ability of the milk protein to clot, thicken and separate when mixed with an acid to create its unique texture and create the layering effect of sauce and cake.

When foods with a low pH, such as lemon or tomato, are combined with milk or cream in a recipe, over-coagulation or curdling, the separation of the protein, casein and the liquid, occurs. Examples of this are evident in cream soups, particularly tomato soup, which are heated above the temperature at which the milk proteins begin to coagulate. The unpleasant curdling in tomato soup can be prevented by avoiding boiling after the addition of cream or milk.

Effect of milk on other foods

- **Using milk to develop colour** – Milk is often brushed onto the surface of scones and pastries as a glaze just before baking. The formation of a golden brown colour is an example of the Maillard reaction; that is, the breakdown of the protein and milk sugar (lactose) during baking.
- **Milk adds moisture to baked products** – Milk is a liquid, so when it is used in mixtures for baked products, the moisture it provides helps to combine ingredients as they are stirred together. It also assists in dissolving the sugar and hydrating the gluten in wheat flour. Using full-cream milk in products such as sauces and custards creates a rich flavour and smooth, full mouthfeel as a result of the fat in the milk.
- **Milk creates soft crusts in baked products** – Baked products such as cakes, muffins and sweet breads, which include milk as an ingredient, have a soft crust because the milk proteins and lactose absorb water, thereby slowing down its evaporation from the outside of the product.

PROTEIN IN PLANT FOODS

Gluten

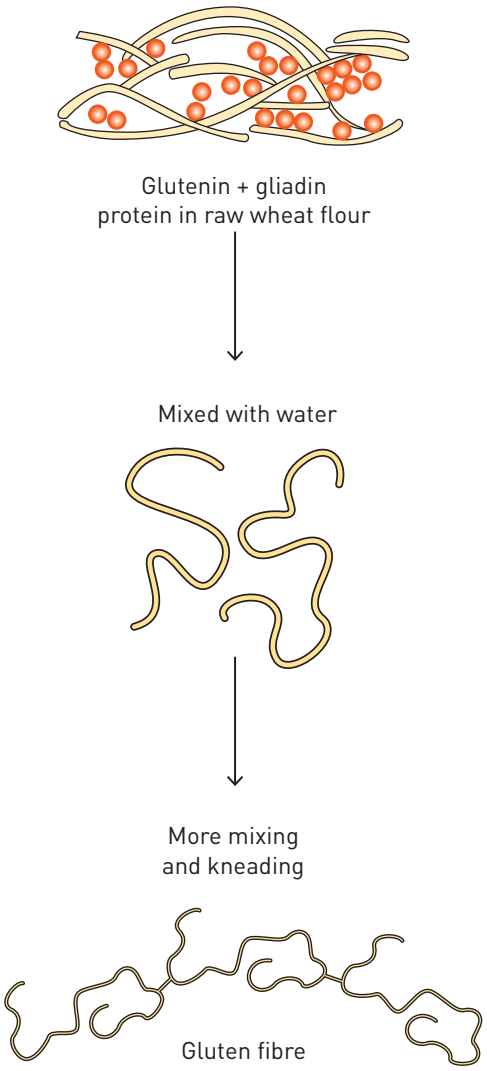
Gluten is the protein component of many cereals and is found in high amounts in wheat flour. It can only be formed when flour is mixed with water. Under a microscope, it is possible to observe the two proteins of wheat flour, glutenin and gliadin, which join together when they are mixed with water to form gluten.

Mechanical actions

Kneading a dough

When gluten is developed in a flour mixture, it creates a strong network that can be stretched like an elastic band and will then spring back. The more the gluten is developed – using the mechanical actions of kneading or mixing – the more it is capable of stretching into a thin film without tearing or breaking. With continued mixing and kneading, batters and doughs become smoother and stronger. They can then trap solid particles, liquids and gases as they expand. This property is important in the production of yeast doughs and pasta, which rely on a strong structural framework to enable them to hold their shape once cooked.

In contrast, one of the key sensory properties of cakes, muffins and biscuits is their light and tender texture. So when we make these products with wheat flour, it is important to use minimal mechanical actions when combining the ingredients; for example, folding the flour in lightly rather than beating reduces the development of gluten and prevents a dry, tough texture.



Stages in the formation of gluten

Beating legume protein

Some creative cooks have spent time researching ingredients that could be substituted for eggs in recipes such as meringues. Surprisingly, the brine drained from canned chickpeas and cannellini beans is rich in a range of plant proteins which, when beaten, can be stretched and stabilised with sugar. The mechanical action of beating changes the shape of the proteins and they behave similarly to egg whites in a recipe for meringues. This property of the chickpea brine allows vegans and people allergic to egg to enjoy many sweet baked products.

Making tofu

Tofu or bean curd is a custard-like high-protein food made from curdled soy milk. Soy milk is cooked, then cooled and coagulated with salts. The curd is then pressed as in cheesemaking. The final product is a delicate but firm curd with a bland flavour that has the capacity to take on the flavours of foods with which it is cooked. When is it fried, the outside becomes golden brown due to the Maillard reaction.

Understanding the text

41 Draw a flow chart to explain the effect of heating on milk.

42 Identify the process that causes a milk and egg custard to thicken and explain why it should be heated over water to achieve the most desirable sensory properties.

43 Why do the sensory properties of milk change when it is mixed with lemon juice?

44 Describe the changes to the sensory properties of milk when lemon juice is added.

45 How do the proteins in milk contribute to colour development and creation of a soft crust in cakes and muffins?

46 What is gluten?

47 Describe how the mechanical action of kneading a dough changes the physical properties of gluten.

48 Why should the mechanical action of kneading be kept to a minimum when making products such as scones but maximised in bread making?

49 Explain why the brine from canned legumes such as chickpeas can be used as a substitute for eggs in meringues?

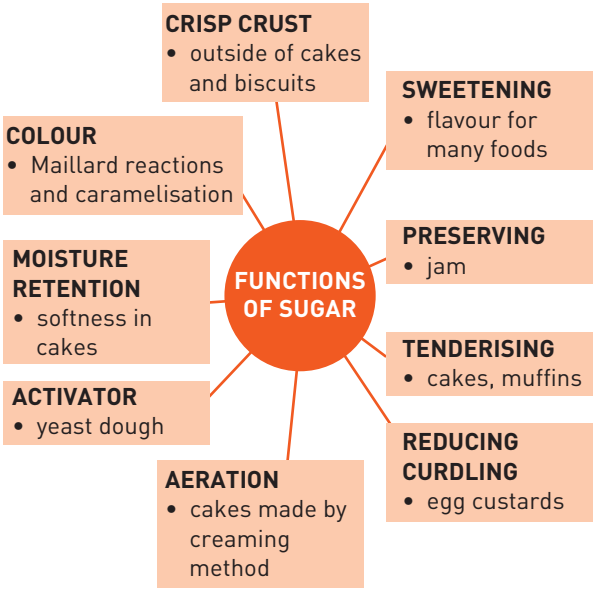
50 How is mechanical action used in the production of tofu from soy milk?

Sugar

TYPES OF SUGARS

Sugars are carbohydrates: they contain the elements of carbon, hydrogen and oxygen. Sugars dissolve in water and have a sweet taste. Sugars are divided into two major groups according to the number of saccharide units they contain as can be seen in the table on page 83.

FUNCTIONAL PROPERTIES OF SUGAR



Sugar is added to many foods during their preparation and processing; it has many valuable functions. Sugar comes in a crystalline form as A1, caster, icing and brown sugar, or in a syrup form such as golden syrup, maple syrup and honey.

Sugars and syrups are used to sweeten foods such as drinks, biscuits, desserts, cakes and pastries. Sugar is also used as an ingredient in a variety of non-sweet foods, such as tomato sauce, relish, chutneys and salad dressings. When added to these salty or acidic foods, it softens the dominating flavours. Sweet and sour Chinese-style dishes combine the salty or savoury flavours with the sweetness of ingredients such as pineapple. Roast lamb is often paired with the sweetness of mint sauce or jelly, and pork with apple sauce.

Ice-creams are made with a high proportion of sugar and many seem over-sweet when taste-tested at room temperature. However, after the mixture has been frozen, the sweet flavour is difficult to distinguish because the cold temperature tends to numb the taste buds.

- **Sugar as a valuable activator** – Sugar acts as an activator and food for yeast during fermentation. Yeast breads require a little sugar initially to speed up the yeast in producing carbon dioxide for leavening the dough.
- **Sugar as a tenderiser** – Sugar has a tenderising effect on baked products such as cakes and muffins. The sugar in the mixture helps to produce a fine crumb texture and good volume during mixing and baking. During mixing, sugar tenderises cakes by absorbing the liquid and preventing the uptake of water by the flour. This retards gluten development and prevents the products developing a tough, dry texture.
- **Sugar assists in moisture retention** – Sugar helps to retain moisture because it has a hydroscopic property; that is, water-attracting capabilities. This increases the softness in freshly baked products and also extends the shelf life by keeping baked goods from drying out. Sweet biscuits become soft when left uncovered or not kept in a sealed container because the sugar in them attracts moisture from the air.
- **Sugar's capacity to reducing curdling** – The addition of sugar to custard mixtures raises the coagulation temperature of an egg custard, allowing the eggs to coagulate or set slowly. This produces a smooth, stable consistency and prevents curdling.

GROUP	NAME/STRUCTURE	SOURCE
Monosaccharides	• Glucose – the form of carbohydrate the body uses as energy • Fructose – known as 'fruit sugar' • Galactose – found in the milk of mammals	• Onions, unripe potatoes and sweet fruits • Fruits, plant juices and honey • Forms part of the milk sugar, lactose
Disaccharides formed when two monosaccharides are joined together	• Sucrose – 1 unit of glucose + 1 unit of fructose • Lactose – 1 unit of glucose + 1 unit of galactose • Maltose – 2 units of glucose joined together; known as 'malt sugar'	• Fruits, vegetables, sugar cane • Milk • Formed when barley is malted in the brewing process

Types of sugar

COOKING WITH SUGAR USING DRY HEAT

Effect of baking on sugar

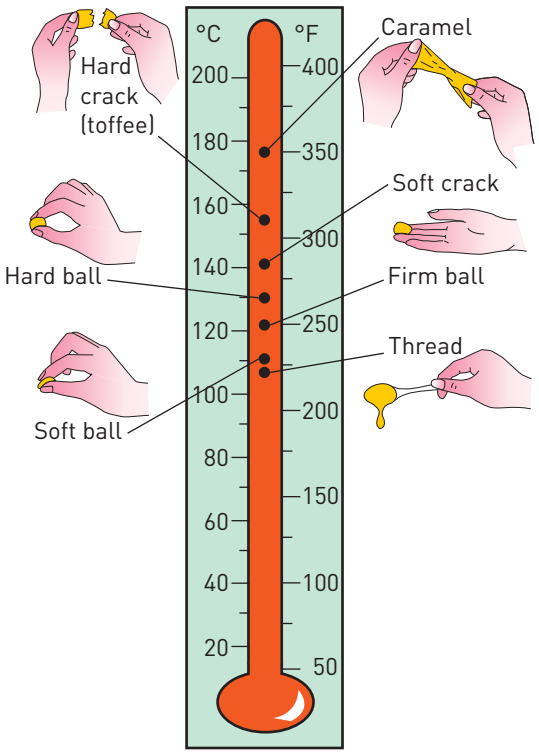
The Maillard reaction occurs when sugar or starch, and proteins from egg or milk, are present in the same mixture and dry heat is applied during baking. This reaction produces a golden crust on baked food, such as cakes, biscuits and muffins, and a desirable flavour often likened to roasted coffee or cocoa. The higher the sugar content, the darker brown the surface appears to be.

Caramelisation of sugar

Caramelisation is the process that sugars undergo when heated to high temperatures when the molecules begin to break apart. Consider table sugar crystals, which have no colour or aroma but are sweet to taste in their original form. When they are heated in a dry pan, the high temperature creates lots of new and different compounds that can be bitter or very aromatic, have a deep-brown colour and are less sweet. The more sugar is cooked, the less sweet it becomes and the darker the colour.

When making caramel, the sugar is usually dissolved in a little water – this enables the sugar to be heated over high heat immediately and reduces the danger of burning because it allows the process of caramelisation to take place over a longer time.

Using a sugar thermometer helps take the guesswork out of making caramel so is a very useful tool when making different types of confectionary.



Stages in caramelisation

EFFECT OF SUGAR ON AERATION

Many cakes, biscuits and puddings are made using the 'creaming' method. When beating the sugar and butter together, the sharp edges of the sugar crystals help form small pockets of air in the fat or butter. The mixture becomes lighter in colour and fluffier in texture, hence the description that creamed butter and sugar should look like lightly whipped cream. During the cooking process, the tiny air pockets expand and contribute to the aerated texture and the increased volume of the end product.

EFFECT OF ACIDS ON SUGAR

Crystallisation occurs when a supersaturated sugar solution, using A1 or table sugar, is boiled and large crystals form. When the sucrose solution is heated with acid it is 'inverted' or broken down into monosaccharides – glucose and fructose molecules. These substances are very soluble; therefore they hold and retain moisture, which prevents crystal formation. In making confectionary such as toffee, this crystallisation process in sugar mixtures can be slowed down or prevented by the addition of an acid such as vinegar.

The setting of jam depends on the right proportion of acid, sugar and pectin from the fruit to form a gel. The pectin in ripe fruit is soluble and can be set free from the cell walls if it is crushed or stewed for a short time. In unripe fruit, the pectin is in an insoluble form called 'pectose', which can be freed from the fruit and converted to pectin by stewing the fruit with an acid. Acid is needed in jam making, not only to change pectose to pectin to create the gel, but also to improve the flavour and colour of the jam.

In jam making, the inversion or breaking down of sucrose occurs when sugar is added to fruit. It is the acid from the fruit that contributes to the smooth texture of the jam and helps prevent crystallisation during storage.

Starch

Starches are carbohydrates made up of polysaccharides, which are composed of many monosaccharide or glucose units joined together. Starch granules are the small gritty granules found in the endosperm of

STARCH	PHYSICAL AND CHEMICAL PROPERTIES	USES IN FOOD PRODUCTS
Flour – from wheat	• Cloudy, heavy gel • Dull flavour	Bread, cakes, biscuits, pastries
Cornflour – from wheat or maize	• Cloudy, good sheen • Syneresis occurs over time • Not stable in high-acid mix	Thickening agent in stews, casseroles, cream pastries
Arrowroot – from the arrowroot tuber	• Clear, shiny, soft, stretchy gel • Stable in high-acid mix • Clean flavour	Glazes on fruit tarts
Pectin – from fruit and vegetables	• Clear, shiny gel • Clean flavour • Requires a high-acid/high-sugar mixture to gel	Fruit jams, fruit jellies, glazes
Rice flour	• Gluten free • Slightly coarse, white powder • Faint nutty flavour when baked	• Gluten-free foods designed for people with coeliac disease • Some biscuits, puddings and shortbread • Thickens Asian-style sauces
Potato starch – from cooked, dried and ground potatoes	• Gluten free • Thickener • Retains moisture in baked products	Indian-style breads, gluten-free products

Thickening properties of starches

cereal grains from which flour is made and also in the tubers and roots of certain plants. The starch in plants forms the 'store house' or nature's way of storing energy for growth and reproduction in the plant.

THE FUNCTIONAL PROPERTIES OF STARCH

Starch contributes to the structure

Flour, which is mostly starch with a little protein, is one of the most important ingredients in baked products such as cakes and breads because it provides structure. Gluten and starch are responsible for the structure-building properties of flour. The structure allows products to hold a new, larger size and shape as gases produced by raising agents or the fermentation of yeast expand and leaven. The cooked starch prevents products collapsing once they have been removed from the oven and cooled. Starch also forms the structural body for extruded snack foods such as Twisties and pretzels.

Starch absorbs moisture

Flours have the ability to absorb moisture such as water, milk, butter and oil. This is a very important function and helps to bind ingredients together during cake and bread making. Flour absorbs fat when making a roux for the base of a sauce, either a white sauce for a gratin or brown sauce for gravy. Cornflour is often added to dry products such as icing sugar and baking powder to absorb moisture. This prevents caking and lumps forming during storage. It is also used as a dusting powder combined with icing sugar when making confectionary such as jelly sweets or Turkish delight.

Starch can thicken

There is a large range of starches available for use as thickening agents and they are a significant structural ingredient that forms the soft shape of many foods. Knowledge of their different properties is useful in order to select the most suitable one when cooking. Starches such as Hi-maize can be used to increase the fibre content of a product without influencing the sensory properties of other ingredients.

EFFECT OF DRY HEAT ON STARCH

Grilling and baking

Dextrinisation is the process in which a starch is exposed to dry heat: the starch is broken down to dextrin, resulting in a change in colour to golden brown.

In the process of dextrinisation, large starch molecules or polysaccharides in flour are broken down into smaller molecules to form the disaccharide dextrin when exposed to high temperatures. The cooking methods in which dry heat is applied to food are baking, grilling and toasting.

Dextrin does not dissolve in water and does not have the same strong thickening properties of raw starch. Dextrinisation only occurs on the surface of food products because the moisture inside restricts the temperature from becoming hot enough to brown the starch. The formation of dextrin alters the sensory properties of food. It changes the colour of starch from white to brown and develops a slightly sweet, nutty flavour. A desirable 'cooked' aroma is produced and the texture of the food is altered to produce a crisp mouthfeel. Examples of dextrinisation during cooking:

- toasting a slice of bread, which turns brown
- baking a loaf of bread – the crust or outside edge turns brown
- browning a roux for gravy
- baking starchy vegetables such as potatoes to develop a brown outer layer.

When starches are subjected to dry heat, the **Maillard reaction** occurs and a brown colour forms on the outside of starchy foods.

EFFECT OF MOIST HEAT ON STARCH

Boiling starch

Gelatinisation is the process in which starch granules absorb liquid in the presence of heat and thicken the liquid, forming a gel.

Starch is not soluble in water. When it is blended with water and allowed to stand it will settle to the bottom of a bowl. If the starch solution is heated, the starch granules absorb the water and begin to swell. The swollen granules then take up more space and the solution becomes more viscous and thickens to form a gel. During the heating, the mixture must be stirred to keep the starch evenly dispersed so the end product is smooth and lump-free. This process is irreversible and is called 'gelatinisation'.

The method used to combine a starch and liquid may influence the texture of the mixture. If the starch is not blended with cold liquid before heating, lumps will form because water cannot penetrate all the starch. Similarly, if the starch solution is not stirred during heating while the gelatinisation process is taking place, lumps will form and create an uneven texture in the end product.

It is important to boil the mixture because complete gelatinisation does not occur until just before boiling point. If the mixture does not boil, it will not be as thick as desired and will have a raw, uncooked flavour.

When making a roux, butter or fat are blended with the starch to separate the granules before the liquid, such as milk, stock or water, is added – this helps prevent lumps forming. A roux is always heated over low heat to cook out the raw starchy flavour before the liquid is added. A roux is used to thicken sauces, soups and gravy. The colour and flavour of a roux depends on the cooking temperature and the length of time it is cooked before the liquid is added.

Food products that incorporate the gelatinisation process in their production are white, béchamel and

Process of gelatinisation

cheese sauces, the filling for vanilla slice and lemon meringue pie, and glazes for fruit tarts.

The viscosity of a gel will change when other ingredients are added. The addition of sugar will decrease the temperature at which a starch will gel or thicken. Adding acid ingredients, such as lemon juice, will have a thinning effect on a starch mixture.

Syneresis

After a gelatinised mixture is allowed to cool and stand for a long period, it will go through the process of syneresis. As the starch cools, the molecules pull closer together, tightening the 'gel' structure and squeezing out liquid. The 'weeping' effect can often be seen in the filling of a lemon meringue pie that is allowed to stand for several days, or in the over-coagulation or curdling of a custard.

Cooking starchy vegetables and pasta

Cooking starchy vegetables such as potatoes causes the starch to gelatinise; that is, to swell up and become thicker. The form of starch in raw potatoes can only be partially digested – after cooking the starches absorb water, swell and convert to a form that is more readily broken down by our digestive system.

Rice and pasta are cooked by exposing these starchy foods to moisture and heat at the same time, just enough to soften and gelatinise the starch. Rice can be boiled, steamed or cooked by the absorption method. Pasta is cooked in a large amount of boiling water where the starch granules absorb water and expand and the protein network of gluten sets or coagulates so the pasta holds its shape.

CHANGING THE pH – ADDING AN ACID TO STARCH

Acids decrease the ability of starches to thicken liquids, particularly when they are heated together. The process of gelatinisation is disrupted when an acid such as lemon juice, tomato, vinegar or pineapple juice is added to a mixture thickened with a starch such as wheat flour, cornflour or arrowroot. The starch granules gelatinise or thicken more quickly and easily but do not form a firm gel. This occurs because the acid breaks down the starch grains into smaller particles. This process is called 'hydrolysing'. The problem can be overcome by allowing the mixture to thicken and fully gelatinise before adding the acid. When making a lemon meringue pie, the lemon juice should be added after the cornflour mixture has thickened and gelatinisation is complete.

Activity 5.2

Gelatinisation of starches

Aim: To investigate the effects of the gelatinisation process on a variety of starches

Equipment

- 1 tablespoon of each of the following starches: wheat flour, cornflour, arrowroot and rice flour
- ½ cup water for each starch
- 4 small bowls for blending starches
- a wooden spoon
- 4 small wetted moulds
- 4 copies of measuring scale drawn on baking paper (see diagram)

Method

1. Wet the moulds by rinsing with water and draining quickly.
2. Place the wheat flour in a small saucepan and slowly add the water, mixing well so there are no lumps.

Worksheets

3. Place the saucepan over heat; stir continuously until the mixture comes to the boil. Continue stirring and cook for 1 minute.
4. Pour the thickened mixture into the wetted mould. Label and allow to cool and set.
5. Repeat with the other three starches.
6. Loosen the edges of each mould and turn it onto a measuring scale.

Analysis

When analysing your results, consider the relationship between spread and viscosity. The spread refers to the distance the moulded starch moves from its original shape after unmoulding. This is sometimes referred to as 'viscosity'. Rate a very viscous mixture 1 and a less viscous mixture at a higher number.

1. Which starch was easiest to blend? Which starch took the longest time to remove the lumps?
2. Did any of the starches settle to the bottom of the bowl after blending? If yes, which ones?

3 Which starch spread the least and held its shape on unmoulding?

4 Did any of the starches show signs of syneresis?

5 Which starch would you use to prepare a clear glaze for a fruit tart? Why?

6 Which starch would be most suitable for the roux of a cheese sauce to pour over cauliflower? Why?

7 Which starch would be most suitable for a moulded fruit-flavoured dessert? Why?

8 Suggest the most suitable starch to slightly thicken a stir-fry or meat casserole. Explain your answer.

Conclusion

Rank the starches tested from most viscous to least viscous after gelatinisation is completed.

STARCH	SPREAD	APPEARANCE	TEXTURE	FLAVOUR
	Degree of spread in centimetres	White, cloudy, cream, beige, translucent, opaque, transparent, shiny	Smooth, uneven, lumpy, firm, holey, tough, tacky, soft	Floury, starchy, dull, clear, sharp, bland
Wheat flour				
Cornflour				
Arrowroot				
Rice flour				

Results of gelatinisation of starches experiment

Understanding the text

51 What is sugar? List some sources of sugar.

52 How does sugar contribute to the golden brown colour of baked cakes?

53 What is 'caramelisation'?

54 Describe how sugar assists in aerating a cake made by the creaming method.

55 How does sugar tenderise cakes and muffins?

56 What are some key properties of starch?

57 Explain how starch contributes to the structure of baked products?

58 Dextrinisation is a process that occurs to starch when it is exposed to dry heat. Describe the process and list examples of dextrinisation.

59 Draw up an annotated flow chart of the process of gelatinisation of starch.

60 Describe the effect of adding an acidic ingredient to a starch mixture.

Fats and oils

Fats and oils have the same chemical elements as carbohydrates – carbon, hydrogen and oxygen – but the structure varies, so the foods have different properties. The elements are linked together to form fatty acids and glycerol. Fats and oils can be classified according to:

- their source – animal or vegetable
- the way in which they are distributed throughout foods – visible or invisible

- their chemical composition – saturated or unsaturated
- their state at room temperature – liquid or solid.

A fatty acid is a long carbon chain with hydrogen atoms attached. When each carbon chain has its full complement of hydrogen atoms, it is said to be 'saturated'. Saturated fatty acids are mainly present in fats that are solid at room temperature, and are of animal origin. They are found in foods such as milk, butter and fats in meats. Coconut oil is an exception, as it is a saturated fat of plant origin; it is solid at room temperature.

When each carbon chain has less than the full number of hydrogen atoms attached, and double bonds exist between the carbon atoms, the fatty acid is said to be 'unsaturated'. Unsaturated fatty acids are mostly present in plant and vegetable oils such as peanut, olive, maize and canola oils.

PROPERTIES OF FATS AND OILS

Oils and fats used in food preparation

FATS	OILS
White, cream or yellow in colour	Pale golden colour
Opaque	Translucent
Solid at room temperature	Liquid at room temperature
Insoluble, less dense than water	Insoluble, less dense than water
Greasy mouthfeel	Oily mouthfeel

Physical properties of fats and oils

Products containing large quantities of fat and oil, particularly baked products, have a moist, often oily texture and smooth mouthfeel. The droplets of liquid fat are like tiny balls that roll over the tongue and give the rich, creamy texture to foods high in fats. The oil used in cakes, such as banana cake or carrot cake, gives a moist mouthfeel to the cake. The inclusion of oils or cream in dressings, mayonnaise and ice-cream gives these foods a greasy, smooth and moist mouthfeel.

Fats and oils enhance the flavour of foods. Butter adds a rich flavour to baked products, and flavoured oils, such as macadamia and sesame oils, give a distinctive flavour to dressings and sauces.

COOKING WITH FATS AND OILS USING DRY HEAT

Frying

Fats and oils are good conductors of heat because they can be heated to high temperatures, so during the cooking process heat is readily transferred from its source such as a gas flame or electric hotplate. Frying is a dry, fast method of cooking. Food that is deep- or shallow-fried in fat or oil not only cooks fast, but also absorbs some of the fat or oil, giving it a distinctive flavour and a brown, crisp texture.

The pleasant aroma of fried food comes from the breakdown of fats and oils as it is exposed to heat. This is particularly evident in foods such as potato chips and battered fish. The high temperatures reached also cause food to become golden brown on the outside as a result of the Maillard reaction and dextrinisation.

Shutterstock.com/Tobik

The Maillard reaction turns hot potato chips golden brown when fried.

Roasting

Roasting involves cooking food such as meat, poultry and vegetables uncovered in the oven in a little fat or oil. This method usually produces food that is well browned on the outside and moist inside. Fat and oils play an important role in roasting as a medium to transfer heat and to prevent the outside of the meat or vegetables drying out. The Maillard reaction and caramelisation contribute to the colour development of the food.

EFFECT OF FAT ON AERATION

Fats assist in the aeration of baked products, especially cakes that are made from the creaming process; that is, when the butter and sugar are beaten together to form a light, fluffy mixture before egg and other ingredients are added. Fats trap tiny air cells during the beating or creaming process. During baking, the trapped air bubbles in the cake batter expand and leaven the product to create a light, airy texture in baked products.

EMULSIFICATION

Emulsions can only be made from two immiscible liquids; that is, they don't dissolve in each other and keep their distinct properties when mixed together. One liquid is broken up into separate droplets and the other liquid surrounds these. An oil-in-water emulsion has oil or fat droplets dispersed through water as in liquid milk. An example of a water-in-oil emulsion would be butter. Oil-in-water emulsions often used in food preparation are French dressing and mayonnaise.

amanaimages/Winkelmann, Bernhard/the food pa

French dressing is a temporary emulsion because the ingredients separate on standing.

Temporary emulsion

When making a French dressing, oil (usually olive oil) is combined with vinegar, or the water component of the emulsion. Shaking the ingredients in a closed jar or whisking vigorously breaks the surface tension between the liquids and they appear to be evenly blended for a short time. This is a temporary emulsion because on standing the two liquids separate.

Permanent emulsion

To make mayonnaise, emulsifying is done slowly by adding oil drop by drop to beaten egg yolks. This process disperses and suspends minute droplets of oil within the yolks, and vinegar or lemon juice is added towards the end. Lecithin, the protein in the egg yolk, acts as an emulsifying agent and holds the oil and water molecules in suspension so the mayonnaise has a thick, satiny texture that does not separate on standing. It is a permanent emulsion.

EFFECT OF FAT ON THE TEXTURE OF BAKED PRODUCTS

In baked products, such as pastries and biscuits, fat provides tenderness to the cooked food. The fat, usually butter, coats the starch grains and separates the gluten strands, preventing strong cohesion and providing a crisp effect, which is described as shortening. The butter is usually combined with the flour by the rubbing-in method, which can be done by hand or in a food processor.

FATS AND OILS ASSIST IN RETAINING FRESHNESS

After baking, the starch molecules from the flour in cakes and biscuits begin to bond and solidify, causing the products to stale or have a dry, crumbly texture. Fats such as butter or margarine delay this process of staling and increase the keeping qualities of these products. Cakes such as rich fruit cakes or shortbread biscuits have high proportions of butter and therefore remain fresher than scones that have a small quantity of butter and become stale within several hours of baking.

Understanding the text

61 Identify sources of fat and oils used in food production.

62 Why are fats and oils used to cook many foods?

63 Compare the similarities and differences between the properties of fats and oils.

64 Explain why frying food creates food that is appealing to many people.

65 Why are fats or oils used in the process of roasting?

66 What is the role of fat in the aeration of cakes made by the creaming method?

67 What is an emulsion?

68 Describe the difference between a temporary and permanent emulsion.

69 How does butter shorten pastry and biscuits?

70 Explain how the inclusion of butter in a cake improves its keeping quality.

PREPARING FOR EXAMS

Applying knowledge

Prepare individual knowledge maps for each of the following natural food components. Identify the properties that make them useful in food preparation.

- Acids
- Alkalis
- Enzymes
- Protein
- Sugar
- Starch
- Fats and oils

Analysing information

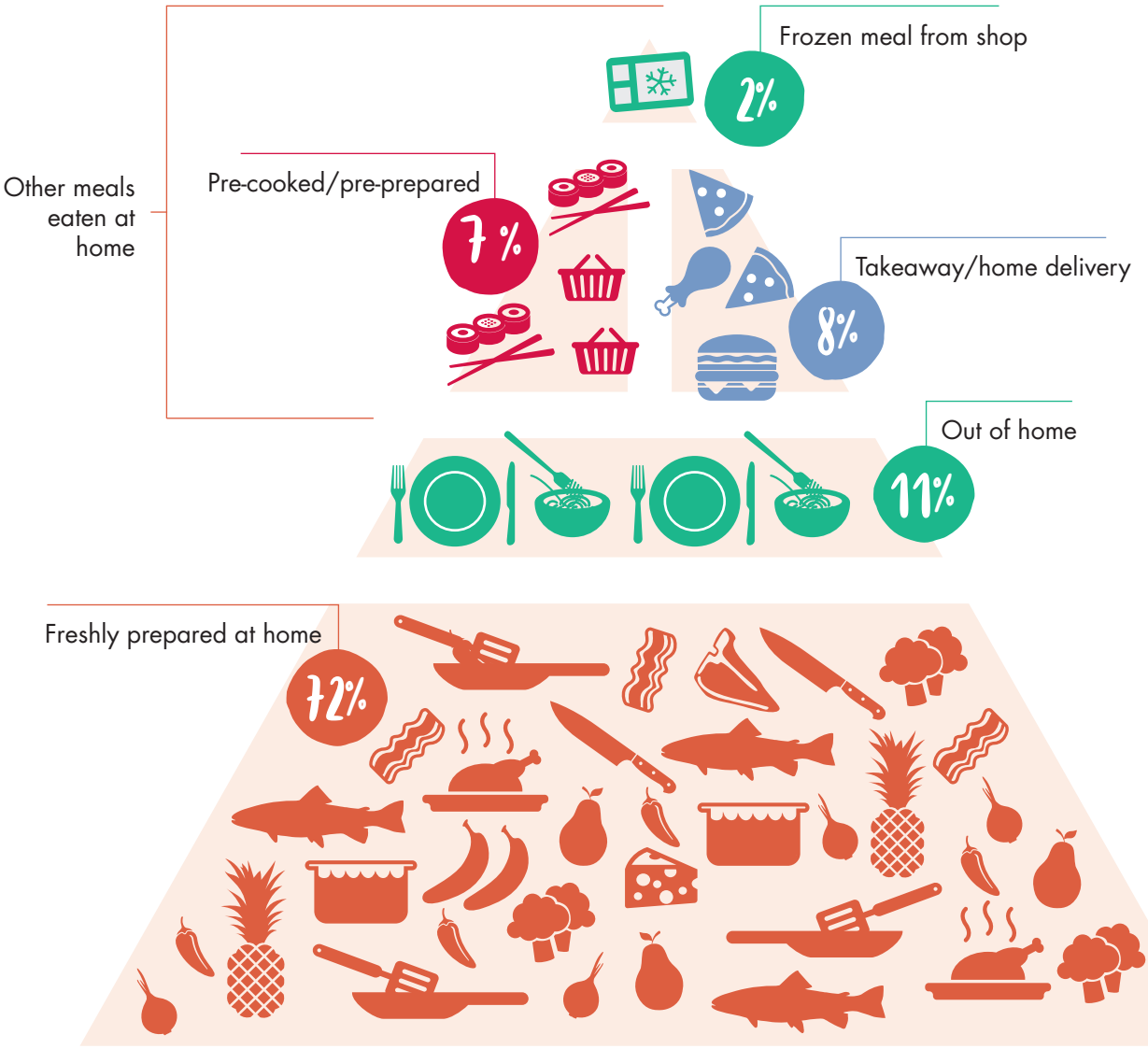
Describe the changes in the physical properties of meat when it is cooked. Use a simple diagram to support your analysis.

Evaluating concepts

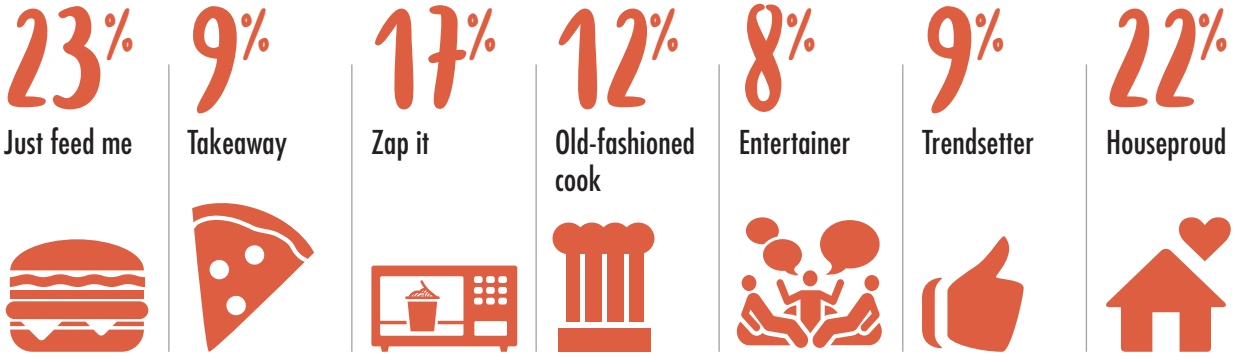
There are many processes used to aerate food products. Evaluate the benefits of using each of the following during the preparation of food products:

- biological processes
- chemical processes
- mechanical processes.

LAST NIGHT'S MEAL IN AUSTRALIA



FOOD PURCHASING BEHAVIOURS IN AUSTRALIA



6

AUSTRALIAN EATING PATTERNS

INFLUENCES ON FOOD TRENDS IN AUSTRALIA

SOCIAL FACTORS THAT INFLUENCE HEALTHY EATING

Education:

- Food models
- Kitchen garden program
- Health star ratings on packaging

Location:

- Rural and remote communities
- The elderly living alone

Income:

- Private labels in supermarkets

Available time:

- Pre-prepared/pre-cooked meals
- Online ordering and delivery of ingredients and meals
- All-in-one food preparation appliances

Cultural norms:

- Customs
- Religion

Accommodation

- Apartment-style living
- Homelessness

KEY TERMS

Functional foods are foods that provide a health benefit to individuals beyond that of basic nutrition.

Superfoods are generally recognised as foods that have a high concentration of nutrients and are rich in phytochemicals and antioxidants.

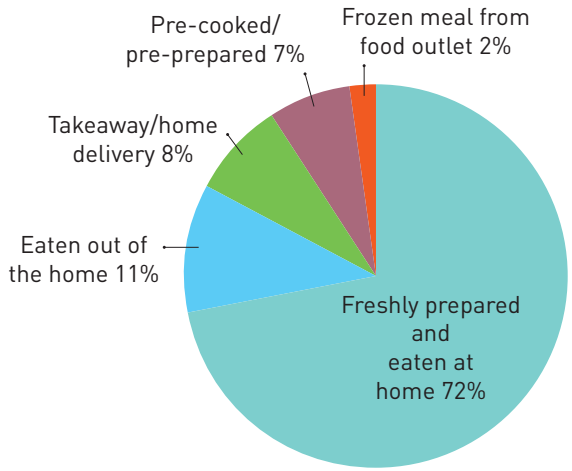
Trends are general changes or movements towards a new result or pattern, for example trends in food consumption.

Patterns of eating in Australia

Meat & Livestock Australia (MLA) commissioned a report in 2009 on the Australian main meal. This research, *Last Night's Dinner*, focused on the main meal practices of Australians, particularly meals prepared in the home.

The results were surprising, and challenged the misconceptions and popular beliefs of dinner meal practices in Australia. The research showed that seven out of ten dinner meals were cooked at home. These meals typically consisted of red meat and fresh vegetables and were cooked using healthier cooking methods. Typical meals included steak and vegetables, roast chicken, stir-fry and spaghetti bolognaise.

Only one in ten meals was prepared and eaten outside the home – the most common meals were take away meals, meals eaten at the home of family or friends, or in a restaurant, pub or club. The most popular meals eaten away from the home were Asian, chicken, fish and chips, pizza, pasta and curries. The results also showed that older Australians tend to cook at home more often, while single people are less likely to do any meal preparation at home. The least enthusiastic about home cooking are younger males.



The results of the MLA survey of the source of 'last night's dinner'

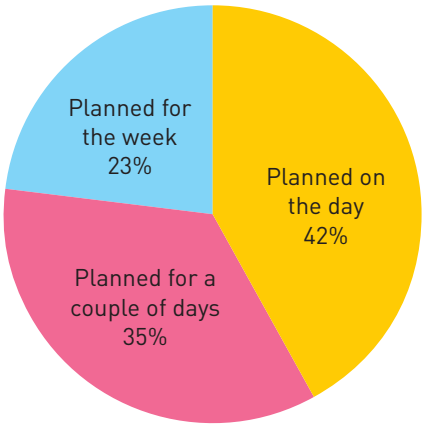
Source: Meat & Livestock Australia, *Last Night's Dinner*, 2009

The report showed that most Australians have a preference for fresh, home-prepared meals, which they mostly eat at home with the family; and they enjoy cooking from scratch with fresh ingredients. A key driver in the selection of ingredients when preparing a meal was nutrition. Most people removed the fat from meat before cooking, or chose lean cuts, and nearly half used reduced-fat dairy options such as low-fat cheese. Many people also use fresh herbs and spices to flavour their meals.

Another interesting finding of the report was that many Australians claim to cook more often than they do, and say they find cooking at home enjoyable and rewarding. Television cooking shows such as *MasterChef* and *My Kitchen Rules* are increasingly popular and seem to be inspiring many people to cook.

CHANGES IN PLANNING AND FOOD PURCHASING PATTERNS

Further research conducted by MLA in 2011, called *Main Meal Repertoires*, showed that it is now rare for Australians to plan meals for the whole week. Most families only seem to plan their main meal on the day they need it, or they have a few meals planned for a couple of days ahead. Many seem to purchase the basic ingredients for the week and then buy any additional ingredients as they need them.



Main meal planning

Source: Meat & Livestock Australia, *Main Meal Repertoires*, 2011

Many people who prepare meals see the old-fashioned way of planning meals well ahead of time as stifling creativity and variety. In many homes, meals are planned at the last minute, for example in the car on the way home from school or work. This means that consumers can purchase whatever foods or ingredients are on 'special' at the supermarket or adapt to changes in household activities and tastes. Most supermarkets stay open late and many trade 24 hours a day, so ingredients can be purchased at almost any time of the day or night. This allows consumers to be more flexible with their planning and cooking of meals, and to make decisions at the last moment.

Preparing for different needs

'Meat and veg' three times a week, fish on Fridays and a Sunday roast are no longer the norm in Australia. According to the 2011 MLA report, in most households, different meals suit different requirements. Some of the most common patterns in family eating include:

- Sandwiches are a quick meal.
- Barbecues are an easy entertaining meal.
- Spaghetti bolognaise is a versatile meal that everyone loves.
- Roasts are a two-in-one meal – one meal for now and leftovers for later.
- Casseroles can be prepared beforehand and are easy to reheat.

The *Main Meal Repertoires* report also shows that different meals suit different groups within the population, for example:

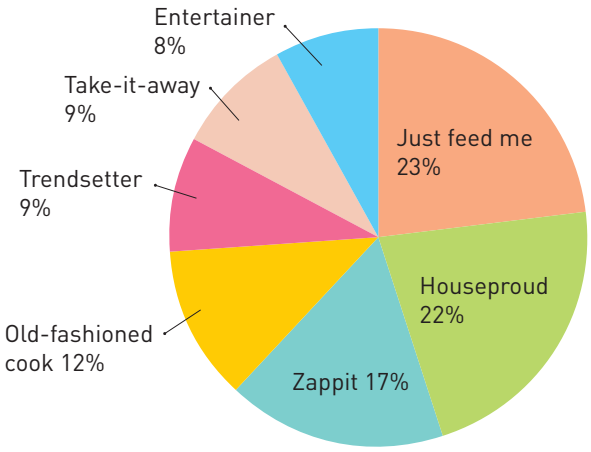
- Vegetarian choices, Asian noodles and 2-minute noodles are ideal for young singles and couples.
- Rissoles, beef casserole, roasts, lasagne and beef sausages seem to be preferred by households with children.
- Two-minute noodles, burgers, Mexican, beef and chicken nuggets are popular in households with younger children.
- Households with older adults prepare pork and lamb chops and vegetable soup more regularly.

Drivers for main meal choices

The 2011 MLA report found that the main drivers in deciding the choice of meals are health, flavour, convenience, cost and cooking skills. The taste of food is the most important issue for people at all stages of life. For young singles, all couples and families with older children, the next most important issue is convenience. By contrast, cost is more important for households with younger children and for older singles. While the cooking skills of the food preparer are relatively important, work commitments and children's activities more less impact on the preparation of food.

Who purchases what?

In July 2015, Roy Morgan Research conducted a survey to identify new segments within Australia's food market. The research showed that not all Australians are obsessed with food, despite the growing café culture and the large number of cooking programs on television.



Australian food market segments

Source: Roy Morgan Single Source (Australia), July 2014 – June 2015

This research of Australians aged over 14 years, showed that many new **trends** are currently making an impact on patterns of eating in Australia.

Twenty-three per cent of people had an attitude of **Just feed me** and, of that number, 60 per cent were male.

Seventeen per cent made up the **Zappit** category – , people who think cooking is a waste of time because they have better things to do. This group is made up equally of men and women who prefer to purchase easy-to-prepare meals or meals that can be reheated in the microwave oven.

Nine per cent of people opt for take away meals. The **Take-it-away** category is made up mainly of men who perhaps have little desire to cook or have limited food preparation skills. As long as the take away meal is tasty, they are happy.

For the remaining 51 per cent of people surveyed, food is high on the agenda; they are interested in what they eat, what impact it has on their health and where it comes from. This group includes the 'Houseproud', 'Trendsetters', 'Entertainers' and 'Old-fashioned cooks'.

The **Houseproud** category makes up 22 per cent of Australians. This group is interested in food for both its taste and nutritional properties. They are mainly family-oriented people who love cooking and enjoy grocery shopping.

The **Trendsetters** make up 9 per cent and this is a group that enjoys new foods, new flavours and new culinary experiences.

Eight per cent are **Entertainers** and this group is fond of the social aspects of meals, such as entertaining at home or dining out. This group can afford to eat at expensive restaurants.

Old-fashioned cooks make up the final 12 per cent. This group love to cook and eat traditional home-cooked meals. Although they can cook a wide variety of meals, they seem to choose the same food, menu and brands each week.

CURRENT TRENDS IN FOOD PURCHASING AND CONSUMPTION

Just as trends in clothing fashion are constantly developing or changing, so are trends in food. Recent developments in food trends have an impact on eating patterns of Australians and their purchasing and consumption behaviours.

The health trend

Health remains a major concern for many consumers. Of particular concern is the increasing incidence of obesity and other diet-related diseases. Consequently, consumers are buying foods that contain unsaturated fats and oils, particularly omega-3 fatty acids, and are moving away from yellow table spreads that may contain trans fats.

Naturally occurring sugars such as stevia are replacing sugar and artificial sweeteners.

Functional foods are foods that provide a health benefit beyond that of basic nutrition. These foods are constantly being designed to specifically improve health by regulating the functions of the body or by slowing the progress of some degenerative diseases. For example, omega-3 in food products such as yoghurt and bread improves the health of the brain, eyes and heart. Foods containing prebiotics and probiotics, such as bread, breakfast cereals and yoghurt, have been developed to optimise digestive and bowel health. Cardiovascular disease is one of the leading causes of death in Australia and manufacturers have developed functional foods such as cholesterol-lowering margarines and breads containing omega-3.

Once, 'free-from' products were only found in small health food stores. Now they are becoming mainstream, and major supermarkets include 'free-from' products in their private label range. In 2014, more than 9 per cent of the new products launched in the marketplace were gluten-free products.

'Free-from' foods include gluten, lactose, soy, salt - and egg-free foods, as well as foods that contain no sugar, additives, preservatives or genetically modified organisms (GMOs). Initially, only consumers who had diagnosed allergies and intolerances bought these products. With the increase in self-diagnosis and a general concern and interest in health and wellbeing, this sector has grown.

Christodoulou

Woolworths 'free-from' range of products

The trend towards snacking

There is a growing trend to snack or graze on nutrient-rich foods at more frequent intervals throughout the day rather than eating three main meals. AUSVEG, a national body representing Australian vegetable growers, reported in 2015 that snacking in Australia has increased by more than 400 per cent in terms of money spent and frequency of eating over the last decade. The busier Australian lifestyle has tended to push aside traditional meals, and Australians are replacing meals, particularly during the day, with more flavoursome and versatile single-serve items. Eating more frequently during the day helps consumers avoid hunger pangs. Snacking also prevents a big drop in blood sugar that can sometimes drive the need to overeat unhealthy foods before mealtime arrives. Breakfast, lunch and dinner still remain the main meals of the day, but grazing and snacking allow consumers to reduce the portion sizes of meals, which is more nutritionally sound. The trend towards packaged healthy snacks that have high nutritional value, such as fruit varieties, dried fruit, nuts, protein bars and muesli bars, has increased significantly.

Consumers should take care to read labels on commercial snack foods because many of these products contain hidden fats, salt and sugar, resulting in more kilojoules. Fresh fruit and vegetables are a better alternative.

Activity 6.1

Australia's growing love of fresh fruit

Read the article below, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. Briefly explain the changes to Australia's typical grocery basket today compared with ten years ago.
3. Suggest some likely reasons why fresh fruit has moved up eight spots and is now the second highest grocery category today.
4. What foods continue to dominate grocery baskets?
5. List the foods that dietitian Joanna McMillan says are missing from shoppers' baskets.
6. Explain why anti-sugar campaigners' advice to reduce fruit intake is nutritionally dangerous.
7. Why are growers now able to supply berries all year around?
8. What are some of the healthy eating marketing drivers and how do they support healthy eating?

AUSTRALIA'S GROWING LOVE FOR FRESH FRUIT TRANSFORMS TYPICAL GROCERY BASKET

Take a peek inside Australia's typical grocery basket and into the minds of the nation's shoppers. There will be plenty of fruit, more vitamins than tea or coffee, a humble loaf of bread and – compared with 10 years ago – far less lollies and chocolates.

In the past decade, fresh fruit has leapt eight spots to become the second-best selling grocery category this year, based on frequency of purchase, leaving staples such as milk and chilled meats in its wake.

In that time, biscuits have been knocked off the top perch by bread, according to Nielsen's Homescan data, which tracks the purchases of 10000 households across the country.

Chocolate has dropped out of the top 10, and other sugar confectionary has slipped three places to 17th.

'Shoppers are putting more fresh, healthy foods in their baskets, more often. It means the competition is set to get tougher as consumers seek out organic, locally grown options in lieu of pre-packaged and processed foods,' said Megan Treston, director of Nielsen's retail industry group.

The fresh food category, which includes fruit, vegetables and meat, represented a fifth of the $10.2 billion overall grocery growth from 2005 to 2015.

Milk, chilled meat and poultry, soft drink and cheese continue to dominate grocery baskets, remaining in the top 10 for the past decade.

Dietitian Joanna McMillan said the trends were generally positive, but her ideal basket would also be brimming with seafood and nuts and legumes.

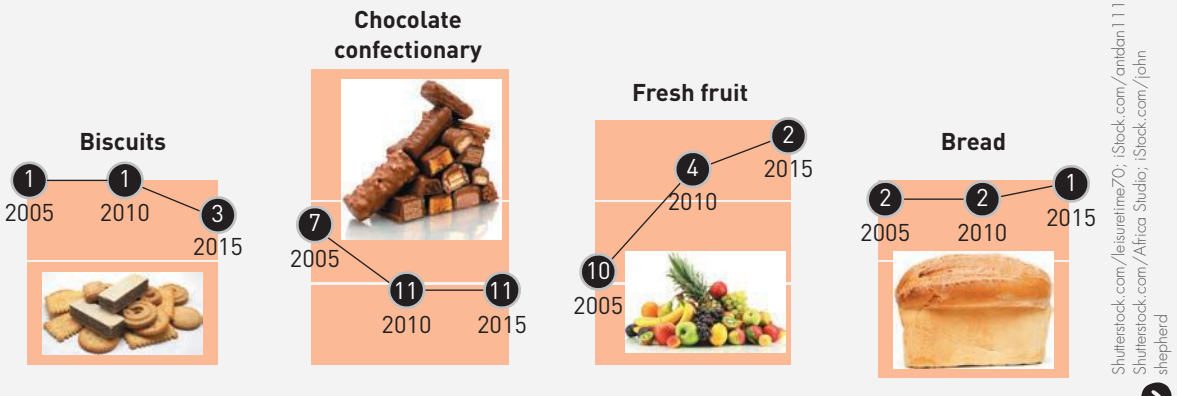
She said consumers should ignore claims by some anti-sugar campaigners, such as *I Quit Sugar* author Sarah Wilson, that fruit intake be reduced as it is full of fructose.

'The sugars naturally present in fruit are bound up in the plant cell walls. Our bodies have to break these cells down to get to the sugars which can then be absorbed. Most fruits therefore have a low glycaemic index,' she said.

'Fruits are also fibre rich, which helps to slow the attack of our enzymes, plus vitamins, minerals and phytochemicals such as antioxidants. Whole fruits are more filling and satiating.'

While bananas and apples dominate the fruit category, the Nielsen data shows fresh berries are fast moving up the ranks, surprising growers, retailers and industry observers.

Top products ranked by year



Shutterstock.com/leisuretime70; iStock.com/antdan111; Shutterstock.com/Africa Studio; iStock.com/johnshepherd

Jonathan Eccles from Raspberries and Blackberries Australia, which represents 200 growers, said production had tripled in the past 5 years.

He said new varieties, expansion of production areas and better storage technology had meant the industry could deliver fresh local berries all year round, which in turn, sparked greater consumer demand

'It's only going to get more popular, as people begin buying them on a regular or semi-regular basis. It used to be a Christmas time thing, from the specialty greengrocers. Now they're in supermarkets 12 months of the year,' he said.

Gary Mortimer, marketing expert at the Queensland University of Technology, said the growing focus on healthy eating was driven by reality shows, such as *The Biggest Loser*, celebrity chefs, and government-led health campaigns.

Esther Han, *The Age*, 13 September 2015

Shutterstock.com/Ewais

A fresh fruit snack pack is a healthy option.

The trend towards superfoods

Although there appears to be no clear definition of **superfoods**, they are generally recognised as foods that have a high concentration of nutrients. They are believed to have health benefits beyond those of common foods, particularly because they are rich in phytochemicals and antioxidants.

Many of the health claims for superfoods are unsubstantiated and require long-term trials to verify their benefits. Despite this, superfoods are constantly being promoted as particularly healthy food choices in magazines and on social media.

Oats

Oats contain a large amount of beta-glucan, which research suggests can lower high cholesterol levels and improve bowel health. They also have a low glycaemic index rating and so are the perfect breakfast food to sustain the body until lunch.

Blueberries

One of the naturally blue-hued foods, blueberries contain anthocyanins, a type of flavonoid or plant compound that contains significant amounts of micronutrients and fibre. Blueberries are believed to protect the brain and memory, prevent urinary tract infections and assist in lowering blood pressure.

Shutterstock.com/gillmar

Blueberries contain anthocyanins.

Kale

Kale is a cabbage variety with large stems and frilly green leaves. It is high in fibre and has high levels of antioxidants, vitamin A and C and iron, and is thought to have cholesterol-lowering benefits. It can be steamed as a vegetable or used raw in salads and juices or added to soups.

Shutterstock.com/geniuscook_com

Kale is high in fibre and contains high levels of antioxidants.

Ancient grains

The term 'ancient grains' refers to ancient types of grains that have only recently been discovered by the West. These grains are gluten free and are usually cooked in wholegrain form. The following ancient grains have become popular in recent years.

- Chia (pronounced *chee-a*) comes from a desert plant in the mint family. They have black or white seeds that can be eaten raw or added to dishes. Although tiny, they are high in fibre, contain a

significant amount of omega-3 fatty acids and are also a very good source of protein and calcium.

- Quinoa (pronounced *keen-wa*) is a gluten-free grain originally cultivated on the steep slopes of the Andes Mountains in Peru and Bolivia. As well as being gluten free, it contains iron, B-vitamins, magnesium, phosphorus, potassium, calcium, vitamin E and fibre. It is one of only a few plant foods that are considered a complete protein, comprising all the essential amino acids. It is served as an alternative to rice and couscous, and in salads.

Connection with the land

There is a growing trend for consumers to want to have a better knowledge of where their food is grown and by whom. Knowledge of 'country of origin' is becoming very important to many consumers who link it to food safety.

Farmers' markets have become very popular for many consumers who are concerned about sustainable food production because they are able to connect with producers and have a conversation about the produce for sale. When people purchase food from a farmers' market they consider they are buying food that is in season and, therefore, at its cheapest price with the best flavour. Linked to this is the concept of food miles – how far food has travelled to reach the consumer and its resulting impact on the environment. This connection to the soil has resulted in backyard and balcony vegetable patches, and even vertical gardens or large pots of vegetables and herbs on balconies.

The changing face of breakfast

About a quarter of Australians say they often do not have time for breakfast according to Roy Morgan Research. Many people who skip breakfast are hungry by mid-morning and are often tempted to eat unhealthy snacks. In March 2012, Newspoll Research conducted a survey of 1207 Australians aged 18 years and over, which indicated that Australians are increasingly eating breakfast on the move or outside the home. Food companies are meeting consumer demands for meals on the go that require no preparation and are easy to carry to work – liquid breakfasts are a growing trend. However, these liquid breakfast products may not be as healthy as some consumers think. While manufacturers state that their products are made from Australian low-fat milk, many contain as much as 10 per cent sugar.

Roy Morgan Research showed that sales of breakfast drinks increased from 4.1 per cent of people buying

Breakfast drinks are often high in sugar.

Weet-Bix breakfast biscuits target the consumer who wants to eat breakfast on the go.

Orgran Multigrain O's

them each month in 2008 to 7.7 per cent in 2013 – almost double the number of consumers purchasing these products. Where previously Australians under 25 years of age were the main consumers, now breakfast drinks are growing in popularity with 35 to 39-year-olds.

Weet-Bix has expanded its grab-and-go range of breakfast foods with a breakfast biscuit. This biscuit is conveniently packaged in individual servings and is marketed as an alternative for those who do not have time to sit down and eat a bowl of cereal.

New breakfast cereal options of quinoa puffs and quinoa flakes have been added to the breakfast cereal range by gluten-free food producer Orgran.

Breakfast alternatives are not just being produced by cereal manufacturers. Juice bar chain Boost markets a number of breakfast smoothies and fruit juices, with drinkable yoghurts also proving popular.

Alamy Stock Photo/Lenscap

Boost breakfast smoothies are increasing in popularity

New cultural influences

There is a strong trend at present for consumers to purchase foods from Mexico and South American countries such as Peru and Argentina. Foods such as tacos, enchiladas, tortillas and salsas are appearing on supermarket shelves. This food is fun, cheap and ideal for the relaxed culture of Australia.

Young Australian families are purchasing Asian vegetable varieties, such as bok choy, choy sum and wombok, more frequently and are buying more each time, according to the latest Nielsen research. These foods are highly nutritious and can be cooked quickly in a wok for a delicious, healthy meal.

Understanding the text

1 Outline the main findings of the Meat & Livestock Australia report *Last Night's Dinner* on the Australian main meal.

2 Explain how many families plan their weekly meals and give reasons for this approach.

3 List the main drivers for meal preparation for consumers.

4 Outline the main characteristics of the 'Zappit' category in the food market and the type of food this group generally consumes.

5 Explain how the trend towards the consumption of health foods can benefit the health of consumers. Use examples to support your answer.

6 Outline three benefits to consumers of consuming snack foods.

7 Prepare a PMI (plus, minus, interesting) chart on the trend towards the purchase and consumption of superfoods.

THE TREND TOWARDS THE PURCHASE AND CONSUMPTION OF SUPERFOODS		
Plus	Minus	Interesting

8 Explain why the trend towards purchasing food from farmers' markets is increasing.

9 Create a diagram to summarise the key information about Australians' changing breakfast habits.

10 Write a sentence to explain why foods from Mexico and South America are becoming increasingly popular with consumers.

Social factors that influence food choices

Food is fundamental to the health and wellbeing of all Australians; however, a number of social factors can have a positive or negative impact on healthy eating. Health and wellbeing are influenced by broad, but closely related, socioeconomic factors, such as

education, location and income. These factors are important determinants of food choices, eating behaviours and general access to social resources, and they help to explain many of the health inequalities in Australia today.

Food purchases are influenced by income, the price of food and access to, and availability of, food supplies, particularly retail facilities. They are also influenced by people's culture, knowledge, attitudes and beliefs. The food environment, marketing and food labelling also affect food choices.

EDUCATION

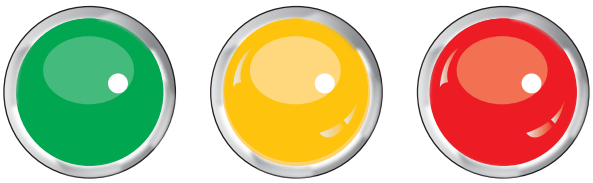
As income and education levels rise, consumers are increasingly concerned about the nutritional content and health benefits of the foods they consume. Consequently, they are becoming more vigilant, demanding and discerning buyers of new food products. The level of knowledge and demand for information is driven by greater access to the Internet, lifestyle magazines, television and smartphone and tablet apps. Many websites also have health advice columns where experts discuss current health issues. In addition, there is a heightened public awareness of the risks of an unhealthy diet as the number of people living with obesity, type 2 diabetes, cancer and cardiovascular disease in the community increases.

Government programs such as the Eat Well Be Active campaign, the Australian Dietary Guidelines and the Australian Guide to Healthy Eating focus on providing information on healthy eating to the community. Non-government agencies such as Nutrition Australia also provide educational information to the community by providing the Healthy Eating Pyramid as an educational guide to healthy eating. This guide has also been adapted for Indigenous Australians.

Food and nutrition education in schools is an important way of increasing knowledge of health-promoting eating behaviours. In both primary and secondary curricula, schools foster an awareness of food and health through the areas of Health and Food Technology classes. In order to bring about behavioural change in eating habits, teachers must connect with their students' world and the foods they choose in their lives, guiding them in the choice of nutritious foods. Food preparation classes are an ideal way to teach about food and nutrition and for students to learn how to prepare meals that are cost and time effective as well as nutritious and tasty.

Schools have a very important role in improving the health of students through supportive environments. The National Healthy Canteens Project assists schools by providing guidelines for healthy food and drinks supplied in canteens. These guidelines are based on the Australian Dietary Guidelines and include three categories of food:

- **green category** – Foods in this category are always on the menu because they are the best choices. These foods are nutrient dense and contain little saturated fat, salt and/or sugar.
- **amber category** – Students should be careful about choosing these foods; although they contain some important nutrients, they are generally higher in saturated fat, salt and/or sugar and are higher in kilojoules.
- **red category** – It is not recommended that foods in this category be included on canteen menus as they have little nutritional value and are generally high in kilojoules because they contain significant amounts of saturated fat, salt and/or sugar.



Categories for foods and drinks sold in healthy canteens

The Kitchen Garden Program

By participating in growing and preparing food, children can develop a greater understanding of the pleasure that food can play in our life. One of the main aims of the Stephanie Alexander Kitchen Garden Program is to positively influence children's food choices. This program is being implemented in a growing number of schools throughout Australia. Many children are now reaping the benefits of being involved in a hands-on activity where they not only help to grow and harvest fresh food, but then use the produce to make simple but delicious meals to share with friends. Programs such as these can have a positive influence on family meal planning. Children involved in growing and preparing fresh ingredients are often introduced to new foods and their special flavours, textures and aromas. They are then more willing to prepare and cook these foods in their own home, encouraging other members of their family to try them too.

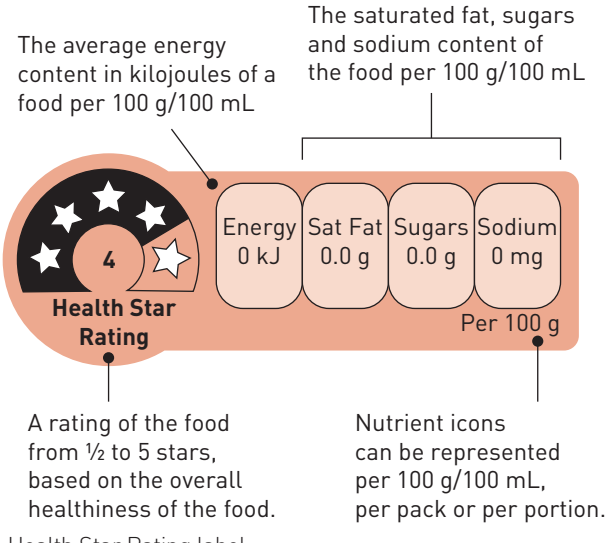
Fairfax/Rodger Cummins

A school kitchen garden

The Health Star Rating

The Australian Government has endorsed the Australian Health Star Rating on food labels, an educational tool to assist people in making healthy food choices.

The Health Star Rating is a front-of-pack labelling system that rates the overall nutritional profile of packaged food and assigns it a rating from ½ to 5 stars. It provides a quick, easy, standard way to compare similar packaged foods. The more stars, the healthier the choice. For busy shoppers, the Health Star Rating provides an easy way to compare similar packaged food and helps consumers to make healthier choices. The Health Star Rating is designed to take the guesswork out of reading labels. They will help consumers to quickly and easily compare the nutritional profile of similar packaged foods and to make informed, healthier choices when shopping.



Health Star Rating label

INCOME

The cost of food shopping is a large financial outlay for all families. However, in lower- and middle-income families, the weekly food shopping bill takes up a large part of their budget. People who have a low income may be restricted in the choice of food they purchase. Households with limited financial resources often stretch their food budgets by purchasing cheap, energy-dense foods that are filling rather than more expensive nutrient-dense options.

The rise of supermarket private labels

Supermarkets have developed a range of everyday household products that are value for money and cheaper than similar branded products. These private labels, which are owned by the supermarkets, make up about 25 per cent of sales. IBISWorld research predicts that by 2016 one in three products on the supermarket shelves will bear a private label or be a home brand.

The Australian Institute of Food Science and Technology publication *Food Australia* reported in August 2015 that the majority of consumers who purchase either block, grated/shredded or sliced cheese opted for supermarket or home brands. The segments of the population driving the private label movement are consumers in the 35–49 age bracket. Supermarkets are now attracting customers, particularly those on limited income, with a quality, affordable range of their own-brand products.

Christodoulou

A range of supermarket private-label cheeses

The rise of low cost supermarkets

In recent years, the German supermarket giant Aldi has made significant inroads into the Australian supermarket scene. Many shoppers have changed their allegiance from the big two of Coles and Woolworths

to Aldi because they see Aldi as providing better value for money. A comparison of supermarket prices shows that Aldi is approximately 25 per cent cheaper than its competitors, which appeals to consumers looking for affordability. Aldi stores stock a selected range of 900 products, many of which are packaged to look very similar to well-known brands. These products are chosen based on the perceived weekly shopping requirements of consumers. This compares with more than 20 000 products stocked in the major chain supermarkets. Because Aldi stores stock a reduced number of brands, offer no bagging service and operate from smaller premises, their running costs are lower. The Aldi supermarket chain also reduces its overheads by running simple mail-drop campaigns and weekly specials delivered to customers via email, and can therefore keep its prices lower.

LOCATION

Where people live is one of the most important factors in determining their access to quality ingredients when shopping.

Most people who live in metropolitan areas have a variety of supermarkets, wholesale fruit and vegetable markets and specialty food shops within easy distance of where they live. For many people living in urban areas, it might only be a five-minute drive to the nearest shopping centre so they have little trouble purchasing fresh, good-quality ingredients on a daily basis. Consumers can call into the supermarket on their way home from work or after the school pick-up to buy the fresh meat, vegetables, fruit, milk or bread they need for their family. Food prices are generally competitive because there is usually more than one supermarket or fresh food market in the same vicinity, which keeps prices reasonable for consumers.

Families who live in more remote rural areas may have greater difficulty in accessing fresh ingredients for meals. The range of products available might also be more limited and the nearest shops could be many kilometres away – in some cases even hundreds of kilometres away. Calling into the local supermarket to pick up a fresh free-range chicken for dinner, for example, may simply not be possible. Fresh fruit and vegetables might not be available on a regular basis and so the family may need to rely on more frozen or canned produce. Unfortunately, people who live in more remote areas find that food is often more expensive. Transportation, distribution costs and lack of market competition inflate food prices, particularly the prices of fresh produce, such as fruit and vegetables. The cost of basic nutritious foods in remote regions is often at least 30 per cent higher than in metropolitan areas and there is limited choice of healthy foods. The higher prices that consumers in these regions are required to pay impacts on their ability to purchase good-quality fresh foods and consequently on their nutritional and health status. Lack of access to healthy food often means that people who live in remote areas experience greater health concerns and have a lower life expectancy.

Poor-quality housing has been associated with poor health and nutrition, particularly in Aboriginal and Torres Strait Islander communities. Resources for preparing healthy meals in remote communities are often extremely difficult, with issues such as the absence of a working stove or oven. One survey of almost 4000 Indigenous homes in the Northern Territory found that only 38 per cent had facilities such as stoves, ovens, running water and adequate storage for food (Bailie & Runcie, 2001). This further encourages a reliance on ready-made and often nutritionally poor foods, and can have a negative impact on the overall health of people living in these areas.

Suburbs with high levels of social disadvantage may become the target of fast-food restaurants. In these suburbs there is often a larger number of fast-food outlets that serve energy-dense, nutrient-poor meals at relatively low prices. Healthy food, and especially fresh food, is often of a lower quality in these areas and is therefore less appealing to consumers.

ACCOMMODATION

While our location in either a metropolitan, regional or remote area can have a significant impact on our access to and the availability of fresh food, the type of accommodation in which we live can impact on our ability to prepare healthy meals.

For many decades, most Australian families lived in a detached or semi-detached house. One of the key features of this typical house is that it contains a well-equipped kitchen with cooking facilities such as a stove and microwave oven and even barbecue facilities for cooking outdoors. Refrigerators and freezers are also considered to be essential appliances to keep food safe and fresh. These facilities mean that consumers can store, prepare and cook a wide variety of nutritious meals to maintain good health.

Apartment-style living

In recent years, there has been a dramatic change in the Australian housing landscape and many people are now choosing to live in apartment-style accommodation. From 2010 to 2015, the number of new apartments being constructed in Melbourne has risen by more than 72 per cent and now equals the number of new houses being built. In Sydney, the trend to apartment living is even greater, with the number of apartments being built outstripping home construction.

Most apartments are constructed in major cities and regional areas that have access to a wide range of fresh foods in nearby fresh food markets and supermarkets. However, sometimes the kitchen facilities in apartments can be restricted because space is limited. Many apartments are now designed with limited food storage, preparation and cooking facilities. A microwave oven may be the only cooking facility and refrigerator storage may be limited to a small bar-style fridge. This may mean that consumers are not able to store food for the week, and have to shop on a daily basis. This can limit the ability to prepare nutritious meals. Reliance on pre-prepared and packaged meals, fast food or eating out is often the easiest option for people living in apartments. Many of these foods are high in kilojoules because they contain a high proportion of saturated fats, sugar and salt compared with a meal made from fresh ingredients such as a stir-fry, and they can impact on their overall health and wellbeing.

Homelessness

Homelessness has a devastating impact on the ability of people to have a healthy diet. Results from the Australian Bureau of Statistics 2011 Census data indicates that one in every 10 000 people is homeless. This meant that on Census night in August 2011 more than 105 000 Australians were homeless. Many of these people often find temporary accommodation in a shelter or hostel or may end up sleeping rough on the street. These temporary living conditions make life difficult and the ability to obtain a healthy meal is sometimes impossible. Shelters and hostels may not provide meals or cooking facilities and homeless people are therefore reliant on food from welfare agencies through the provision of food vouchers, food parcels or meals. People who lack money or who lack access to a home in which to store and prepare food have a limited ability to access healthy food and therefore maintain good health.

AVAILABLE TIME

A lack of time often makes it very difficult for families to prepare a healthy home-cooked meal from scratch. Arriving home after a busy day at work or juggling children's sporting commitments and school activities can all impact on the time that families have for meal preparation. The food industry has been quick to provide a wide range of products to meet the needs of individuals and families who have less time available for meal preparation. This need has been met with a shift in the fruit and vegetables market from loose produce to pre-packed, prepared and ready-to-cook products. These products are more expensive, but people are willing to pay the extra cost because of the convenience they bring. Developing a greater range of tasty, convenient, healthy foods offers a way to improving the diet of these groups. However, consumers should be careful in their choice of convenient products because some can be deceptively high in saturated fat, salt and/or sugar, which can increase the kilojoules consumed. For example, while oven-baked chips appear to be a healthy food option because they are baked rather than fried, they are actually very high in fat.

dlibrary

Pre-prepared frozen vegetables save consumers time.

Woolworths Supermarkets have also made home-cooked meals easier and quicker with the launch of their new range 'Created with Jamie'. This range of easy-to-cook food products use locally sourced Australian ingredients and are quick and easy to prepare. Woolworths also place the recipe and

ingredients all in one location in the supermarket to reduce the amount of time consumers need to spend finding the ingredients they need for dinner. Meals such as the Crispy Garlic Chicken Fillets are pre-seasoned with a blend of garlic and pepper and only require ten minutes to cook. When this dish is combined with a salad mix from the supermarket, dinner is ready in a flash.

'Created with Jamie' meal

Online food ordering systems

A wide range of companies are now producing either a home-cooked meal delivery service or the fresh ingredients for time-poor consumers to prepare the meal themselves in their own kitchen. HelloFresh is an online ordering system that delivers recipes and a box of ingredients for the preparation of an evening meal that serves 2–4 people. Chefs create recipes that are varied, simple, quick to prepare and healthy. This service is designed to meet the needs and time pressures of busy families with parents who work. It enables families to enjoy a tasty and healthy home-cooked meal, with recipe guidance to ensure success. This service saves time in planning and shopping for ingredients. There is little food waste because the ingredients are measured for the quantities in the recipe, so out-of-date foods do not accumulate in the pantry and refrigerator. However, this service is relatively expensive.

The all-in-one kitchen machine

Many people in today's busy households have less time to prepare healthy home-cooked meals. Appliance manufacturers have now developed a wide variety of small appliances such as an all-in-one kitchen machine, food processors, 'nutribullets' and stick mixers that help families prepare healthy meals.

HelloFresh

HelloFresh food delivery box

Many households are now purchasing an all-in-one kitchen machine to make food preparation simpler and easier. This new cooking appliance combines over ten appliances in one compact unit and makes food preparation simple. These appliances have the ability to chop, beat, mix, whip, grind, knead, mince, juice, blend, heat, stir and steam. The machine can weigh food ingredients during the preparation of recipes and cleans itself after food preparation. An all-in-one kitchen machine allows consumers to prepare a meal using fresh ingredients quite quickly and its steaming function supports healthy cooking methods. Although the machine is expensive, it replaces a large number of kitchen appliances.

amanaimages/Rolf Vennenbernd/dpa/Corbis

Tefal all-in-one kitchen appliance

CULTURAL NORMS

A person's culture, their family and beliefs all influence the food they choose and eat. The influx of migrants has made Australia an ethnically diverse nation, with many new cultures, languages, religions and cuisines. Food is a very important part of socialisation and recreation, and many eating behaviours are shaped by family and social gatherings.

Food is also an important part of religious and spiritual observance. Some cultural and religious practices restrict certain foods; for example, many Seventh Day Adventists do not eat meat or dairy products. Followers of other religions deny themselves food, or fast as a way of improving spiritual discipline. Some of these practices can limit food choice and may impact on health, even if only at particular times of the year.

Families from some parts of Greece and southern Italy have been shown to have a particularly healthy diet that is often referred to as the 'Mediterranean diet'. Their diet contains plenty of fresh vegetables and fruit, whole grains and fish. They also use olive oil in much of their cooking. This type of diet has been shown to reduce the risk heart disease and some forms of cancer.

Families who have an Asian heritage also have a long history of consuming a healthy diet. Meals in Asian cuisines typically contain a high proportion of fresh vegetables, particularly leafy greens, and meat is only used as a flavouring ingredient. These meals are often cooked by stir-frying, which uses minimal fat and is seen as a healthy cooking technique. Rice is also served at most meals and provides a healthy low-fat food. Fish is also a favourite food for many Asian families, providing a good source of protein and omega-3 fatty acids.

New refugees settling in Australia are often faced with many additional challenges as they adapt to living in a new country. These challenges and adjustments are significant because new arrivals attempt to maintain their traditional cultural practices, particularly if they are not able to fully understand the language of their adopted country when they first arrive. Their access to a new food environment often proves quite difficult because they are faced with low income and a lack of the traditional foods they are accustomed to eating.

Refugees are often housed in outer suburban areas where there are many fast-food outlets. With little money to spend, inadequate cooking facilities and equipment, and a lack of nearby public transport, they are forced to resort to purchasing these foods.

Many newly arrived people need greater access to education about the healthy food choices available to them if they cannot access their traditional ingredients. Support in accessing information about the nutrient value of many of the foods available in the supermarkets is also necessary for them to make healthy food choices rather than relying on fast-food outlets.

Case study

Jess's story

Read the case study, then answer the questions that follow.

1. Describe how Michael's reduced income would have affected the family's access to healthy food.
2. What impact would the lack of cooking facilities and hot water have on Jess's ability to prepare healthy food?
3. How would charitable organisations, like the Salvation Army, assist Jess when she approached them for help?
4. What other problems would this family have faced in their access to healthy food and their food choice since arriving in Australia from Sudan?

Michael and Jess and their five children arrived in Australia from Sudan in January 2009. Michael was able to secure some casual work but his work hours were reduced and consequently his income decreased significantly. The financial strain took its toll on their marriage and Michael walked out of the family home. Jess came to The Salvation Army for help to buy food for herself and the children and we discovered that she was living in a house that did not have heating or hot water. The landlord had refused to do anything about it and Jess felt like she was in a powerless position. Fortunately, Salvation Army workers were able to advocate on Jess's behalf to get the heating and hot water service fixed, but there are many people who are unaware of their rights or how to get help with their problems that seem beyond their control. They go on trying to live and raise their children in appalling conditions.

Source: Wilma Gallet, *Perceptions of Poverty: An Insight into the Nature and Impact of Poverty in Australia*. © 2010 The Salvation Army

Understanding the text

11 Create a mind map to demonstrate the factors that influence food choice and food purchases.

12 Explain how education has become a major factor in the types of foods that consumers purchase.

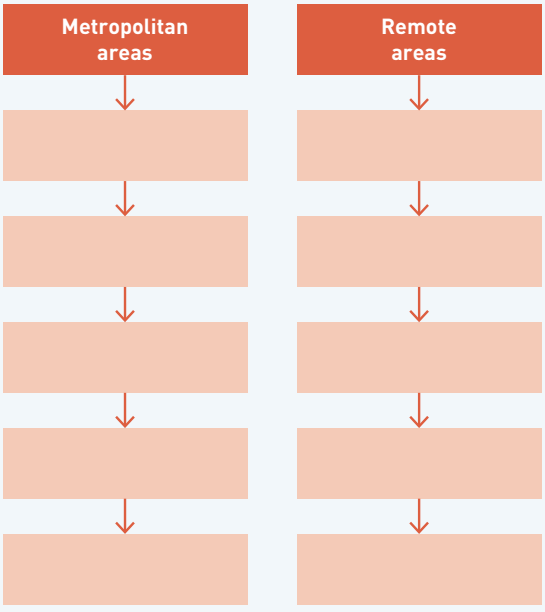
13 Outline two strategies that schools use to improve the knowledge of students about making healthy food choices.

14 Why is the Kitchen Garden program an effective tool in increasing children's knowledge about good health?

15 Explain how the use of the Health Star Rating system helps consumers make healthy food choices.

16 Outline two advantages to consumers of the increase in the availability of private label products.

17 Draw up a diagram like the one below to compare the availability and choice of fresh food for families living in metropolitan and remote regions of Australia.



18 Describe the limitations that people living in an apartment may face in trying to prepare healthy meals.

19 Explain how the food industry is assisting consumers who are time poor to prepare healthy meals.

20 Explain how a person's culture may act as an enabler or a barrier to consuming a healthy diet.

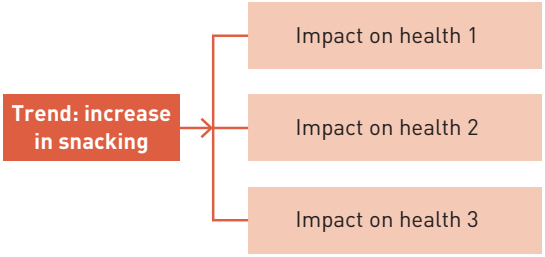
PREPARING FOR EXAMS

Applying knowledge

Write a news item to highlight the short- and long-term goals of the School Kitchen Garden project.

Analysing information

There is a trend for consumers to snack more during the day rather than eating three formal meals. Outline three ways in which snacking can impact on health.

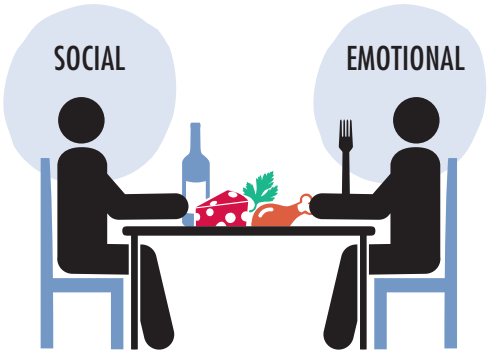


Evaluating concepts

Rank the impact of each of the following factors on access to and choice of healthy food. Justify your decision.

- Education
- Income
- Time pressures

THE ROLE OF FOOD



SHARING AND CELEBRATING WITH FOOD

- Family
- Peers
- Community

RESTRICTIVE DIETS

THE DUKAN DIET

- low-carbohydrate, high-protein diet
- four phases; with phase one being a strict restrictive diet of lean protein, such as chicken, turkey, fish and eggs
- the next three phases gradually introduce some fruit, vegetables and carbohydrates, and finally a return to all foods
- puts the person at risk of deficiencies in nutrients such as calcium

THE LIVER CLEANSING DIET

- eight-week eating plan
- efficient metabolism and weight control
- liver repair
- the diet has three phases, each phases day begins by drinking purified water with the addition of lemon, lime or orange juice to 'cleanse' the liver
- about 40 per cent of the diet is based on raw vegetables and fruit
- sources of protein include legumes, grains, seeds, nuts, fish and seafood, free-range chicken and eggs
- follows many of the national guidelines as it contains large quantities of vegetables and fruits, wholegrains and lean protein but eliminates other nutritious foods such as dairy products and lean red meat

THE LEMON DETOX DIET

- ten to fourteen days
- does not allow any meals, snacks or foods
- does not provide the body with essential nutrients
- weight will return as soon as a normal diet is started again

THE PALEO DIET

- often called the Caveman diet
- includes meat, fish, birds, roots, wild fruits, vegetables and nuts
- no dairy so calcium intake may become a problem

7

FOOD AND SOCIETY

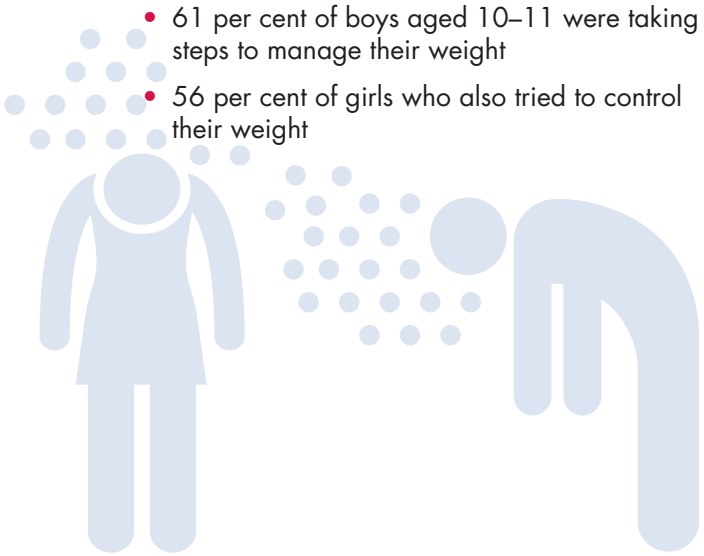
BODY IMAGE

POSITIVE BODY IMAGE

- generally a high level of physical and psychological health
- high levels of self-esteem
- feel good
- coping skills
- less susceptibility to unrealistic body images in media

NEGATIVE BODY IMAGE

- is occurring earlier in life
- half of all children who are underweight or in a normal weight range are dissatisfied with their body size
- 75 per cent of children who are overweight are dissatisfied with their body size
- by age 10–11 the majority of kids are taking steps to maintain, reduce or increase their body size
- 61 per cent of boys aged 10–11 were taking steps to manage their weight
- 56 per cent of girls who also tried to control their weight



KEY TERMS

Body image is the perception a person has about their physical self and the thoughts and feelings.

Comfort or emotional eating is recognised as a psychological condition or eating disorder.

Connectedness is linking a family together and creating a family bond.

Disordered eating is described as an unhealthy eating pattern that includes restrictive dieting, compulsive eating, comfort or emotional eating or skipping meals.

Emotions relate to the mind and are often described as psychological factors or influences.

Individual identity refers to qualities, beliefs, likes and dislikes that make a person different from others.

Restrictive diets, often referred to as fad diets, ban certain foods or food groups, and promise quick, dramatic results in weight loss.

Social roles are the parts people play as members of a social group.

The social and emotional role of food

Food and food choices play a major role in shaping and expressing a person's identity. A person's **individual identity** refers to qualities, beliefs, likes and dislikes that make that person different from others.

Food is central to every person's sense of identity and it is important in constructing and sustaining their individual sense of self. Many people believe that food choices are a personal matter and controlled by emotions. **Emotions** are feelings such as joy, sorrow, fear, happiness, sadness, stress or boredom. They relate to the mind and are often described as psychological factors or influences. They can show what type of person we are, what we care about and what we want to achieve. On the other hand, others believe that food choice is influenced by social occasions – throughout life people tend to share eating experiences with others, forming an identity within a social, family or cultural group.

A person's values can also define and shape their food choices and express their personal identity. These values may reflect their family and the culture in which they were raised, or they may be a response to life experiences. They may value their health and choose a healthy diet, or have respect for the rights of all living things and find the killing of animals cruel and so choose a vegetarian diet.

EMOTIONAL ROLES OF FOOD AND INDIVIDUAL IDENTITY

Emotions relate to the mind and are often described as psychological factors or influences. These factors are difficult to describe and often depend on a person's upbringing and lifestyle. Foods selected will vary from day to day as a result of emotions, self-concept and attitudes. Emotions such as depression and anxiety, boredom and stress often lead to unhealthy eating habits both in adults and children. It may be necessary to manage emotions and stresses before a change to these unhealthy eating habits can occur.

When food takes on a psychological meaning, the emotional needs of the person are sometimes satisfied by food. Food then becomes more than just a means of satisfying hunger and obtaining the necessary nutrients. On these occasions, food is used to respond to certain emotional needs and serves different purposes, such as a reward, a punishment, to show affection for someone, to show hospitality, to welcome someone or to make a person feel secure.

Good food habits are learned and shaped when we are infants and children. It is essential that children are exposed to new ingredients, as well as to the different sensory properties of foods; that is, the way different foods look, smell and taste. People who were rewarded as a child for their good behaviour with a biscuit or a lolly may, as adults, reward themselves in the same way.

SOCIAL ROLES OF FOOD AND INDIVIDUAL IDENTITY

Social roles are the parts people play as members of a social group including families, peer groups and communities. The contact they have with people within the group will influence an individual's food choice. A person's employment, their lifestyle, education, size of family and the importance of hospitality within the social group will all help to shape a person's food choices. Sharing food is an important way to get to know people and to strengthen friendships and provide support for one another.

Sharing and celebrating with food in families

Sharing meals as a family has enormous benefits as a way of creating **connectedness**; that is, linking a family together and creating a family bond. Sharing a family dinner allows busy families, who would otherwise spend little quality time together, to reconnect at the end of the day. During this time they can relax, recharge, laugh and tell stories about the day's ups and downs. This allows family members to build an identity or their place in the family. In sharing meals, it is important to try to involve all members of the family in planning and preparation.

Many family gatherings often centre on food, especially when celebrating special occasions. Birthdays, for example, may be celebrated with foods that are considered special or family favourites, and almost always involve a special cake.

Case study

The Shabbat meal – a ritual of connectedness

Read the case study and answer the questions that follow.

1. Briefly describe a Shabbat meal.
2. How does the leisurely, uninterrupted meal help the family connect with one another?
3. Explain how children are made an integral and important part of the celebration.
4. How does the Shabbat assist in passing on the cultural and religious traditions?

The Shabbat is a traditional Jewish meal and celebration shared by the families every Friday night, beginning at sundown. In many orthodox families this observance continues until Saturday evening at sundown.

The preparation for the meal is completed just before sunset and candles are lit – some families light a candle for each family member. Then it is time for all family members, often extended family members as well, to gather around the table. The table is set, the best china is used and family members wear their best clothes.

The celebration begins with a blessing for life and children. The meal begins with wine or grape juice and challah or a plaited bread loaf, which is shared between family members. The food that follows can include a range of dishes that are special and festive. It usually includes several courses of fish, soup, a main meal and dessert. During the leisurely, uninterrupted meal, songs are sung, stories are told and all members of the family, including the children, engage in conversation. This regular celebratory meal is a time to appreciate the family, to be free of distractions such as mobile phones, and to talk to family members 'face to face'. It is also a time to be immersed in the Jewish culture and to share and pass on the significance of the religious observance and for individuals to develop their personal identity as Jews. The Shabbat is a traditional place of family celebration, eating, learning, debating and socialising.

Alamy Stock Photo/ASAP

A family sharing a Shabbat meal

Sharing and celebrating with a peer group

Regardless of our stage of life, our peers, or the people we know who are the same age, have an influence on our food choice. They are our friends and, apart from our family members, they are the people we meet up with most regularly to celebrate and share food with.

Fast-food outlet 'meet-ups'

As children enter their teenage years, their peer group begins to have a significant influence on the types of food they consume. As young people start to develop their independence, they being to look for opportunities to meet up with their friends. This might mean they get together at a fast-food outlet where they can socialise and have an inexpensive snack or meal.

Fast-food outlets provide a leisure or social space to meet up or 'hang out' after school. Young people arrange to meet up in this convenient environment because it has space for a group and affordable food that they can purchase and share. The fast-food outlet has become part of youth culture and identity,

Shutterstock.com/Alinute Silzeviciute

Enjoying food at a fast-food restaurant

and is used to express a youthful self and lifestyle image or one that is moving away from parental influences.

Social meet-ups for dinner

Weblink

Smartphone technology now enables the user to meet new people by joining a group for dinner. Chattable is a sociable dining app that allows peers to share a table at a restaurant with people they may not know. The Chattable app links users through Facebook and lists all the Chattable restaurants. It shows if other users have made reservations at the selected restaurant or if there are people from the group already seated. Every Chattable restaurant has a 'chat table' reserved for its members and users can check in or make a reservation via the app. Diners then join each other for dinner and build friendships and connect with others through this form of social dining.

Getty Images/Franek Strzeszewski

Chattable dining

SHARING AND CELEBRATING WITH COMMUNITIES

Food can unite and strengthen community bonds, and help to maintain and support a common identity among people. A socially connected community is a place where everyone feels they belong. It's a place where people get to know their neighbours and feel motivated to become involved, build relationships and contribute to the creation of strong social networks. Sharing food encourages contact with others, personal relationships and engagement in the community.

Many groups within communities use food to celebrate occasions and support people within their community. Food is a wonderful way to bring people together to celebrate, share, connect, understand and support each other.

Case study

Social Spoons

Read the case study and answer the questions that follow.

Weblink

1. Explain the broad aims of the Social Spoons project.
2. Explain how the food purchases at the Social Spoons cafés are funded.
3. Explain how the project has an impact on the health of the community.
4. What factors encourage cafés to join up with the project?
5. Identify four criteria identified for a Social Spoons café and explain how these criteria improve connectedness in the community.

Social Spoons is a café meals project run by Inner South Community Health in Melbourne, Victoria. It aims to improve the social connectedness across the community. Members of the Social Spoons project are people living within the Inner South community who are hoping to increase their involvement in general community life.

People who belong to Social Spoons can access subsidised café meals at supportive and welcoming cafés in the city of Port Phillip and the city of Stonnington. Through the meal subsidy, funded by the two councils, and the help of a key worker, members have an incentive to dine with others. They can also be linked to existing programs and health services to promote better health and greater social connections among the broader community. Social Spoons cafés are businesses with a healthy social conscience that are interested in working towards a positive change in their neighbourhood.

Inner South Community Health

Social Spoons

In order to join the project, the cafés meet the following criteria:

- ensure a welcoming environment, friendly and interactive staff, with communal seating
- provide healthy multiple food options for $10 or less, and ensure foods on the menu are on display or include pictures of food
- have easy access to public transport
- have wheelchair access, where possible.

Source: http://ischs.org.au/our-services/community-groups/social-spoons/

The Welcome Dinner project

The Welcome Dinner Project, an initiative of joiningthedots

The Welcome Dinner project

The Welcome Dinner Project was initiated by a non-profit organisation called 'joiningthedots' and aims to connect newly arrived people such as refugees, migrants, asylum seekers and international students with Australian people. Australians are encouraged to extend their dinner table by inviting these people to share food and conversation in the comfort of their home. The 'pot-luck-style' dinner is a gathering of people who all bring along food to share with one another. This is a way of making a meaningful connection and sparking friendships and a cultural understanding between people of diverse cultures. Often these people do not have an opportunity to connect with a supported environment to form friendships to bridge some of the invisible divides that exist between people. This project encourages and increases social 'togetherness' and involves the broader community in building a welcoming Australian society that embraces and celebrates diversity.

Weblink

The Albury–Wodonga community oven

In Albury–Wodonga, a wood-fired oven has been built under an old river gum in a park on the banks of the Murray River. The idea to build the community oven came from the local Community Development Office. It is fired up every Sunday and members of the community can use it free of charge. This oven has had a great effect on the local community as locals gather round the oven to share their pizzas, bread, roasts and lasagne, all of which are cooked in the oven. The community members then eat the food together in the park. This cooking and eating of shared food brings the community together so that they are able to learn about the favourite foods of their neighbours, to meet new people and to share friendship, and develop a connection with their local community.

Getty Images/Lisa Romerein

A community wood-fired oven can bring a local community together

A community cultural event

The Polish Festival is held at Federation Square in Melbourne each year and is a celebration of food, music and the customs and culture of the Polish people. Federation Square is transformed into a look-alike historic European square with a lively old-world atmosphere. This event brings together a community of expatriots and descendants of Polish immigrants, as well as Melburnians, to showcase Poland's famous hospitality, hearty food and culinary delights. Popular foods at the festival include stuffed dumplings (*pierogi*), sausages and traditional cakes and pastries. Cultural events, such as the Polish Festival, the Lunar

New Year Festival, the Thai Culture and Food Festival, and the Italian Lygon Street Fiesta, develop a better understanding of different cultures and connect these cultures to the community.

amanaimages/Yvonne Zhai/Demotix/Corbis

The Polish festival at Federation Square, Melbourne

Food and support for the disadvantaged

The Fitzroy soup van provides assistance for people in the local Fitzroy community who are facing challenges or tough times in their life, such as people who are homeless or experiencing financial difficulties. The van is set up every night of the week in different locations for disadvantaged people to access free food. This service not only provides a warm meal, but also a friendly face that provides support and connects them with others in the community.

Food vans also operate in other locations, such as St Kilda, South Melbourne and Footscray.

Fairfax/Jason South

A food van supplying food for people in need

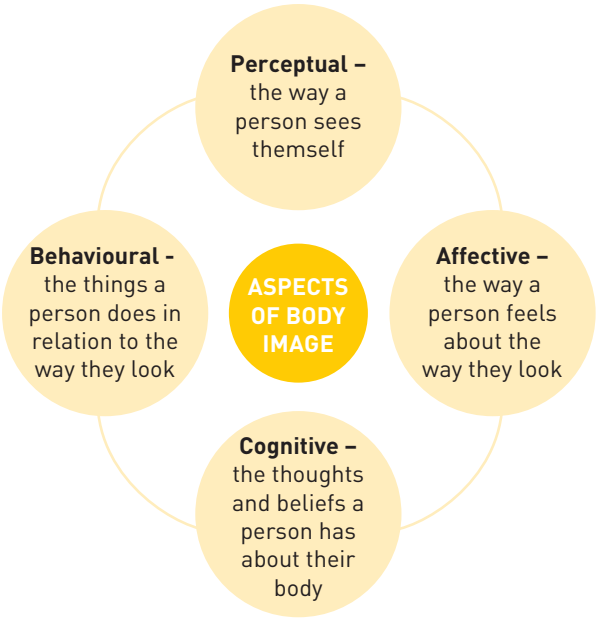
Understanding the text

1 Explain what is meant by the term 'individual identity'.
2 How does a person's identity affect their food choices?
3 Explain the reasons why emotions have a major influence on the foods we choose to consume.
4 Explain how sharing food in a family helps to create connectedness.
5 Outline the reasons why fast-food outlets are a popular venue for teenagers to meet and share food with friends.
6 How does food help create a sense of connectedness within a community?
7 Explain the role that the Welcome Dinner Project has in creating community connections.
8 Identify the similarities in the role of the Albury–Wodonga community oven and the Melbourne Polish Festival in helping to create strong community connections.
9 Explain how people can use smartphone apps to meet up to share a meal. Would you use this technology? Why or why not?
10 How does the Fitzroy soup van support food access for people in need?

The development of body image

Body image is the perception a person has about their physical self and the thoughts and feelings that result from that perception. These feelings can be positive, negative or both and are influenced by individual and environmental factors. There are four aspects of body image: perceptual, affective, cognitive and behavioural (see diagram on opposite page).

Body image is usually a result of comparing a person's body with the stereotypical images presented in our culture. People of all ages are exposed to images of movie stars, models and high-profile sports people who are often unrealistically portrayed in the media, including on television, on social media platforms, in magazine advertising, or in news or current affairs on the Internet.



Aspects of body image

Body images that are often presented by the media as desirable and ideal play a critical role in persuading young people to conform, often at the risk of their health. If a person feels they are unable to 'measure up' in comparison to these images, feelings of body dissatisfaction can have a damaging effect on that person's psychological and physical wellbeing. People with a poor body image may adopt an unhealthy lifestyle such as increased dieting and dangerous exercise behaviours, driven by the desire to achieve the 'perfect body'. Many of these people resort to fad or restrictive diets to try to achieve that 'dream' image.

Based on images in the media, the ideal female body is characterised by thinness, which can create unrealistic expectations in many young women. Many females with a negative body image based on their weight focus on attempting to lose weight. The ideal body for males is portrayed as lean and muscular, and adolescent males tend to focus on either weight loss or body building to develop a more muscular upper body.

While many people, particularly young people, aspire to an ideal body image that may be unobtainable, what is often forgotten is that professional photographers use many tricks to enhance particular characteristics or to minimise less desirable features of the celebrity. Enhanced lighting, airbrushing and the use of Photoshop are all used to make their models appear as though they have the 'perfect' body. In April 2015, the French government passed legislation to set minimum weight standards for female models, only allowing models with a healthy weight to be employed.

BODY IMAGE AND ITS IMPACT ON HEALTH

People with a positive body image have been shown to have a high level of physical and psychological health. They normally have high levels of self-esteem and consequently feel good about themselves and are more comfortable with how they look. As a result, they find it easier to cope with their daily life, and the unrealistic body images portrayed in the media and society have less impact on them. Research also shows that a positive body image will lead to a healthier, more balanced lifestyle, and healthier attitudes and practices with food and exercise.

However, the development of a negative body image is more problematic. Body image problems often occur at stressful stages during the life span, especially during adolescence, but research shows that issues of negative body image are occurring more frequently in childhood. The desire to lose weight and make physical changes to the body encourages people to adopt disordered eating habits such as restrictive diets or comfort or emotional eating.

Shutterstock.com/Dmitry Abaza

Models on the catwalk don't represent average people.

Activity 7.1

Kids as young as eight unhappy about body size

Read the article below, then answer the questions that follow.

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and the presentation of evidence.
2. Explain why the recent data about eight-year-olds is of concern to health professionals.
3. What has influenced half of the children as young as 10 years old, in the 'normal' weight range to be dissatisfied with their body weight?
4. What are the benefits to children who are happy with their bodies?
5. Suggest some ways the important message that 'everyone is different and loved regardless of their shape and size' can be conveyed by the media.

KIDS AS YOUNG AS EIGHT UNHAPPY ABOUT BODY SIZE, AUSTRALIAN INSTITUTE OF FAMILY STUDIES REPORT REVEALS

MOST 10-year-olds are taking steps to manage their weight, while primary school children as young as eight are unhappy with their body size.

An alarming new report into the body image battles of Aussie kids, released today by the Australian Institute of Family Studies, reveals about half of all children who are underweight or in a normal weight range are dissatisfied with their body size.

And that figure jumps to 75 per cent for children who are overweight.

The data, from the landmark Longitudinal Study of Australian Children, also reveals that by age 10–11 the majority of kids are taking steps to maintain, reduce or increase their body size.

AIFS executive manager Ben Edwards said it was concerning that the link between body image and emotional wellbeing was developing in children as young as 10.

'There are some concerns there, that at that age, children are already feeling bad about their bodies,' Dr Edwards said.

'What we are seeing is that kids are starting to think about this far earlier than people had realised and the implications of that on psycho-social development also seem to be occurring much earlier,' he said.

Boys and girls ... both sexes face body image issues.

The study, which surveyed more than 4000 children, found more than half of 8–11-year-olds wanted a slimmer than average body size.

And body-image consciousness is just as much of a problem for young boys as it is girls, with the study finding 61 per cent of boys aged 10–11 were taking steps to manage their weight, more than the 56 per cent of girls who had also tried to control their weight over the last year.

AIFS researcher Galina Daraganova said, 'while there were no differences between boys and girls trying to lose weight, more boys tried to gain weight and fewer did nothing to control their weight compared to girls of the same age.'

Dr Daraganova also said the research revealed children who were happy with their bodies were more likely to have better social-emotional and physical health.

Paediatric dietitian Eve Reed said the results of the study were alarming.

'I find it really disturbing that we are finding these statistics at such a young age,' she said.

Ms Reed said it was important that parents are careful about how they discuss their own body image battle in front of children and shield them from popular television programs which focus on body weight.

'I think it is important to communicate the very strong message that children are loved, whatever shape and size they are, and that everybody is different,' she said.

Kids as young as eight unhappy about body size, Australian Institute of Family Studies report reveal, by Lauren Wilson, 4 July 2014, News Limited

Restrictive dieting

The use of restrictive dieting is closely linked to our emotional and psychological responses to food. Many people go on a restrictive diet in order to lose weight and improve their self-esteem. However, while losing weight may have a positive impact on their emotions by making them feel happy, the reality of gaining weight, if they cannot maintain the rigid eating routine imposed by the diet, may cause the dieter to become unhappy or even depressed.

Disordered eating is described as an unhealthy eating pattern that includes restrictive dieting, compulsive eating, comfort or emotional eating or skipping meals. Dangerous dieting and excessive exercise behaviours can be driven by the emotional desire to achieve the 'perfect body'.

TYPES OF RESTRICTIVE DIETS

Restrictive diets are often referred to as fad diets that ban certain foods or food groups, and promise quick, dramatic results. In 2011, Newspoll conducted a survey commissioned by the Dietetic Association of Australia (DAA) to determine the top four fad diets that most Australian women aged 18–20 years have tried. The DAA then analysed these diets to determine their effectiveness in weight loss and their impact on the overall health of people who used them.

The Dukan Diet

The Dukan Diet is a low-carbohydrate, high-protein diet designed by French doctor Pierre Dukan. The diet is completed in four phases, with phase one being a strict restrictive diet of lean protein, such as chicken, turkey, fish and eggs. Carbohydrates are restricted except for a small amount of oat bran. The next three phases gradually introduce some fruit, vegetables and carbohydrates, and finally a return to all foods.

Although this diet has some good features such as the promotion of lean protein foods and fruit and vegetables, it excludes the core foods of cereals and relies heavily on protein. This form of restrictive dieting is not sustainable in the long term and also puts the person at risk of deficiencies in nutrients such as calcium.

The Liver Cleansing Diet

The Liver Cleansing Diet is an 8-week eating plan devised by Australian doctor Sandra Cabot. It combines certain foods for a more efficient metabolism, weight control and liver repair. By cleansing the liver it is believed that the metabolism will be improved and will be able to burn fat more efficiently. The diet has three phases, with each phase beginning the day by drinking purified water with the addition of lemon, lime or orange juice to 'cleanse' the liver. The dieter must then follow this citrus drink with a glass of raw vegetable juice. About 40 per cent of the diet is based on raw vegetables and fruit. Sources of protein include legumes, grains, seeds, nuts, fish and seafood, free-range chicken and eggs. The dieter cannot consume any other types of meats or dairy products.

This diet follows many of the national guidelines because it contains large quantities of vegetables and fruits, wholegrains and lean protein, but eliminates other nutritious foods such as dairy products and lean red meat. Sound evidence suggests that a healthy liver is best maintained by increasing fibre, reducing saturated fats and eating to keep a healthy balance with energy needs.

The Lemon Detox Diet

Weblink

The Lemon Detox Diet is a 10 to 14-day cleansing program that is sold as a kit by Australian company Pure National Health. It involves consuming six to nine glasses of lemon detox drinks a day. This restrictive diet does not allow any meals, snacks or foods. It is a low-kilojoule diet designed to cleanse the body while taking a break from solid food.

iStock.com/stuartpilkin

Lemons are a key component of the Lemon Detox Diet

As this diet does not provide the body with any essential nutrients, weight is most likely to be lost, but will return as soon as a normal diet is started again.

The Paleo diet

The Palaeolithic or Paleo diet (often called the 'caveman diet') works on the principle that a person should eat the same diet as their hunter-gatherer ancestors. This diet includes meat, fish, birds, roots, wild fruits and vegetables, and nuts. Foods that are

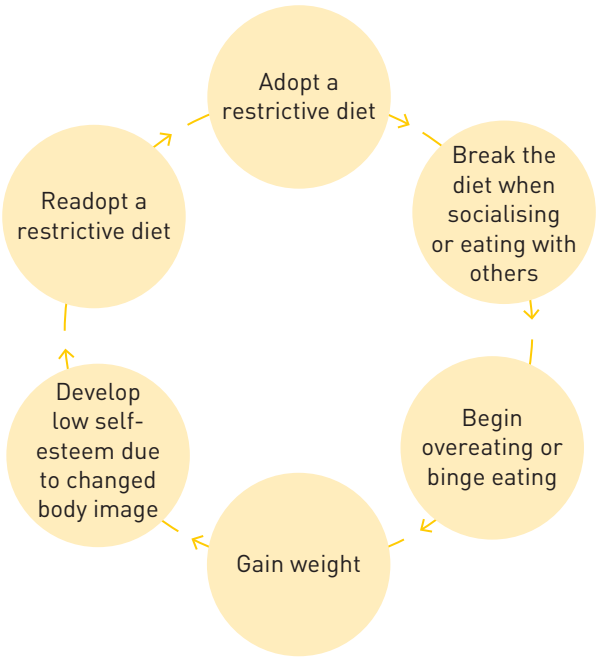
the products of more-advanced food systems and agricultural practices, such as grains, legumes, all dairy products, oils, salt and sugar, are excluded.

The Paleo diet has some benefits in that there is a reduction in kilojoules as foods are eliminated, particularly sugar. However, the elimination of all dairy foods and therefore a major source of calcium intake may become a problem.

CONSEQUENCES OF RESTRICTIVE DIETING

Severely restricting the amount of food you eat can become very dangerous. If the body does not receive sufficient food, it goes into 'survival' mode and reduces the rate at which the body burns energy; that is, it reduces the body's metabolic rate. This slowing of the metabolic rate often leads to overeating and binge eating, which results in weight gain, making people feel very guilty because they have broken the diet.

One of the main emotional responses of people who have disordered eating behaviours or undertake restrictive diets is that they may isolate themselves from friends and family. They may become anxious about eating with others, concerned about what other people might think of them. This emotional and psychological response to dieting can often lead to a lower self-esteem and so the cycle continues.



The cycle of restrictive dieting

Emotional, psychological and physical consequences of restrictive diets

There is strong medical research to show that restrictive dieting can have a significant impact on a person's emotional and psychological wellbeing. Many people who follow a restrictive diet become obsessive about food and it can become the focus of their entire day and the main topic of conversation. Some people develop emotional stress and may become more anxious and depressed and suffer from anxiety. If a dieter feels that they are not being successful in managing to maintain their weight loss, but instead regain weight, they may become confused, puzzled and sometimes angry with themselves. Food can then become a source of comfort in the future when they are emotionally and psychologically upset.

Possibly the most significant physical consequence of restrictive dieting is that, instead of helping lose weight, most people inevitably end up gaining weight once they resume their normal eating patterns. The National Eating Disorders Collaboration reports that 'contrary to popular belief, research has shown that at least a third to two-thirds of people on diets regain more weight than they have lost within four or five years, and the true number may well be significantly higher. Weight loss and "fad" diets do not take people's individual requirements into consideration and can result in a person feeling hungry, experiencing low moods, lacking in energy levels and developing poor health'.

Any diets that put restrictions on certain healthy foods will increase a person's risk of nutrient deficiencies. A Roy Morgan Research poll found that fewer than one in 10 Australians eat the recommended amount of vegetables and fruit, so diets should encourage their consumption, rather than restricting them.

People who embark on severe restrictive diets may develop other serious clinical eating disorders such as anorexia nervosa or bulimia nervosa. In addition, restrictive dieting can lead to osteoporosis, a disease in which bones are easily fractured. Side effects of restrictive diets include fatigue, constipation and diarrhoea, headaches or muscle cramps.

Health professionals recommend that before embarking on a restrictive diet, people should seek the help of their GP who may recommend a practitioner such as a dietitian with specialised knowledge in health and nutrition who can help them implement a healthy weight-loss program.

Activity 7.2

Analysing restrictive diets

1 Select two of the restrictive diets discussed on page 117 and analyse the consequences of each diet using a PMI (plus, minus, interesting) chart.

2 Analyse each diet for weight loss and health using the following headings.
- Exclusion of certain foods or food groups
- Promises of quick and dramatic results
- Sound scientific evidence backing the diet
- Health risks associated with the diet
- Long-term maintenance after returning to a normal diet

3 Make recommendations about the diets for weight loss and the health of people who follow these diets.

Worksheets

RESTRICTIVE DIET 1		
Plus	Minus	Interesting
RESTRICTIVE DIET 2		

Comfort eating

We all have a range of emotions and sometimes our emotions can swing – we feel happy and excited one day and unhappy, sad or frightened the next. Stress, loneliness, anger and boredom are all emotions we have felt at one time or another. Dealing with grief, for example, can be very difficult to manage. However, while most of us manage to cope with our emotions without too much difficulty, some people turn to food and use it as a 'buffer' in times of stress; that is, they 'comfort eat'.

Comfort or emotional eating is recognised as a psychological condition or eating disorder. This condition involves eating a large quantity of food within a short period of time, usually over two hours, and feeling a sense of loss of control while eating.

This lack of control means that the person is not able to stop themselves from eating; for example, they eat a biscuit but cannot stop until they have eaten the whole packet. Individuals who show symptoms of comfort eating have lost their innate ability to self-regulate their hunger and satiety. A range of eating behaviours, such as eating quickly when excited or stressed, are linked to comfort or emotional eating. The person continues to eat even when they are not hungry and may not stop until they feel overfull and very uncomfortable.

People who comfort eat often demonstrate emotional responses such as feeling guilty or they feel ashamed of their habit and consequently eat in secret or hide the food packaging. This eating behaviour is an unconscious response to coping with challenging emotions such as feeling stressed or anxious. People who are comfort eaters are often those who are depressed or extremely critical of their body image.

Many people who are comfort eaters are overweight because they cannot self-regulate their eating and consume far more kilojoules than they need. When life gets stressful they find themselves reaching for the biscuit tin or for a large packet of potato crisps and eating until the tin or packet is empty. It is often said these people manage their emotions and moods with food.

Emotions and food

Left to right: iStock.com/delmonte1977; Shutterstock.com/resnyier; Shutterstock.com/David Orcea; amanaimages/WB-Images/Westend61/Corbis

Some people suffering from stress and emotional issues can't stop eating once they start. This form of disordered eating often causes distress and self-loathing afterwards. The comfort food of choice is often chocolate and there are sound biological reasons why fatty and sugary foods provide comfort. Fats and sugars trigger the release of endorphins and dopamine – the body's feel-good chemicals. These chemicals induce a natural high, but when this recedes, guilt and depression set in. This disordered eating pattern is often developed in childhood and overeating is used as a strategy to cope with and control high levels of internal anxiety.

Case study

Suzie

Read the case study and then answer the questions that follow.

1. Suggest reasons why Suzie may have become preoccupied with her weight.
2. Explain what is meant by only eating when hungry.
3. Why did Suzie begin to comfort eat?
4. Why were the healthy eating messages from family and school friends ineffective in changing her comfort-eating behaviour?
5. Suggest strategies that could have been used to change Suzie's eating behaviour.

When Suzie was an 8-year-old child she was often called 'fat' by another child in her primary school. This regular taunt led Suzie to become preoccupied with her weight and she became more and more socially isolated and miserable about her body image. Food became her 'comfort' and her 'enemy'.

She was a little chubby at eight, but as she approached adolescence her family thought this weight would become more appropriately apportioned as her growth spurt began. But, instead, she became obsessed with her body and its image and with food. She almost never ate, but because she was hungry, she thought about food all the time. And then she began to comfort or emotional eat to give herself relief and satisfaction from the problem. But sadly the relief never came and she was filled with self-hatred.

Some of the 'fat' comments continued from her classmates and she became very self-critical and hard on herself because she felt she could never have the slim, perfect body she craved. Her family and teachers encouraged her in healthy eating habits, but suggesting she should not eat dessert made her want it all the more.

By the age of 11 she was 'sneaking' food and hiding her 'stash' behind her bed and she couldn't have just one chocolate bar but needed several. At her worst comfort eating session, she devoured a large bag of corn chips and two family blocks of chocolate. After the session, she felt disgusted with herself and felt out of control.

CONSEQUENCES OF COMFORT OR EMOTIONAL EATING

There are a number of health risks associated with this form of eating disorder. Comfort or emotional eaters become overweight and consequently develop osteoarthritis or a degeneration of the joints, leading to cartilage loss. They are also likely to develop chronic kidney problems, high blood pressure or high cholesterol, leading to stroke, type 2 diabetes and heart disease.

Understanding the text

11 Draw up a summary frame on body image. In your summary frame include:
- a definition of body image
- how body image is developed
- the dangers of a negative body image
- the outcomes of a positive body image.

12 Explain the term 'disordered eating'.

13 Outline two of the main features of restrictive diets.

14 Outline the reason some people would chose to follow the Liver Cleansing Diet.

15 Explain the similarities and differences between the Dukan Diet and the Paleo diet.

16 Outline the way the body responds if a person follows a restrictive diet and reduces the amount of food they consume.

17 Identify three ways in which following a restrictive diet can impact on the emotional and psychological wellbeing of some people.

18 Outline three ways in which restrictive diets can impact on the physical health of some people.

19 Explain what is meant by comfort or emotional eating.

20 Describe the likely health consequences of comfort or emotional eaters.

PREPARING FOR EXAMS

Applying knowledge

Describe the impact of restrictive dieting on health. Give examples to support your answer.

Analysing information

Explain how connectedness can be increased by sharing food in families and communities.

Evaluating concepts

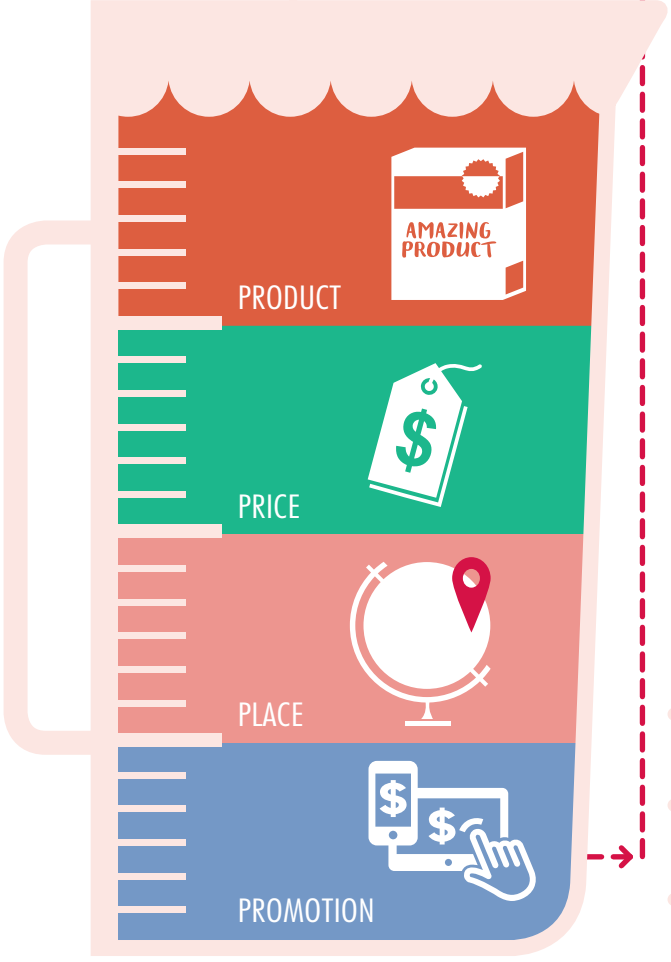
Imagine you are someone who has negative feelings about their body image. Explain how this view of body image could affect your eating behaviour.

HOW DOES THE MEDIA SHAPE FOOD INFORMATION AND CHOICE?

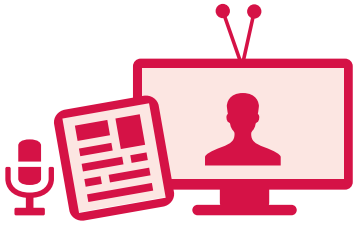
MARKET RESEARCH

An important first step of marketing to determine the customer's wants and needs.

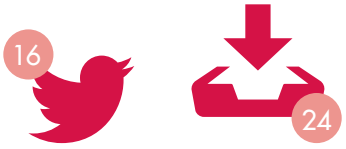
THE MARKETING MIX



MARKETING STRATEGIES



- Television
- Radio
- Newspapers
- Magazines



- Social media
- Targeted emails
- Third-party endorsements

POPULAR CULTURE

- Celebrities
- Sporting stars
- Cartoon characters
- Toys and giveaways
- Sponsorship
- Reality television

NEWS REPORTAGE

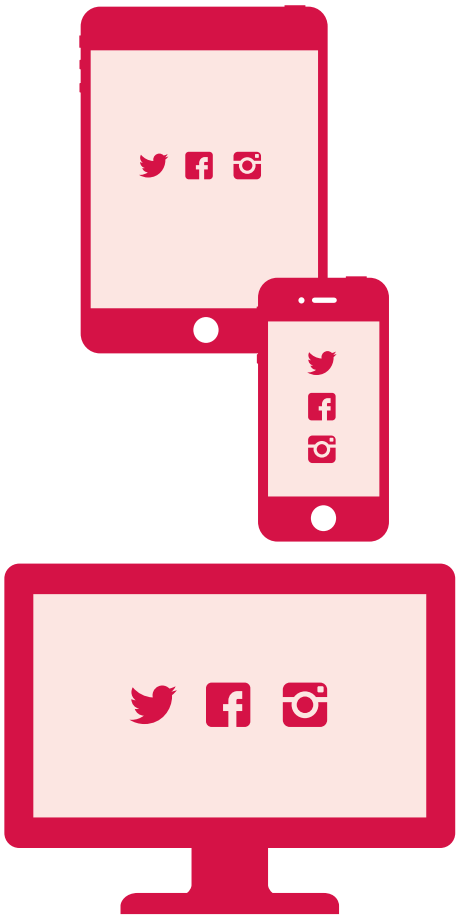
- Newspaper reports
- Articles by consumer and advocacy groups
- TV current affairs programs
- Books, magazines
- Radio interviews

8

FOOD AND THE MEDIA

SOCIAL MEDIA

- Facebook, Twitter, Instagram
- Smartphones
- YouTube
- Blogs
- Advergames
- Data collection and targeting



KEY TERMS

Advergames are video games that contain an advertisement to promote a particular product.

Advertising is a process of communication that persuades consumers that they desire a particular product and then to buy it.

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are supplemented by computer-generated sensory input such as sound, video and graphics.

Blogs are online journals or diaries that are frequently updated.

Data analytics is the process of examining raw data to draw conclusions about that information.

Gamification is adding game design to non-game applications to make them more fun and appealing.

Marketing involves a series of planned activities and techniques that aim to develop products that consumers need or want and then sell these products for a profit.

Media are the means of mass communication for promoting products and services.

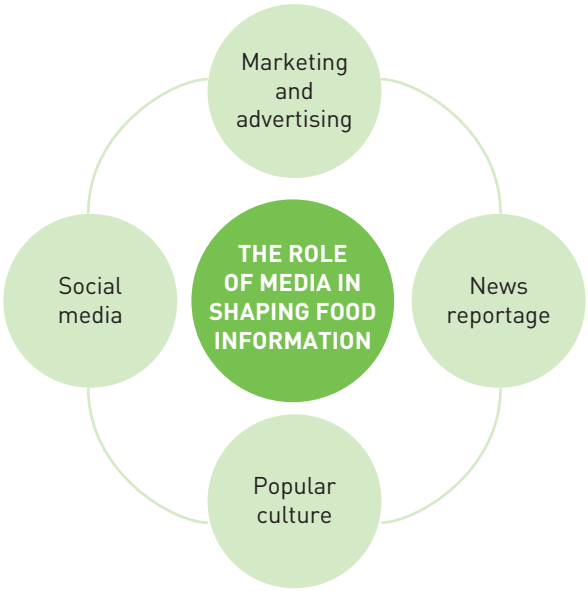
News reportage is the reporting of news on current issues or events in newspapers, on television or on the radio.

The role of the media in shaping food information

The **media** are the means of mass communication for promoting products and services through television, radio, newspapers and magazines, billboards, direct mail, computers, smartphones or tablets. Popular culture, social media and news reportage also influence consumers' food choices.

According to *Australia's Food and Nutrition 2012* report produced by the Australian Institute of Health and Welfare, Australians spent 17 per cent of their weekly household expenditure on food and non-alcoholic drinks in 2009–10. This cost was second only to the percentage of their income that households spent on rent or mortgage repayments.

Because Australians spend a considerable proportion of their weekly income on food and have access to a wide variety of food, food manufacturers must go to great lengths to influence consumers' food choices and promote their products.



The main influences on consumers' food choices

Marketing

Marketing involves a series of planned activities and techniques that aim to develop products that consumers need or want and then sell these products

Marketing of natural and ethically produced tea

© Copyright Clipper Teas

for a profit. All food manufacturers depend on marketing to promote their products.

Food promotion is everywhere and every day we are exposed to a vast range of advertising text, images and sounds. However, much of the food advertised through the media is lower in nutritional value and higher in fat, sugar and salt than unprocessed or less refined alternatives. The high visibility and repetition of these promotions is having an impact on the health of Australians, particularly children. Unfortunately, there is very little direct promotion of more healthy food options, such as fruit, vegetables, grains and legumes.

Many food companies focus their product promotion and advertising on products that have added value; that is, foods with marketable qualities that consumers pay extra for. These foods are usually convenient, or may have added nutrients or enhanced flavours and sell at a higher price than traditional products.

THE PROCESS OF MARKETING

Product marketing encompasses many factors, all of which have a significant impact on the ability of a food manufacturer to maximise their sales and the overall success of their product. The market place and environment, the results of market research and analysis, market types and the fundamentals of marketing, including decisions about the product, price, place and promotion are all key components of the marketing process.

The food manufacturer must make a thorough investigation of the potential consumers of a proposed product. Lifestyle, attitudes, age and income are important considerations in determining the needs and wants of consumers. Marketing campaigns are carefully designed to appeal to specific groups, and children in particular make attractive customers because they are easy to convince.

Types of markets

When food manufacturers are planning the development of a new product, they initially consider the markets the product will appeal to – this might be a target market or a niche market.

A target market is a group of consumers who share common needs or characteristics and which a company determines to be a focal point of a marketing strategy. This particular segment of the population can have similar characteristics, such as age, gender, income or location. New product ideas will focus on the specific needs of the group that are not currently being fulfilled by existing products. It is this group that becomes the target market for promotion because they are the most likely to repeatedly purchase a new product that meets their needs.

A niche market is a small portion of the target market that is not being readily served by other products. Niche marketing aims to provide a service or specialty product for a limited segment of the market, such as cholesterol-lowering margarine, lactose-free milk or Vegemite in a tube.

MARKET RESEARCH

A food manufacturer starts market research by collecting data on consumers' needs and wants. Then the research team uses **data analytics** – a process of examining raw data – to draw conclusions about that information. Data analytics is used by the food industry to make better marketing decisions, by uncovering patterns of consumers' food choices and preferences, and general market trends in the food industry. When data is collected, it is categorised to identify and analyse consumer behaviour and purchasing patterns, to determine whether marketing campaigns are successful, to predict the direction of future campaigns and to develop a competitive advantage over rival food companies.

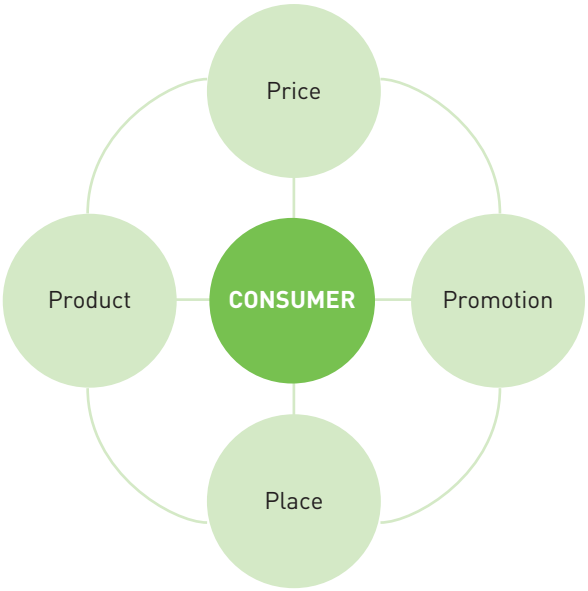
Food manufacturers also evaluate existing research work published by Australian and overseas groups – usually a review of the published research of universities and government bodies (for example, census results), and the research published by other companies in the same field. They also gather information from salespeople, customers and suppliers.

THE MARKETING MIX

Marketing considerations include the customer and the marketing mix, known as the '4 Ps' – product, price, place and promotion.

A marketing manager addresses all the '4 Ps' to market their products; the **consumer** is at the centre of the marketing strategy.

- **Product** refers to the product that is for sale to the target market.
- **Price** refers to the amount of money a customer is prepared to pay for the product.



The marketing mix

- **Promotion** refers to communicating the benefits of the product to the consumer through a range of media.
- **Place** refers to where and how the customer can purchase the product, such as a retail outlet or the Internet.

HOW DOES MARKETING INFLUENCE FOOD CHOICES?

Compared with other goods and services, food promotion is unique in that every person is exposed to food throughout their life. Food advertising can appeal to our senses of smell, taste and touch, both on television or in a magazine. The skill in effective food promotion lies in the promoters' ability to enliven the sense of sight and allow it to work on and activate the other senses. Visual presentations often bring back memories of previous 'mouth-watering' experiences and encourage the reader or viewer to purchase the product.

In order to market a new product, a food manufacturer may use a variety of promotional tools:

- advertising in the media – television, radio, newspapers and magazines, posters, billboards, signs, pamphlets, the Internet (online shopping), social media (Facebook, Twitter, Instagram), on blogs and through interactive games and free downloads
- personalised advertising – telemarketing, SMS and promotional mail
- free sample packs distributed to householders or taste samples at food fairs and supermarkets
- products that carry a cash-back offer or entry details for contests or special offers
- point-of-sale displays
- company sponsorship of sporting events
- promotion of products by using recipe cards and books; for example, Woolworths Supermarkets produce recipe cards featuring Jamie Oliver in 'Jamie's recipe'
- tie-in promotions, which involve combining related products, such as bread and margarine; these products can be packaged together and sold at a special price.

ADVERTISING

Advertising is one marketing tool used by food manufacturers. It is a process of communication that attempts to persuade consumers to want, and therefore to buy, a particular product. It is a paid, non-personal presentation or promotion of goods and services. Without advertising and promotional strategies, a company would find it difficult to sell its product. Effective advertising involves three essential factors: it must attract attention, arouse interest and create a desire to buy.

Depending on the profile of the company and the product they have to sell, the advertising can take several forms, including advertising on television or radio, in newspapers and magazines. Billboards, posters and pamphlets are also popular forms of advertising as they have strong visual appeal. Advertising through online shopping sites, websites, social media such as Facebook and Instagram, and the use of telemarketing and SMS are also increasing in popularity.

In order to get their message across to consumers, an advertiser will use a variety of strategies.

- The advertising may be designed to **inform** the consumer about a product. This type of advertising provides detailed information about the product. It is a particularly important technique used to promote a new product by explaining what it does and what it is. Television advertisements for Kraft Foods products sometimes include a short segment on how to cook a dish.
- Advertising can **persuade** consumers to purchase a product because of its brand. With a competitive or 'me-too' product, it is important to build a selective demand or competitive edge. This important technique helps to build brand preference, superiority or 'liking' and encourages consumers to switch brands. They must be convinced that the product will be of greater value to them. For

example, the advertisement may draw comparisons between two components of each product, such as the amount of kilojoules or dietary fibre present to show why one is preferable.

- Some advertisers feel it is important to **remind** consumers about a product. This applies mostly to a product that has been around for a long time and may have a new competitor. It is important to maintain the loyalty of consumers by reminding and reinforcing the benefits of the product to keep consumers thinking about the older product. For example, Vegemite promotions use old-fashioned advertisements to remind consumers about the product's history.

Advertising techniques

Advertising uses a range of techniques to communicate its message to consumers.

- The message is designed to evoke a lifestyle the consumer aspires to. For example, a family setting may be shown with the food required for the evening meal, or hungry children are shown arriving home from school, with an emphasis on healthy food.
- The image is designed to create a fantasy or mood, such as love, care, romance, style, relaxation or reward.
- Music is used to set the mood, often in the form of a catchy jingle.
- Scientific research is used to support the claims made, particularly in relation to health.
- Celebrities or personalities who are well known, popular and trusted are used to deliver testimonials.
- Cartoon or real characters are used to represent the product and appeal, particularly to children.

Understanding the text

1. Explain why food manufacturers use the media to influence consumers' food choices.
2. Why do many food companies advertise products that are described as having 'added value'? Give examples to support your answer.
3. Outline the key components of the process of marketing.
4. Explain the difference between a target market and a niche market. In your answer, identify a niche market in the white bread market.
5. Describe two methods manufacturers use to undertake market research.
6. What is data analytics and why is it an important aspect of market research?
7. Explain what is meant by 'the marketing mix', and why the consumer is an important part of the marketing mix.
8. Draw a mind map to demonstrate some of the key promotional tools used for marketing food.
9. Explain why advertising is an important marketing tool.
10. Describe one advertising tool used to communicate a marketing message to consumers, and provide an example.

MARKETING TECHNIQUES

Use of colour

Colour plays an important role in marketing food because consumers take only moments to make a decision to pick up a product from the shelves, and colour registers much faster than the text written on the package.

Different colours are used for different purposes and for different consumer personality types. Gourmet items are designed for the sophisticated consumer and so the packaging tends to be in tasty, earthy tones and colours rather than bright blue.

Tucker's Natural

Gourmet items packaged in earthy tones

Packaging colour is also influenced by trends – a green colour is often used to depict foods that are considered healthy and environmentally friendly. Blue is not often used for food packaging except for milk and water. Colour and appetite appeal are also important because consumers would be reluctant to choose a package that included an image of green potatoes or brown bananas. Bright colours are

also used to depict fun products in comparison to nutritious foods; for example, the confectionary aisle shows brightly coloured packaging on nearly every product.

Food brands have emotional dimensions too, and these are used to appeal to customers. A brand's personality is communicated to customers by the packaging, the product's picture, and the words that are used to describe the product. Unusual colour names on labels can encourage a consumer to purchase the product. For example, naming the colour of a jellybean 'razzamatazz' is more likely to create interest and encourage customers to choose it than calling it 'yellow'. Describing the colour of a product as 'mocha' will have more impact than calling it 'brown'. Certain colours represent certain aspects of a brand's personality, such as brown representing ruggedness, purple for sophistication and red for excitement.

The colours of emotions

Sponsorship

Children are exposed to enormous amounts of advertising and promotion of unhealthy foods and beverages on television as well as through other media forms such as popular children's magazines and sponsorship of children's sporting activities. These forms of marketing influence children's food choices and, because they promote foods that often don't meet the Australian Dietary Guidelines, they can contribute to weight gain and obesity in children.

Some fast-food companies sponsor junior sporting events such as basketball and cricket development programs. Through these partnerships that offer award certificates, for example for the best player in the weekly competition, or through the donation of money for new sporting equipment, children are encouraged to form a positive acceptance of these foods through their participation in sport. However, many children lack the knowledge of the link between food and health and the implications that the consumption of high-fat, high-salt and/or high-sugar fast foods have for their long-term health.

Shutterstock.com/Morrowind

Children are exposed to advertising on television.

Shutterstock.com/kwanchai.com

Unhealthy lifestyle choices can lead to childhood obesity.

Activity 8.1

A local sporting organisation has been offered sponsorship by a major fast-food company to provide three weekly awards for the best player, most improved player and the best team member. Each award allows the recipient to receive a free hamburger and soft drink from the local fast-food outlet. In addition, the company is offering the club $1000 to upgrade sporting equipment. The parent committee and coach need to make a decision about whether to accept this sponsorship offer.

1. Prepare a SWOT analysis (strengths, weaknesses, opportunities, threats) on the proposed sponsorship offer.
2. Analyse your results and justify whether the parent committee should accept or reject the sponsorship offer.

Toys and giveaways

Toys and giveaways with food products are another way of enticing children to make food choices. Patties released *Mr Men Little Miss* packs of 36 Mini Party Pies, which also include a free *Mr Men* or *Little Miss* book inside. The *Mr Men* and *Little Miss* characters have universal appeal and the books are international bestsellers, with over 100 million copies sold worldwide.

The popularity of the books encourages children to pester their parents to purchase the pies so they can get another book, or perhaps make up the set! Party pies are a discretionary food and it is recommended they are only eaten occasionally because they are a high-fat, high-salt food. The desire for the giveaway has a major influence on the children's choice of this product.

Cartoon characters

The use of cartoon characters is another strategy used by food companies to market their food products to children. Although Kellogg's market some healthy cereals, the varieties targeting children, such as Coco Pops, Fruit Loops and Frosties, are high in sugar and salt. In March 2015 the Obesity Policy Coalition released the results of an analysis of the labels of 20 popular breakfast cereals and found that' … the cereals with the most sugar were Kellogg's Frosties (41.3g per 100g), Kellogg's Froot Loops (38g per 100g) and Kellogg's Coco Pops (36.5g per 100g) – all of which are heavily promoted to children'. Kellogg's uses favourite cartoon characters such as Coco the monkey for Coco Pops, Tony the Tiger for Frosties and Toucan Sam for Fruit Loops. These cartoon characters are fun, easily recognised and loved by young children. The cartoon characters and their adventures are heavily used in television marketing for these products and also appear prominently on the cereal packages.

Kellogg's also markets a Kellogg's Fun Pack of cereals, targeted at children, which consists of multipacks of assorted cereals such as Coco Pops, Fruit Loops, Frosties and Rice Bubbles. These small, single-serve packs introduce children to a range of cereals they may not have tasted before. The packaging of these single-serve packs is bright and the packs feature large images of these cartoon characters.

An article entitled 'Are fat cartoon characters super-sizing our kids?' published in *The Age* in October 2015 reported on new research from the United States relating to the influence of cartoon characters on children's health. The research has shown that children in late primary and secondary school years are likely to eat unhealthy food after watching overweight cartoon characters used in marketing strategies in their favourite television program or computer game. The study 'Kids, cartoons and cookies', published in the *Journal of Consumer Psychology*, described how overweight cartoon characters create an 'overweight stereotype' or normalise the condition of obesity and lead children to overeating.

Alamy Stock Photo/Photos 12

Homer Simpson enjoys eating doughnuts.

This view was supported by Dr Bridget Kelly, a senior lecturer in public health at the University of Wollongong, NSW, who said that a recent local study showed that 'children who watched advertisements on television were more likely to have poorer diets than those who don't'.

According to the United States study, the producers of popular children's program *Sesame Street* have made

changes to demonstrate the importance of healthy eating – the Cookie Monster is now eating fewer cookies and setting a better example for children!

amanaimages/Georg Wendt/dpa/Corbis

Cookie Monster is now eating fewer cookies!

Advergames

Advergames are video games that contain an advertisement to promote a particular brand, product or message by integrating and embedding it into the play. This is a relatively new technique used by fast-food companies to market foods to children. It was developed to overcome the restrictions enforced by government bodies on traditional marketing to children, such as television advertising. The games promote a sense of fun and achievement and these feelings become associated with a brand. While playing the game, the child can become immersed in the game over a prolonged period and develop a personalised relationship with the game and brand. This encourages the child to ask their parent to buy more of the product for them to consume. When children play advergames, particularly those that feature unhealthy foods, they are more likely to choose unhealthy snack foods.

The game 'Snack! In The Face' is an example of **gamification** or adding game design to non-game applications to make them more fun and appealing. This form of marketing is used by marketers to reach into the personal lives of players and it can be highly addictive. Players download the brand app to their mobile phone and then play to earn points (or stars) by completing challenges. The challenge in this case is helping popcorn chickens escape from the lair of Dr SnackBot by propelling them into the mouth of Colonel S. Players are then encouraged to share their scores and earn rewards to purchase KFC products.

Advances in GPS technology have allowed users of advergames to receive push notifications or messages that pop up on their mobile phone screens. These notifications connect to the player's profile on Facebook and collect personal data and that of their friends. They also connect to their Twitter feed and encourage others to share the app and their scores with friends on social networks.

Augmented reality

Food marketers are now using the technique of augmented reality to market products, particularly to children. **Augmented reality (AR)** is a live, direct or indirect view, of a physical, real-world environment whose elements are enhanced by computer-generated sensory input such as sound, video or graphics.

The promotion for Paul's yoghurt uses Warner Bros. Entertainment Company's iconic popular culture figure of Scooby-Doo. The packaging of this yoghurt pack has a code so parents can help their children scan the barcode using a smartphone or tablet to download and enjoy a Scooby-Doo activity. This new media technique brings the Scooby-Doo characters to life and the game allows players to take control of the Mystery Machine to help Scooby-Doo and his myth-busting pals on a 'spooky snack mission'. This technique of marketing to children shapes their food choices because this well-recognised and popular cartoon figure appeals to children. Children then use 'pester power'; that is, they constantly pester their parents to buy the yoghurt so that they can play the game. It is a powerful marketing tool because digital games like this can be played on a smartphone and are useful to entertain children.

INTEGRATED MARKETING

Integrated marketing is delivering a marketing message across multiple marketing channels, using a range of different marketing promotional tools. Each channel works in harmony to send out marketing messages to promote the product. This ensures that information about the product reaches as many consumers as possible.

Activity 8.2

Meat & Livestock Australia's integrated approach to marketing lamb

Read the information on the following pages about Meat & Livestock Australia's integrated approach to marketing lamb, then answer these questions:

1. Discuss the reasons the red meat industry has embarked on such an extensive marketing campaign.
2. Describe in detail an innovative strategy that Meat & Livestock Australia (MLA) used to promote their products.
3. Explain what is meant by an integrated approach to marketing.
4. Describe the target market for red meat.
5. What assistance does the cook receive by viewing the app Meat Cuts?
6. Why is the information on making the best uses of leftover meat and meals that can be prepared in less than 30 minutes important to consumers?

MLA and integrated marketing

When marketing their meat, MLA must ensure that they create a successful marketing mix: the right product, at the right price, available in the right place and promoted using the most suitable channels.

- **Product** – As part of their mission statement, MLA has a commitment to marketing and promoting beef and lamb. Various cuts of red meat are promoted, such as beef mince, beef for casseroles, lamb roasts and lamb cutlets.
- **Price** – The price of lamb products is influenced by season, demand and availability.

iStock.com/meral yildirim

MLA use the marketing mix to promote the sale of lamb and beef cuts

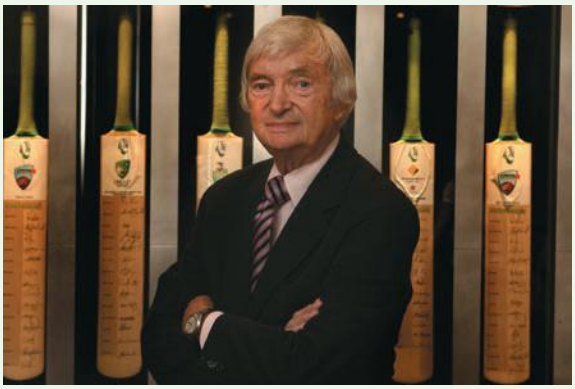
'You Never Lamb Alone' integrated marketing campaign

- **Place** – Lamb cuts are available from butcher shops, fresh food markets and the meat departments of most supermarkets.
- **Promotion** – MLA uses a variety of promotional tools in its consumer campaign to promote the purchase and consumption of red meat. They promote the sale of meat at key times of the year such as Mother's Day and Australia Day, to promote enjoyment of meat as part of a meal, as well as educating consumers about the importance of including red meat in the diet.

The Australia Day 2015 campaign to promote lamb used the theme 'Richie Benaud will not Lamb alone this Australia Day'. This is an excellent example of integrated marketing because it uses a range of marketing strategies.

The television commercial

A television commercial was a key part of the MLA marketing campaign launched in early January 2015. In this advertisement, iconic cricket commentator Richie Benaud asked his mates over to his place so that he didn't have to 'lamb alone'. Sam Kekovich, Billy Birmingham and Ita Buttrose, as well as Australian historic icons, including Captain Cook, Burke and Wills and Ned Kelly, were invited to enjoy lamb at an Australia Day barbecue at Richie's place.



Fairfax Syndication/Justin McManus

Richie Benaud was featured in a MLA television commercial to promote the use of lamb at an Australia Day barbecue.

Social media

Weblink

The use of social media, especially Facebook, was another key arm of the campaign and included a consumer competition on the 'We Love Our Lamb' Facebook page. This competition invited people to impersonate Richie Benaud's lamb barbecue call, 'Top Lamb Chop That'. Ten Aussies (and two of their mates) could win a ticket to Richie's own lamb barbecue on Australia Day!

Digital media

The MLA also added content to its website beefandlamb.com.au, including a suite of delicious and economical recipes for lamb meals. Recipes such as barbecued lamb ribs, mince koftas and lamb loin chops were featured.

Fairfax Syndication/William Meppem

Lamb recipes were included as a part of the MLA integrated marketing campaign.

The MLA has also developed a meat cuts app for use on a smartphone or tablet to help consumers cook lamb successfully. This app is meant to help consumers when they are shopping for meat or planning a meal by providing information about the characteristics of different cuts of beef, lamb, veal and goat, along with suggestions for appropriate cooking methods and recipe ideas.

Shutterstock.com/Dean Drobot

MLA app for meat cuts helps consumers in planning and preparing meals using meat

Print media

The MLA produces a magazine that is available in both butcher shops and online. The *Entice* magazine provides consumers with valuable information on:

- how to buy and cook lamb
- popular recipes using lamb
- videos on a step-by-step approach to cooking some of the more popular lamb recipes
- nutritional information about the importance of lamb in a healthy diet.

Posters and pack stickers

MLA also promoted lamb through a range of posters and pack stickers available at butcher shops and fresh food markets.

Interactive panels in shopping centres

In an effort to increase consumer engagement and awareness of using lamb and beef in meals, the MLA recently joined forces with the advertising company oOh! Media. The new marketing strategy aimed to

provide shoppers in key shopping centres with a series of beef and lamb recipes using new interactive recipe-dispensing panels called 'ShopaLites'. This technique is an important marketing channel and is used to inspire shoppers to purchase lamb when they are near a supermarket or butcher's shop. Consumers simply use the touch screen to search for a recipe, then they press a button to have the recipe printed. This means the consumer can start shopping with the recipe in their hand and can purchase the ingredients they need for their meal.

According to the MLA, the campaign was very successful and more than 454700 recipes were printed during the campaign.

iStock.com/gmutlu

ShopaLites used by the MLA provide touch-screen recipes to inspire shoppers.

News reportage

News reportage is the reporting of news on current issues or events in newspapers or on television or radio. News reportage is a key source of information for consumers and a powerful tool in shaping food information and choice by highlighting issues of nutritional importance and bringing them to the public's attention. This information assists people to become more aware and knowledgeable about nutritional and food issues. However, it is critically important that the news item presents a balanced view of the issues.

Often television news and current affairs programs air news items that draw attention to issues of overweight and obesity, and in the coverage, present ways to support or oppose efforts to overcome these conditions. The *Medical Journal of Australia* conducted research into the effectiveness of these programs, entitled 'Choice and voice: obesity debates in television news'. Health information news reportage on television can reach up to 1.9 million viewers and 88 per cent of consumers get this information from television compared to 76 per cent from newspapers. The results of this research showed that most of the television news items (72 per cent) portrayed obesity as a problem related to poor personal behaviour and the responsibility of the individual as a result of poor nutrition and lack of exercise. The solutions most often presented focused on consumers selecting a healthier diet and not on overeating. Increased exercise and possible medical intervention or 'medical solutions'

such as lap band surgery were also identified as solutions.

Although these are immediate solutions to a difficult health issue, they ignored the bigger issues related to environmental and sociopolitical issues such as government responsibility in regulating junk food advertisements, or taxing foods high in fat, salt and sugar. Other structural issues and changes, such as better nutritional education, improving the availability of healthier food in school canteens and the provision of parks for exercise, were not discussed. Discussion of these issues would have provided a better balance to overcome overweight and obesity problems, particularly at a population level, with a focus on how environmental and sociocultural forces are also drivers in unhealthy behaviour, rather than just focusing on an individual's personal level of responsibility.

www.nutritionaustralia.org

National Nutrition Week poster

During National Nutrition Week in October 2015, many issues relating to healthy eating were reported in newspapers and aired on news broadcasts and television programs.

MAGAZINES AND NEWSPAPERS

Magazines such as *Australian Healthy Food Guide* and *Body+Soul*, a daily section of the *Herald Sun* newspaper, feature articles that shape food choices by providing information about nutrition and healthy living.

Recent articles that have appeared in the *Body+Soul* include '5 ways to mindful eating', 'Why you need to eat less as you age', and 'The new healthy food pyramid and what you need to know'. These articles, and many more like it, are helpful to people because they provide important information to guide them in making sound food and lifestyle choices to maintain good health in the long term.

Australian Healthy Food Guide is a monthly magazine that provides information on healthy food choices. It has practical advice from expert dietitians and nutritionists, and tips on how to made sound food choices at the supermarket. It contains healthy recipes and a nutritional analysis for each recipe, showing amounts of energy, and nutrients such as fat, protein, carbohydrate and sodium.

Australian Healthy Food Guide

Reproduced with permission from *Australian Healthy Food Guide* magazine, available at supermarkets and newsagents. For more healthy tips and recipes see www.healthyfoodguide.com.au © Healthy Life Media Pty Ltd / Next Media Pty Limited (ABN 84 128 805 970)

CONSUMER ORGANISATIONS AND ADVOCACY GROUPS

Choice is an Australian consumer organisation that researches and campaigns on behalf of Australian consumers. It provides up-to-date information on a wide range of issues including food and health. In August 2014, Choice produced a report, *Food to Lower Your Cholesterol*, which featured information on selecting foods with added plant sterols, who can benefit from selecting these new food products and whether they are safe to consume.

Each year Choice shines the spotlight on products that are described as 'unscrupulous or sneaky'. In 2015, one of the 'Shonky Award' winners was Arnott's Tiny Teddies biscuits. Consumers were alerted to the fact that Arnott's placed a statement on the biscuit pack stating 'school canteen – meets amber guidelines.' These biscuits contained hundreds and thousands together with chocolate chips and coatings and were classified by the National Healthy School Canteen guidelines as confectionary! Confectionary items like these biscuits are not recommended on canteen menus because they are high in sugar.

An article written by Esther Ham for the *Sunday Age* newspaper on 18 October 2015, entitled 'Lunchbox logos misleading parents', reported on the Choice Shonky awards. This form of news reportage provides information to alert parents to concerns about products and assist them in making healthy food choices for their children.

The Obesity Policy Coalition is an organisation that aims to influence change in policy and regulations to help prevent obesity, particularly in children.

Some of the action areas of the Obesity Policy Coalition are advertising and marketing, food labelling, urban planning and health environments, and policies and laws impacting on obesity, such as the tax on sugary, sweetened beverages.

News reportage from the Obesity Policy Coalition includes media releases, opinion pieces and newsletters.

Weblink

In July 2015, the Obesity Policy Coalition issued a media release entitled 'Fanta loses fizz: Ad pulled for directly marketing to kids'. A Fanta television advertisement and mobile phone app was removed after the Advertising Standards Board found the manufacturer had broken the rules by directly marketing an unhealthy drink to children. This decision came after the Obesity Policy Coalition lodged an official complaint. News reporting on this decision alerted parents to the health concerns and the link between sugary drinks and obesity by highlighting the fact that there are 14 teaspoons of sugar in a 450-millilitre bottle of Fanta.

Obesity Policy Coalition

The Obesity Policy Coalition aims to influence change in policy and regulation to help prevent obesity, particularly in children.

Popular culture

Popular culture surrounds us! We all have our favourite actors, singers, TV personalities, sports stars, reality TV shows, and we can follow their lives, listen to their music or watch them on television. Popular culture is found within the mainstream of a culture and is influenced to a large degree by the mass media. It is sometimes referred to as the culture of the people. Food manufacturers develop strategies to use each one of these aspects of popular culture to promote their products to consumers with the aim of increasing sales. When we see our favourite TV personality or sports star endorsing a particular product, we are more likely to think – if they like it, so will I!

REALITY TELEVISION

Watching television programs such as *MasterChef* is a popular form of entertainment. *MasterChef* is a competitive food and cooking show, where a number of contestants prepare and present a food dish to judges. Finalists then compete in several challenges, such as the 'pressure test' or the 'mystery box', to test their food knowledge and preparation skills.

MasterChef Australia uses marketing to support and promote their television show. The show is influenced predominantly by the food industry and food businesses such as Coles and Nandos. *MasterChef*

Australia uses its cooking and culinary theme of the show to advertise and promote certain food products and ingredients such as Coles products. *MasterChef* contestants use fruit and vegetables supplied by Coles, and the Coles website contains the recipes cooked by contestants. This marketing technique influences the food information and food choices of consumers as they watch the series and learn new skills and cook the recipes, having purchased the ingredients that are promoted on the program.

CELEBRITIES

Supermarkets and food manufacturers often contract celebrity chefs to promote the supermarket chain and market particular foods. These chefs are also authors of bestselling recipe books and have a following of dedicated cooks. Their influence, opinions and promotions have a considerable impact on food information and food choices.

Jamie Oliver is a celebrity chef and restaurateur who has become a media personality presenting food-focused television shows, cookbooks and a global campaign for better food education, particularly for young people. He has teamed with Woolworths Supermarkets to promote fresh food and fresh food ideas, and has created a range of easy-to-cook dishes for consumers who are time poor. Jamie's recipes and ideas feature in the Woolworths *Fresh* magazine, which is a free publication available in the store. This magazine encourages consumers to use Jamie Oliver's recipes and ideas and 'get cooking' to prepare healthier food.

Curtis Stone is another celebrity chef; he has teamed with Coles Supermarkets, promoting and endorsing Coles food products. Coles uses Curtis Stone in a range of marketing strategies including in their television advertisements, presenting recipes featuring Coles products, on the cooking section of the Coles website as well as featuring Curtis Stone in the Coles free magazine with recipes and creative food ideas.

Newspix/Peter Ristevski/News Ltd

Curtis Stone, an Australian, is a well recognised celebrity chef.

SPORTING STARS

Sporting stars are used in food marketing, particularly to promote food products targeted at children. A study by the Centre for Behavioural Research into Cancer surveyed 1300 boys in Years 5 and 6 in Melbourne primary schools. The results of the research found that 65 per cent of boys are more likely to choose a product if a male sports star is featured on the packet. The Obesity Policy Coalition's Jane Martin says, 'If the product was endorsed by a male sports identity, there is a likelihood of a boy choosing the unhealthy product'.

Newspix/Phil Hillyard/News Ltd

KFC is a prominent sponsor of the Twenty20 Big Bash cricket tournament.

Understanding the text

11 Explain how the colour used in the design of food packaging can influence consumer choice. Select three colours and give examples of products that match the emotion linked to the colour.

12 Explain why the sponsorship of children's sporting activities may have a negative impact on the health of children.

13 Prepare a PMI (plus, minus, interesting) chart on the use of toys, giveaways and cartoon characters in food marketing.

PMI CHART – TOYS, GIVEAWAYS AND CARTOON CHARACTERS		
Plus	Minus	Interesting

14 What are advergames? How does the playing of advergames shape the food choices of young consumers?

15 What is meant by the term 'augmented reality' and how does it influence the food that children select to eat?

16 What is meant by the term 'news reportage'? Explain how news reportage can assist the consumer in shaping their food choices.

17 Draw a diagram to demonstrate how magazines and newspapers can shape consumer's food information.

18 Why are consumer advocacy organisations a valuable resource for consumers in guiding their food choice?

19 How do reality television programs such as *MasterChef* promote food products and influence the food choice of their viewers?

20 Why do supermarket companies use celebrity chefs in their marketing campaigns? List some of the ways these chefs promote food products for the supermarket companies.

Social media

Social media describes a group of technologies including blogs, online networks, digital tools and online collaboration tools. Social media marketing is said to disrupt traditional marketing methods because it provides a vehicle for engaging with people's daily interactions and social relationships. Popular social media services such as Facebook, Twitter, Instagram, YouTube and Google+ can be used to increase market research and reach people on a larger scale.

Social media is effective for marketing food products because they influence buying behaviour, create 'brand advocates' and encourage people to share information about a product and therefore influence food choices. Social media helps to engage with customers and generate conversation and find out what people are saying about the products. It is making a difference in the way food is experienced and shared, and consumers will increasingly rely on social networks to shape their food choices.

Australians now have information about food and cooking at their fingertips, and one-third claimed to get most of their information about food from online and media sources. Ben Bale from Weber Shandwick, a public relations and communications agency in Australia, reported in an article in *Food Forward 2014* that 'social platforms have allowed everyone to be a food critic. Traditional food writers and celebrities must now compete with our friends in social feeds and review sites when attempting to influence our decisions'.

DIGITAL MARKETING AND SOCIAL MEDIA

Food and beverage marketing has made a dramatic move into the digital age and companies are now drawing on sophisticated online and social media techniques. Connected devices, such as smartphones, are starting to drive food marketing strategies. The message to marketers is 'get mobile or be left behind'. Smart digital marketing companies focus on creativity and the best strategies will use clever ways of engaging consumers. For example, in 2015, Kellogg's Australia launched a campaign inviting consumers to post a photo of their favourite combination of a breakfast cereal and yoghurt on Instagram using the hash tag #doublethegoodness.

Kellogg Australia

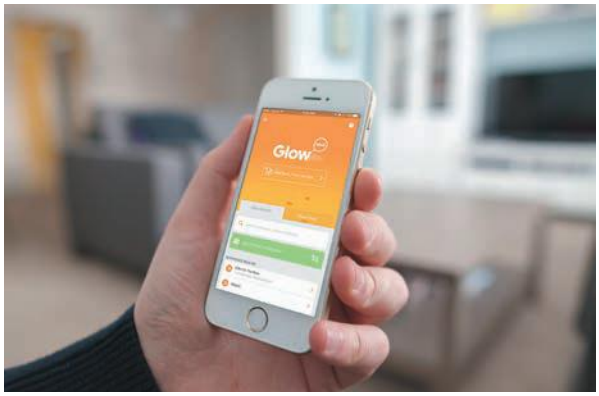
Kellogg's Instagram campaign for breakfast cereal and yoghurt

SMARTPHONES AND TABLETS

The smartphone has had a major impact on food marketing because it has become an integral part of the shopping experience, both in store or at home. More families are moving towards shopping online and using their mobile device to browse and order from the supermarket. Relationships with food marketing are no longer one-sided as when viewing a television advertisement for food. This device is now offering a way to connect with the marketers, or to use personalised shopping apps to guide supermarket choices based on what people like to eat, or what fits their lifestyle or health requirements. The mobile phone is the place many consumers go first for guidance and to explore, discover, connect and share, and most importantly, it is always within arm's reach. Mobile content advertising is growing and food advertising is pushing this growth. Smartphones and tablets also give quick access from any location to fast-food store locators, menus, special deals and ordering apps.

The use of apps, or applications, are software programs that are designed to perform a specific function for the user. These are being used when shopping and making food decisions in the supermarket. For example, they give consumers the ability to scan labels to find the sustainability of a food product, its country of origin or what to swap the product with for a healthier alternative.

Recently a scan-barcode app called 'Glowfeed' has allowed consumers to make contact with producers and retailers and ask questions about a product. This app was initiated after a hepatitis A outbreak in which 27 Australians contracted the disease after eating frozen berries from Chile and China.



Glowfeed.com

Glowfeed app

When Choice conducted a review of junk food marketing they found that fast-food companies were using mobile apps and social media to promote salty, fatty and sugary foods. The popularity of mobile devices has encouraged these companies to develop a range of sophisticated strategies to market these foods to children. Children are being exposed to junk food advertising via apps, viral marketing, celebrity endorsements, competitions, and advergames with embedded brand messages.

Activity 8.3

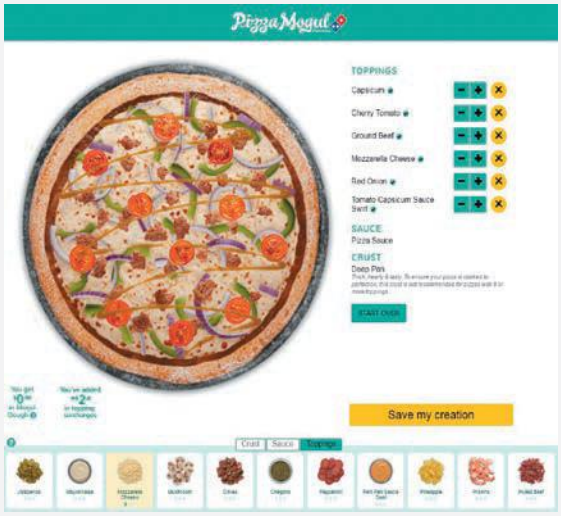
Domino's Pizza

Domino's Pizza uses innovative technologies in their pizza business, such as creating mobile apps for ordering pizza and a GPS driver tracker that allows customers to track how far away their pizza might be when they are having it home-delivered. The app also allows customers to become a Pizza Mogul so that they can create their own pizza. Domino's also have a pizza tracker available on smart watches.

Read the article, then answer these questions:

1. Explain the new marketing initiative developed by Domino's Pizza.
2. Outline some reasons why this new initiative has been so successful.
3. Suggest ways Domino's may have marketed their pizza before mobile phones.
4. How did Domino's manage to register thousands of 'moguls'?
5. Who is the focus of the Pizza Mogul marketing strategy? Would you, or have you, become a Pizza Mogul? Justify your answer.
6. Explain how the technology and use of a smartphone will help shape food choices.

CAMPAIGN: DOMINO'S ON THE HUNT FOR A PIZZA MOGUL



Domino's Pizza Enterprizes

Domino's Pizza Chef page

Domino's Pizza Mogul is a responsive website and mobile app that allows customers to: create their own pizza, identity and branding; share to their social networks; and earn a cut of every sale.

Domino's CEO, Don Meij, says the Domino's mantra, People Powered Pizza, is at the heart of their operations and that Pizza Mogul is all about putting power in the hands of the customer.

"Pizza Mogul was designed to appeal to entrepreneurs and social media savvy pizza lovers, as it empowers its users and gives them the freedom to craft their own product and message to reach their market," Mr Meij said.

Pizza Mogul provides the vehicle for Domino's to utilise social selling as a powerful revenue and viral advertising stream.

"We are looking for our passionate customers, fans and followers to share their creativity with their social networks."

Mr Meij says that the most innovative and thought-provoking Pizza Mogul will be given the once in a lifetime opportunity to appear in Domino's multi-million dollar TV promotional campaign.

"This is what Pizza Mogul is all about – putting the brand back into the hands of the consumer. It was an idea created because we have seen amazing creativity in our fans – social media has opened up all kinds of new age marketing ideas."

"We have already had a great response, with thousands of 'moguls' registering and making dough.

"If you have a great pizza idea, and an innovative way to market it send us your ideas and you might become the next TV superstar!"

www.bandt.com.au 15 July 2014

Domino's Pizza Enterprizes

Innovative technologies used by Domino's

Location-based marketing using geolocation techniques

Location-based and mobile marketing is most often targeted towards young people who rely on their mobile device for a number of services such as the Internet, phone and social network access. Mobile marketers target consumers based on where they are and what they are doing at that moment. This form of marketing is designed to create a form of impulse purchasing, and is used by fast-food outlets. Cravings for food can easily be triggered at the exact point when a person is near a fast-food outlet and they are further encouraged to enter the store through discounts and free offers. Some very sophisticated location-based marketing companies can use the weather to market drinks such as Diet Coke to people when the temperature is over 30 °C.

The Hungry Jack's app uses the GPS functionality, location services, map integration, dynamic feeds and social media integration to reward a fun and satisfying experience, and encourages consumers to share it with friends.

The Shake & Win Challenge 'is just so easy – all consumers need to do is':

- find the store nearest to their present location using the online map on their phone
- enter the Shake & Win challenge, by shaking the accelerometer on the mobile phone from side to side to reveal a coupon for one of the million prizes.
- ... and, of course, purchase a hamburger!

When young people feel hungry, they reach for their smartphone and their food choice is simple and easy, but unhealthy!

Data collection and targeting

Data collection and targeting are woven together by the functions of digital media, allowing marketing companies to track a customer's online journey and target the data they receive. Some companies can now combine the data they have collected and track a customer's buying habits, creating a buying behaviour pattern. Using this technique means that the company is not targeting large age groups or demographics of people, but individuals. Retailers such as Woolworths and Coles track shoppers' habits through their loyalty cards and then send targeted promotions to their customers through email, offering special prices on foods they regularly buy. This technique is called micro-targeting and sending these personalised messages is based on the profiles collected by past buying patterns. This form of marketing has benefits for the consumer because it encourages them to buy their most commonly purchased products at special prices. When a food recall is undertaken, data containing customer's purchases is accessed and a warning message emailed to the customer informing them of the details of the product to be recalled.

The ability to identify the audience or target market becomes increasingly important. Marketing companies need to be able to create personalised relevant messages in the right medium and context in order to reach the target market and influence their food choices to get the best results. Internal data targeting has proven successful in creating and driving new trends in food.

Taste.com.au's quinoa story began in 2010 when editors of the website noticed an increase in the number of consumers who searched for the grain on their website. At that time there was only one recipe on their website containing quinoa. Taste.com then set about creating over 40 recipes that contained the ingredient quinoa and placed a photo of one on the front cover of the *Taste* magazine. Just before Christmas in 2012, Google Analytics charted its peak for quinoa searches and by the end of the year *Taste* had registered 10 000 in-site searches and 190 000 views for quinoa content. In 2013, it became one of the three most searched ingredients on Taste.com.au, ahead of potatoes and pizza.

Andrew Young

Indian spiced quinoa

YOUTUBE

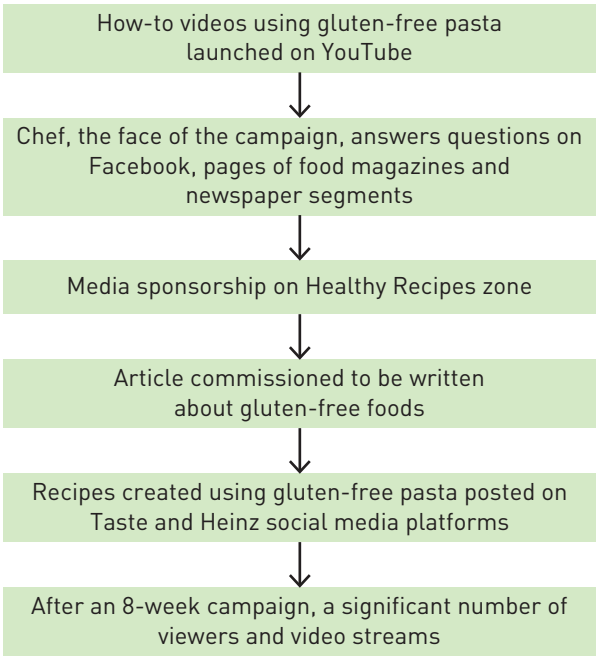
YouTube is becoming an important media platform to view food content. Recently, Kidspot aired a short video for a two-ingredient Nutella cake. This went viral and reached 20 million people in 14 days.

Taste.com.au recently created a series of eight 'how to' videos using Heinz Gluten Free Pasta as a 'hero' ingredient.

Newspix/Nicole Cleary

Toby Puttock became the face of the Heinz Gluten Free Pasta marketing campaign

A campaign partnership was formed with Tobie Puttock, an Australian celebrity chef, as the face of the campaign and as an interviewee for question-and-answer sessions across social media. Media sponsorship of the Healthy Recipes zone was obtained and an article commissioned on gluten-free foods and cooking. Ten recipes were created using Heinz Gluten Free Pasta as the hero ingredient and the company used social media exposure across Taste and Heinz social media platforms to promote the product and the recipe ideas. After 8 weeks, the campaign resulted in 35 939 view hits and 600 video streams. This video brand integration marketing approach is experiencing significant growth and is shaping consumer's food choices.



YouTube now shapes consumer food choices.

FACEBOOK

Facebook is a social networking agency that makes it easy for people to connect and share information with friends, family, businesses and customers, at the same time. Viral marketing is often referred to as the 'electronic word of mouth' and involves prompting website visitors to use email or social media to share information about a brand or product. Popular food companies use their brand logos, viral marketing, product images and links to their website on their Facebook pages. This communication technique encourages young people to 'like' a food company's Facebook page and then to read about news of the company, games, surveys and products. As fans of the product's Facebook page, their friends are immediately notified and encouraged to also become fans.

Junk food marketing is prolific online and in social networks, such as Facebook. The pages use social media features, such as competitions based on user-generated content, interactive games and apps, to increase consumer's interaction and engagement.

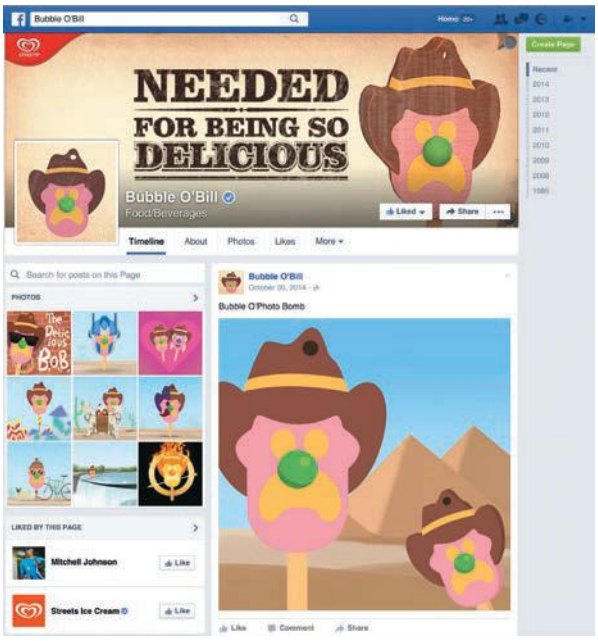
Recently, the most popular food brand page on Facebook in Australia was for Bubble O'Bill ice-cream. The administrators responded to almost every post and engaged with post comments daily, which explains its popularity.

Some of the brands included on Facebook apps allowed customers to place an order without having to click outside Facebook. These apps are promoted by offering prices and menu upgrades exclusive to Facebook users, and these easy purchase options encourage impulse food choice and purchasing.

Daily login habits by users and posting new content material regularly by the food manufacturer mean that marketing messages spread quickly. Users become willing participants in spreading marketing messages on behalf of food manufacturers with little incentive or reward required.

Soft drinks and energy drinks are popular with adolescents and young adults, and these products are heavily promoted through Facebook. New content appears every two days and, considering the daily login habits of 'connected' adolescents, the marketing message for these products quickly goes 'viral'. Research carried out by a health survey in 2012 showed that 42 per cent of people drink sugar-sweetened drinks, contributing to Australia's rising obesity rates. Energy drinks popular with adolescents and young people contain high levels of caffeine. Young people have a lower tolerance to caffeine, and these drinks are known to produce the cardiovascular effects of caffeine such as higher blood pressure, as well as anxiety, insomnia and heart palpitations.

While social media has proven to be a very effective tool to promote some food products, it has not been successful in promoting healthy options. Any attempts to use social media to influence behavioural change in these areas has led to negative emotions and young people have avoided engaging with health promotion messages on Facebook.



Facebook page for Bubble O'Bill ice-cream

Streets Ice Cream

BLOGS

The word **blog** is a short form of the word weblog, and is best described as an online journal or diary that is frequently updated. It is a place where thoughts can be expressed and shared with many hundreds of people about a certain topic. It is really like a personal website that is constantly being updated. Bloggers are people who use their voice to share their thoughts, opinions and passions with a global audience.

Case study

The Gourmet Chick

Weblink

Read the case study, then answer these questions.

1. What is Cara's passion and what does she write and share opinions about on her blog?
2. Why has it become possible to have many blogs on the Internet, sharing thoughts and opinions with many people?
3. In the past, who were the food writers and critics writing about food in magazines and newspapers, and how effective were they in spreading their message?
4. Suggest ways blogs can influence our food choices and healthy eating.
5. Outline some of the problems with unqualified people giving nutritional advice on their blogs.
6. Explain how Cara's comments and work with Philadelphia Cream Cheese will have an impact on the marketing and success of their products.

Gourmet Chick

Gourmet-Chick.com documents Cara's experiences and thoughts on eating out and eating in. It includes restaurant reviews, travel tips and recipes.

'I've always really loved food and I also love to write, so it seemed quite natural to write a blog. I first started Gourmet-Chick.com eight years ago when there weren't that many blogs around and taking photographs of your food was considered quite strange,' she says.

But now there are thousands of different blogs in Australia alone and nobody bats an eyelid when you whip out your smartphone to take a photo of what you've just ordered or cooked. With the increased use of the Internet and rise of smartphones, blogs and social media are becoming more and more popular. It used to be that food trends were driven and documented by a handful of experts and food writers who were generally white, middle-aged men. Blogging has really democratised food and now there are a whole range of different voices out there. If you want to find out what a young Chinese girl thinks are the best cheap yum cha places in Western Sydney, there will be someone with a blog or Instagram account out there who fits the bill. Everyone has to eat and it seems that everyone has an opinion on food!

Current trends that are featuring on lots of blogs and social media are 'freak shakes,' which are milkshakes topped with doughnuts or bacon. There is also a growing interest in wellness and clean eating such as the popularity of green smoothies and breakfast bowls. I read other blogs and follow lots of people on social media to find out about where and what to eat and I know from readers' comments that a lot of people also follow my recommendations. In this way bloggers and popular social media users help influence what we eat.

But the democratisation of food writing also has its downside as there are people offering expert advice who don't have any nutritional qualifications. For example, blogger and author Belle Gibson has stopped writing about food and had her cookbook pulled after it was revealed she lied about having cancer. I always make it clear that I'm just an enthusiastic eater and home cook and my recommendations are based on what's tasty rather than any health benefits.

I work full-time as a journalist and so Gourmet-Chick remains something I do in my spare time, but blogging and social media are becoming increasingly commercial. Food, travel, restaurant and kitchen appliance marketers all

work closely with successful bloggers and social media influencers. For example, I've worked with businesses like Philadelphia Cream Cheese to create recipes using cream cheese, which I photograph and cover on Gourmet-Chick.com, and Philadelphia can also use in its marketing campaigns. This is the type of work that bloggers and social media influencers are paid for so I always mark this on Gourmet-Chick.com as sponsored content but not everyone does this so it's something to watch out for. A lot of the popularity of bloggers and social media influencers is that they are seen as an independent and alternative voice to the mainstream media, but that's a balance that can be difficult to maintain when you are being paid to promote a product.

Source: Cara Waters, Gourmet-Chick.com, accessed November 2015

Gourmet Chick

Cara Waters writes the food blog Gourmet-Chick.com and is a 'social media addict' @carawaters on Twitter, Instagram and Facebook.

INSTAGRAM

Instagram is an online mobile photo-sharing, video-sharing and social networking service that enables its users to take pictures and videos, and share them on a variety of social networking platforms, such as Facebook, Twitter, Tumblr and Flickr.

Hashtags are a way to group ideas, concepts and conversations. They make it easier to find others who are posting about topics they are interested in. Instagram's engagement rate is one of the most successful social networks to showcase and sell products.

A case study by Instagram showed how Chobani yoghurt used social media to focus their marketing campaign on highlighting the versatility of their yoghurt, by showing pictures of how people used the product. Chobani posted sponsored photos targeted at females aged 18–49, over a 4-week period. These photos showed beautiful food imagery and lifestyle settings in a series of sponsored photos on Instagram. This lifestyle series included a quick breakfast, a savoury snack and a dessert, made with Chobani Greek yoghurt. The results after 4 weeks showed exposure four times that of online marketing and shifted the perceptions of the yoghurt only being eaten for breakfast. This strategy is often termed 'the pathway to purchase'.

Chobani

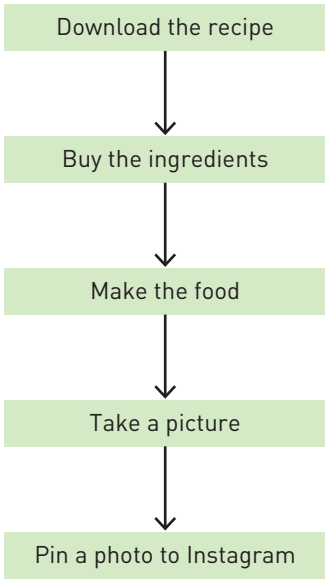
Chobani yoghurt

Chobani

Chobani Instagram post of Mug cake magic

The pathway to purchase

Many food manufacturers now draw together a range of strategies to develop a pathway to encourage consumers to develop the desire to purchase their product. For example, Arnott's wanted to increase the sales of its Butternut Snap biscuits so it undertook a new marketing approach in a tie-in promotion with Taste.com.au. In this strategy, Arnott's brands were included in 148 recipes, inviting people to engage in a five-step process or pathway to purchase.



Arnott's pathway to purchase

The results are fascinating! The recipes were downloaded 4 million times and one in particular, Butternut Snap Rudolph Choc Tartlets, which uses Arnott's Butternut Snap biscuits, has received 2600 likes, and photos of the finished recipe have been pinned 1500 times to date.

Brett Stevens

Butternut Snap Rudolph Choc Tartlets

Understanding the text

21 What is social media and why is it considered to be an effective marketing tool?

22 Outline four points explaining the role of the smartphone in the marketing of food products.

23 Explain the impact location-based marketing has on the food choices of young people.

24 Describe how large supermarkets use data collection and target marketing.

25 How can data collection and target marketing benefit the consumer?

26 Explain how Taste.com.au was able to use data collection to meet consumers' need for information about quinoa.

27 Draw a table like the one below to compare the effectiveness of YouTube and Facebook in marketing food products.

YOUTUBE	FACEBOOK

28 Describe how blogs can influence food choices.

29 How has Instagram helped Chobani yoghurt increase the uses of their product from a breakfast-only food?

30 How do food companies use the 'pathway to purchase' strategy to sell their food products?

PREPARING FOR EXAMS

Applying knowledge

Select two food products, such as a cup of noodles and low-fat yoghurt. Identify and describe the components of the marketing mix – product, price, place and promotion – of these two food products.

Worksheet

Analysing information

Select a form of social media such as Instagram or Facebook and prepare a SWOT analysis of the effectiveness of this strategy in marketing a food product.

Worksheet

Strengths	Weaknesses
Opportunities	**Threats**

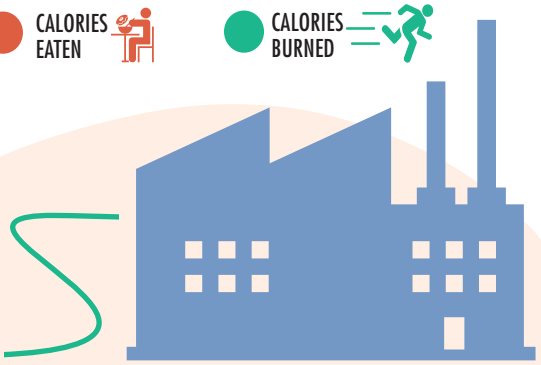
Evaluating concepts

Write a letter to the editor of a newsfeed recommending changes to television advertising of junk food during children's viewing times.

A FOOD SYSTEM IS A FOOD JOURNEY FROM:

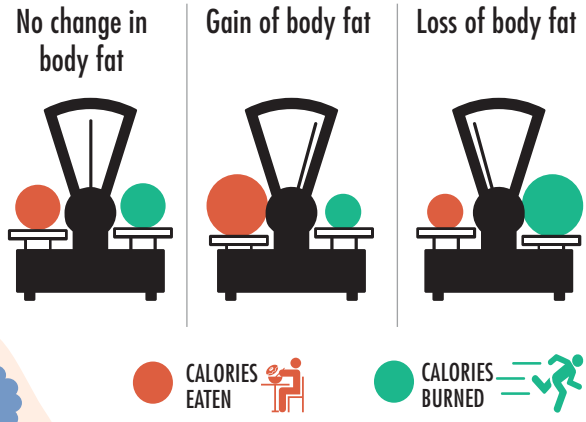
PADDOCK TO PLATE

FOOD PRODUCTION



FOOD DISTRIBUTION

ENERGY BALANCE



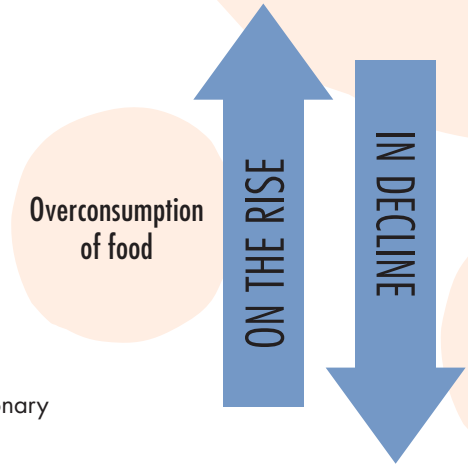
MODELLING HEALTHY EATING PATTERNS TO CHILDREN

Increasing physical activity in children

- Less screen time
- More outdoor play
- Walking to school

Improving food habits in children

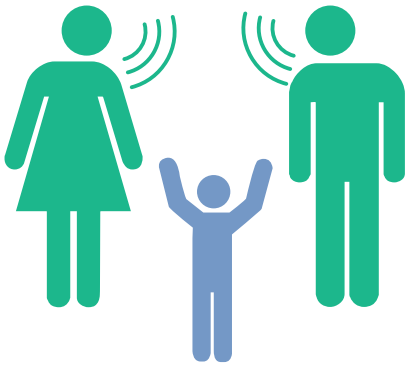
- Eat more fruit and vegetables
- Eat fewer meals away from home or in front of the TV
- Eat less soft drinks, chips and discretionary foods



9

TODAY'S FOOD CONSUMERS

THE ROLE OF PARENTS IN MODELLING HEALTHY EATING TO CHILDREN



- Breakfast is important
- Talking and learning about food
- Shopping and planning meals together
- Cooking and preparing food together
- Exposure and repetition of new foods and tastes
- Make mealtimes enjoyable

KEY TERMS

Food system is the pathway that food travels from the farm to food manufacturers, to food retailers and finally to the consumer's plate.

Healthy diets are those that reflect the Australian Dietary Guidelines and the Australian Guide to Healthy Eating.

Mindless eating is eating food without paying adequate attention to what and how much is being eaten.

Obesity is carrying excess body weight in the form of fat.

Physical activity refers to any structured or incidental body movement that causes the muscles to work and uses more energy than the person would be using if resting.

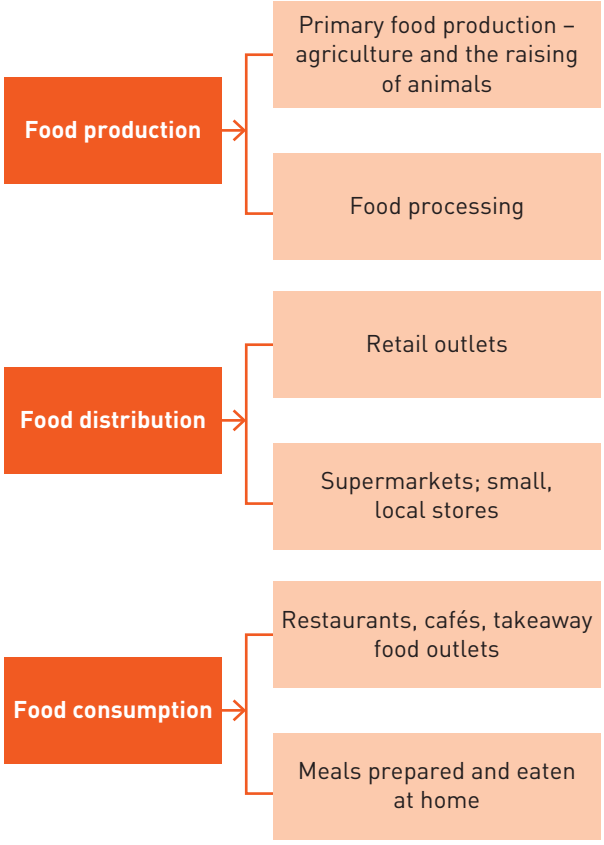
Sedentary behaviour refers to sitting or lying down (not sleeping), and uses little energy.

What is a food system?

A **food system** is the pathway that food travels from 'paddock to plate'. Food's journey begins on the farm, is transported to food manufacturers, then on to food retailers and finally to the consumer's plate. This pathway begins when the primary producer or farmer grows crops or raises animals. After harvest or slaughter, the food is transported to food manufacturers where it undergoes secondary processing to produce a range of food products. These food products are then packaged and transported to retailers such as supermarkets or to food service outlets, for example restaurants and cafés, where they are used to prepare meals. The final stages of the pathway occur when consumers eat the food either as home-cooked meals or as meals in food service outlets. The waste is then disposed of.

Australia's present-day food system

Australia's present-day food system involves three key components: the production of food, its distribution throughout the food chain and its eventual consumption.



The three major components of the present food system in Australia

FOOD PRODUCTION IN AUSTRALIA

Australian farms supply 93 per cent of the food consumed by the Australian population and also export much of their produce to overseas markets. Today, primary food production and agriculture have moved away from the individual farmer on the land or the small orchardist or market gardener to large-scale agribusinesses with more intensive and efficient production systems. Egg production is a good example of this trend with a move to large numbers of hens, often up to 700 kept in sheds. The number of farms throughout Australia has declined over the last decade and many of the smaller farms are now operated by 'hobby farmers' or have become part of a large landholding.

Today's farmers have access to technological developments that have made cropping and grazing more efficient and profitable through crops that are more suited to Australia's climatic conditions and as a result of advice from agronomists on land and soil management. This has increased productivity and profitability for many of Australia's primary food producers. Meat provides the greatest value in the agricultural industry, followed by grains and oil seeds, fruits and vegetables.

The food processing industry is now the largest manufacturing industry in Australia. Technological advances have produced changes in the way food is manufactured. New food manufacturing and packaging systems have been developed, such as continuous computerised processing and modified atmosphere packaging systems. Food manufacturers produce a huge range and variety of food for the Australian consumer.

iStock.com/agrifirits

Growing canola for oil production

Food producers in the dairy, beef, lamb and grain sectors export their products overseas, while imported foods such as cheese, smallgoods such as bacon and salami, and processed fruit and vegetables are often imported. These imported foods often fill seasonal gaps

iStock.com/Orientaly

Wheat is grown and harvested.

Shutterstock.com/Denton Rumsey

Wheat is transported to flour mills.

iStock.com/andjic

Wheat is milled into flour.

iStock.com/Wicki58

Flour is made into bread.

Getty Images/Quinn Rooney

Bread is transported to retail outlets such as supermarkets.

Shutterstock.com/racorn

Bread is purchased at bakeries.

Age Fotostock/FoodCollection

Bread is toasted for breakfast.

Age Fotostock/CSP_meinzahn/Fotosearch LBRF

Toast is eaten.

A food system for wheat

or a lack of local supply in the market. For example, oranges from California and asparagus from Peru are imported as many consumers wish to purchase these products all year round rather than only being able to obtain them when they are in season in Australia.

FOOD DISTRIBUTION

The distribution of food in Australia is very complex and requires efficient logistics systems and record keeping. Computer-based systems have improved the logistics and efficiency of the transport and distribution of food, ensuring it arrives quickly and safely to the consumer. Supermarkets use refrigerated trucks with 16- to 24-pallet capacity to transport food along the supply chain to their supermarkets. They also have a fleet of refrigerated trucks for making deliveries of food that has been ordered online.

Christodoulou

Coles delivery trucks

In Australia, the food retail industry is dominated by Coles and Woolworths, the two major supermarket chains, who hold 80 per cent of the grocery market. Other supermarkets include IGA, FoodWorks and Aldi, as well as a few small independent supermarkets.

Shutterstock.com/Monkey Business Images

Supermarkets have extended shopping hours for consumer convenience.

There is also a range of small specialty stores such as butchers, bakeries, fruit and vegetable stores, fishmongers, specialty delicatessens and Asian grocers.

Food is available in many and varied locations, such as 24-hour convenience stores and supermarkets, as consumers demand more flexible shopping.

FOOD CONSUMPTION

Just as the production of our food has changed over the past century, so too have our eating behaviours. We eat more meals outside the home and the number of casual dining and takeaway food outlets seems to increase daily.

amanaimages/Mark Peterson/Corbis

Casual dining in a fast-food outlet

There is pressure on food manufacturers to offer consumers a greater supply of convenience foods that require less preparation and cooking time. This need has led to a rise in ready-prepared meals, such as heat-and-serve meals from the supermarket fridge and freezer sections. Meal solutions or pre-prepared components of a meal, such as pasta and curry sauces,

Alamy Stock Photo/Christine Whitehead

A bag of salad mix is a convenient option for many consumers.

bags of salad mix and peeled and chopped vegetables are all popular with many consumers. These products come in a range of pack and portion sizes and offer the consumer convenience and versatility. Today, dual-income families have more disposable income to spend on food but less time to prepare it – this has led to a greater demand for quick, easy-to-prepare foods. Consumers, too, have taken a greater interest in healthy eating and this has seen the rise in functional foods; that is, food with added health benefits. Some consumers are now also more interested in purchasing food that has been produced ethically and are concerned about the environmental impact of wasted food.

Households are smaller than in previous decades and the population is ageing as the postwar 'baby boomers' reach retirement age. The 2011 Census reported that one in four people in Australia was born overseas, beginning with the influx of migrants after World War II. Australia is a multicultural nation and this has had a major impact on food choices and the availability of a wide range of new food products.

NAA: A12111, 7529335

Migrants have had a major impact on the types of food available to Australian consumers.

Understanding the text

1 Explain what is meant by a 'paddock to plate' food system.
2 Draw up a flow chart of the 'paddock to plate' system for milk.
3 Outline the three main components of the present-day food system in Australia, giving examples of each.
4 Explain how primary food production in Australia has changed over the past century.
5 Explain how agriculture, cropping and grazing have been made more efficient and profitable.
6 Describe some of the technological developments that have helped the food processing industry to become more efficient and economically viable.
7 Outline the main features of the way food is distributed in Australia.
8 Outline the role that Coles and Woolworths play in the distribution of food.
9 Describe the present trends in eating behaviours in Australia.
10 Explain how food manufacturers have responded to changing trends in eating.

Overconsumption of food

The rate of overweight and **obesity** among the Australian population has increased significantly over the past 20 years. Based on measured height and weight statistics from the 2011–12 Australian Bureau of Statistics Australian Health Survey used to calculate body mass index, almost two in three, or 63 per cent, of Australian adults was shown to be overweight or obese – a 10 per cent increase since 1995. Of these people, one in four, or 25 per cent, was classified as being obese.

A change to our social and physical environment tends to encourage obesity-promoting behaviours, such as the overconsumption of food and lower levels of physical activity. **Physical activity** refers to any structured or incidental body movement that causes the muscles to work and uses more energy than the person would be using if resting and is essential in maintaining a healthy weight.

Urban design and the impact of the 'urban sprawl' have had a big influence on people's ability to maintain an active lifestyle. Physical activity is difficult in many new housing developments on the fringe of cities because there is little access to public transport. It can mean residents often don't live within walking distance of shops and parks and are forced to rely on their car to travel to the shops to purchase food, which discourages physical activity. Many parents are concerned for their children's safety and so, rather than allowing them to walk or ride to school, they drive them to school.

There is also a greater access to unhealthy food, and changes to the food supply have led to the ready availability of cheap, high-kilojoule unhealthy foods that are actively marketed, particularly to children.

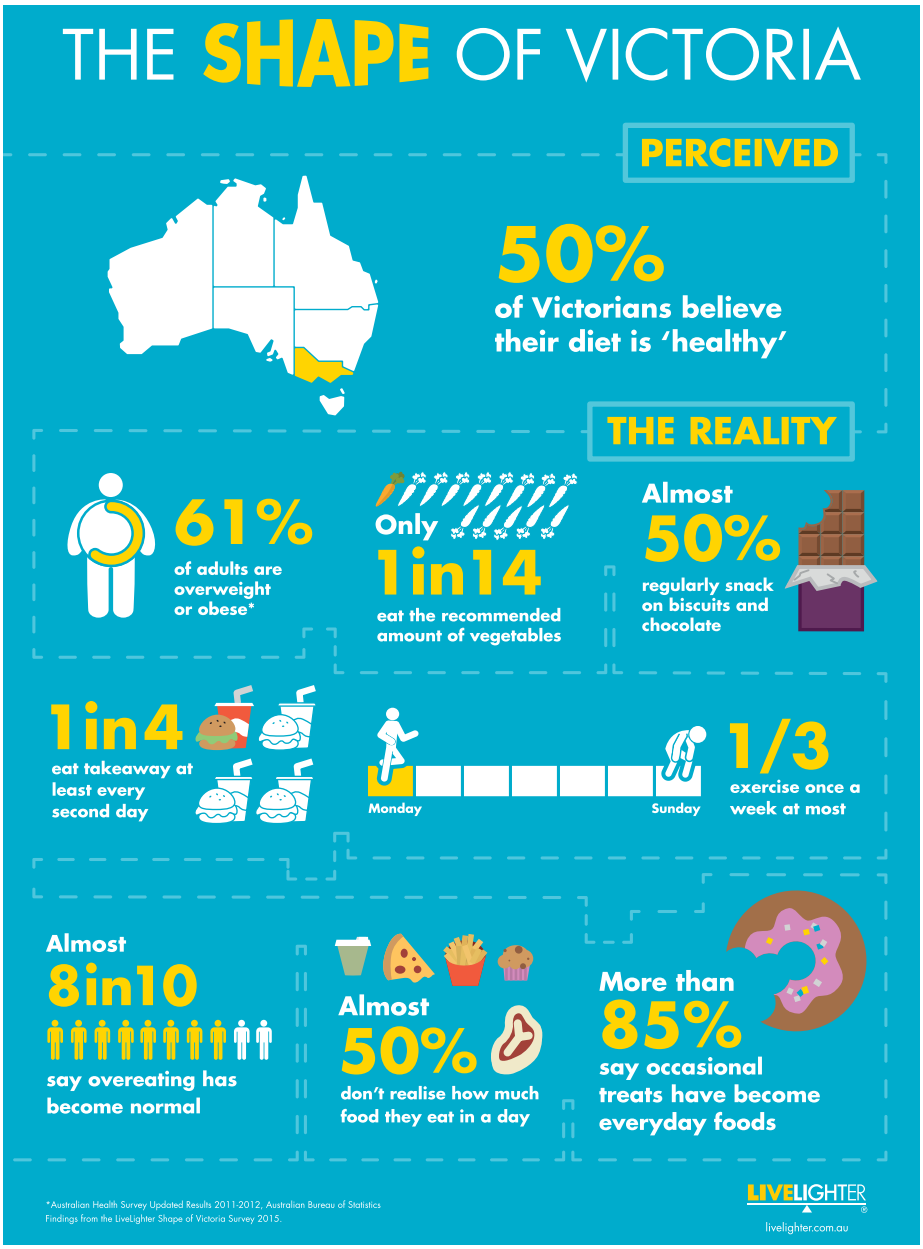
The portion size of snack foods and the consumption of sweetened drinks and takeaway foods have increased as their relative cost has decreased.

The structure of the work environment has also changed and many of the physically active workplaces have been replaced with desk-bound and more sedentary occupations. A plumber, for example, whose work is physically active would have once used a shovel to dig a drain but can now use machinery such as a bobcat.

Furthermore, many people now spend very long hours at work and travelling to work, leaving very little time for preparation of food at home or leisure time for physical activities. It is often easier to purchase takeaway food rather than take the time to shop and cook a healthy meal when it is late and family members are tired. Many of these foods are high in saturated fat and sugar, which can lead to weight gain.

THE DAILY EATING HABITS OF VICTORIANS

The Shape of Victoria Survey conducted by the Cancer Council found that 'overeating, skipping breakfast and occasional treats are now seen as normal'. Follow-up research conducted by LiveLighter in April 2015 surveyed 1000 Victorians aged 25–49 years about



© LiveLighter® 2015, created in Victoria

Results from the Shape of Victoria Survey

their diet and exercise habits. The results showed that many people regularly eat fast food, skip breakfast and do not participate in regular exercise. Of those surveyed, four out of five people expressed the view that overconsumption of food has become normal behaviour. The results also showed that foods such as chips, chocolates, snacks and muesli bars that were once considered occasional or discretionary foods are now becoming a regular part of the daily staple diet for a large proportion of people. This changing trend towards overconsumption of food, particularly discretionary foods such as those that are high in fat, sugar and salt, is directly related to weight gain and obesity.

The Victorian Minister for Health said, 'The Shape of Victoria Survey results reiterate that more needs to be done to encourage Victorians to take greater care of their health and wellbeing'. This view was supported by Diana Heggie, CEO of the Heart Foundation Victoria, who said, 'We are becoming accustomed to overeating and having unhealthy foods readily available. Many people also seem to be falling into the habit of "**mindless eating**" which can add up to a lot of kilojoules, which are difficult to burn off'.

Craig Sinclair, the Cancer Council Victorian Prevention Director, said that 'by choosing to eat healthier meals at home more often, opting for healthier snacks like fruit, nuts and low-fat yoghurt and incorporating more physical activity into our day, we can start to make a healthy difference to our lives and the lives of others'.

Activity 9.1

One-quarter of Australia's teenagers are overweight or obese, new health survey reveals'

Read the article that follows, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. What percentage of Australia's adolescents is overweight or obese?
3. Explain reasons offered by the Cancer Council and the National Heart Foundation for these figures.
4. What is the recommended amount of physical activity for adolescents per day?
5. Describe how being overweight or obese in adolescence can present health risks in later life.
6. Suggest some strategies schools and local councils could adopt to encourage greater physical activity in adolescence.

ONE-QUARTER OF AUSTRALIA'S TEENAGERS ARE OVERWEIGHT OR OBESE, NEW HEALTH SURVEY REVEALS

Health experts have called on schools and parents to take a more proactive role in the long-term health of Australia's teenagers after a new survey found a quarter of the country's adolescents were overweight or obese.

A report by the Cancer Council and National Heart Foundation revealed teens were spending too much time in front of the television, with 58 per cent of students having at least three televisions in their home and 40 per cent with video games in their bedrooms.

In addition, more than three-quarters of teenagers were spending more than two hours in front of computers, laptops, tablets, video games and televisions every school day.

Chair of the Cancer Council's Public Health Committee Craig Sinclair said there was a marginal improvement in their physical activity levels, but any modest benefits were undone by the increased screen time.

'That's increased from 71 per cent in 2010 to 77 per cent in 2013,' Mr Sinclair said.

'The vast majority of adolescents, you know, 82 per cent, are not engaging in more than 60 minutes of physical activity per day as is recommended. 'As a parent myself I know the challenges of managing electronic devices in the home and it's not easy.'

Sinclair said schools needed to encourage physical activity while local and state governments needed to ensure adequate recreational facilities for teenagers such as cycle tracks or skate parks.

'Already, a quarter of male secondary students are overweight or obese; for female students, a fifth fall into this group,' he said.

'And as they carry this extra weight into adult life, their risk of chronic diseases and cancer increases.

'We certainly have very strong evidence of a direct link between obesity and a range of cancers, particularly breast cancer in post-menopausal women, bowel cancer and kidney cancer.

'So it is critically important that we minimise the risk of future adult Australians from getting to the point where they are managing excessive weight.'

However, finding a way to get teenagers to look 30 years into the future and consider a health condition they might develop is not an easy task, Mr Sinclair said.

'What we can do and what the evidence is clearly showing is that if we create environments where it's easy for teenagers to be active then they are very likely to be engaged in that activity and we've certainly seen that in other health areas.

Jo Salmon from Deakin University's Centre for Physical Activity and Nutrition Research said Australia needed a physical activity strategy.

'They could be walking and cycling to school more, we could have much more activity at the school, on weekends and even standing strategies in classrooms to get adolescents to stand up and engage in a more active curriculum throughout the day. It helps them not only to increase their energy expenditure but also to focus and pay attention in class.'

There is a suggestion urban planning could also play a huge role.

'Parents are concerned about safety and traffic safety so we need to build streets that support adolescents cycling safely to school,' she said.

One quarter of Australia's teenagers are overweight or obese, new health survey reveals, by Rachael Brown, © ABC, http://www.abc.net.au 19 Feb 2015.

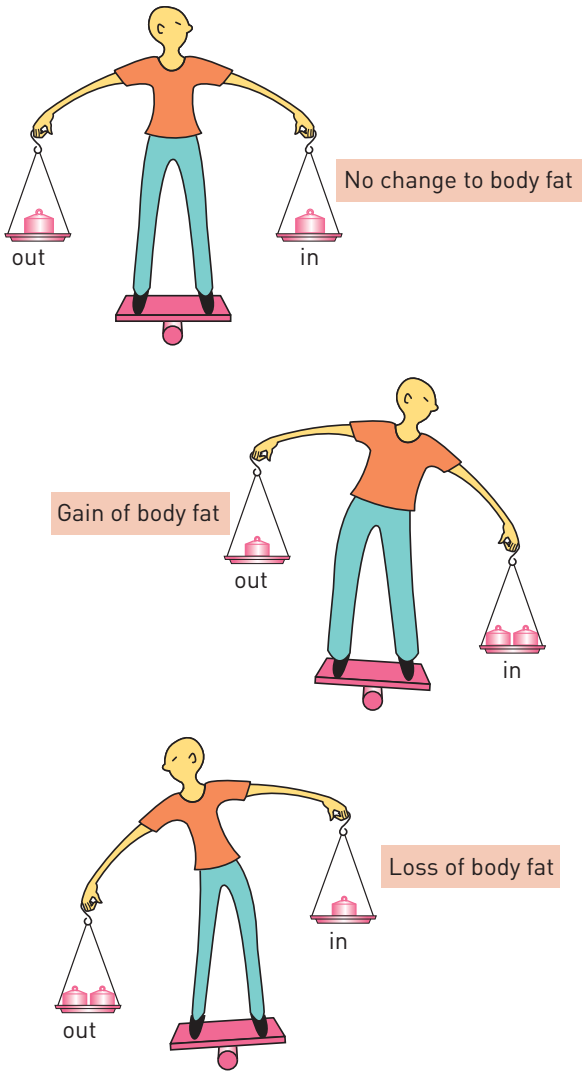
CAUSES OF OVERWEIGHT AND OBESITY

The causes of overweight and obesity are complex and may differ from person to person. Maintaining a healthy weight means ensuring you achieve an energy balance by accessing a fresh, healthy food supply and avoiding mindless eating.

Energy balance

Under normal circumstances, it is important to achieve an energy balance so that the energy you expend is equal to the energy you take in, in the form of food. However, sometimes your body requires energy in addition to that supplied by the food you have just eaten. In these circumstances, your body needs to call on its reserves, stored in the fat tissue. If more energy is expended than is taken in, even over a fairly short period, this may lead to weight loss. Alternatively, if you consume more food than your body is able to use in the form of energy, excess energy will be stored as fat tissue, leading to weight gain.

Overweight and obesity are conditions that arise from carrying excess body weight in the form of fat. For adults, obesity is defined as having a body mass index (BMI) of over 30 or a waist measurement of more than 89 centimetres for women or more than 102 centimetres for men.



Energy balance

Balancing the energy going into the body and the energy being used for body functions, growth and repair and physical activity will maintain weight. If there is excess energy intake through overeating, a weight gain will occur.

Availability of food

In Australia, there is a wide variety of tasty, convenient and safe food that is relatively cheap and easily obtained. Access to food has increased dramatically over the last few decades and a huge range of ready-to-eat foods is available in most locations. Many of these foods are highly processed and high in kilojoules. Ready-to-eat food is now available anywhere, at any time, in places such as 24-hour petrol stations, at work, from food trucks at sporting or community events,

coffee carts and vending machines and fast-food outlets in hospitals. Takeaway food can be delivered to the home, pre-prepared meals can be delivered for the week, or lunch is delivered to the office.

We usually give a lot of thought to what we select to eat but often not to how much we eat. Many consumers believe that the size of the packet or the portion served represents what is a normal amount to eat. Someone purchasing a large quantity of food tends to eat more than if they buy smaller quantities. All-you-can-eat buffets are an example of people heaping their plates with food because 'they have paid for it'. You should leave a restaurant feeling satisfied, not full.

Mindless eating

We do not always eat because we are hungry. Sometimes we overeat because of our state of mind and our emotions – whether we feel happy, sad, bored, stressed or anxious. These feelings can draw us into eating without thinking about it. This condition is often described as **mindless eating** – eating food without paying adequate attention to what and how much is being eaten. Mindless eating occurs because the desire for food and eating is influenced, not by conscious thoughts, but by the subconscious. The amount of food that is being consumed or the reason why it is being consumed isn't necessarily known or recognised by us or may be forgotten. It is often said that we 'eat to finish, rather than eat to full'. As children, many of us were encouraged to eat all the food on our plate. We often find ourselves 'cleaning up' the plate of food because it is served up to us, even though we are no longer hungry and feel 'full', or because we are unable to resist eating food that is put in front of us.

Programs such as Food Addicts Anonymous and Overeaters Anonymous are groups that have been established to assist people who have food addictions that, in turn, lead to overeating. Many people who have a food addiction have cravings for food and a 'loss of control' that leads to overeating and eating even when they are not hungry. They often feel powerless over food and may have tried a number of diets with little success. These support programs do not rely on following a diet or being weighed regularly, but on a 12-step recovery process that involves phone coaching and support. People who attend these groups are taught to 'ride out' their emotions and to understand their hunger signals in order to develop mindful eating techniques. Overeating is most often driven by emotions, and many believe the best way to help people with this condition is not through dieting and restricting food, but by helping sufferers handle stressful situations.

IMPACT OF THE ENVIRONMENT ON OVERCONSUMPTION OF FOOD

Eating is not always about hunger or mindless eating; it is also influenced by our environment, the size of the plate that food is served on, or the size of the biscuit or muffin. Visual cues also influence the amount of food we eat.

Reading, watching television or working on the computer can be a distraction while eating and can cause people to eat more than they need or would ordinarily eat. It is far better to stop and take time for a snack and eat it without distractions.

When we see food we enjoy, we are tempted to eat it. When a box of chocolates is placed on the office desk or on the kitchen bench it becomes a visual trigger, encouraging a person to overeat. If the chocolates are out of sight and placed in the pantry or desk drawer, they will not be so tempting. It is a good idea to keep energy-dense snacks that are high in kilojoules, such as chocolate, biscuits and potato crisps, out of sight and place healthy snacks, such as fruit and vegetables, in view and readily available. The kitchen bench should be free from food except for a bowl of fruit. Another strategy to use is to keep pre-cut fruits on the middle shelf of the refrigerator, ready for snacks. It is also important to restrict soft drinks to special occasions and keep water chilled in the refrigerator in summer. These strategies or changes to the food environment will 'trick' people into making healthier food choices.

Portion sizes

Food portions have dramatically increased over the past few decades and, as the amount of food we eat has risen, so too has the amount of kilojoules we consume. In the 1980s, individual serves of soft drink were sold in 237-millilitre containers, whereas today, their usual size is between 500 and 600 millilitres. Equally, cupcakes and scones have doubled in average size over the same period from 40 grams to 80 grams. King-sized or 'Texas' muffins have become the norm. Cakes, slices and biscuits sold in bakeries and cafés are now so big that they are in fact large enough for two or three people to share. Similarly, a giant serve of popcorn at the movies is enough for the whole family. Many other treats such as chocolate bars are now served in king-size packets or twin packs. 'Super-sized' meals and 'meal deals' available in fast-food

Three sizes of potato crisps packets, all possible to be eaten as a serve

outlets also provide far more food (and therefore kilojoules) than we really need. The problem for consumers is that they are not increasing their activity levels to match this food trend of super-sizing.

How has this happened?

The food industry has been eager to increase serving sizes, which they call 'upsizing' or 'portion creep'. Food manufacturers know that customers like to feel that they are getting value for money and so will be happier to pay a little more for a larger serve than pay what seems to be an expensive price for a smaller portion. Another trick manufacturers use is to bundle together food items to make a 'combo pack' or 'meal deal'. In such cases, the manufacturer wins, because the profit margin they make from the additional items, such as drinks or fries, is usually high, so the actual cost to them is almost negligible.

Another problem is that in Australia serving sizes listed on packages of food are often inconsistent, and the serving size is determined by the food manufacturer rather than by regulation.

Evidence clearly suggests that making even a small reduction in the amount of food you eat can make a big difference in managing your weight. So one of the best strategies is to resist king-size treats and meal deals and to only order small portions when eating out. Alternatively, share a sweet treat such as a muffin or cake with a friend. Eating more slowly will also enable your brain to register when you have had enough. Finally, only eat enough to satisfy your hunger – you can always leave some food on your plate!

Comparing different serving sizes

When going the movies we are often temped to upgrade the popcorn from a small to a medium size. The upgrade will cost about a dollar more, but it will contain approximately 185 kilojoules extra.

SERVING SIZES OF POPCORN	KILOJOULES PER SERVE	COST
Large – 13 cups	2260	$9.50
Medium – 5 cups	885	$8.50
Small – 4 cups	705	$7.50

Alamy Stock Photo/Stian Olsen

Small, medium, large and giant serves of popcorn

One of the major concerns with serving size is that it is the food industry itself that determines what constitutes a serve. This makes life difficult for consumers if they are trying to compare similar products. This problem was highlighted in an article by *Choice* magazine in July 2014, entitled 'Are you being fooled by portion creep?' In its study, *Choice* compared the serving sizes on the labels of two similar products including two different brands of oats, and two chicken dinners produced by McCain.

Woolworths Home Brand Quick Oats (30 grams) and a serving of Freedom Foods Quick Oats (60 grams)

A serving of McCain Healthy Choice Chinese Chicken and Cashews (280 grams) and a serving of McCain Healthy Choice Plus Honey Stirfry Chicken (420 grams)

Packaging and plate size

The food industry encourages overeating by packaging food in large-sized containers, serving large-sized portions in restaurants and using large-sized dinnerware. The suggestion is that this is a typical, normal and reasonable way to serve, present and eat food.

Food packaging sizes have a major impact on overconsumption of food. Food producers have increased the packaging sizes of many of the food items available in supermarkets and food stores, and the bigger the package, the more generous the serve. Sometimes foods are packaged so that there are multiple servings available in the one packet, which makes it difficult for consumers to know how much food they should eat. Often manufacturers add extra food in a package for the same price, using this as a promotional strategy to encourage the consumer to purchase the product. The unfortunate outcome of an increase in packaging size is that, as the packaging size increases and becomes the norm, the amount of food many people eat increases, and consequently their kilojoule intake increases as well.

Another factor that has led to overconsumption of food is the increase in the size of what is considered a normal plate. The size of the dinner plate in the 1950s was 25 centimetres in diameter; today, it has grown to between 30 and 40 centimetres. Research by the University of Cambridge in the UK found that people eat and drink more when large tableware is used. The research suggested that if portion sizes were reduced, energy consumption could be lowered by 16 per cent.

In the past, it has been suggested that overeating and being overweight was the result of personal behaviour such as a lack of self-control. It is now recognised that the environmental influences on food consumption such as serving plate size, have a major impact on overeating. Shops and restaurants can assist consumers by providing more realistic serving sizes of the meals and foods they provide. Smaller plates encourage consumers to eat smaller portions of food.

Shutterstock.com/DSBfoto

Larger plate sizes encourage overconsumption of food.

Positioning of food in supermarkets

When the consumer looks at food items on supermarket shelves they are looking at a 'planogram' or a diagram or model that indicates the placement of foods in order to maximise sales. Within this plan, the key position for products is the 'eye and buy level'. Often products that sit at eye level or just below are the most expensive and the store's private labels are above and below the eye-level products. The number of 'facings' is how many food products the consumer can see and the more visible the products, the better sales are likely to be. Many products placed at the beginning of an aisle do not sell as well as those at the end because it is believed a customer needs time to adjust to being in the aisle and takes a little time to decide what to buy. Sometimes supermarkets place products together that are not in the same category, such as soft drinks and nuts and potato crisps. The rationale behind this strategy is that if you are buying drinks, it is likely that you will also need some snacks!

Activity 9.2

Australian obesity rates climbing faster than anywhere else in the world

Read the article below, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. What percentage of adults and children are considered to be overweight?
3. Describe the recommendations made by spokesperson Jane Martin to tackle the problem of growing obesity.
4. Why is overweight and obesity a public health concern for the Australian community?
5. Identify the health issues that are likely to arise for a person who is overweight.
6. Explain the factors that Professor Moody says are linked to the issue of overweight and obesity.
7. What recommendations does Professor Moody make to address this issue?
8. Suggest an anti-obesity strategy that the government could implement to combat the rising overconsumption of food and consequent health issues of being overweight or obese.

AUSTRALIAN OBESITY RATES CLIMBING FASTER THAN ANYWHERE ELSE IN THE WORLD, STUDY SHOWS

The results of the global study into obesity rates, published in the medical journal *The Lancet*, show almost a quarter of the country's children and 63 per cent of the adult population is overweight.

Australia's obesity levels are now on par with the United States, but slightly less than New Zealand.

The study has prompted health experts to call on the federal government to commit to a national anti-obesity strategy.

Obesity Policy Coalition spokeswoman Jane Martin says obesity is an issue that governments can tackle in a number of ways.

'It's around looking at policies around food that are supplied by institutions that are funded by governments,' she said.

'[It's about] looking at encouraging smaller serving sizes, having social marketing campaigns that give education to people and help put it on the individual's agenda, and in an environment where it pushes people to make healthier choices and be more active.'

Professor Alan Lopez, who was among the international researchers working on the study, says the numbers should be of concern.

'We are at the levels of overweight and obesity as the US is, three decades ago obesity levels in Australia were a half to a third of what they are now,' he said.

'We need to understand that overweight and obesity is not just something at an individual aesthetic level, it has serious health consequences.

'It ought to be taken much more seriously by the public health community in Australia.'

Professor Rob Moodie, former chair of the National Preventative Health Taskforce, says as other areas of Australian health improve, obesity rates are getting dramatically worse.

'Put New Zealand and Australia together, we really have major levels amongst our kids, let alone amongst our adults – 75 to 80 per cent of middle-aged men are overweight in Australia,' he said.

'Unfortunately our diet has changed pretty dramatically over 30 years.

'The composition [of] what we're eating has changed, the really high levels of sugar and fat in our food.'

Professor Moodie says the government needs to regulate the fast-food industry, and stop advertising unhealthy food to children.

Australian obesity rates climbing faster than anywhere else in the world, study shows, © ABC, http://www.abc.net.au 29 May 2014.

Understanding the text

11. Create a diagram to demonstrate the way changes in the social and physical environment have influenced eating behaviour.
12. Outline the main findings of the research conducted by LiveLighter.
13. Define the term 'obesity'.
14. Explain what is meant by the term 'energy balance'.
15. How has the availability of food changed in recent years?
16. Define the term 'mindless eating'.
17. Explain how portion size is a risk for overconsumption of food.
18. Outline two strategies food manufacturers use to increase the serving size of food.
19. How has the size of serving plates changed over the years and what implications does this have for health?
20. Explain how the product positioning of the 'eye and buy' level influences the shopper.

Sedentary behaviour

Sedentary behaviour refers to sitting or lying down (though not sleeping), and uses little expenditure of energy. This is very different to a person who is physically active. A person can have sedentary aspects to their life but still meet the physical activity guidelines.

Sedentary behaviours are described as:

- sitting down or lying or lounging on the couch while watching television, or playing electronic games, reading emails or using social media such as Facebook
- sitting down while driving a vehicle or while travelling on a train or tram
- sitting down to read or work on the computer.

In 2010–12, the Bureau of Statistics undertook a health survey to examine the physical and sedentary behaviour of the Australian population. The results showed that only one-third of children aged 5–17 years met the recommended 60 minutes of physical activity each day. They also found that 60 per cent of Australian adults did less than 30 minutes of moderate intensity physical activity each day.

In terms of sedentary behaviour, the results showed that fewer than one in three children aged 5–17 years did not exceed the recommended maximum two hours of screen-based entertainment each day. The picture for adults is equally grim, with 70 per cent of Australian adults – or approximately 12 million people – displaying either sedentary behaviour or low levels of physical activity.

HEALTH IMPLICATIONS OF SEDENTARY BEHAVIOUR

Sedentary behaviour is characterised by low energy use. Undertaking moderate intensity physical activity and limiting sedentary activities, combined with a nutritious and balanced diet, will balance energy needs and control weight. As physical activity increases, so does energy usage. However, when more energy is taken into the body in the form of food than is needed to maintain current body size and levels of physical activity consistent with good health, weight is likely to be gained.

Sedentary behaviour can have serious effects on a person's health and can be associated with the development of overweight or obesity that can lead to type 2 diabetes, stroke or heart disease.

Screen-based entertainment, such as watching television or DVDs, or playing electronic games, has had a major impact on physical activity levels of children and young people over the last decade. Although toddlers and preschool children spent around six hours a day in physical activities, they still spent at least an hour and a half in sedentary activities, mainly screen-based activities. As children grew older (5–17 years), their screen-based activities increased to more than two hours a day and their physical activities decreased. Three-quarters of children in the 15–17 years age group had some kind of screen-based medium in their bedrooms. This situation meant that these children spent an extra two hours on these sedentary activities than those without these resources in their bedrooms.

Australia's Physical Activity and Sedentary Guidelines recommend at least 60 minutes of moderate to vigorous exercise daily for young people aged 5–17 years.

The highest levels of physical activity occurred in the young adult age group – people aged 18–24 years. Levels of activity then began to decline with older age, with people aged 75 years and over recording the lowest level of physical activity.

Dr Paul Jelfs from the Australian Bureau of Statistics, in a media release entitled 'Australians spend one month a year watching television', commented on the high levels of sedentary behaviour across the adult population, noting that Australian adults spent an average of 13 hours a week watching television.

The 2011–12 Health Survey also found that socio-economic disadvantage often led to lower levels of physical activity and those people who believed they were 'healthy' were more likely to have acceptable levels of activity. People in the underweight and normal category were more than twice as likely to have undertaken sufficient physical exercise. The main sedentary activities undertaken by the adult group were sitting at work, especially in occupations such as clerical work. Watching television was a popular sedentary activity as well as computer and Internet activities.

The benefits of moving more		
• reduces your risk of developing cardiovascular disease	• prevents weight gain and assists weight loss	• provides ways to socialise and meet new people
• reduces your risk of type 2 diabetes	• assists in maintaining good mental health	• builds strong muscles and bones
• improves your blood pressure, blood sugar and cholesterol levels	• reduces your risk of developing some cancers	• assists in maintaining overall physical and mental wellbeing

The benefits of moving

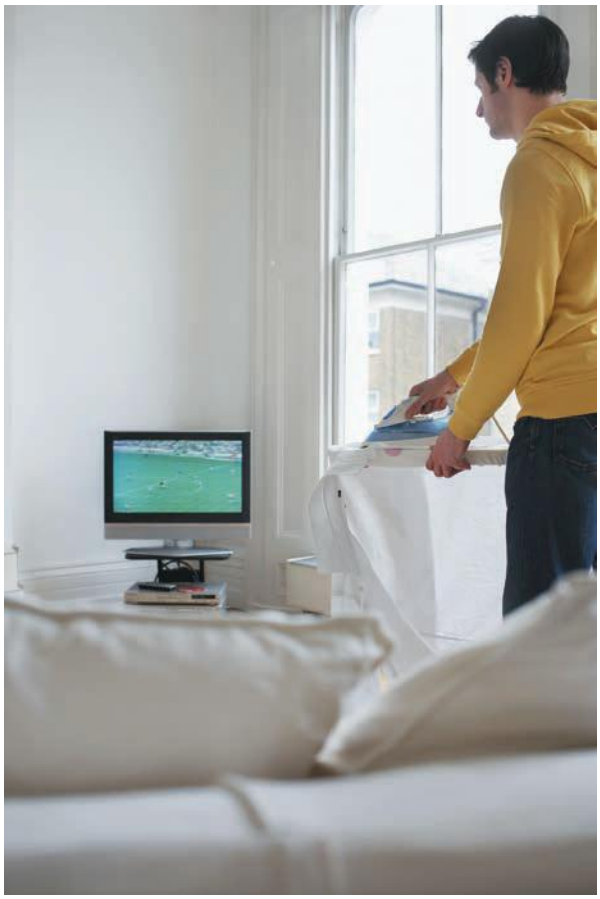
Tips for reducing the time spent sitting down

The Heart Foundation has developed some tips for ways people can spend less time sitting at home, at work and travelling to work.

- **At home** – Adults can reduce the time they spend sitting and watching television by getting up during the advertisements and walking around, perhaps to do the dishes. They also recommend that adults should stand or move around the house when checking emails or using their mobile phone.
- **At work** – The Heart Foundation recommends that adults take a break from the computer every 30 minutes and stand up and walk around, use the stairs where possible and walk to a colleague's desk rather than send an email. Even a simple strategy to increase incidental exercise such as moving the rubbish bin away from the desk so a person has to stand up and walk to put something in it will help reduce the time spent sitting. Eating lunch away from the desk or walking to a nearby park for lunch in good weather are other ways of increasing exercise. Another suggestion is to stand when taking phone calls.

The Heart Foundation has developed 'Workplace Well' and 'Workforce Health Solutions', with a focus on providing visual examples of ways to reduce sitting time. Its 'Sit Less' posters were produced for workplaces and aim to prompt sedentary workers to stand or move more frequently in their work setting.

- **While travelling** – A key recommendation suggested by the Heart Foundation was to leave the car at home and walk to public transport, or ride a bike at least part of the way to work. Offering a seat on the train or tram to someone who needs it and getting off one stop earlier and walking the remaining distance to work also increases exercise. Another suggestion is to plan regular stops on a long car journey, perhaps at wayside parking areas where both driver and passengers can take a short walk.



Shutterstock.com/bikeriderlondon

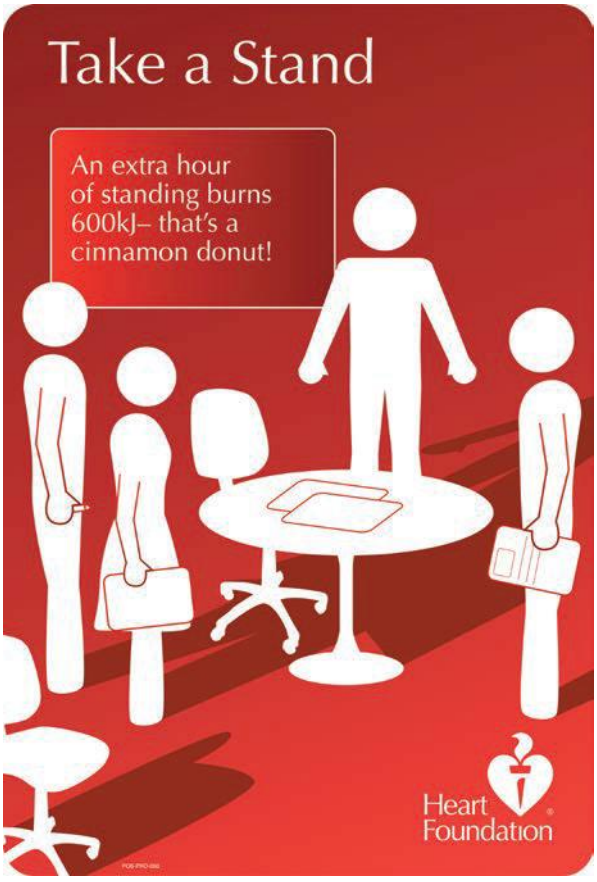
Standing while doing household tasks such as ironing helps minimise sedentary behaviour.

iStock.com/DragonImages

Office workers should take a break from their computer every 30 minutes.

Shutterstock.com/ymgerman

Walking to and from public transport increases exercise.



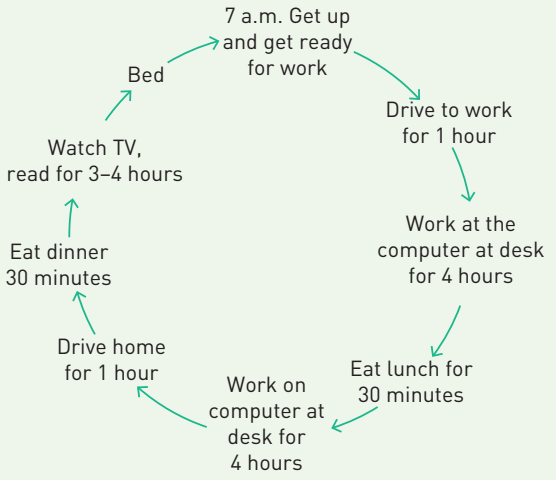
Reproduced with permission from National Heart Foundation of Australia. Take a Stand. Melbourne: NHFA; 2013.

'Take a Stand' poster

Activity 9.3

Reducing sedentary behaviour and increasing physical activity

1 Examine the following diagram outlining the daily activities of an office worker.



2 Suggest ways the person could increase their physical activity during the following activities:

- after they get up and get ready for work
- driving to and from work
- working at the computer desk before and after lunch
- eating lunch
- at home watching TV and reading.

3 Outline the impact your recommendations would have on their weight and health.

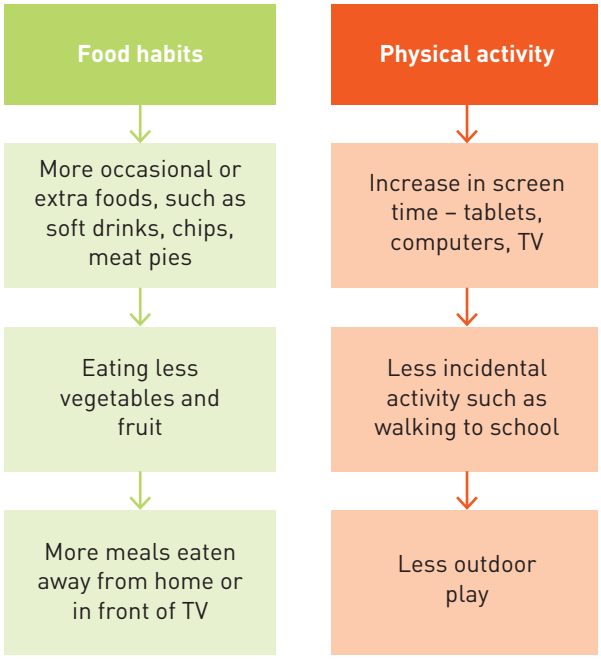
Establishing healthy diets in children

All children need to establish **healthy diets**–that is, diets that reflect the Australian Dietary Guidelines and the Australian Guide to Healthy Eating–and patterns of healthy eating to reach their full potential and to lead a healthy life. There has been an alarming increase in obesity rates in Australian children, with 25 per cent now being classified as overweight or obese.

The reasons for this behaviour relate to changes in children's food habits and physical activities.

Children often eat more discretionary foods such as soft drinks in preference to water and also consume more high-fat, high-sugar and high-salt foods as snacks and more fast-food meals. Results of the 2007 Australian Nutrition and Physical Activity Survey found that these 'extra' foods contributed 35 per cent of the energy intake for children aged 2–16 years. The National Health and Medical Research Survey undertaken in 2011–12 showed that fewer than 30 per cent of children consumed the recommended amount of fruit and vegetables. Potatoes in the form of chips or crisps were often the only vegetables eaten by some children. Busy families, who are tired and short of time after work, often resort to takeaway meals or eating out at a fast-food restaurant.

The screen time children are exposed to has increased with the growing popularity of tablets, computers and computer games, as well as television. Only 32 per cent of children met the national screen-based recommendations on all seven days of the week according to the 2011–12 National Nutrition and Physical Activity Survey. The increase in screen time has meant that children spend less time than in previous generations in active play, such as playing outside or riding their bikes or scooters. The majority of Australian primary-age schoolchildren do not use 'active' transport to school. Many children no longer ride or walk to get to school, but are driven to school because parents are concerned about their safety and security.



Changes in children's food habits and physical activities

MODELLING HEALTHY EATING PATTERNS FOR CHILDREN

Modelling healthy eating patterns means demonstrating healthy ways of eating to someone watching. Children learn by example and watching how other people, such as parents, carers or other children, eat is the best way to influence healthy eating behaviours.

Families are the most important and significant role models of eating behaviours in a child's life. Parents have a critical role in establishing a healthy relationship with food for the family. Healthy eating habits are learned through modelling; that is, through observation and by imitating others. Positive modelling by parents and families will mean a child has an increased interest in food and will be less fussy and more adventurous. Poor role models create negative perceptions around food and mealtimes. If parents exclude certain foods from their diets or make negative comments about the taste or texture of food, the child will be less likely to try the food themselves. If a child sees parents and family members enjoying a food, they are most likely to try it too. It is important to establish good eating behaviours from an early age as these habits become much harder to change as the child grows older. It is important, therefore, for parents to model the type of eating behaviour they want their children to have.

Mealtimes

Regardless of whether it is breakfast, lunch or dinner, mealtime experiences must be positive and enjoyable. It is important for parents to introduce conversations about hunger, helping children recognise when they feel satisfied or full. Before having another portion or piece of food themselves, parents could suggest

that they already feel full so they will wait until later. Parents can make dinner time a family time and try as often as possible to sit at the table at mealtimes to model good habits. The television and electronic devices should be turned off. Food eaten in front of the television or computer only encourages mindless eating, as it is easy to ignore the cues about when you feel full and satisfied if you are distracted. Children are good at recognising their hunger cues and will normally stop eating when they have had enough. Having a variety of healthy snacks on hand for when children are hungry is another good strategy parents could use to ensure that their children don't reach for the biscuit jar!

Making mealtimes a positive experience for children, free from bribes and rewards for 'cleaning up' their plate, which can cause them to miss cues that tell them they are no longer hungry may lead to overeating. When a child is pressured to eat, they lose interest in food, especially if they are encouraged or threatened to eat a certain food.

The importance of breakfast

Ensuring that children have a nutritious breakfast is an important parental role. This may involve getting up a little earlier and sitting down for breakfast together to model this healthy eating behaviour. The Shape of Victoria survey estimated that one-third of children skip breakfast. Research has shown that eating breakfast helps to improve mental and physical performance, while skipping breakfast has a serious impact on a child's ability to learn. Nutritional studies have also shown that eating a healthy, balanced breakfast will help children start the school day in a less stressed way and to concentrate on classroom activities.

iStock.com/_Ella_

A healthy breakfast is a good start to the day.

Talking and learning about food

Parents and carers can also use language as a means of modelling the principles of healthy meal patterns, When parents and carers talk to children about food it is important not to focus on what they shouldn't eat but on what foods are good for them. Parents and carers should avoid using negative language when describing foods, for example words such as 'bad' or 'fattening', and refer to these foods as foods that can only be eaten occasionally. It is also important that the family limits these foods to perhaps once a week and make sure the rest of the family follows this rule too.

Introducing children to the language used in food models is another successful strategy in developing good food habits. Young people can learn about foods that fall into the five food groups and understand what each of these groups of foods does for our bodies. For example, when offering a snack such as a cheese stick, the parent or carer could say to the child 'these cheese sticks are delicious and they contain lots of calcium that will make your bones and teeth healthy and strong'.

Shopping

Parents should try to involve children in the planning of meals and shopping for the ingredients, as this is another means of modelling healthy food choices. Choosing and buying healthy food will be a good foundation that will allow the child to make healthy choices throughout their life. Pushing the trolley through the supermarket is a perfect time to begin the discussions about the purchase of healthy foods and making healthy food choices.

iStock.com/DragonImages

Learning about food while shopping

The discussion can include information about foods that are in season, the quality of foods and how to read a food label. This will encourage children to be more aware of what they eat and to develop greater 'ownership' of their own healthy eating behaviour.

Cooking and preparing family meals

Modelling healthy meal preparation is another way children can establish a healthy diet. As the parent models preparing foods that make up a healthy meal, children develop their understanding of healthy food choices. Children should be encouraged to participate in the preparation of their school lunch, as they are more likely to make healthy choices and eat the lunch if they are involved in the lunch box preparation.

Shutterstock.com/Ivonne Wierink

A healthy lunch box

Even small children can be involved in the preparation of the family dinner. Giving children small jobs and acknowledging their efforts helps them to begin to learn food preparation skills and the cooking of healthy food. This involvement will help children learn what different foods look, feel and taste like, and where foods come from. Even toddlers can be involved in simple tasks such as washing vegetables or tossing a salad.

As children grow, they can take on more complex cooking and preparation tasks such as preparing a stir-fry or chopping the vegetables and preparing a soup. Children who are involved in meal preparation are much more likely to want to try new foods and eat the food prepared together.

It is important to offer water as a drink because it is the best way to quench thirst and, importantly, it does not contain sugar found in fruit juice drinks and soft drinks. Children who regularly consume sugary drinks are more likely to be overweight. Sweetened drinks such as fruit drinks, cordials, soft drinks, and flavoured mineral waters are high in sugars and, consequently, kilojoules. A can of soft drink can contain up to 12 teaspoons of sugar.

iStock.com/SolStock

Involve children in family meal preparation.

Drinking water also prevents tooth decay and fluoridated water supplies assist with the strengthening of teeth. Children should take a water bottle with them wherever they go and in summer, a frozen water bottle can be placed in the lunch box. Parents could place a jug of cold water on the kitchen bench or dining table during meals and keep the sweetened drink supply to a minimum.

EXPOSING CHILDREN TO NEW FOODS AND FLAVOURS

Many children are fussy eaters. They may be reluctant to try new tastes and prefer to simply eat the foods that are familiar to them. However, it is important for children to be exposed to new foods and flavours so that they develop a liking for a broad range of foods. This will give them a greater chance of establishing a healthy diet as they grow.

Children's food preferences and a willingness to try new foods are greatly influenced by those around them, especially their family, friends and teachers. Positive exposure to multiple foods, such as wholegrains and different varieties of fruits and vegetables, will help children develop a taste for more foods and enable them to develop greater dietary variety. They are then more likely to choose these as regular mealtime selections. Sitting with children during mealtimes or snack times and discussing the sensory properties of appearance, aroma, flavour and texture of new foods will encourage children's acceptance of the new foods.

Tips for exposing children to new foods and flavours

- Offer a wide variety of food to increase children's exposure to different foods.
- Include a range of colours, textures and flavours in the child's lunch or on their dinner plate to increase their exposure to a range of foods.
- Serve a small amount of vegetables and encourage children to take at least one small bite.
- Encourage children to look, smell, touch and taste the new food.
- Encourage rather than demand a child to eat a new food.

Meals in childcare and early learning centres

Carers and staff in childcare and early learning centres have a very important role in fostering and modelling early healthy eating behaviours in children. They have the opportunity to expose children to a variety of foods in a social setting. Many childcare centres use family-style dining where students and staff sit down together to eat the same food. Children continue to learn new ideas about food when eating outside the home. They can also help the carers making and assembling the healthy lunches and planning for healthy snack ideas such as fruit platters.

iStock.com/MachineHeadz

Sharing food in a childcare centre

Meals at school

When children start school, they are exposed to the foods that their classmates bring in their lunch box and this may give them greater courage to try new tastes. School kitchen garden programs also encourage children to try foods, particularly vegetables, that they may have never tasted before, especially if they have helped to grow it. This exposure may also encourage them to ask their parents to cook these foods for their family at home.

THE IMPORTANCE OF REPETITION IN DEVELOPING HEALTHY FOOD HABITS IN CHILDREN

Most toddlers and young children under the age of three refuse to eat some foods at various stages of their development. Food refusal is a demonstration of the child's fear of trying new or unfamiliar foods and is a normal developmental phase called 'neophobia'. According to a 1999 study produced by Dr Leann Birch of Penn State University, it is a normal protective behaviour of children to refuse new foods that are offered to them because it prevents humans from consuming substances that may be harmful. However, the problem for children who demonstrate neophobia or food refusal is that they consume fewer fruits, vegetables and protein foods, which can have an impact on their growth and development.

Repetition is important in encouraging a child to try a new food. Research has shown that it may take up to 15 exposures to a new food before a child is willing to try and then accept the new food. In practice, this means that it is necessary to offer a child the same food many times over several weeks before they will try it.

Being persistent and providing repeated exposure to new foods is essential because it provides children with the opportunity to learn about and become familiar with new foods. While this is a slow process, this strategy will eventually pay off and the repetition will increase the likelihood of acceptance of the new food. The more opportunities children have to try a new food, the more likely they are to accept it and to eventually enjoy the new flavours and textures. It is equally important for parents to be patient and relaxed with children at mealtimes and to continue to offer them new foods without pressuring them to eat. It is important for parents not to give up or say 'they just don't like it' after only a few tries.

Parents could try varying the way new foods are prepared because some children prefer cold, crunchy vegetables, while others enjoy their vegetables cooked. Introducing new foods into the diet should be a fun experience so, for example, parents could cut vegetables into different shapes such as making little celery fans or using a spiral grater to slice carrots or cucumbers. Serving tiny carrot or capsicum sticks with a vegetable or cream cheese dip can also tempt the child to try some new vegetables along with some they are already familiar with. Threading

a variety of vegetables such as cherry tomatoes, capsicum and carrot into mini raw vegetable kebab sticks may also present a colourful and fun way to repeat an offering of a vegetable that has previously been refused. Another strategy parents could try is grating vegetables such as zucchini and adding it to a spaghetti sauce, mini hamburgers or a soup.

Activity 9.4

Children's fruit drinks deliver more sugar than soft drink

Read the article opposite, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. Explain the evidence about children's fruit drinks that the Obesity Policy Coalition is most concerned about.
3. What is your opinion about the statement advertising Golden Circle Sunshine Punch 'a perfect fit for the school lunch box'?
4. Discuss the long-term health implications of including fruit juice drinks such as Sunshine Punch a child's lunch box every day.
5. Explain the Australian Dietary Guidelines recommendations for children's fruit intake.
6. List healthier choices for a beverage and fruit in a lunch box and justify your choice.

Sunshine Punch fruit juice drink

CHILDREN'S FRUIT DRINKS DELIVER MORE SUGAR THAN SOFT DRINK, OBESITY POLICY COALITION SAYS

The Obesity Policy Coalition has delivered shocking evidence to all parents, highlighting the added sugar content of some of the most popular children's fruit drinks.

The Coalition has found some fruit drinks marketed specifically for children's lunch boxes contain more added sugar than Coca-Cola.

'I was pretty shocked when we did this analysis,' the Coalition's executive director Jane Martin told Robbie Buck on 702 ABC Sydney.

'Some of these fruit drinks have almost eight teaspoons of sugar in one serve,' Ms Martin said.

Golden Circle Sunshine Punch is advertised as 'perfect to fit in a school lunch box' yet contains 30.6 grams of sugar in a 250 mL package compared to Coca-Cola's 26.5 grams of added sugar per 250 mL.

'These drinks are not 100 per cent fruit juice; they are high in added sugar, and they are not recommended for children,' Ms Martin warned.

The drinks are marketed with labels including 'no artificial flavours or colouring' and have pictures of fruit on the packaging while not making it clear that the products are high in added sugar.

'People think they are doing something healthy for their kids, but I think parents would be pretty shocked to realise that there is a lot of added sugar in them.'

Ms Martin said the Australian Dietary Guidelines recommended children should eat whole fruit, and when that was not available then half a cup of 100 per cent fruit juice each day was next best.

'It is absolutely against the dietary guidelines to be giving children drinks that have added sugar,' Ms Martin said.

Pop Tops 250 mL Orange Fruit Drink contains 27.5 grams of added sugar, Coles 250 mL Orange Fruit Drink contains 27.3 grams of added sugar, and Pop Tops 250 mL Apple Fruit Drink contains 26.8 grams of added sugar.

'Apples and oranges are ready to go, and that's the best thing for kids; that's the healthiest option,' Ms Martin said.

While most parents would not put a carbonated soft drink in a child's lunch box, these drinks are just as bad.

'People would be surprised that these popper drinks and box drinks are so high in added sugar and we need to be looking at what we can do to raise healthy kids.'

The Obesity Policy Coalition was formed by the Cancer Council Victoria, Diabetes Australia, and VicHealth to identify, analyse and advocate for evidence-based policy and regulatory initiatives to reduce overweight and obesity, particularly in children.

Children's fruit drinks deliver more sugar than soft drink, Obesity Policy Coalition says, by John Donegan, © ABC, http://www.abc.net.au 13 April 2015

Understanding the text

21 Define the term 'sedentary behaviour'. Give two examples of sedentary behaviour.

22 Explain how screen-based entertainment has impacted on the physical activity of children and teenagers.

23 Outline three strategies an office worker could use to increase their physical activity while at work.

24 Outline two reasons that can contribute to some children becoming obese.

25 Why is breakfast considered to be an important meal for children?

26 Write a short article to include on a blog for parents of young children to explain how they can model sound eating behaviours to their children by talking about food or when shopping for food or preparing food.

27 Provide three examples of how young children can be involved in the preparation of family meals.

28 Suggest some ways parents can expose children to new foods and tastes.

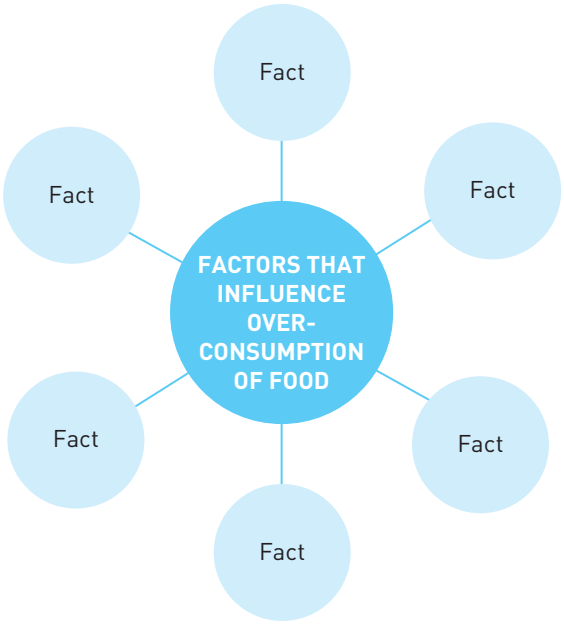
29 Why is it important that childcare centres and early learning centres expose children to new food tastes and model sound eating habits?

30 Explain why repetition is an important principle in establishing healthy diets in children.

PREPARING FOR EXAMS

Applying knowledge

Draw a diagram to identify the factors that influence the overconsumption of food.



Analysing information

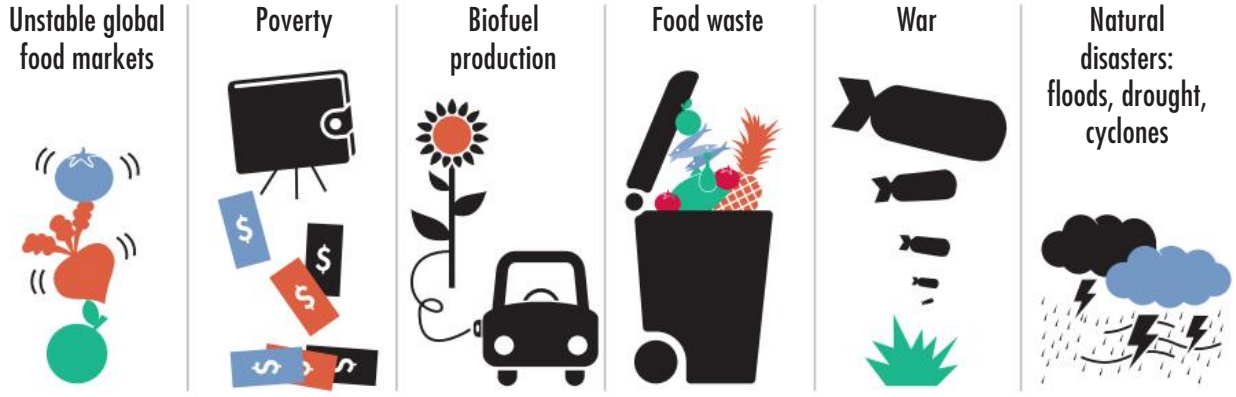
Discuss how mindless eating of foods high in fat, salt and sugar has a direct impact on the health of consumers.

Evaluating concepts

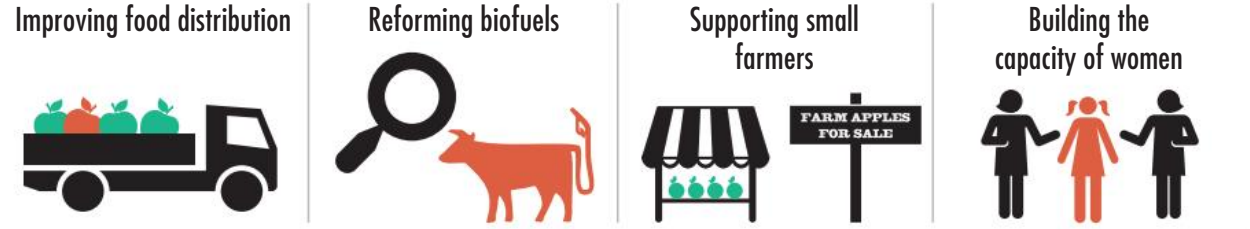
Compare and contrast the role of exposure and modelling as key practices in developing healthy diets for children.

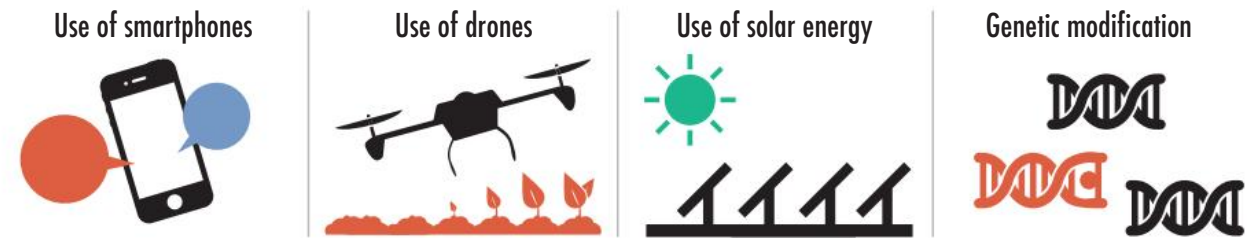
FEEDING THE WORLD – GLOBAL FOOD SECURITY

CHALLENGES TO GLOBAL FOOD SECURITY



SOLUTIONS TO GLOBAL FOOD INSECURITY





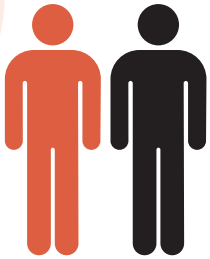
10

GLOBAL FOOD SECURITY

843 MILLION HAVE INSUFFICIENT FOOD

14% OF POPULATION IN UNDERDEVELOPED COUNTRIES IS MALNOURISHED

2.1 BILLION POPULATION GROWTH IN ASIA AND AFRICA



KEY TERMS

Biodiesel is a clear-burning liquid fuel produced from animal fats that are combined with an alcohol.

Biofuels are an energy source, for example ethanol and biodiesel, produced from organic or living material.

Ethanol is produced from feedstock crops that produce large amounts of sugar and can be added to petrol for fuelling cars.

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Food insecurity exists when people do not have adequate physical, social or economic access to food.

Feeding an increasing world population

The continuing growth of the world's population places enormous demands on global food supplies. In 2014, the United Nations Department of Economic and Social Affairs reported that there were more than 7.2 billion people on the planet. They project that this figure will increase to approximately 9.3 billion by 2050. Most of this future 2.1 billion population growth will occur in the less developed regions of the world, particularly in Africa and Asia.

One of the key challenges facing the world is how to ensure that everyone has access to sufficient safe and nutritious food to lead a healthy life. While the number of people who face the daily prospect of not having a secure food supply has decreased since the 1990s, there are still some 843 million people across the globe who do not have sufficient food to eat.

What is food security?

The World Food Program 2015 defines **food security** as existing 'when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'. This means that people who have food security can live each day without the fear of being hungry or starving.

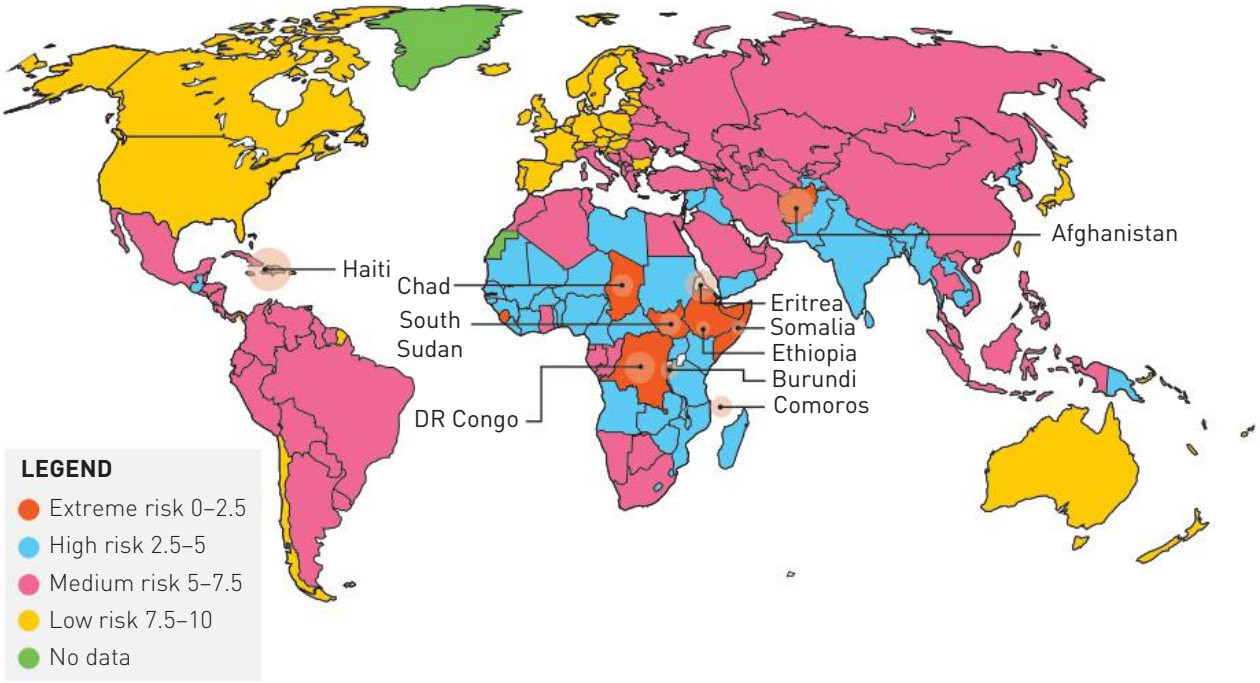
Activity 10.1

Twelve billion people – how will we feed them?

Read the article on the opposite page, then answer these questions:

1. Evaluate the validity of the news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. What differences are there in Professor Raftery's projections for population growth and those adopted by the United Nations?
3. What challenges does Professor Raftery argue are likely to face the world as the population increases?
4. Outline the concerns of Professor Sharma of an increasing population on food security.
5. Explain how the increased food production required to feed a far greater world population could have a negative impact on the environment.
6. Outline some of the solutions put forward by Professor Sharma for feeding an increasing world population.

However, despite our best intentions, there are millions of people who live each day undernourished and not knowing how they can feed themselves and



Source: Maplecroft.org, 2014

Food security risk index

WORLD POPULATION COULD HIT 12 BILLION, BUT HOW WILL WE FEED THEM?

Estimates of the global population in 2050 have been questioned, following new research suggesting the challenges of producing enough food is even more serious than first thought.

An international research team believes the world's population could increase by up to 3 billion more people by the end of this century than has been predicted.

For 20 years, global scientific consensus has been that the world's population will peak at around 9 billion people by 2050.

That assumption has been adopted by the United Nations and has been used by groups like the Intergovernmental Panel on Climate Change.

Professor Adrian Raftery, from the University of Washington, led an international research team that has drawn different conclusions.

'Our results suggest it will keep growing for the rest of the century probably, and reach somewhere between 9.5 and 12 billion by the end of the century,' he said.

Professor Raftery says an increasing population is going to have severe consequences.

'It could exacerbate various challenges that are likely to arise in any event. Environmental challenges such as pollution, potentially, and climate change, health challenges such as infectious disease, also social challenges to do with poverty.'

And if his predictions are correct, how will the world be able to feed up to 12 billion people?

Professor Shashi Sharma, from Murdoch University, is an expert in food security. He says feeding that amount of people will be very difficult.

'Currently we have 7 billion people and we are able to feed about 5 billion. Two billion people are suffering from hunger or under-nutrition,' he said.

Professor Sharma says the global population has doubled since the 1950s, but advances in technology have dramatically increased food production to match.

But he says any further advances in food production have to take long-term impacts into account.

'We must not forget the way we increased our food production during the 20th century had very significant impact on the environment.'

'So if we now have to produce food for about 4 billion more people in the next hundred years, or less than a hundred years, we need really environmentally wise agriculture, so we have to really plan it very well.'

He gives India as an example of a country that has increased its food production exponentially through irrigation and the use of fertilisers, herbicides and pesticides.

'But at the same time, if you have a hundred years' perspective or maybe two hundred years' perspective, then many of those areas start showing some impact in terms of degradation, in terms of the appearance of some facts that are not very conducive for ongoing crop production.'

Professor Sharma says policy planners need to protect the environment from agricultural advances that have the potential to degrade it.

'If we don't do that, what would happen is we might be able to produce food for our generation, but at the same time we do it at the cost of our future generations. That's not acceptable, so we need to look at agriculture and the first and foremost need would be environmentally wise agriculture.'

And if the global population hits 12 billion, we're going to have to be much more efficient with food, Professor Sharma says.

'There are reports that a third of food that we produce is lost or wasted. So are we producing food for the landfills, or are we really producing food that we need to feed our population?

'So I think there's a much broader question than only producing more food.'

He says we also need to broaden what we grow and match crops to unique environmental conditions.

'Are there other sources of carbohydrate, are there other sources of protein? We should put that also in our mix of our thinking, of our planning, and should not be just in a compartment where we are looking at how to increase wheat, how to increase our sorghum yields.

'So I'm talking about a much broader approach of looking at food production for a larger population base than 7 billion.'

World population could hit 12 billion, but how will we feed them?, by Steven Schubert, © ABC, http://www.abc.net.au 21 October 2014.

their children. The vast majority of the people facing food insecurity live in developing countries, where approximately 14 per cent of the population is undernourished. According to the United Nations Food and Agriculture Organization (FAO), these people are facing **food insecurity**, a state that 'exists when people do not have adequate physical, social or economic access to food'.

Children are often the most vulnerable to food insecurity. Information from Global Education demonstrates the impact of an insecure food supply on many children throughout the world:

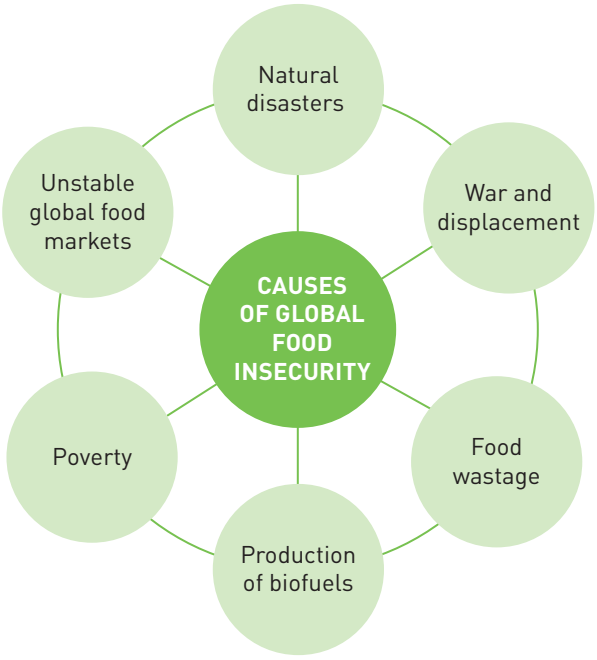
- Approximately 100 million children, or one in every six children, living in developing countries lack sufficient nutrition for a healthy diet and are underweight.

- Approximately 3.1 million children die each year as a result of a lack of adequate nutrition. Of all the children under 5 years of age who die each year, 45 per cent of these deaths are as a result of poor nutrition.

WHAT ARE THE CAUSES OF GLOBAL FOOD INSECURITY?

Many experts agree that the planet produces enough food to feed the world's population. So why do so many people lack food security?

The answer is complex and involves a range of interrelated factors, including extreme weather events and climate change, war and displacement of populations, unstable global food markets, food wastage, the production of biofuels, high levels of poverty, a lack of investment in agriculture and land degradation.



Causes of global food insecurity

Impact of natural disasters on food security

One of the major causes of food insecurity is the impact of natural disasters such as drought, floods, cyclones, typhoons and tsunamis. These severe weather events have the greatest impact on the world's poorest people. Data released in May 2015 by the FAO shows that 'between 2003 and 2013, natural hazards and disasters in developing countries affected more than 1.9 billion people and caused over US$494 billion in estimated damage'. These natural disasters can devastate a small landholder's entire crop – a crop that the family and their local community rely on as their main source of daily food.

Periods of severe drought have the greatest impact on agriculture as water supplies dry up. Poor farmers who rely on seasonal rainfall to plant crops and to provide pasture and fodder for their livestock can be completely devastated. Between 2011 and 2012 and again in 2015, severe drought hit much of East Africa, especially in Somalia, Ethiopia and Kenya. Rural farming communities in these areas suffered the worst effects of the lack of the usual spring rains for two consecutive seasons, and crops failed and their livestock died. According to the FAO, an estimated 9.3 million people in these countries were affected. In 2014, drought once again hit Kenya as the normal rains failed to arrive in the arid and semi-arid regions, affecting many pastoral communities. During 2015, drought struck Papua New Guinea, wiping out subsistence crops in the Highlands region, which affected more than 1.8 million people.

AAP/EPA via AAP/JAKOB DALL/DANISH RED CROSS

Drought conditions in north-eastern Kenya

Just as drought had a devastating effect on the sub-Saharan region of Africa, so tropical storms and typhoons have devastated much of the agricultural sector in the Philippines. Typhoon Haiyan, or Typhoon Yolanda as it is called in the Philippines, hit the mainland in November 2013. The typhoon caused extensive damage to the country's agriculture, wiping out a significant proportion of the rice paddies and corn, cassava and vegetable crops that form the basis of the Philippine agricultural sector. The fishing industry, which makes up 20 per cent of the primary sector, was also severely hit during the typhoon. Whole fishing fleets, which are the backbone of the fishing industry on many of the islands around the coast, were completely destroyed. However, the worst affected were small-scale fishers, who lost their only boat as well as all their fishing equipment.

The destruction of most of the commercial fishing had two immediate impacts on local communities. First,

their ability to access a basic food supply was destroyed, and second, local communities that relied on these boats to transport water supplies and other basic food commodities had no other means of transportation.

Alamy Stock Photo/Images & Stories

Small fishing boats were destroyed during Typhoon Haiyan.

Hand in hand with the destruction of the small-scale fisheries was the devastation of local seaweed farms – the livelihood of many women living in the island communities of the Philippines.

War and displacement of populations

Another major impact on farming and food production is the effect of armed conflict. Whether fighting occurs in areas of East Africa, such as Somalia, Nigeria or South Sudan, or in Syria or Afghanistan or in the Ukraine, the impact on the food security for people living in these regions is very much the same.

Conflict, especially involving armed forces, prevents rural communities from carrying out their normal farming practices such as herding cattle or planting crops. This in turn jeopardises the food security of these farmers because their agricultural production may be significantly reduced. Making life even harder, many farmers in conflict zones find that they are the victims of looting as the armed forces steal their crops and livestock. Young men especially are often forcibly recruited to join the conflict, which in turn means that their family is deprived of their labour in the fields or in herding their livestock.

For many of these families, faced with a threat to their safety and wellbeing, the only solution is to flee the conflict. The displacement of rural communities can have an enormous impact on neighbouring countries if hundreds of thousands of people seek sanctuary across the border.

In some conflict zones, armed forces lay landmines across much of the arable land to ensure that even when their fighting forces leave, agricultural production, and therefore the economic viability of a region, will continue to be disrupted.

Another impact of conflict on food security is the effect it has on the broader community as it disrupts normal commerce and the sale of food through regional markets. Theft of produce before it reaches the marketplace or trying to protect their produce at market can place a significant burden on local traders.

Food wastage

In a 2013 report entitled *Food waste harms climate, water, land and biodiversity,* the Director-General of the FAO, José Graziano da Silva, stated that 'all of us – farmers and fishers; food processors and supermarkets; local and national governments; individual consumers – must make changes at every link of the human food chain to prevent food wastage from happening in the first place, and re-use or recycle it when we can't'. The Director-General's comments followed the release of data indicating that over 1.3 billion tonnes of food, or approximately one-third of all the food produced across the globe annually, is wasted.

As stated earlier, about 843 million people have insufficient food to eat each day. If strategies were implemented to address the inappropriate practices that lead to the enormous amount of food that is lost or wasted annually, they would go a long way to reducing the number of people who go hungry each day.

Food waste has been estimated to cost US$750 billion annually. According to the 2013 FAO report, food loss occurs in both the primary food production phase, where 54 per cent of food waste occurs, and also in the secondary production and consumption phases, where losses account for 46 per cent of food waste. In developing countries most food is lost as a result of the limited equipment available during harvest and a lack of infrastructure for the storage and transportation of crops. Much of the food produced in these countries is highly perishable and therefore at risk of contamination by insects, bacteria or fungus, making the food inedible if storage and transportation facilities are not improved.

Food wastage in more affluent economies is a result of poor communication in the supply chain and consumer behaviour. Many consumers tend to go shopping without planning their meals, which means they are likely to over-purchase to cover the 'what if?' situations of family life. Many consumers are also likely to buy on impulse or buy foods that are 'on special' because they seem too good to miss! 'Use-by' and 'best-before' dates are another cause of food

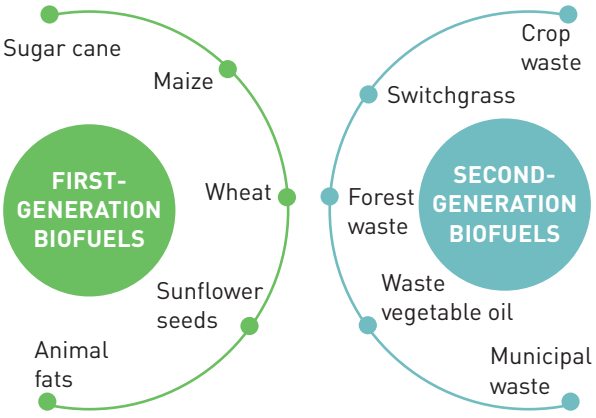
waste, because some consumers prefer to throw food away if it is past this date rather than consume the food even though it is still safe and perfectly edible.

While wasting food causes economic harm to communities throughout the world, it also has a significant impact on our environment, including the production of greenhouse gases, the loss of water, and the use of fertilisers and herbicides to produce the food. The environmental impact of food waste will be discussed in greater detail in chapter 14, page 268.

The production of biofuels

The production of biofuels has also had a major impact on food security across the globe. World demand for energy has risen as a result of a growing world population and the overall increase in the number of private vehicles, particularly in China. Worldwide concern about energy security grew following the rapid rise of crude oil prices in the early part of this century. Increasing concern about climate change has also led many governments to seek alternatives to fossil fuels, such as coal, oil and natural gas, to supply our energy needs. Many governments have turned to biofuels as part of the solution to our future energy needs. This push into biofuels has caused a fivefold increase in their production in less than a decade.

Biofuels are an energy source produced from organic or living material. A large proportion of the biofuels produced today are made from plant materials, especially agricultural crops such as sugar cane or sugar beet, or from cereal crops such as maize and wheat. Both **ethanol** and **biodiesel** are first-generation biofuels. These feedstock crops produce large amounts of sugar and are used to produce ethanol that can be added to petrol for fuelling our cars. Biodiesel is another form of biofuel that is produced from crops that produce oil, such as sunflower or canola, and animal fats that are with improvements in technology over the past decade, scientists and engineers can now produce biofuels from crop waste and wood. These types of biofuels are called second-generation biofuels.

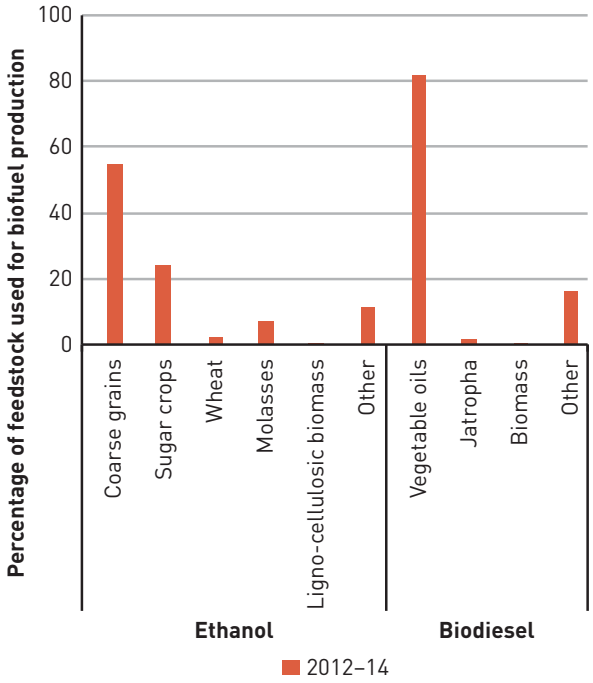


First- and second-generation biofuels

The production of biofuels has been closely linked to a decreasing food supply and increased prices especially for global stocks of wheat and maize. According to a report by the World Bank, the increased production of biofuels has had an impact on the world food market in the following ways:

- Grain is now being used as a source of fuel rather than food. In the United States, more than a third of the corn harvest is now being diverted to the production of ethanol. Similarly, in many countries in the European Union, 50 per cent of vegetable oil production is used to produce biodiesels.
- Many farmers have converted their farming land from food production to the production of crops for biofuel as these provide a greater profit.
- Prices for cereal grains have been driven higher because of market speculation.

In 2007–08 and again in 2011, the world faced a series of major food crises. Sharp rises in food prices affected the poor in many developing countries such as Bangladesh, Egypt and Haiti, where more than 60 riots occurred. Reports indicate that the poor in many of these countries faced soaring costs of basic food items such as wheat, which jumped 120 per cent, taking a basic loaf of bread out of the reach of



Share of feedstock used for biofuel production

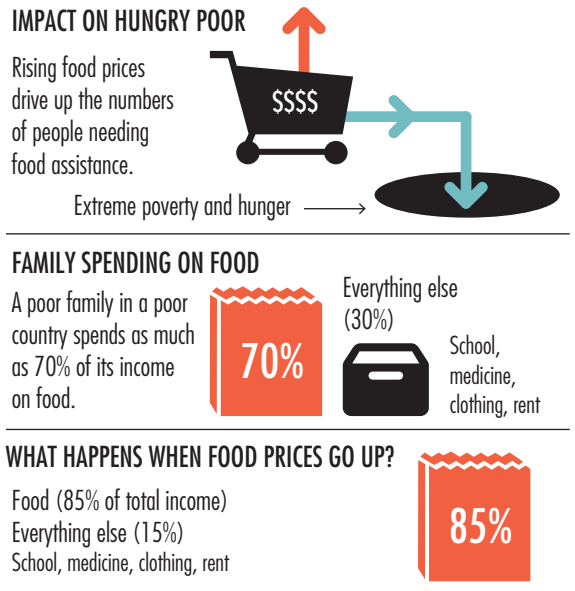
Source: OECD (2015), Share of feedstocks used for biofuel production, in OECD-FAO Agricultural Outlook 2015, OECD Publishing, Paris.

many families. The World Bank reported that biofuel production had forced food prices up approximately 75 per cent, and that between 30 and 75 million people faced hunger as a result of biofuel production.

High levels of poverty

Evidence shows that there is a strong connection between poverty and food security. In 2011, the World Bank estimated that more than 1.3 billion people lived in extreme poverty; that is, they subsist on less than $1.25 per day. For many of these people, the issue is not simply the lack of an adequate supply of food, but the fact that they do not have the purchasing power to allow them to buy the nutritious food they need for their family.

Many of the poor identified by the World Bank live in rural and remote communities where agriculture is their main form of employment either as small landholders or as farm workers. Poor farmers may not be able to afford to purchase seeds to plant new crops or may lack the tools and fertilisers that would help them increase their yields. In addition, many poor farmers subsist on small plots of land that barely enable them to grow enough food for their family. For them, the prospect of selling some of their produce to try to escape the poverty trap is unrealistic when survival is all important. These people are also more vulnerable to a spike in the price of basic commodities, and so the effects of poverty will be deepened if there is a lack of income to purchase food at the current market price.



The impact on the hungry poor

Unstable global food markets

For centuries, each country produced the food its citizens needed to survive and prosper, only relying on trading foods they were unable to grow or produce themselves. Unlike in past centuries, the number of countries that now rely on importing staple food products as their main means of feeding their population has increased dramatically.

Today, the food market is globalised and food is traded as a commodity. The world food markets are dominated by multinational agribusinesses and exporters, with the trade in global grain, for example, being controlled by just a few multinational companies. Market instability has increased as speculation increases and more traders realise they can make money by trading food commodities. This market concentration means that just a few companies have all the power and can manipulate commodity prices at the expense of the poor. As mentioned earlier, dramatic increases in world food prices in 2007–08, 2010 and 2012 led to food price shocks around the globe and significant global unrest.

Another problem linked to unstable world food markets is that agricultural subsidies in wealthy developed nations allow their farmers to sell crops and other food commodities at prices that are far below production costs. Such subsidies give these farmers an unfair advantage over poor farmers in developing nations who cannot compete with an artificially low commodity price.

Understanding the text

1. What is the predicted increase in world population by 2050? Explain the key challenge this population increase will cause.
2. Outline two examples of the impact of food insecurity on children throughout the world.
3. Explain how drought can have a severe impact on food security.
4. List three examples of how Typhoon Haiyan affected the food supply in the Philippines in 2013.
5. Explain how armed conflict can jeopardise the food security of local communities.
6. Draw up a mind map to demonstrate the key issues associated with food waste and its impact on food security.

7 Explain why many governments have encouraged the production of biofuels.

8 What is the difference between first-generation and second-generation biofuels? How has the production of first-generation biofuels impacted on food security across the world?

9 Write a short paragraph to explain how poverty affects food security.

10 Create a flow chart to show how the globalisation of food markets affects food availability.

The four pillars of food security

Achieving food security is a challenge facing all nations across the globe, but particularly for those people living in developing communities. An FAO report has found that food production worldwide must increase 70 per cent by 2050 if we are to meet the demands of a growing population. The FAO has developed a model entitled 'The four pillars of food security' to guide countries and communities in their decision making in improving food security.

The four pillars of food security

Food availability	Access to food	Utilisation of food	Stability of the food supply

1 Food **availability** refers to individuals and communities having access to sufficient quantities of food on a consistent basis. Food availability relates to the production, distribution and trading of food.
2 Individuals and communities must also have **access** to sufficient resources to obtain the food they need to remain healthy. Access to food may be obtained through household production, purchase at local markets or through trade or food aid.
3 Food **utilisation** is based on the quality of the food that is available to individuals to obtain adequate nutrients for growth and development. Knowledge of basic nutrition, the safe use of food, an adequate water supply and sanitation are all key features of being able to maximise the use of food.
4 Food **stability** is the ability to obtain an adequate food supply over time at prices individuals and communities can afford.

Solutions to global food insecurity

Addressing improvements in equity and access in food distribution and utilising key developments in technology are critical to ensuring a secure global food supply.

IMPROVING EQUITY IN FOOD ACCESS AND DISTRIBUTION

Reforming biofuel mandates

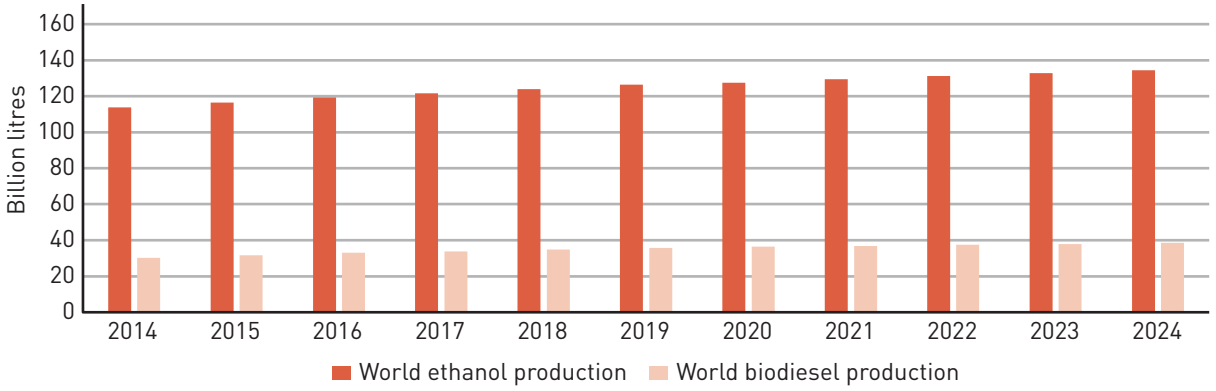
Across the globe, more than 60 countries have introduced mandates for including biofuel blends in fuel for motor vehicles. Many governments also provide biofuel producers with tax incentives and subsidies.

The desire to reduce the world's dependency on oil has been one of the key triggers to the increase in biofuel production. However, as mentioned on page 174 the mandated use of biofuels increases volatility in the market by raising demand for cereal crops and vegetable oils used in their production. As can be seen from the graph on page 177 produced by the FAO, the production of ethanol and biodiesel is expected to continue to increase over the foreseeable future.

While it has been recognised that there is a need to cut emissions from the transport sector that contribute to global warming, many world experts agree that solutions must be found to the impact of first-generation biofuels on food security.

One solution is to slow the growth in demand for first-generation biofuels and implement strict sustainability criteria for production and use of these fuels. In April 2015, the European Parliament introduced laws that would limit the use of first-generation biofuels in the transport sector to 7 per cent.

Many experts are also pushing for an increase in research into, and the development and production of, second-generation biofuels. To be considered a second-generation biofuel, sources must be crops that are not commonly consumed by humans, for example native grasses such as switchgrass and elephant grass. There are a number of other restrictions to being classified as a second-generation biofuel crop, including that they can only be grown on marginal land that would not be considered suitable for growing food crops. Second-generation crops must



Projected world ethanol and biodiesel production in 2014–24

Source: OECD (2015), OECD-FAO Agricultural Outlook 2015, OECD Publishing, Paris.

also be able to be grown with only minimal amounts of fertilisers and water.

Second-generation biofuels can also be produced from sources such as crop waste, forest waste, waste vegetable oil and municipal solid waste.

iStock.com/sponner

Elephant grass is a second-generation biofuel.

Advancing Asian and African agriculture by supporting small farm-holders

In sub-Saharan Africa, at least one in four people is at risk of hunger. An even greater number of people living in Asia are at high risk of food insecurity.

One of the key problems facing farmers on the African continent is that they have low levels of agricultural productivity. Many African farmers are faced with poor-quality soils and an unpredictable climate that poses challenges in enabling them to produce a sustainable food supply. To increase their yields, farmers need support through access to fertilisers, high-yielding crop varieties and products to improve the health of their animals. Technical advice and assistance with finance are other keys for a sustainable future.

A range of projects, supported by the Australian Government, are currently underway in sub-Saharan Africa to aid small farm-holders to increase the productivity of their land. Over many decades, farmers in these regions faced a number of significant hurdles to providing the energy needed to run their farm. Traditionally, farmers relied on their own labour and that of their children to prepare the soil, sow and tend their crops, and eventually to reap the harvest. However, with the onset of severe drought, many of the working animals such as buffalo used to plough the fields died. Younger members of the family, particularly young men, migrated to larger cities in search of work, and many family members succumbed to pandemics such as HIV/AIDS. These tragedies meant that the accumulated knowledge passed down through the generations was lost and there were few people or the machinery such as tractors to work the farms.

Purchasing a tractor is unaffordable for farmers in these regions given their high cost and the inability of small-scale farmers to access finance. The Australian International Food Security Centre (AIFSC) is involve in supplying small, multipurpose two-wheel tractors to local farmers, which are intended as an alternative source of farm power. These machines can be used to plant crops, pump water, apply fertilisers and herbicides, cut grass and fodder, and aid farmers with transportation. To ensure the sustainability of the project, the AIFSC has also introduced short training workshops for local farmers to teach them how to operate and manage the new two-wheel tractors.

Weblink

In Bangladesh, where approximately two-thirds of the population are involved in agriculture, almost 80 per cent of the community now farm their land

Alamy Stock Photo/Joerg Boethling

A two-wheel tractor helping to increase farm productivity

using a two-wheel tractor. These machines can be used for planting, threshing and irrigation, and are particularly useful in their production of rice, enabling Bangladesh to become almost self-sufficient in meeting the rice needs of its population.

Alamy Stock Photo/Susan Liebold

A Bangladeshi farmer using a two-wheel tractor to till his rice paddy

Activity 10.2

Aiding food security in Tanzania and Zambia

Another project funded by the Australian International Food Security Centre is called 'Strengthening food and nutrition security through family poultry and crop integration in Tanzania and Zambia.' The project is in response to chronically high rates of undernutrition in sub-Saharan Africa, where between 42 and 45 per cent of children suffer from stunted growth.

Undertake a search of the AIFSC website to locate information about this project, then answer the questions that follow.

Weblink

1. What is the importance of family poultry in many communities in Tanzania and Zambia?
2. How can improved poultry production assist the nutritional needs of these families?
3. Explain how women have been restricted in their ability to be involved in small-scale farming.
4. What strategies will the program use to meet its aim of reducing childhood malnutrition in the targeted areas?
5. Research another project on the AIFSC website. Describe the problem to be overcome and identify the strategies the project managers have used to find solutions to the problem.

Building the capacity of women

Across the globe, women form the backbone of small-scale agriculture. According to the FAO, approximately 61 per cent of women in developing countries work in the agricultural sector. In sub-Saharan Africa, 31 per cent of rural households are headed by women.

However, for many women in developing countries, life in rural communities is very hard. As a result of cultural and religious beliefs that are the basis of community life, girls do not have the same access to education as boys, which limits their opportunities in later life.

As well as working on the farm, women in developing countries are expected to support their family by collecting water and gathering firewood, providing for the food needs of their family and undertaking all the domestic chores. Although women are key decision-makers in relation to the wellbeing of their family, many do not have the same rights as men. For example, in some developing economies women cannot own land or hire labour. Without the financial security that landownership brings, women have less access to credit and the ability to access essential resources such as purchasing seed, farm tools or the fertilisers and herbicides to make their farm productive. In 2001, the FAO stated that 'if women farmers had the same access to resources as men, the number of hungry in the world could be reduced by up to 150 million'.

One of the most successful developments to help Kenyan women create a secure future and ensure food security for themselves and their families has been

through the establishment of microfinance organisations such as 'table banks'. A Kenyan women's table banking group called 'The Joyful Women Organisation' or 'JoyWo', gives loans to enable its members to improve their lives. These loans are used to purchase small animals such as poultry, pigs and goats, or to purchase cattle or dairy cows. Some women use the loans from the table bank to enable them to start a small business or to develop greenhouse farming projects.

Weblink

amanaimages/Philippe Lissac/Corbis

A table banking session in Nairobi, Kenya

Activity 10.3

Kenya's table banks

Undertake an Internet search on a case study of a microfinance organisation such as Kenya's table banking system. 'Africa Renewal Online – Loans to women = smart economics' or ActionAid Kenya are good starting points for your research.

1 Describe how the person who is the focus of the case study has been able to develop a money-generating activity and to improve their life as result of their involvement with the table bank.

2 Outline the way in which a microfinance organisation such as a table bank operates.

3 Complete the 'plus/minus' table to identify the advantages and challenges of table banks.

PLUS/MINUS – TABLE BANKS	
Advantages of table banks	Challenges facing table banks

4 How many women does the Kenya table bank expect to reach by 2016?

5 Explain how organisations such as the table bank will help to address the issue of food insecurity in Kenya.

Improving food distribution methods

A safe and reliable food distribution system is a key requirement for a secure food supply. All food producers need access to markets through which they can sell their crops or stock. If there are no markets nearby or if transportation systems are inadequate, farmers will not be able to get their produce to market to sell or to purchase basic food commodities. A lack of adequate transport facilities also dramatically compromises the distribution of food aid.

In many developing countries, the road system is the main way farmers get their produce to market. However, many roads are not sealed and they are often in poor condition. Driving on these dirt or gravel roads makes the journey to market difficult and dangerous for farmers. Road maintenance is expensive, so many rural roads are often poorly maintained. In sub-Saharan Africa, only 29 per cent of roads are paved.

In sub-Saharan Africa, strategies are being considered to improve the road infrastructure so that farmers can get their produce to market and to enable more reliable inter-country trade. A project proposed by a group of MIT students planned to link 80 major cities in Africa, to increase trade and make food distribution more efficient, and in doing so, increase the overall national wealth of the countries involved. Individual countries would be encouraged to maintain their existing roads to ensure that food distribution was secure.

In many poor rural areas, local people would be employed to build the roads under the 'Food For Work Program'. This program would enable workers to be paid in food for their work on local roads, providing them with a secure food supply and adequate nutrition. Such a program would benefit both the individual by providing a safety net against food insecurity and also for governments by improving local economic growth.

In many countries, bridge construction is a vital component of road transport infrastructure. In developing countries, smaller communities can be cut

Alamy Stock Photo/Guenter Fischer/imageBROKER

Road construction in Africa

off from markets because their only means of moving their produce across large waterways is by barge or ferry. In the Mekong Delta in Vietnam, the Australian Government is working with the government of Vietnam to build a new bridge across one of the branches of the Mekong River. The Cao Lanh Bridge will link the communities in the Mekong Delta to the rest of South-East Asia and further afield. This new bridge will be a vital part of a major new road transport link and will have enormous benefits for the people who live in the Mekong Delta. The Mekong Delta is a vitally important agricultural and aquacultural area and is often referred to as the 'rice bowl' of Vietnam. The new Cao Lanh Bridge will mean farmers and fishers who live in this region will have greater access to markets, which will ensure greater food security for people in the region. It will also improve the access of local people to many social and health services, and will bring significant economic benefits to the region as a whole. Once completed, the bridge will be approximately 2 kilometres long and will allow more than 170 000 road users to cross the Mekong River each day.

CONTRIBUTION OF TECHNOLOGIES TO FOOD SECURITY

Use of mobile technology in agriculture

One of the fastest and most effective forms of technology helping to transform agricultural production in many of the world's poorest countries is the mobile phone. Throughout Asia and sub-Saharan Africa, farmers are using mobile phone technology to help them access the latest information on current weather conditions, weather forecasting, up-to-date seed prices, planting guidelines, recommended harvest times and information on crop diseases and marketing.

Weblink

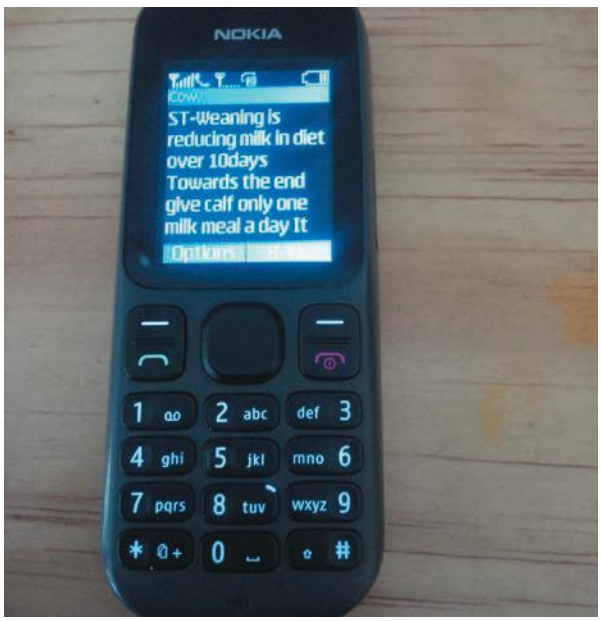
A global non-profit organisation, the Grameen Foundation, brought smartphone technology to Uganda through an initiative called Village Phone. Farmers, especially women, in remote villages can purchase or lease a smartphone at low cost. Owning a smartphone enables them to access information to improve their food production and to share the knowledge they gain with fellow farmers.

Alamy Stock Photo/Jake Lyell

In sub-Saharan Africa, smartphones are a useful tool to check the prices of crops.

In sub-Saharan Africa, the smartphone also enables farmers to receive SMS text messages about the wholesale and retail price of their crops, allowing them to maximise their profit once they send their crop to market.

Another creative application of the smartphone has been the development of an application through Green Dreams TECH Ltd, called the iCow app.



Green Dreams TECH Ltd

iCow app

This SMS-based app allows small-scale dairy farmers to track when each cow is likely to be at its most fertile so that they can maximise the number of calves born and increase their herd size. The app also gives the farmer important information about animal breeding and nutrition and how to produce milk efficiently.

Many small-scale farmers in Tanzania now use a mobile network, Tigo Kilimo, to access an SMS service that gives them instant weather information so that they can manage their crops effectively. They also have access to crop prices and agricultural techniques to improve farm productivity. In Kenya and Ghana, too, small landholders can receive SMS messaging services warning them when periods of heavy rain, floods or drought are likely to occur.

Use of drones in agriculture

The development of drones, or unmanned aviation vehicles, is transforming the agricultural industry in many advanced agricultural communities. Today these flying robots are used for a vast range of tasks that could not have even been imagined a few decades ago. They can be equipped with cameras to allow farmers to survey their crop from the air and take images to evaluate the health of the crop and any diseases or pests that are present on the plants or in the fields. Farmers can then determine the amount of fertiliser and pesticide to use and the best time to spray the crops. By targeting the use of chemical fertilisers and pesticides, farmers can reduce the run-off and pollution of local waterways. By seeing the crop from above, the drones can aid farmers to detect any problems with irrigation systems or identify crops that are facing water stress. Given their small size and flexibility, farmers can use the drones to track changes that occur to the crops much more frequently than they would have been able to using traditional methods. They can even launch their drone every day or week if they think they need additional data to maximise productivity.

Although not widely used in developing agricultural communities at this stage, drones are relatively cheap and easy to use, which means that they will be an invaluable addition to the toolkit of small-scale farmers in Africa, Asia and India in the future. Farmers in these communities will be able to harness this precision technology to help them develop more sustainable farming practices and to improve crop yields.

One developing country that is encouraging its farmers to use unmanned aerial technology is the Philippines. The Philippines is one of the world's largest producers of bananas; however, banana growing brings with it many environmental and sustainability problems. Topmost of these is the use of fertilisers, pesticides and herbicides necessary to achieve high crop yields. The government of the Philippines is concerned about the negative impacts on the environment associated with the aerial spraying of chemicals and sees the use of drones as a key solution to this problem. Supporters of the use of drones in the banana industry say that they are far more accurate in their chemical application than traditional aerial spraying methods because they can hover just 2 metres from the ground as they spray the bananas. Hovering just above the crop reduces the amount of chemicals used and limits the wind drift of contaminants onto other crops and run-off into nearby waterways, causing pollution. Drones are also able to take aerial photographs that can help farmers detect disease on the banana palms that could devastate their harvest.

Alamy Stock Photo/67photo

A drone undertaking a crop survey

Use of solar energy to improve food security

The vast majority of rural communities in sub-Saharan Africa have no access to electricity. A lack of energy is a huge barrier to all aspects of life, including health, education, agricultural production and food security.

Today, with the aid of a number of non-government organisations, many rural communities in developing countries are able to access a reliable and sustainable supply of electricity through solar energy. This helps to ensure the safety of the community by improving food security through a reliable water supply system, providing lighting for homes and enabling wireless Internet connection for communication. Another advantage of using solar energy is that it provides a cost-effective and environmentally friendly method of providing power.

Case study

The Solar Electric Light Fund

Read the case study below, then answer these questions.

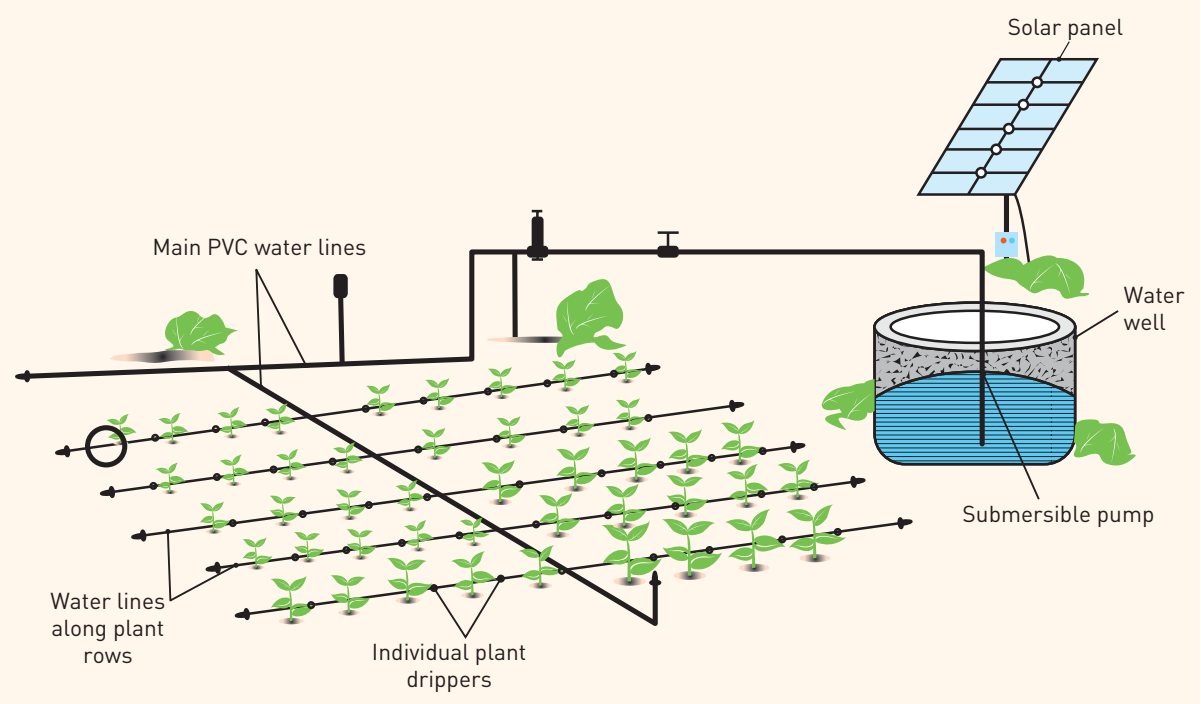
1. Explain how a lack of adequate rainfall impacts on the life of the people in Kalalé.
2. Describe the solution that the Solar Electric Light Fund used to help local villagers overcome their lack of a regular water supply.
3. Write a paragraph to describe how the Solar Market Garden will help the people in the Kalalé district become more food secure.
4. In what way has solar power been able to free the women villagers from their responsibility to collect water? Explain how this development in technology will benefit all members of the local community.
5. How will access to solar power for education help to improve food security in the Kalalé district?

The Solar Electric Light Fund (SELF) states that 'in Benin, as in many other parts of Africa, solar energy has an enormous, yet largely untapped, potential to increase food security in regions that experience a long dry season'.

Weblink

Villagers in Kalalé, located in the northern part of Benin, live in a part of Western Africa where rainfall is scarce, making food production very difficult, and famine a constant threat. This ongoing threat is particularly profound for the children who live in and around Kalalé because many of them become the victims of malnutrition. In the past, small farmers in remote communities had to rely on seasonal rainfall, which meant that their growing season was limited to between 3 and 6 months each year. This lack of a consistent water supply and an inability to produce a regular supply of adequate fresh food limited their ability to improve their health status and to break out of the cycle of poverty.

In 2008, SELF started work in the Kalalé district, seeking solutions to the key problem of food security facing the local villagers. By building small banks of solar panels, SELF was able to produce sufficient solar energy to power a water pump that could draw water from an underground aquifer to a drip-irrigation system. Like traditional drip-irrigation systems, the solar-powered systems provide water and essential nutrients directly to the roots of the plants, minimising water loss through evaporation.



A solar-powered drip-irrigation system

Getty Images/Franz Aberham

Solar panels used to power a drip-irrigation system in Africa

SELF built new solar-powered drip-irrigation systems that could gravity feed a community garden, known as a Solar Market Garden (SMG) in three villages in Kalalé. The new solar-powered drip-irrigation systems provide water for the community food gardens that produce a wide variety of fruit and vegetables all year round.

The produce from the garden is used by local families as a secure food supply, improving their nutrition and health. The new irrigated food gardens have been so successful that local women who tend the gardens are able to sell any excess produce in local markets, giving them additional income they can spend on the education and health needs of their family.

One of the major responsibilities of many women in remote communities is to collect water for their family's survival. For most women the only means they have to do this is to haul the water by hand from local streams, rivers or a community well. SELF has assisted other small rural communities in Benin to install solar-powered community water wells to provide families with a safe, clean water supply that is accessible at all times of the year.

Solar Electric Light Fund self.org

A Solar Market Garden in Kalalé

In 2012 and 2013, SELF built an additional four solar market gardens, giving even more members of the surrounding villages a chance to improve their food security and to enhance their nutritional status. SELF also provided solar power to three schools in the district, giving local children greater educational opportunities through power-lit classrooms and a power supply for computers. Members of the local community believe that these advanced educational opportunities will give them a chance to free themselves from poverty.

Source: adapted from www.self.org/benin/

Use of biogas

The development of small-scale biogas systems is an alternative form of energy production that is gaining acceptance among many farmers in developing countries. A new portable biogas technology called Flexi-biogas, which has been developed in Kenya, has the advantage of producing a clean, renewable form of energy. According to the Food and Agriculture Organization, biogas production has the ability to increase agricultural productivity and create new employment opportunities. The FAO argues that improving the economic circumstances of the rural poor will provide them with greater food security.

The biogas system is made up of a domed, industrial-strength plastic 'digester' bag that is housed inside a greenhouse tunnel. Inorganic material such as cow dung, or even human waste, is used to 'feed' the digester. As the system is located outdoors and exposed to solar radiation during the day, heat is trapped inside the tunnel, which keeps the temperature in the digester bag between 25 and 36 degrees Celsius. The high temperature allows microbes present in the inorganic material to break it down into a gas. The gas is then siphoned off into a series of small pipes that are attached to equipment such as a cooking stove, generator or water pump.

A small landholder who owns just one or two cows can use the manure they produce to generate enough gas to power a small gas cooker for 3 hours each day. The Flexi-biogas system also has the advantage of being portable, which means that the farmer can pack it up and take it with them if they need to move.

A number of local and international agencies are involved in various projects supporting the development of biogas throughout the world. One such project in Africa is the Pass-on-the-Cow scheme. Farmers participating in the scheme receive a milking cow to help produce enough dung to feed the biogas system. In payment for the cow, the farmer must pass

on the first female calf that is born to another small landholder. This builds a network of local farmers who have greater food and energy security.

Biogas production also has significant environmental benefits. It helps prevent land degradation by reducing the amount of firewood that must be collected and burnt each day to provide heat and light for the family. A reduction in wood burning helps to reduce greenhouse gas emissions such as methane and nitrous oxide.

Flexi Biogas Technology www.biogas.co.ke

Flexi-biogas system

Genetic modification technology

Rice

Rice is a staple food crop that is consumed by about half of the world's population on a daily basis. Given the projected increase in population, not only in Asia but throughout the world, there will be an urgent need to escalate the production of all staple foods including rice. Like all other food producers, small-scale rice farmers face the challenge of a changing climate, including the flood and drought conditions that are becoming more prevalent. In addition, many of these farmers face problems of increased soil salinity that has come about as a result of centuries of flood irrigation of their paddies.

The International Rice Research Institute (IRRI), in conjunction with many major rice-producing countries throughout the world, is using the latest advances in biotechnology to map almost 3000 rice genes. The aim of the 3,000 Rice Genomes Project is to identify specific genes that will increase rice productivity and help address the problem of world food security. The project will be of greatest benefit to 2 million of the poorest rice farmers and will enable them to plant improved rice varieties with specific desirable characteristics.

Weblink

Using the knowledge of rice genomics will help scientists develop new rice varieties that are:

- tolerant to floods and drought
- salt tolerant
- high yielding
- tolerant to pests and diseases
- able to provide increased nutritional quality.

Cassava

Feed the Future is an initiative developed by the US Government in 2010 to help address the problem of global hunger and food insecurity.

In Busia, a town in western Kenya on the border with Uganda, cassava has been the staple crop of local agriculture for many decades. However, over the past 20 years the cassava crops in this region have been devastated by the cassava mosaic virus (CMV). CMV causes the plant to develop stunted tubers and deformed leaves that are covered in a yellow mosaic pattern. The failure of the cassava crops meant that local small farmholders were at risk of food insecurity because they no longer had a crop that they could use to feed their family or to sell to gain income. In 2012, agricultural researchers used developments in technology to cultivate new varieties of cassava that are resistant to this disease. A partnership was developed with a non-profit company to establish a project called Feed the Future. This project enables small farmers to access information about new technology including improved varieties of crops suitable to their local conditions. Training of local farmers to produce sufficient disease-resistant cassava that can be shared with other members of their village will ensure that everyone will have access to increased yields of their cassava crops. This project also encouraged local farmers to learn about new techniques in soil and water management so that they will be more sustainable.

Weblink

© FAO/Giulio Napolitano

Cassava destroyed by cassava mosaic virus

Understanding the text

11 Identify the four pillars of food security and outline why each is an important factor in supporting a secure food supply.

12 What is the proposed 'Roads in Sub-Saharan Africa' project and how would it improve food security in the region if it was implemented?

13 The graph showing projected ethanol and biodiesel production on page 177 shows that production of first-generation biofuels will continue to increase. Explain how the production of second-generation biofuels will help to ensure the sustainability of the food supply while still allowing for ethanol and biodiesel production.

14 Draw up a diagram to demonstrate the problems facing many small farm-holders in Asia and sub-Saharan Africa and some strategies being implemented to overcome these barriers to food security.

15 Write a short paragraph to highlight the way table banks are enabling women in many parts of Africa to access the resources they need to become sustainable farmers.

16 Explain why the use of smartphones is considered to be an essential tool for farmers in Uganda.

17 Prepare a PMI (plus, minus, interesting) chart on the use of drones in agriculture.

Worksheet

DRONES IN AGRICULTURE		
Plus	Minus	Interesting

18 Explain why the use of solar energy technology is considered to be essential to ensuring food security in many developing countries.

19 Draw up a flow chart to demonstrate the way in which a small-scale biogas system is able to produce energy for farmers in developing countries.

20 Explain how the 3,000 Rice Genomes Project will improve food security across the globe.

PREPARING FOR EXAMS

Applying knowledge

Describe three facts that demonstrate how each of the following issues impacts on food security:

- natural disasters
- food wastage
- the production of biofuels.

Worksheet

Analysing information

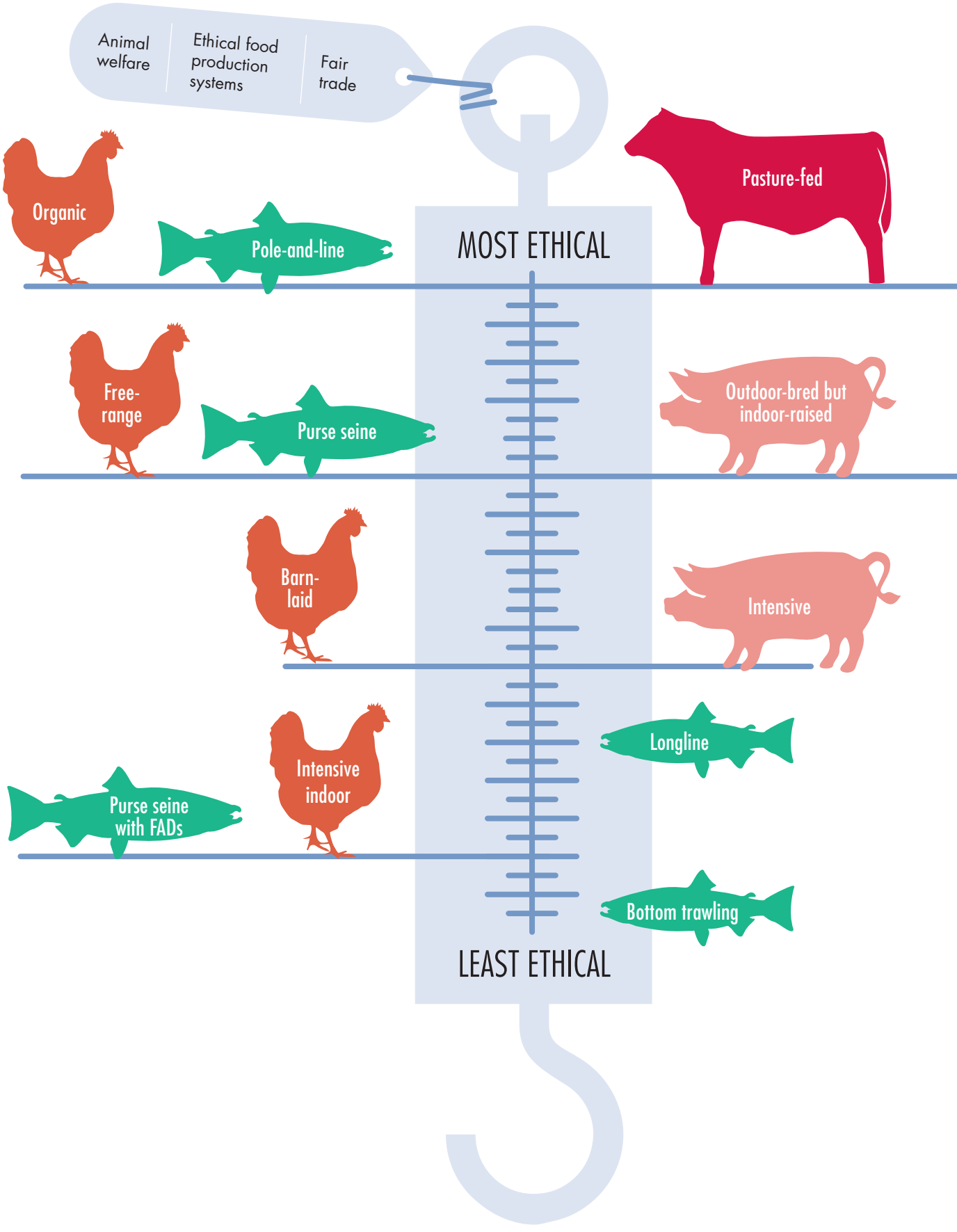
Prepare a SWOT analysis of the use of smartphones as an emerging technology in agricultural production in developing countries.

SWOT ANALYSIS OF THE USE OF SMARTPHONES IN AGRICULTURAL PRODUCTION IN DEVELOPING COUNTRIES	
Strengths	Weaknesses
Opportunities	Threats

Evaluating concepts

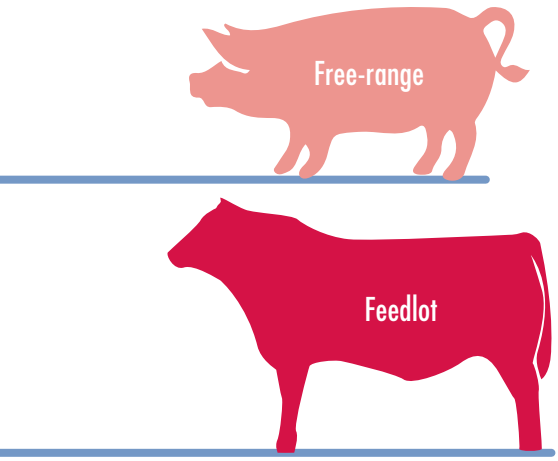
Write a brief proposal (100–200 words) to submit to a crowdfunding website to raise funds to purchase agricultural drones to support small-scale farmers in sub-Saharan Africa. Your proposal should justify the importance of using drones to improve food security in developing nations.

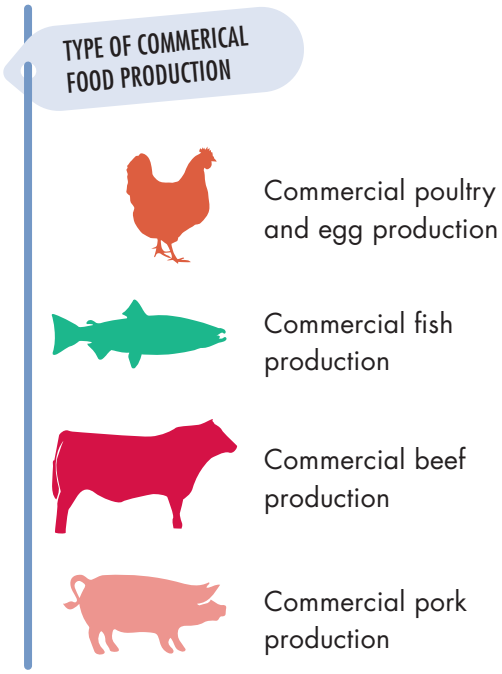
ETHICAL CONSUMERS



11

ETHICAL FOOD PRODUCTION





KEY TERMS

Bycatch is the incidental capture of non-target fish species and other marine life.

Cattle feedlot is a managed facility for the purpose of producing beef of a consistent quality and quantity.

Ethics are a set of moral principles that are motivated by ideas of right and wrong, or good and bad.

Free-range animals are animals that are not closely confined and have some access to the outdoors.

Free-range pork production involves producing pigs that are born and raised with free access to the paddocks outdoors.

Intensive animal farming involves stocking animals in dense and crowded conditions.

Organic food production involves growing and producing food without the use of synthetic chemicals such as pesticides and artificial fertilisers.

Ethical principles for Australian consumers

Many Australians are becoming discerning consumers and are starting to question where and how their food is produced. More and more people are making ethical food choices based on their concern that our food production system is sustainable and has a minimal impact on the environment, and that animals used in our food production system are treated humanely. **Ethics** are a set of moral principles that are motivated by ideas of right and wrong, or good and bad. Consequently, an increasing number of shoppers are checking where the apples or berries they want to purchase were grown, and whether the chicken meat was produced in a factory farm or in a free-range environment. Other consumers are concerned that the farmer who produced their food is making a fair wage.

From top to bottom: Shutterstock.com/FiledIMAGE; Shutterstock.com/Arina P Habich; Shutterstock.com/Thinglass.

Ethical issues in food choice

Consumer concern about animal welfare

The way in which meat is produced is a growing ethical concern for many Australian food consumers. Intensive farming practices in the production of our meat, poultry and eggs became increasingly common in the past century as the population increased and consumers began to demand cheaper meat, eggs and milk. This demand increased the pressure on farmers to produce these basic commodities at a cheaper price for sale in supermarkets. However, in recent years many consumers are questioning these practices and demanding that animals be treated in an ethical and humane way.

PRODUCTION OF CHICKEN MEAT AND EGGS

Chicken meat is popular with most Australians. Data from the Australian Chicken Meat Federation indicates that the annual consumption of chicken meat per person is over 45.5 kilograms; this means that most Australians eat chicken meat as a main meal at least three times a week. Chicken meat is produced using a variety of production methods: in an indoor intensive farming system, in a free-range system, or using organic production methods. Currently, approximately 80 per cent of chicken meat sold in Australia is produced using indoor intensive production methods where birds are floor-reared in large sheds. Of the remaining 20 per cent of the market, most is chicken meat produced using free-range systems, with some organic chicken meat produced. The production of free-range turkey products is also expected to increase in the future.

Layer hens used for the production of eggs are housed in cages, barns or free-range systems. Layer hens are different to meat chickens in that they have been bred large numbers of eggs rather than muscle for chicken meat. According to market research undertaken by market analysts IBISWorld in May 2015, the egg production industry 'has been shifting from cage to barn-laid and free-range eggs. This has been due to consumers' concerns about animal welfare in cage egg production systems'.

Intensive indoor chicken meat and egg production

In Australia, intensive indoor production of chicken meat and eggs is highly mechanised. **Intensive animal farming** involves stocking animals such as chickens in

much more dense and crowded populations than other types of animal husbandry. With intensive indoor egg production, the hens are housed in rows of wire cages stacked several tiers high in huge sheds. These battery cages are very crowded and each hen only has a tiny amount of floor space – about the size of an A4 sheet of paper. The temperature and lighting in these sheds is controlled to maximise egg production. The hens do not have access to nesting boxes or perches and are unable to forage or dust bathe.

When birds are grown for chicken meat, the amount and type of feed they consume is monitored to ensure the chicken meat is produced in a specific time and to a standardised quality. The chickens (for meat production) have been genetically selected and bred so that they grow rapidly and are of a suitable weight for slaughter within 42 days. This rapid growth rate and weight gain puts great physical stress on the birds and can lead to significant health issues. The birds can suffer from heart failure, or malformation and weakness in their legs, which cause them to become lame. This deformity in turn may restrict their ability to access water and food. As the birds grow rapidly, conditions in the sheds become cramped and they may die from heat stress.

iStock.com/yolrak

Intensive poultry production

Barn-laid eggs

The laying hens are free to roam in a shed, and are able to spread their wings and stretch, but they do not have access to outdoors. In barn-laid or cage-free systems, hens are provided with nest boxes. Egg producers who run higher welfare systems will also provide hens with perches on which they can roost, and litter they can use to scratch in, dust bathe or use for foraging.

Free-range poultry and egg production

For many years there has been no legislated definition for the term **'free-range'** in relation to egg production in Australia. However, on 31 March 2016, all Commonwealth, state and territory consumer affairs ministers agreed to the introduction of a new standard defining the term 'free range'. According to the new legislation, 'Eggs labelled as "free range" are required to have been laid by hens with meaningful and regular access to the outdoors and with an outdoor stocking density of 10 000 hens per hectare or fewer. The information standard will also require producers to prominently disclose the outdoor stocking density of hens laying free-range eggs, allowing consumers to easily compare the practices of different egg producers'.

However, while many large-scale egg producers were pleased with the new standard, it has not satisfied small-scale free-range egg farmers, the RSPCA or the consumer advocacy group CHOICE. Following the announcement of the new standard, CHOICE spokesman Tom Godfrey stated that 'the new "free-range" rules clearly reflect the commercial interests of the big industrialised egg producers, allowing stocking densities up to 10 000 hens per hectare and no requirement that hens actually go outdoors'. CHOICE also states that the new legislation does not satisfy the CSIRO Model Code, which recommends a maximum 1500 hens per hectare.

One of the key features of small-scale free-range poultry and egg production is that birds are allowed to range outdoors in large runs during daylight hours. Some free-range poultry producers now use mobile sheds so they can move their chickens onto a fresh paddock in order to maintain the grass cover and minimise the build-up of bacteria and the likelihood of spreading disease.

The hens also have access to a wide range of grain and green foodstuffs such as corn, wheat, peas and lupin. Any additional food products must not contain antibiotics or synthetic colour additives that might increase the colour of the egg yolk. Instead, some

Shutterstock.com/Pack-Shot

Free-range poultry production

farmers are experimenting with other pasture crops such as purslane in order to increase the omega-3 content of the eggs naturally. Purslane, or pigweed, is a native of inland Australia and is naturally high in omega-3.

Stocking densities of poultry production using a free-range system are lower to ensure that the birds are kept in a healthy environment – they have room to flap their wings, to socialise with other hens and to enjoy dust baths.

Organic chicken meat and egg production

Poultry that is classified as organic must comply with stringent certification requirements. From birth, the chicken feed must be 95 per cent organic, and all birds must be able to range freely and have access to green pasture to forage. The feed must also be free of any antibiotics, vitamins and minerals. These hens are not beak-trimmed, they have a larger area in which to range and are outdoors for extended periods. Stocking levels on farms that are certified for organic poultry production are very low in comparison with conventional systems.

Consumer concern about poultry and egg production

Free-range and organic poultry products are more expensive to produce than chicken meat and eggs produced using conventional methods. This means that consumers have to choose between price and animal welfare.

Activity 11.1

When is free-range not free-range?

Read the article that follows, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. Why would CHOICE investigate the issue of labelling free-range eggs?
3. Outline the problems that face the Australian Egg Corporation Limited in relation to the production of free-range eggs.
4. Why would some egg producers decide to ignore the industry model code of practice?

AUSTRALIAN SHOPPERS RIPPED OFF ON MORE THAN 200 MILLION 'FREE-RANGE' EGGS, CHOICE SAYS

Australians are forking out twice the cost of caged eggs to buy 'free-range' but are not getting what they think they are paying for, analysis by consumer advocacy group CHOICE has found.

The group says egg companies are cashing in on the desire of shoppers to buy ethically, but the lack of a national standard has rendered the term 'free-range' meaningless.

'For the first time we've actually put a number on the amount of eggs being sold in Australia that don't meet the free-range expectations of consumers and it's over 213 million eggs sold last year,' CHOICE spokesman Matt Levey said.

CHOICE says the Australian Egg Corporation Limited has admitted about one-third of so-called free-range egg productions stock more than 20 000 hens per hectare.

The model code of practice for the industry recommends a maximum of 1500 hens per hectare.

When CHOICE analysed 55 'free-range' egg products, 20 companies refused to give information about how many hens were on their properties.

Twenty-one other 'free-range' producers revealed they stocked up to 10 000 hens per hectare.

Only 14 of 55 complied with the code of practice and had 1500 hens or less per hectare.

'It's become an absolute farce,' Mr Levey said.

'Some producers are actually cashing in on Australia's ethical shopping motivations without actually delivering the product that meets those expectations.'

CHOICE found Australians were currently paying on average 99 cents per 'free-range' egg, and about 55 cents per caged egg.

State and territory consumer affairs ministers are meeting in Melbourne on Friday to consider a national code for free-range eggs.

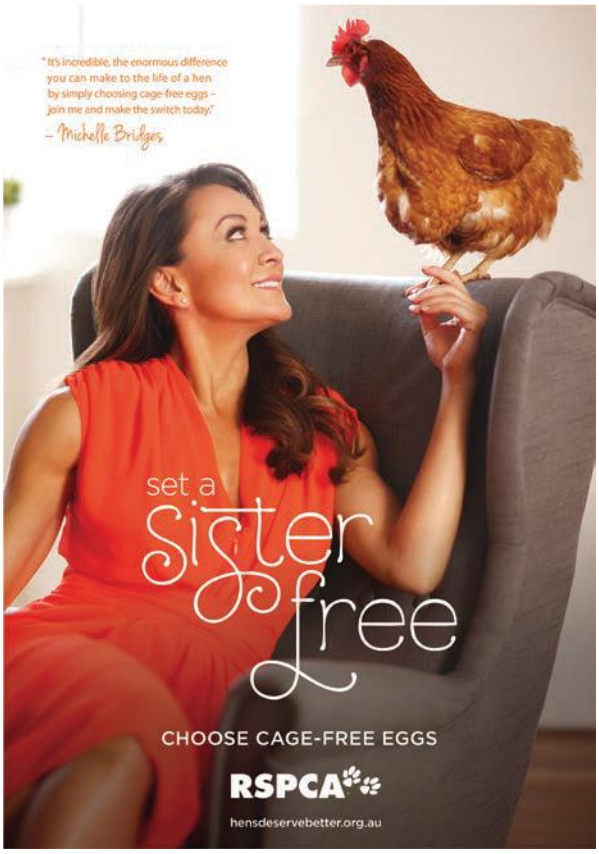
Australian shoppers ripped off on more than 200 million 'free range' eggs, Choice says, by Josie Taylor, © ABC, http://www.abc.net.au, 10 June 2015

Consumer campaigns

As a result of significant consumer demand, food retailers are now selling more barn-laid and free-range eggs than cage eggs. Coles Supermarkets have now removed all cage egg production from their Coles brand eggs; and more than 50 per cent of all eggs sold in Woolworths Supermarkets are produced in a cage-free environment, and the supermarket chain has committed to removing all cage eggs from their shelves by 2018.

In 2015, the RSPCA developed a campaign called 'Set a Sister Free' to encourage consumers to make the change from cage eggs to non-cage eggs. The campaign was based on print and social media advertising, calling for consumers to contact their local supermarket to voice their concern about the sale of eggs produced in cage systems.

Weblink



© RSPCA Australia

The RSPCA 'Set a Sister Free' campaign

amanaimages/Colin McPherson/Corbis

Free-range eggs

Activity 11.2

Consumer views on purchasing free-range eggs

1 Work in a small group to develop a questionnaire about consumer views of purchasing free-range eggs. Use the following points as the basis of your questionnaire:
   - the frequency of purchasing free-range eggs
   - the reasons for purchasing/not purchasing free-range eggs
   - the consumer's understanding of the free-range production system
   - the consumer's sense of confidence that the eggs they are purchasing have been produced based on what they expect to be free-range conditions.
2 Interview six people from your neighbourhood who are the main purchasers of food for their family.
3 Draw up a table to summarise your findings.

Analysis

1 How frequently do consumers purchase free-range eggs?
2 What are the main reasons consumers purchase free-range eggs? What are the main barriers to purchasing free-range eggs on a regular basis?
3 Have the types of eggs consumers purchased changed over the past decade?
4 How well do consumers understand the systems used in free-range egg production?
5 Do most consumers feel confident that, when purchasing free-range products, they are getting what they paid for? Why or why not?

Conclusion

How have the egg-purchasing habits of consumers changed over time and what has led to this change?

Ethical poultry and egg products

A wide range of ethically produced free-range and organic poultry and egg products is now available.

Lilydale Free-range Chicken is one of the most recognised brands of free-range poultry produced in Australia. The first Lilydale free-range farm was established in Lilydale in Victoria's Yarra Valley.

Lilydale poultry is farmed not only in Victoria, but throughout South Australia and New South Wales. Lilydale produces a wide range of consumer products, including whole chickens, chicken portions, thigh and breast fillets, drumsticks, chicken drumsticks, mini roasts, chicken mince and cuts suitable for stir-fries. The Lilydale company also produces a range of free-range products flavoured with barbecue or Asian seasonings, which are ideal for busy families who also want to purchase ethically produced products.

Dlibrary

Lilydale Free-range Chicken mini roasts

Inglewood Farms is another ethical poultry producer, producing a range of certified organic poultry products. The company has an extensive range of whole birds and poultry cuts, which are available in many supermarkets and butchers'. Inglewood Farms also provides a variety of value-added products for consumers who are time poor, such as marinated chicken kebabs, chicken wings and drumsticks, and seasoned rolled chicken roasts.

Inglewood Farms

Inglewood Farms organic chicken marinated kebabs

Other poultry such as free-range turkey, duck and quail are also available for consumers to purchase.

PRODUCTION OF PORK

Animal behaviour experts agree that pigs are highly social, intelligent animals that live in complex social communities. In some research studies, pigs have even outperformed dogs and chimpanzees! However, conventional methods of pork production do not recognise or acknowledge these behaviours and do not take into consideration the welfare of the animals. Various organisations, including the RSPCA, have run campaigns through traditional media outlets and social media, highlighting the issues of intensive pig farming. These campaigns have been highly successful in raising public awareness and have had a significant influence on the types of pork products available to Australian consumers.

Another concern for many Australian consumers is whether they can be sure that the pork products they purchase were produced from Australian pigs. According to industry experts, 75 per cent of the bacon sold in Australia is made from imported pork product.

There are three main systems used in the farming of pigs for meat production: indoor or conventional farming, animals that are bred outdoors but raised indoors, and free-range.

Conventional pork production

In Australia, 90 per cent of all pig meat is produced using conventional farming methods. These systems present the greatest animal welfare concerns. In conventional systems, the pigs are typically raised in indoor sheds that prevent their natural behaviours, such as wallowing in mud baths, foraging for food or socialising.

The sheds used to house pigs in conventional farms are designed for a large number of animals in a highly automated environment. Typically, these sheds have concrete floors that can be easily cleaned and the

iStock.com/DarcyMaulsby

An intensive pig farming shed

animals are fed via automated feeding and water supply systems. These surroundings are very barren and lack any stimulation for the animals.

However, of most concern to many consumers is the treatment of the breeding sows. These sows are kept in small metal pens called 'sow stalls' for a significant part of their 16-week pregnancy. The standard sow stall is just 2 metres long and 60 centimetres wide, which means that the animals do not have enough room to turn around. Just before the sow is due to give birth to her piglets, she is moved into a metal-barred 'farrowing crate' that is even narrower than the sow stall. These crates do not provide bedding or nesting material and therefore do not allow the pig to give birth naturally. The sow is confined to the farrowing crate until the piglets are weaned at about 3–4 weeks of age. The purpose of farrowing crates, according to members of the pig industry, is to ensure that the mother does not crush the piglets so the survival rate of piglets is greater. These methods of confining pigs cause the animals to become stressed and can lead to injury and displays of abnormal behaviour.

iStock.com/Tawintaew

Pigs confined to a farrowing crate

Soon after the piglets are born, many intensive farming systems routinely cut off their tails to prevent them from being bitten by other piglets. Teeth clipping is also common, so that they can't damage their mother's teats while they are feeding or injure each other as they jostle for a feeding position.

Free-range pork production

Free-range pork production accounts for approximately 5 per cent of all pigs raised in Australia. These pigs are born in a free-range environment and raised with free access to the outdoors. They can enjoy fresh air, sunshine and pastures, have access to communal shelters and dig wallows for mud bathing. When the pregnant sows are ready to give birth, they are moved to 'farrowing' paddocks where they have access to specifically designed huts where they can build nests for their young in a calm and spacious environment.

All pigs, including the piglets that have been newly weaned from their mothers at 3–4 weeks of age, the adolescent pigs that have not yet reached the size required before they are sent to market, and the sows, must have access to outdoor paddocks for their entire life. They have the opportunity to seek shelter in the huts in hot or inclement weather and to move freely around the paddocks to graze and forage in pasture where they are able to raise happy, healthy pigs in small family groups.

Alamy Stock Photo/Eye Candy Images 2

Free-range pigs

Free-range pork is more expensive for farmers to produce than indoor intensive farming methods, because farmers require more land to allow their animals to range freely, so farmers have a larger area to manage and oversee the welfare of the animals.

Outdoor-bred, indoor-raised pork production

Another alternative to purchasing pork produced using intensive farming practices, is to purchase pork that is bred outdoors but raised indoors. Breeding pigs (the parents) live in a free-range environment and are allowed to roam in the paddock; they have open huts for shelter and can enjoy wallowing in mud baths. When the mother sow is ready to give birth, she is moved to an open straw-based shelter. These shelters protect the piglets from predators, but allow them access to the outdoors. The piglets are weaned from their mother at 4 weeks of age and are then moved to an indoor separate shelter to be raised before they are sent to market. This production method does not use sow stalls and the pigs are never housed on concrete floors. Their diet is based on natural grains that are free from growth hormones and antibiotics.

Activity 11.3

The advantages and challenges of free-range pork production

Worksheets

Prepare a PMI (plus, minus, interesting) chart for free-range pork production.

FREE-RANGE PORK PRODUCTION		
Plus	Minus	Interesting

Ethical pork products

A large number of food retailers now supply free-range pork products to consumers who wish to purchase ethically produced pork. Under its 'Coles finest' label, Coles Supermarkets provide consumers with an extensive range of fresh free-range pork products, including boneless pork leg roasts, pork cutlets, pork belly and pork belly strips, minced pork and free-range pork sausages. This range also includes a number of 'value added' products such as pulled pork shoulder with BBQ chilli glaze, slow-cooked pork belly and rolled pork with apple sauce. Woolworths also offers a variety of free-range products, such as pork scotch fillet and minced free-range pork, under its 'Macro' brand.

Understanding the text

1 Outline three recent patterns in the purchase and consumption of poultry products.
2 Describe the main concerns associated with intensive poultry production systems.
3 Draw a mind map to demonstrate the key features of free-range poultry production.
4 What is organic poultry production and how does it differ from free-range production?
5 Outline two main consumer concerns when purchasing free-range poultry or eggs.
6 Explain how consumer campaigns have had an impact on the types of eggs available to consumers.
7 Write a short paragraph to explain the key ethical issues in the production of pork products.
8 Make a list of the key features of conventional or intensive pork production.
9 Explain how outdoor-bred, indoor-raised pork production systems differ from free-range pork production.
10 Draw a diagram to demonstrate the types of ethically produced pork products available to consumers.

ETHICAL ISSUES IN THE PRODUCTION OF BEEF

Beef continues to be a popular food with many Australians. According to the Australian Bureau of Agricultural Resource Economics and Sciences (ABARES) the consumption of beef in Australia is increasing, and by 2017 Australians will consume approximately 33.8 kilograms of beef annually.

Beef produced for the Australian market is based on both pasture-fed and feedlot beef. However, some consumers are concerned about animal welfare in feedlot systems.

Feedlot cattle

Meat & Livestock Australia states that a **cattle feedlot** 'is a managed facility where livestock are provided [with] a balanced and nutritious diet for the purpose of producing beef of a consistent quality and quantity'.

Beef cattle spend 85–90 per cent of their life grazing on pasture. The feedlot is the final stage of production where beef cattle spend between 50 and 120 days being fattened up for market before they are trucked to the abattoir for slaughter. During their time in the feedlot, the cattle are fed on a special diet of grains including barley, wheat and sorghum.

Feedlots are widely used in Australia to overcome the problems producers face in ensuring there is sufficient pasture for animals to graze on given the dry climate, especially during years of drought when pasture is limited. The use of feedlots also enables producers to provide consumers, both in Australia and overseas, with beef that is of a consistently high quality in flavour and texture.

iStock.com/Brian Brown

Feedlot cattle being fed

The ethical issues surrounding feedlot cattle are complex. Some consumers are concerned about the issue of overcrowding and lack of shade for the animals. There is also debate about the environmental impacts of feedlot cattle production in relation to animal waste management, and water, air and noise pollution.

The feedlot industry claims that they have been able to address all of these environmental concerns, for example by composting cattle manure to be used as a soil conditioner and using the run-off from the cattle yards for crop irrigation.

Approximately 80 per cent of beef now sold in major Australian supermarkets comes from feedlot cattle.

Pasture-fed cattle

Rather than using a feedlot system, many cattle producers rely solely on a system of pasture-feeding their cattle. Under the Pasturefed Cattle Assurance System (PCAS) producers must meet a number of strict requirements in the production of their beef.

PCAS producers must ensure that their cattle only feed on pasture for their entire lives. The cattle can be fed cereal grain crops, but only before the crops come into seed or once they have been harvested. Another important requirement of pasture-fed beef is that the cattle are able to graze in open pasture and are not confined at any stage for intensive feeding. Farmers using this system must also guarantee that their animals are not treated with growth hormones or antibiotics. One of the most important features of the PCAS is that the cattle can be identified individually and that they are traceable throughout their lifetime, from when are weaned until their eventual slaughter.

CERTIFIED PASTUREFED

Cattle Council of Australia

Certified Pasturefed beef

Alamy Stock Photo/david hancock

Pasture-fed cattle

Ethical beef products

There is a growing trend among consumers to purchase ethically produced beef products. There is a widely held view that meat produced ethically also tastes better. A wide variety of grass or pasture-fed beef products is available through specialty butcher's shops, markets and farmers' markets. Woolworths and Coles supermarkets also stock a range of pasture-fed meat products, including rump, T-bone, porterhouse, scotch fillet and eye fillet. Other beef cuts, such as beef schnitzel, lean minced beef, beef roasts, stir-fry cuts, diced cuts for casseroles and beef ribs, are also popular with consumers.

Sustainable food production

The impact that our current food production systems have on the environment and the long-term effect for future generations is a major concern for many consumers. Ensuring a sustainable food supply is at the forefront of many consumers' minds when they are deciding what type of food to purchase.

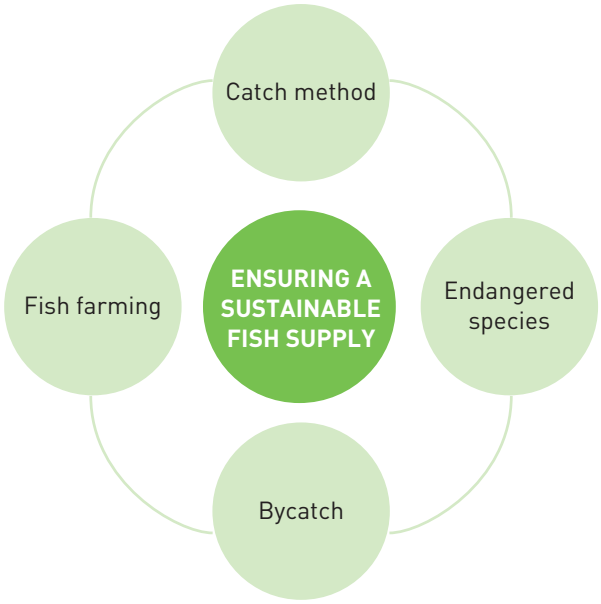
SUSTAINABLE FISH PRODUCTION

In September 2015, the United Nations and its member states unanimously endorsed the 2030 Agenda for Sustainable Development and its 17 sustainable development goals. Included in these goals was Goal 14 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development'. Clause 14.4 of this goal states that 'by 2020, effectively regulate harvesting, and end overfishing, illegal, unreported and unregulated (IUU) fishing and destructive fishing practices and implement science-based management plans, to restore fish stocks in the shortest time feasible at least to levels that can produce maximum sustainable yield as determined by their biological characteristics'.

The United Nations determined that a goal directly linked to the sustainability of the world's fish supply was essential to address the damage done by overfishing.

The 2014 *Living Planet Report* by the World Wide Fund for Nature stated that the population of vertebrate species including fish, had declined by 52 per cent, or more than half, over the past 40 years, and that world fish stocks are at the point of collapse.

There is a growing awareness among consumers that current fishing practices are unsustainable and many are questioning the practices of commercial fishing companies and the impact these methods have on the world's fish stocks. Poor management of fisheries and destructive fishing practices, including the impact of bycatch on future fish stocks, are also factors contributing to the destruction of the world's fish supply.



Ethical issues for a sustainable fish supply

Bycatch

Bycatch, the incidental capture of non-target species, is an inevitable side effect of all large industrial fishing systems. Many of the systems used to catch fish are unselective, so dolphins, sea turtles, seabirds, sharks and juvenile fish are all caught up in the bottom-trawling or purse seines. As they have little commercial value, the bycatch is discarded overboard, dead or dying. So that they gain a commercial benefit from what would otherwise be a waste product, some factory ships grind the bycatch or 'trash fish' into fish flour or fish meal, which is then sold and used as feed for farmed prawns. However, the unintended capture of such vast quantities of marine life has led to a dramatic decline in populations of many marine species.

Alamy Stock Photo/Jeff Rotman

Sea turtles and other unwanted species are caught as part of the bycatch.

Commercial fishing practices

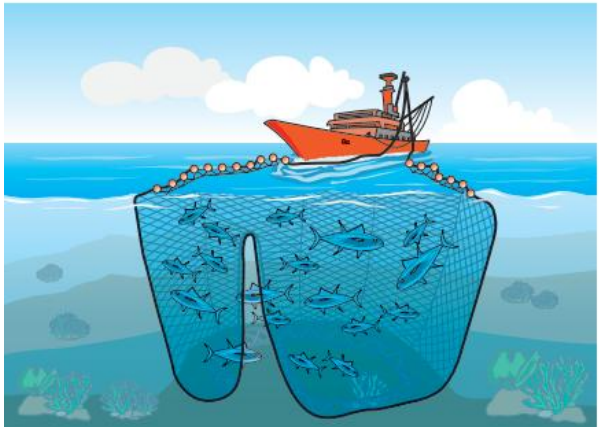
Large-scale commercial fishers use a range of methods to catch large quantities of fish each time they set out from port. Purse seines, fish aggregating devices, longline fishing and bottom trawling are all practices widely used throughout the commercial fishing industry. Most of the ships used, often described as 'factory' ships, are equipped with large processing and freezing facilities so that the fish is not only caught, but also processed, ready for sale when it comes back into port. Many of these ships stay out to sea for months at a time and transfer their catch to a refrigerated cargo vessel. They are also able to replenish their supply of fuel, food and water through these transfer vessels while at sea. This enables them to stay out to sea for much longer than smaller fishing vessels and to maximise the amount of fish they are able to catch and process.

Purse seines

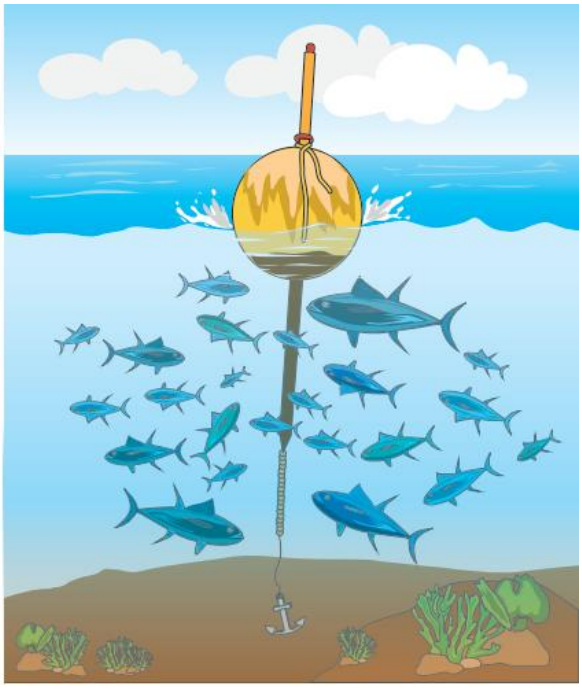
One of the most common methods commercial fishers use to maximise the number of fish they catch is the use of purse seines. A purse seine is a large net that is towed, often by two boats, until a school of tuna is sighted. The net encloses the school of fish and is then drawn closed at the bottom to resemble a purse. The fish cannot 'sound' or swim down to escape through the bottom of the net. Up to 62 per cent of the annual global tuna catch is caught in purse seines. While the fishers may target a specific species, large numbers of non-target species are also caught up as bycatch.

Fish aggregating devices (FADs)

A fish aggregating device is a permanent or temporary device such as a buoy or float used to lure fish. All fish species, like other vertebrates, are biologically programmed to seek shelter when they are feeding. Up to 300 species of fish and other marine life such as sharks, turtles and dolphins have been shown to seek shelter around a FAD. Objects such as buoys that float in the sea are often equipped with satellite-linked sonar devices. Commercial fishers frequently use FADs in conjunction with purse seines and are able to locate the FADs using the satellite system. The FADs attract the target fish, for example tuna, that are then easily seen by fishing trawlers. However, FADs have the unintended consequence of also capturing non-targeted fish. When used together, FADs and purse seines result in 10 times more bycatch than when commercial fishers use nets alone.



A purse seine

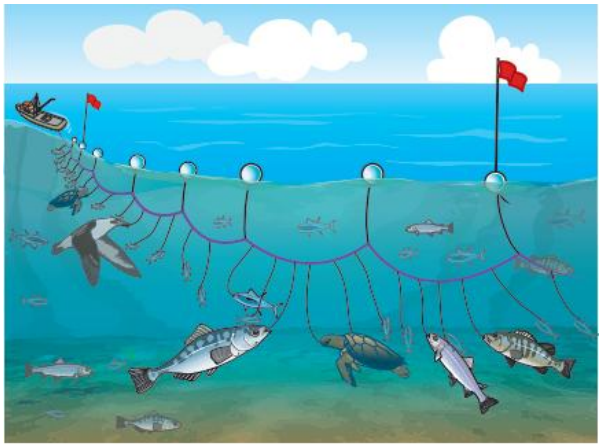


A fish aggregating device

Longline fishing

Another method used by some commercial fishing companies is called 'longline fishing'. The fishing trawlers set fishing lines, up to 150 kilometres long, with a main line and secondary lines branching off it, each with thousands of barbed, baited hooks. Large tuna species such as adult bluefin and yellow fin are the main fish species targeted by longline commercial fishers. However, the baits on these lines also inadvertently catch many threatened or

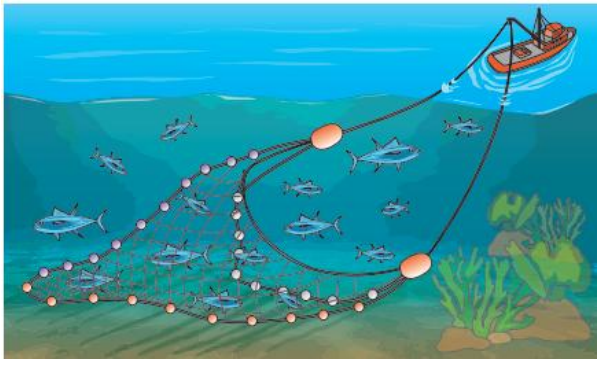
endangered species, such as turtles. Another major environmental impact of commercial longline fishing is that an estimated 300 000 albatross are killed every year using this method. Adult and juvenile birds dive to feed on the bait and become snared on the hooks and are dragged underwater and drown.



Longline fishing nets being set

Bottom trawling

While purse seines, fish aggregating devices and longline fishing are all responsible for overfishing, bottom trawling is by far the most destructive to the world's oceans. Factory ships that use bottom trawling fishing techniques, drag a large, heavy, weighted net across the seafloor. They trawl along the ocean floor, repeatedly working up and down the coast, 'clear felling' the ocean floor. The nets scoop up all the marine life that lives on the seafloor, not just the targeted fish. All the sea life that lives on the floor of the ocean is caught up in the nets, including ancient sea corals and endangered fish species. This bycatch can amount to 90 per cent of the trawler's total catch. The nets also destroy the entire habitat that the marine life uses for food, shelter and safety. Less than 30 per cent of the fish caught in these nets is suitable to be sold for food; the remainder is described as 'trash fish'.



How bottom trawling works

Aquaculture – a sustainable method of fish production

There is a growing demand among Australian consumers for a sustainable seafood supply. As a result, the Australian aquaculture industry has grown considerably over the past decade. This growth in demand has been supported by the Food and Agriculture Organization (FAO), which predicts that by 2021, farmed seafood will make up more than 50 per cent of the fish consumed globally.

The Australian Marine Conservation Society defines sustainable seafood as 'fish or shellfish that reaches our plates with minimal impact upon fish populations or the wider marine environment'. Aquaculture, the farming of captive-bred fish stock, in Australia can be carried out in fresh water or sea water in off-shore pontoons or as sea cage-farming. This method of producing seafood is used to grow many marine species, including Australian southern bluefin tuna, Atlantic salmon, Pacific oysters, prawns, kingfish, mulloway, barramundi and abalone. The sea pontoon can be located up to 25 kilometres out to sea where the fish stock is fed, monitored and harvested. The growing cycle for many farmed fish species takes 6–7 months; however, Atlantic salmon may take up to 2 years to be ready for harvest.

Freshwater trout, Murray cod, silver perch, jade perch and eels are reared in inland freshwater fish farms throughout Australia.

While aquaculture practices are seen to be a solution to the overfishing of some endangered fish species, they do have some negative impacts on the environment. There is a concern that raising large number of fish species in an enclosed environment may cause water pollution through the fish waste; the spread of marine diseases to native species or altered genetic make-up if fish escape into the surrounding waterways; and escaped fish to predate on native species or damage the habitat of native fish.

Of greatest concern though is that feedstock used to feed and grow farmed fish species comes from wild-caught fish. This could severely reduce native fish stocks and affect biodiversity, meaning that some native species may become extinct.

Tassal

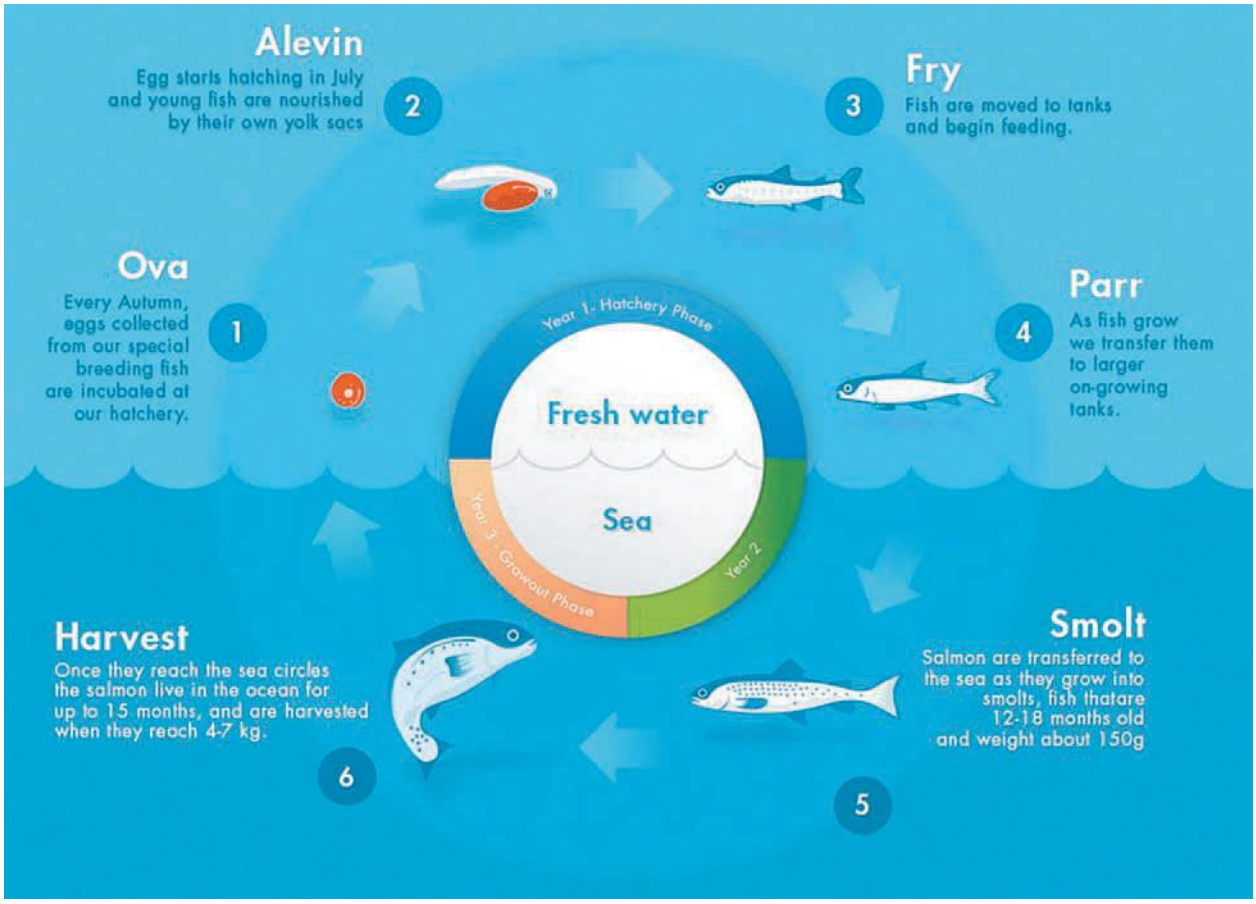
Tassal produces Tasmanian Atlantic salmon from six marine farms in southern Tasmania. Here, they grow the salmon in large sea cages over 12–18 months and they are harvested once they reach about 5 kilograms. The fish are then processed in one of the three processing plants located in southern Tasmania.

Fiona Ewing, Tassal Group

Aquaculture sea cages used for farming Tassal Tasmanian Atlantic salmon

Shutterstock.com/holbox

Pole-and-line fishing



Tassal Group

The life cycle of Tassal Tasmanian salmon

Tassal has a very strong commitment to environmental sustainability and is working in partnership with the World Wide Fund for Nature (WWF) to ensure it achieves ecologically sustainable aquaculture production. For example, Tassal is endeavouring to reduce the amount of wild-caught fish used to feed the salmon by developing a high-protein food using chicken meal and chicken oil along with a mixture of grain and protein oil.

Weblink

Tassal also works with the local community to reduce the environmental and noise impacts of the plant and machinery used in its aquaculture production.

Ethical seafood products

Tassal produces a wide range of salmon for Australian consumers who wish to purchase sustainably produced salmon. Some of its most popular products include whole Atlantic salmon, salmon portions and a wide variety of sliced and smoked salmon products.

All major producers of canned tuna sold in Australia, including Greenseas, John West, Safcol and Sirena, and major supermarkets Coles, Woolworths and Aldi have agreed to end the use of fish aggregating devices in tuna fishing by 2016. Instead, tuna will be caught using more sustainable methods such as pole-and-line techniques.

Labelling of seafood

Being able to determine whether the seafood they purchase has been sustainably produced can be very difficult for consumers given the current food labelling laws. At present, unpackaged seafood, such as seafood that is bought in a fresh fish shop or fish market, only needs to indicate whether the seafood is produced from local ingredients or if it is imported, or is a combination of local and imported ingredients. Seafood that is pre-packaged, such as frozen seafood purchased from a supermarket, must contain a 'country of origin' label. However, the food service industry is exempt from including a country of origin label for seafood included on their menus, in all states and territories except the Northern Territory, where country of origin information is required for fish dishes on restaurant menus. For consumers in the rest of Australia, this means that when they purchase seafood from a fish and chip shop or their local café or restaurant, they may not know whether the seafood is produced in Australia or if it is imported.

A current campaign to address the issue of inadequate labelling requirements is being led by the 'Label My Fish Alliance'. This group represents a wide range of consumers, fishers and chefs throughout Australia who are demanding that the federal government introduce new fish labelling laws so that consumers know what type of seafood they are eating, where it was caught and how it was farmed or caught.

Weblink

Australia's Sustainable Seafood Guide

The Australian Marine Conservation Society has developed the Sustainable Seafood Guide app so consumers can be more informed when they purchase seafood. The app provides consumers with information about the sustainability of 90 seafood species commonly available in markets and fishmongers'. The app uses a traffic light system of green, amber and red, ranking seafood according to its method of production (wild-caught, farmed or imported) and its sustainability. The app also provides consumers with information on where the seafood species is found in Australia.

Weblink

- **Green** – Seafood coloured as green are currently not overfished and therefore not endangered. The environmental impact of fish caught or farmed in this group is also lower than other alternatives.

Australian Marine Conservation Society

Australia's Sustainable Seafood Guide app

Understanding the text

11 What is a feedlot and why is it used in the production of beef cattle?

12 Outline the ethical issues involved in the use of cattle feedlots.

13 Draw a knowledge map of the key features of pasture-fed cattle production.

14 Write a paragraph to explain the key concerns in the sustainability of the world's fish stocks.

15 Explain what is meant by the term 'factory ship' and outline the implications they have for the sustainability of fish stocks.

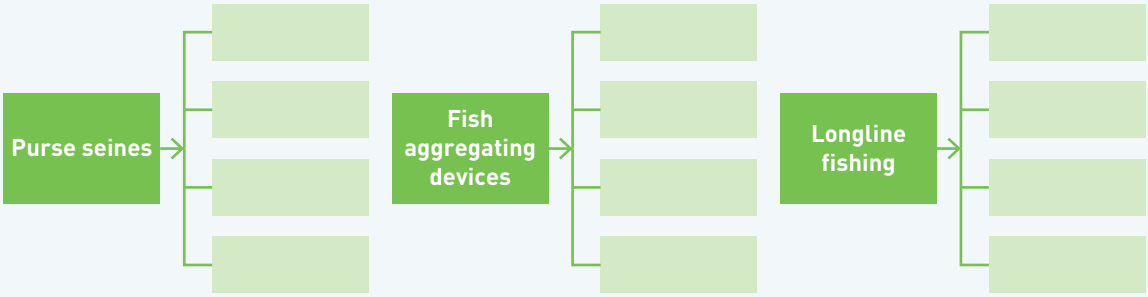
16 Draw a diagram like the one below to compare the features of the following commercial fishing methods – purse seines, fish aggregating devices, longline fishing.

17 Explain the meaning of the terms 'bottom trawling' and 'bycatch' and why they are considered to be so damaging to the sustainability of fish stocks.

18 What is sustainable fish production and how is it carried out in Australian waters?

19 Explain why the labelling of all seafood is considered to be an important issue for many people who purchase fish.

20 Outline three features of the Australian Sustainable Seafood Guide and explain why this would be a useful tool for consumers.



- **Amber** – Seafood species classified as amber are at risk because wild-caught species may be in danger of being overfished or there is some bycatch associated with the method of fishing. Seafood in this group that is produced using aquaculture production has some impact on the environment.
- **Red** – The Marine Conservation Society recommends that consumers should say no to all the seafood species listed in red because they are in danger of being overfished or the fishing method is linked to significant bycatch of other threatened or endangered species.

ORGANIC FOOD PRODUCTION

Organic food is no longer seen as unusual; it is becoming much more commonplace. Recent research shows that 65 per cent of all Australians buy organic food at least occasionally.

Organic food production involves growing and producing food without the use of synthetic chemicals such as pesticides and artificial fertilisers. Genetic modification and food irradiation are also prohibited in organic food production systems.

Consumers are choosing organic foods for a range of reasons associated with ethical food production: because they are assured it is free of chemicals; it is environmentally friendly; and it is not genetically modified. Consumers who purchase organic meat do so because they believe animals are treated more humanely, have access to the outdoors and the meat does not contain any hormones or antibiotics. According to data published in the *Australian Organic Market Report,* 60 per cent of consumers who purchase organic produce buy organic fresh fruit and vegetables; 45 per cent select organic ingredients for cooking at home such as meat, flour, butter and oil; and 39 per cent choose organic canned products.

For more information about organic food production see chapter 13, page 245.

Organic products

There is now a wide range of food producers who provide a vast array of organically produced foods for consumers. Organic food products are available in supermarkets, greengrocers, fresh food markets, certified organic retailers, health food shops and through online retailers. The list of organic food products is almost endless and includes:

- fresh fruit and vegetables
- dairy products – milk, cheese, yoghurt, butter and cream
- fresh meat, poultry and fish
- eggs
- baby foods – yoghurt, baby porridge, toddler rice cakes
- breads and savoury biscuits
- organic ingredients – flour, sugar, pasta, tomato paste, oil and dried fruit
- canned products – baked beans, diced tomatoes and chickpeas
- breakfast cereals – Weet-Bix, muesli and rolled oats
- fruit juices
- chocolate.

Christodoulou

Australian Certified Organic logo

Fair trade

The ethics of fair trade is based on the concept of ensuring that farmers and workers, particularly in developing countries, are guaranteed a fair wage for their work. The fair trade movement, which began to take shape in Europe in the 1960s, aims to address poverty, to empower food producers in developing countries to improve the quality of their lives and to have greater control over their future. A system of labelling products as certified Fairtrade is now in use throughout the world; these products have been produced according to the standards of the Fairtrade Labelling Organizations International (FLO), or Fairtrade International. Fairtrade standards include the minimum requirements for the social, economic and environmental wellbeing of local communities. In order to be certified, producers must agree to meet these standards and to provide ongoing improvement of conditions for farmers and workers.

BENEFITS OF FAIRTRADE

Fairtrade benefits approximately 6 million people in 74 developing countries throughout the world, particularly communities in Africa, Asia and Latin America. The Fairtrade system benefits small-scale farmers and workers by:

- enabling farmers to receive a fair price for their harvest
- ensuring a fair wage and therefore economic independence for workers
- prohibiting both forced labour and child labour
- improving the worker's standard of living
- encouraging sustainability of the local environment through organic food production methods
- enabling farmers access to low- or no-interest loans
- providing access to education and better health care.

Consumers are becoming more aware of ethical issues when purchasing food products and increasingly choose Fairtrade products. Recent data has shown that Australia is one of the fastest growing markets for Fairtrade-labelled products, now worth more than $259 million annually. Research undertaken by Globalscan showed that 90 per cent of Australians and New Zealanders believed that companies have a responsibility to pay farmers fairly for the food they produced.

Fairtrade cocoa and chocolate

The establishment and certification of Fairtrade cocoa and chocolate is an example of ethical food production. Throughout the past decade, world cocoa prices have fluctuated widely. In many cases, the cost of producing the cocoa has been greater than the price the farmers have been paid for their crop. Plummeting cocoa crop prices left many farmers in developing countries to face the prospect of severe poverty. In an attempt to reduce their labour costs, many farmers were forced to take their children out of school to work on their farms. Reports from the International Labour Organization claim that, in some cases, children as young as six, many of whom are sold as child labour, are forced to work picking cocoa beans for 80 to 100 hours a week. They are often subjected to beatings and suffer malnutrition, as well as backbreaking and dangerous work. As a result of the long hours children work on the cocoa bean plantations, most do not have the opportunity

to attend school and gain an education, leaving them with no way out of their cycle of poverty.

Fairtrade chocolate, such as Green & Black's Fairtrade-certified Maya Gold chocolate, drinking chocolate and cocoa products, are made from Fairtrade-certified cocoa that is ethically produced. This chocolate is sourced from the cocoa farmers of Belize and the Toledo Cacao Growers' Association on the Caribbean Coast of Central America. Under this scheme, the chocolate manufacturers agree to pay a guaranteed commodity price to a small group of producers. The producers in turn agree not to use child labour, to pay a fair price to their workers and to conserve the environment. This offers a solution to small farmers and their dependants to break the cycle of poverty because they have a guaranteed market and price for their cocoa beans.

Both Cadbury and Nestlé have also committed to using Fairtrade chocolate in the production of several of their most popular chocolates. Cadbury sources their cocoa for the chocolate used in its Dairy Milk bars from Ghana and the cocoa for Nestlé's Kit Kat comes from the Ivory Coast.

Fairtrade chocolate

Fairtrade products

Consumers who have an ethical concern about how farmers in developing countries are treated can now purchase an increasing range of products that carry the Fairtrade logo, including rice, sugar, coffee, chocolate, cocoa, bananas, mangoes, quinoa, sugar, dried fruit, honey and nuts. However, coffee is by far the most popular Fairtrade product, making up 78 per cent of total Fairtrade retail sales. Much of the Fairtrade coffee sold in Australia is sourced from Papua New Guinea.

Consumer demand for ethically produced food products has encouraged many multinational companies to join Fairtrade, including Coles, Woolworths, Aldi, Starbucks, Cadbury, Nestlé and Jetstar.

A FAIR PRICE FOR FARMERS' PRODUCTS

Four key supermarket chains dominate the supermarket sector in Australia: Coles, Woolworths, IGA and Aldi. This concentration has given the supermarket giants considerable buying power and the ability to set the prices they pay to farmers and food manufacturers for their fresh or manufactured food products. The costs of growing fresh produce have increased dramatically over the past 20 years as a result of the soaring prices of land and agricultural inputs such as fertilisers, and the increasing use of technology. But with the concentration of the supermarket sector, many farmers feel that the supermarket giants force farmers to accept a price for their produce that is barely above the cost of production and does not give them a fair price for their produce. They feel that this practice is unethical because if they do not accept these conditions they will not have a market for their produce. Furthermore, in September 2015 the Australian Competition and Consumer Commission (ACCC) accused Woolworths and Aldi of presenting its suppliers with new grocery supply contracts that led suppliers to believe they could not negotiate the terms of the new agreements.

Milk and bread 'wars'

In January 2011, in an effort to attract more customers into its stores, Coles reduced the price of its home-brand milk to $1 per litre. In order to compete with its supermarket rival, Woolworths also reduced the price of its own label milk to a similar price. The impact of the price war between the two supermarkets on the dairy industry has been dramatic. Dairy farmers have been particularly hard hit, with many leaving the industry as their profit margins were squeezed. An estimated 130 dairy farmers in Queensland have left the industry because the lower prices they were paid for their milk were unsustainable and they could not survive. The impact on the brands of major milk producers has also been dramatic and their share of the milk market has dropped substantially. The leading milk brand, Pura, has experienced a drop in its share of the milk market from 14.4 per cent of the market in 2008 to just 6.4 per cent in 2015.

In 2014, Woolworths cut the price of its private label white bread by 15 per cent to just 85 cents per loaf. While Coles and Aldi were able to match this price, smaller independent bakers could not compete with such a low unit price. Large bread manufacturers such as Goodman Fielder and George Weston suffered significant losses, with the sales of their major bread brands dropping approximately 9 per cent.

Many consumers are concerned about the ongoing viability of Australian dairy farmers and cereal growers and want to see Australian farmers receive a fair price for their produce. If farmers do not receive a fair price for their produce, farming becomes unsustainable. Farmers become unable to invest in the development of their property by maintaining and improving farm infrastructure, investing in staff training, and making improvements to animal welfare and environmental sustainability.

Products from Australian farms

The increase in online marketing has been a great advantage to many small farmers. Online retailers including Aussie Farmers Direct and Farmhouse Direct are now able to connect small producers with consumers.

Consumers can purchase a wide range of fresh produce, including fresh milk, fruit, vegetables, seafood, meat and organic produce online and have it delivered directly to their door. Online purchasing of produce from the farmers is becoming increasingly popular with consumers because they see it as a way of not only supporting Australian farmers, but also as a fairer and more sustainable method of purchasing food.

Activity 11.4

Moral food?

Read the article on the opposite page then answer these questions:

1. How did the study discussed in the article test whether moral satisfaction had an impact on the taste sensation of food?
2. Outline the findings the researchers were able to make as a result of the study.
3. Explain why Jerry Mai continues to use ethically sourced, local ingredients even though they are more expensive. What strategy does she hope will help make her product more affordable in the future?
4. What does Russell Mickle mean when he says that ethical farming is on the verge of becoming mainstream?
5. Why does Professor Keast say that a preference for ethically sourced food is nothing to be ashamed of?

Alamy Stock Photo/Scott Hortop

An example of a fruit and vegetable box that consumers can order

MORAL FOOD? DOES THAT COME WITH CHIPS?

Despite best intentions to try something new for lunch I often find myself back at the same place ordering the same thing: a steaming hot bowl of chicken pho from Emporium's basement restaurant, Pho Nom. It's affordable ($11.90), nutritious and I can pay by eftpos. But a recent study shows there may be something else influencing my behaviour: moral satisfaction.

Published recently in the journal *Appetite* and entitled 'Savouring morality. Moral satisfaction renders food of ethical origin subjectively tastier', the study tested the premise by giving participants the same foods with altered descriptions, indicating either ethical or conventional sourcing. People whose values were aligned to farming practices such as fair trade, organic and free range reported an enhanced taste, even though the food was no different.

'The objective taste of ethical food may well be superior – we don't know that,' says lead author Dr Boyka Bratanova from Scotland's Dundee Business School. 'What we show is that there exists a psychological mechanism that adds to the enjoyment of ethical food. And whether people experience this additional enjoyment depends on their values.'

Rather than being 'tricked', ethical consumers are rewarded with enhanced food enjoyment, and the source of that reward is their own morality, says Bratanova.

'It's a win-win situation where both consumers and our planet and society benefit. It comes down to regulators to make sure ethical labeling is truthful.'

Back at Pho Nom owner-chef Jerry Mai uses only ethically sourced, local ingredients. The beef is grass-fed Warialda, the pork is free range from Greenvale Farm and the chicken is Milawa Free Range Poultry. No wonder I keep going back.

Although it's more expensive, Mai chooses to take a hit on her margins so prices stay affordable.

'I'm not going to be a millionaire overnight but [...] I'm hoping that if we create a high enough demand for it, farmers will have more work and the prices will start coming into line.' But when presented with evidence that her ethically biased mind might be playing tricks on her tastebuds Mai is adamant she can still taste a difference. 'It sounds really weird but a chicken tastes more like chicken, a steak tastes more like beef, a fruit tastes more like fruit.'

Milawa Free Range Poultry farmer Russell Mickle says ethical farming is on the verge of becoming mainstream. His paddock-grazing chickens cost about twice as much as conventional chooks but there is a waiting list for the 800–1000 birds he produces each week. He estimates that of the 20 million chickens consumed in Australia each week about 10 per cent are free range (the Free Range Egg and Poultry Association estimates that figure is closer to 20 per cent).

Mickle's decision to start free-range poultry farming 16 years ago wasn't based on any particularly high or altruistic ideals. 'It was a big, tough journey,' he says. 'But we did it because we wanted to make a different product. That's the only reason. We wanted to have a really, really nice tasting bird.'

But even if your preference for ethically sourced food is all in your mind that's nothing to be ashamed of, says Professor Russell Keast, head of Deakin University's Centre for Advanced Sensory Science.

'The fact that your mind is placing higher value on the product and then it makes you enjoy it more? That's fantastic. I think people who have those values are doing a great job and the fact that they believe it is tasting better – that's just an added bonus.'

Moral food? Does that come with chips?, by Peter Barrett, 26 September, 2015, The Age

Understanding the text

21 Write a definition of organic food production.

22 Explain why many consumers are now choosing to purchase organic food products.

23 Draw a diagram to demonstrate the range of organic food products available to Australian consumers.

24 Outline the basis on which the fair trade movement was established.

25 List five benefits of Fairtrade certification to farmers in developing countries.

26 Write a brief paragraph to describe the role that Green & Black's chocolate manufacturers have in the production of Fairtrade chocolate.

27 Draw a diagram to demonstrate the range of Fairtrade products available to consumers.

28 Outline the barriers to farmers receiving a fair price when selling their produce through large supermarket chains.

29 Explain how the milk and bread 'wars' have affected Australian farmers and food producers.

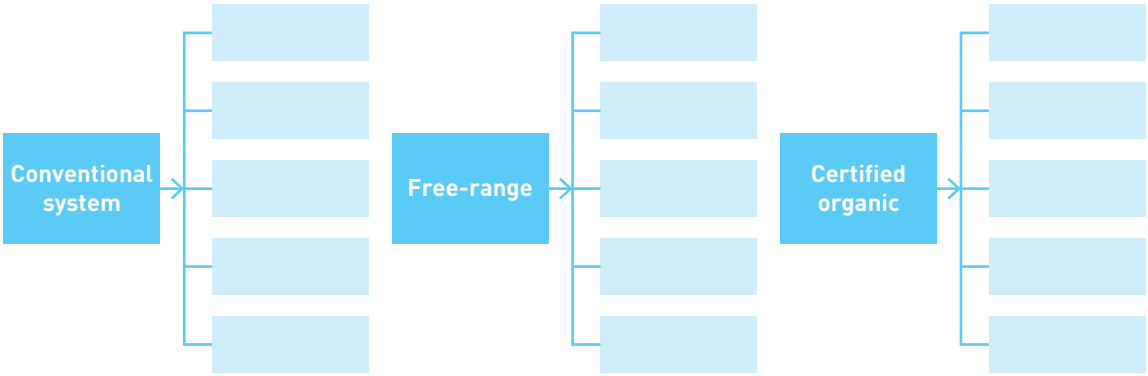
30 Explain how the use of on-line marketing can assist farmers to receive a fair price for their produce.

PREPARING FOR EXAMS

Applying knowledge

Comparing poultry production systems

Draw up a comparison diagram like the one below to compare the features of each type of poultry and egg production system.



A story in five photos

Work in a small group to prepare a 'story in five photos' on the sustainable production of fish.

1. Select five photos that best describe the key characteristic of sustainable fish production.
2. Write prompt notes to give a short narration of each of the five photos that describes the benefits of sustainable fish production. Record your narration.
3. Complete the slide show and recorded narration.
4. Post the slide show in a drop box for students to share.

Analysing information

Prepare a SWOT analysis for Fairtrade chocolate

Strengths	Weaknesses
Opportunities	**Threats**

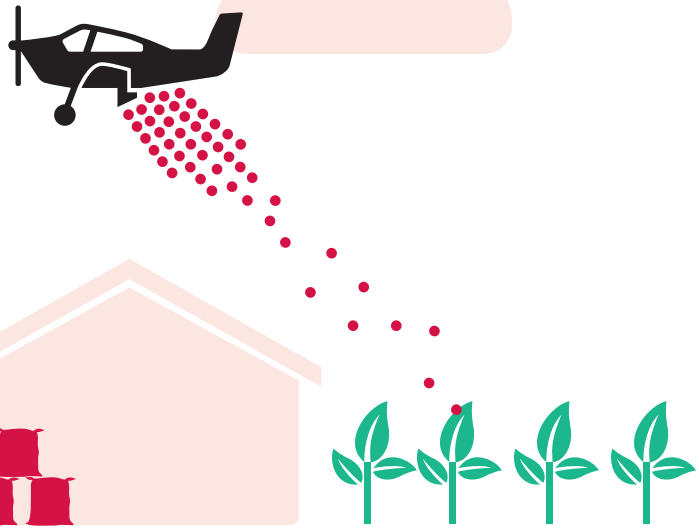
Evaluating concepts

1. Write a paragraph to evaluate the positive features of free-range pork production compared with conventional or intensive farming.
2. Justify why the consumption of sustainably produced beef should be encouraged.
3. Work in a small group to prepare a class discussion on the ethical issues in the sale of fresh milk in supermarkets. Consider the following points in preparing for the discussion:
   - Why would supermarkets promote the sale of cheap fresh milk?
   - What impact does this have on consumers?
   - What is the impact of cheap milk prices on dairy farmers and milk processors?

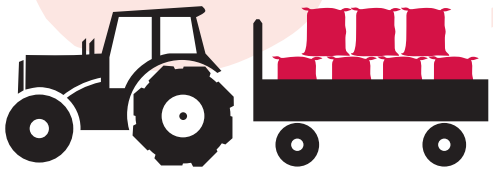
USE OF CHEMICALS IN PRIMARY PRODUCTION

IMPACT OF CHEMICAL CROP SPRAYING ON THE ENVIRONMENT

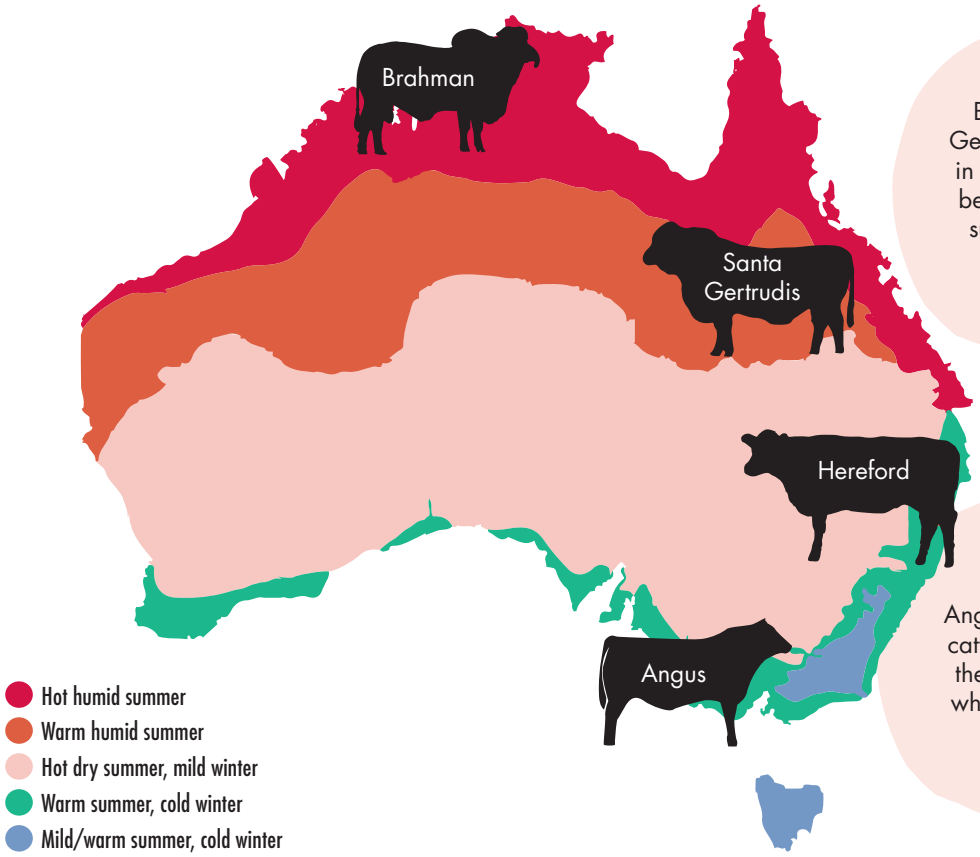
- Soil acidification
- Contamination of waterways and groundwater
- Detrimental effect on biodiversity



5.25 MILLION
tonnes of fertiliser product is used annually by Australian farmers.



AUSTRALIAN CATTLE GRAZING



Brahman and Santa Gertrudis cattle are bred in the north of Australia because they are more suited to the dry arid conditions there.

Angus and Hereford cattle are grazed in the southern states where pastures are richer.

USE OF WATER IN PRIMARY FOOD PRODUCTION

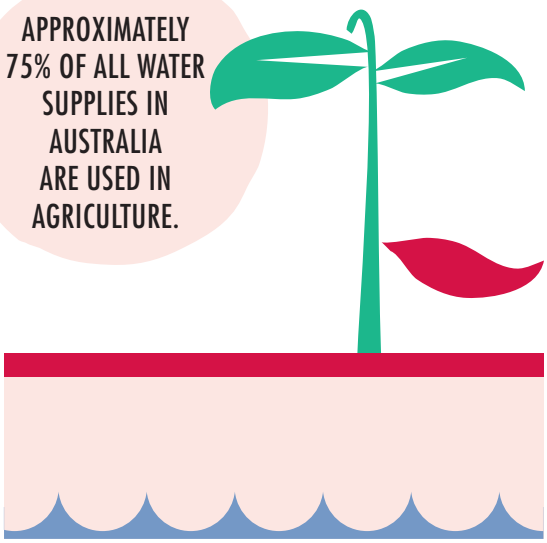
- Irrigation of crops and pasture
- Water for animals
- Domestic water supply for farmers

The water farmers use comes from a range of sources including irrigation, groundwater supplies, river systems, dams or tanks on farms or recycled water.

RISKS OF CLIMATE CHANGE ON PRIMARY PRODUCTION

- Lower rainfall – increased acidification of soil, increase in salinity
- Reduction in groundwater stores – soil erosion

APPROXIMATELY 75% OF ALL WATER SUPPLIES IN AUSTRALIA ARE USED IN AGRICULTURE.



12 FOOD PRODUCTION AND THE ENVIRONMENT

KEY TERMS

Biodegradable describes a substance originally made from plant and animal matter that can be broken down.

Biosecurity is the protection of people, animals and the environment from infectious diseases, pests and other biological threats.

Fertilisers are widely used in agriculture to improve crop yields.

Climate change is a change in the pattern of weather, and related changes in oceans, land surfaces and ice sheets, occurring over decades or longer.

Herbicides are chemicals sprayed onto paddocks to kill weeds that compete for nutrients in the soil needed by food crops such as wheat, oats, rice and barley.

Pesticides are chemicals that are sprayed onto crops to control particular pests such as grasshoppers so that they do not destroy the crop.

Salinity occurs if groundwater rises and reaches the surface and salt emerges through the topsoil.

Soil acidification occurs when plants take up nutrients and release acidic waste from their roots.

Farming practices and sustainability

One of the most critical issues facing Australia today, like all other countries in the world, is to ensure the sustainability of food production systems. It is now widely recognised that there is a strong link between food production systems and the environment. Unfortunately, some of the agricultural practices that have been in place in Australia for the past 200 years have had a detrimental impact on the environmental sustainability of our primary food production systems.

It is a stark reality that, today, over half of the land area in Australia is affected by increasing salinity, soil acidification and soil erosion as a result of farming practices such as the misuse of chemicals and the poor management of irrigation systems.

In the past, Australian farmers would follow a traditional system of preparing the land for planting their next crop. They would plough and fallow their land, or leave the land without planting seed, fertilise the ground and wait for rain or flood to irrigate the paddocks. They simply followed these farming techniques that had been handed down from previous generations and had little access to any scientific evidence.

Today, agricultural production is as much a science as it is a business. Agricultural scientists, or agronomists, work closely with farmers to ensure that all aspects of their agricultural production are considered in a holistic way. Agronomists assist farmers to develop a profile of their soil and to understand the types of fertilisers that will be most beneficial to improving their crop or pasture production. Agronomists also provide farmers with advice on the best methods to control weeds, pests and crop disease while also considering how to conserve and protect the sustainability of the environment.

USE OF CHEMICALS IN PRIMARY FOOD PRODUCTION

Australia is one of the oldest continents and, as a result, has some of the oldest soils on the planet that are nutrient poor and extremely shallow. Unlike soils in other parts of the world, Australian soils replenish themselves very slowly and in many areas are considered non-renewable. To overcome the problem of soil infertility, Australian farmers depend on a range of fertilisers to replenish the nutrients lost from the soil.

However, soil fertility is not the only problem that Australian farmers face. When crops or orchard fruits are growing, farmers need to keep the environment free from weeds, pests and diseases that may spoil the crop or reduce their yield. Sometimes, strategies such as crop rotation, cultivation, using clean seed and healthy plants are not enough to produce high-quality food crops, and so farmers use chemicals to improve their yield.

These chemicals fall into three groups: fertilisers, herbicides and pesticides.

Fertilisers, especially those that are nitrogen-based, are widely used in agriculture to improve crop yields. Most food crops are grown on an intensive farming system where new crops are planted in the same paddock each season. This farming practice does not allow the soil to replenish the nutrients they lose naturally as the crops or pastures grow. One way in which the fertility of farming soils is maintained is by the use of artificial fertilisers. Most inorganic fertilisers contain a range of chemicals such as nitrogen to promote leaf growth, phosphorus to help the roots, flowers and seeds of plants to develop, and potassium to promote the strong growth of stems and to help water move throughout the developing plant.

Herbicides are chemicals sprayed onto paddocks to kill weeds that compete for nutrients in the soil needed by food crops such as wheat, oats, rice and barley. In Australia, glyphosate is the herbicide most widely used to kill broadleaf weeds and grasses that compete with food crops. Another herbicide that is widely used in Australia is 2,4-D to control broadleaf weeds in cereal crops, potato crops and orchards.

Herbicides are **biodegradable**, which means they begin to break down soon after spraying. All legal herbicides go through a rigorous testing program to ensure no harmful chemical residues remain when food is harvested. However, there is a concern that some commonly used herbicides imported into Australia from overseas may contain dioxin, a chemical that is highly toxic to humans.

Pesticides are chemicals that are sprayed on specific crops to control a particular pest such as grasshoppers so that they do not destroy the crop. Pesticides also help to produce food products that have fewer blemishes and are therefore more appealing to consumers. They have varying toxicity levels and must be used responsibly. In the Australian vegetable

industry there is a national registration system of pesticides that are effective, made and labelled correctly, and are safe for humans, animals and the environment when used as directed. Listed pesticides must not leave unacceptable pesticide residue in the vegetables or the soil.

Impact of agricultural chemicals

It is clear that the agricultural sector is a vital component of the Australian economy, and therefore it is essential that all farming and grazing practices ensure the environmental sustainability of our primary food production systems.

Given that Australian soils are low in natural fertility, the use of fertilisers is necessary to improve the nutrient profile of farming lands; it is estimated that Australian farmers use almost 5.25 million tonnes of fertiliser annually.

Fertilisers are used to fortify the soil with some of the essential nutrients in which it may be deficient. This allows farmers to produce high-yielding crops, especially grain foods and pasture crops. Crops have also been shown to grow faster when soils have been fortified with fertilisers. As the crops grow at a faster rate, they also cover the soil more quickly, thereby protecting the soil from direct exposure to rain and the loss of topsoil. The loss of topsoil can lead to soil erosion and make the land unproductive. Faster growing crops also shade out weeds more effectively and can minimise the amount of herbicides needed in agricultural production.

However, there are some significant disadvantages in using artificial fertilisers, herbicides and pesticides in agricultural production. Some of the key concerns in using chemicals in agricultural production are:

- Unless they are applied appropriately, they can lead to soil acidification.
- The use of artificial chemicals in agricultural production can contaminate waterways and groundwater supplies through nitrate run-off.
- They can have a detrimental impact on biodiversity.

Impact of chemical crop spraying on environmental sustainability

The method of application of herbicides and pesticides is of particular importance to the sustainability of the environment because they are sprayed onto crops and plants as they grow. The chemicals are often sprayed using large mobile equipment pulled by tractors or from specially equipped four-wheel motorbikes. However, aerial spraying is the most cost-effective way of covering many broadacre crops such as wheat.

Alamy Stock Photo/Bruce Miller

Spraying a vegetable crop

One of the major concerns in the use of artificial fertilisers, herbicides and pesticides is that the agricultural chemicals can drift onto non-targeted crops or land. This spray drift can affect the health of nearby crops, animals and the natural biodiversity of the area. Research has shown that agricultural spray vapour can drift off-target by up to 10 kilometres depending on the prevailing winds. There is also evidence that nitrogen is released into the atmosphere, a major air pollutant which contributes to acid rain.

Whether the agricultural chemicals are applied using aerial spraying or through land-based machinery, the chemicals can contaminate our water systems. Approximately half of the nitrate in these products is dissolved by rain. The dissolved nitrate runs off the paddocks and can contaminate rivers and groundwater, polluting freshwater systems used to provide water for their animals and adjacent waterways that may have sensitive ecosystems. The nitrate run-off can also contribute to the development of blue-green algae in rivers, streams and dams.

Newspix/Roy Van Der Vegt/News Ltd

Blue-green algae

An increasing number of farmers now use a range of strategies to ensure their use of agricultural chemicals has a minimal impact on the environment; for example:

- monitoring crops on a weekly basis either through a visual inspection or the use of drones to assess the insects present on the crops to determine whether spraying is required and, if so, which chemicals to use
- the introduction of precision technology such as the use of drones that can fly low to the ground and apply agricultural chemicals in a more targeted and environmentally sustainable manner
- the use of satellite tracking technology (GPS) by aerial spray contractors to determine their flight path and application area so the correct amount of chemicals is applied
- ensuring aerial spray contractors fly low to the ground to spray the crop accurately and prevent spray from drifting onto other paddocks
- only allowing aerial spraying to be done on days when there is little wind to prevent wind-drift.

iStock.com/JohnCarnemolla

Aerial spraying

Soil acidification

Soil acidification happens naturally as the soil is weathered over millions of years. Approximately 50 per cent of Australian agricultural land is considered to be acidic; that is, to have a pH of less than 5.5. However, the increased use of nitrogenous fertilisers over the past 50 years has increased the rate at which soil acidification occurs.

One of the main ways in which this form of land degradation occurs is when plants take up the nutrients in agricultural chemicals and release acid waste from their roots.

Nitrogen is necessary for nutrient balance in the soil and is needed to produce protein in cereal crops such as wheat. However, an excess of nitrogen can cause soil acidification. Many cereal farmers in particular have practised monoculture – the planting of the same crop – over many decades. This has left the soil depleted of the nutrients essential for the crop to grow, so the farmers have had to rely on artificial fertilisers to provide these nutrients if they are to grow productive crops. The problem, however, is that the main fertilisers used are high in nitrogen; if it is not used by the growing plants, it leaches nitrate into the soil, increasing the acidity level. Superphosphate, a fertiliser widely used in Australia, is not linked to soil acidification unlike other inorganic fertilisers.

The removal of the remainder of the harvested crop, such as the stalks and leaf matter from the paddock, can also contribute to soil acidification. These crops are naturally alkaline and their removal leaves the soil slightly more acidic.

Soil acidification can also be increased in areas of high rainfall or where irrigation is used, as the level of nitrate leaching, and therefore soil acidification, is increased. Soil acidification can damage the water holding capacity of soil and it is associated with increasing soil erosion.

Once soil becomes acidic, the fertility of the land decreases and plants cannot thrive because their root growth is stunted. This reduces the productivity of the land and the type of crops that can be grown in the acidic soil.

Contamination of groundwater supplies

According to the Australian Government National Water Commission, groundwater is 'surface water that has migrated from the surface through the ground and becomes stored in porous soils and rocks'.

Groundwater is a valuable resource that is used as the main source of water for many farmers and pastoralists, particularly in many remote regions in Australia. Farmers and pastoralists access the groundwater by using water bores that bring the groundwater to the surface. Therefore, the contamination of groundwater supplies by chemical fertilisers and pesticides is a major issue for environmental sustainability.

When nitrogen-based fertilisers are used on crops and pastures, they break down into water-soluble nitrates. As they are water soluble, these nitrates are absorbed into the soil very easily where they can accumulate before being leached into groundwater aquifers. In the Lower Burdekin floodplains of North Queensland, groundwater bore samples detected pesticide contamination in 38 per cent of the samples taken.

The contamination of groundwater supplies can impact on the quality of drinking water for people living in country regions. Farmers or pastoralists also use groundwater to supply water for their crops or stock.

If the groundwater stocks are contaminated, the health of their crops and stock can be put at risk.

In addition, many ecosystems are completely dependent on groundwater supplies for their survival. These ecosystems include wetlands, coastal mangroves, and animals and birds that rely on fresh drinking water for their survival.

amanaimages/John Camenolla/Corbis

A water bore bringing groundwater to the surface

Herbicide resistance

Over the past 20 years, some weeds have developed a resistance to the herbicides developed to control them. One of the problems with herbicide resistance is that if a weed becomes resistant to one herbicide it can go on to develop a resistance to other herbicides that are designed to work in a similar way. This becomes a major problem for farmers if weeds develop a 'multi-herbicide resistance'; that is, they become resistant to more than one group of herbicides.

Case study

The impact of fertiliser run-off on the Great Barrier Reef

The wet tropical coast of northern Queensland is home to most of Australia's sugar and banana industry. Approximately 90 per cent of all bananas produced in Australia are grown in northern Queensland. Banana plantations use large amounts of irrigated water and therefore many of these plantations are located along the northern Queensland river systems. These rivers run into the coastline adjacent to the Great Barrier Reef. As well as having access to a good water supply, growing healthy bananas also requires the heavy application of fertilisers, including nitrogen, phosphorus and potassium.

However, recent evidence clearly demonstrates that fertiliser run-off from banana plantations is entering the river systems in northern Queensland and polluting the waters of the Great Barrier Reef. This pollution of the ocean waters by chemical fertilisers provides a perfect breeding ground for the crown-of-thorns starfish that are contributing to the destruction of the Great Barrier Reef.

Age Fotostock/Spacephotos

A plume of costal sediment carrying chemical fertilisers out to sea near the Great Barrier Reef

Understanding the text

1 Outline three ways in which agricultural scientists assist farmers in developing sustainable farming systems.

2 Explain why the use of fertilisers is important in primary production of food.

3 What is the difference between herbicides and pesticides?

4 Prepare a PMI (plus, minus, interesting) chart on the role of agricultural chemicals on environmental sustainability.

THE ROLE OF AGRICULTURAL CHEMICALS ON ENVIRONMENTAL SUSTAINABILITY

Plus	Minus	Interesting

5 Explain how spraying chemicals on farmland can impact on the health of nearby waterways.

6 Describe three ways in which sprays used in food production can be applied so they have a minimal impact on the environment.

7 Outline two key ways in which soil acidification can occur.

8 Explain how the use of chemicals in agriculture can contaminate groundwater supplies.

9 Why is the contamination of groundwater supplies an important issue for Australian farmers?

10 Why is herbicide resistance becoming a problem for Australian farmers?

USE OF WATER IN PRIMARY FOOD PRODUCTION

Australia is the driest inhabited continent in the world – two-thirds of the continent is classified as either arid or semi-arid, with an annual rainfall of less than 500 millimetres.

Fresh water is vital for agriculture. Farmers use water in their orchards, vineyards, vegetable market gardens, in the production of rice and to produce pasture for dairy cows and sheep or for drinking water for their animals. In Australia, approximately 75 per cent of all water supplies are used in agriculture. The water farmers use comes from a range of sources including irrigation, groundwater supplies, rivers systems, dams or tanks on their farm or they use recycled water.

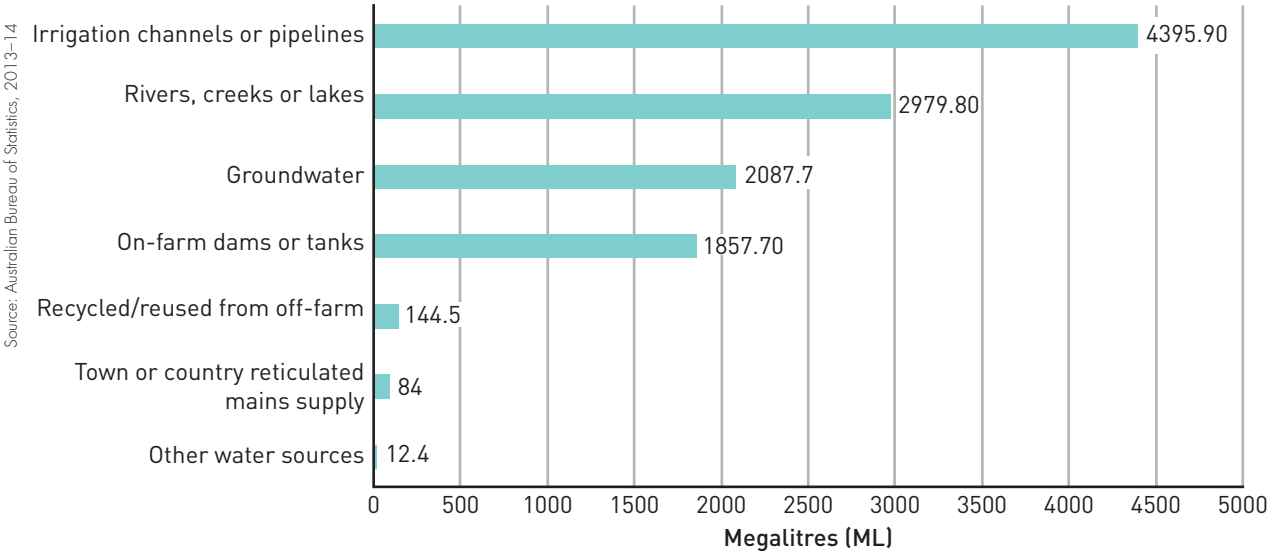
Irrigation in Australian primary food production

Australia has the highest per capita water storage systems in the world, built following World War II in an attempt to ensure a reliable water supply for domestic consumption and also for irrigation.

To support the irrigation systems, the natural landscape is changed, dams and channels are built and paddocks are levelled to move water from natural waterways to agricultural production areas. Unfortunately, some irrigation systems have not been adequately maintained and a large percentage of the water harvested for irrigation is lost through seepage and evaporation. Pollution and salinity problems, as a result of poor management of our rivers and an increasingly dry climate, threaten hundreds of millions of dollars in agricultural production.

The production of rice and cotton crops has the greatest environmental impact. The high levels of irrigation required to grow these crops has led to rising water tables, salinity, the washing of herbicides and pesticides into the water courses downstream, and the potential for nitrates to leach into groundwater and cause contamination.

Many of the problems associated with the use of traditional open channel irrigation have been recognised and, in 2006, work began on building the Wimmera Mallee Pipeline. The Wimmera Mallee region of Western Victoria is recognised as one of the driest areas in the state. Natural rainfall is often insufficient to provide adequate water for the farming properties in the region. Before building the Wimmera Mallee Pipeline, farming communities



Sources of agricultural water in Australia 2013–14

Irrigation areas of the Murray–Darling Basin

in the region relied on 17 500 kilometres of earthen open channel to deliver their water. However, over 85 per cent of all available water was lost through seepage from the channels and evaporation. The aim of the Wimmera Mallee Pipeline was to bring water from the Grampian Mountains storages to farming properties in the western region of Victoria, providing them with a secure, high-quality water supply. The project, funded by the Australian and Victorian governments, replaced the open channel system with approximately 9000 kilometres of pressurised pipeline. Significant water savings from the project have also been used to support environmental projects such as the development of wetland areas and to relieve stressed rivers in the region. Work on the pipeline was completed in 2010.

Salinity

Salinity in Australia has recently been described as a national crisis. Salinity occurs if groundwater rises

Alamy Stock Photo/redbrickstock.com

Spray irrigation of lucerne pasture in Victoria

Newspix/Greg Scullin/News Ltd

Building the Wimmera Mallee pipeline

and reaches the surface and salt emerges through the topsoil. The quality of drinking water and farm productivity are threatened by salinity, as is the future existence of the Snowy, Murray and Darling river systems. Another key problem associated with salinity is that most plants associated with food production will not grow in salty soil.

There are two main causes of salinity: land clearing, called 'dryland salinity', and 'irrigation salinity', where excessive amounts of water are diverted for irrigation.

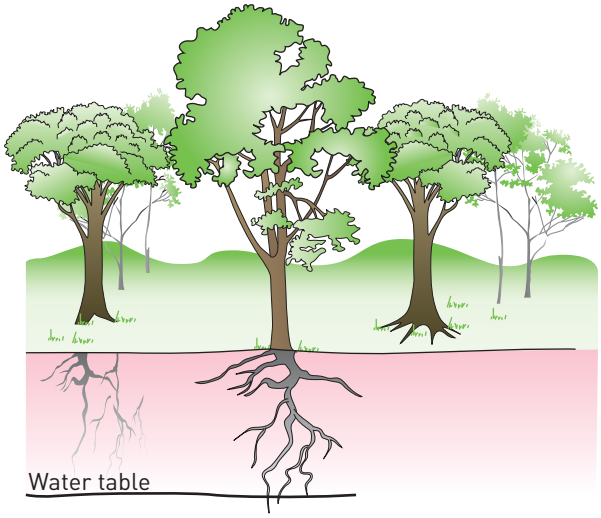
Dryland salinity is mainly caused by the clearing of native trees, shrubs and grasses to plant crops and pastures. Native vegetation is deep rooted and uses significant amounts of water from the water table to grow. By contrast, most introduced crops and pastures are shallow rooted and take less water from the groundwater system. As a result, the water table rises, bringing undissolved salts to the surface.

Irrigation salinity occurs if groundwater rises, generally when excess water is added to groundwater supplies, such as through irrigation. As the water table reaches the surface, waterlogging becomes apparent and water and salt emerge through the topsoil, forming salt crusts and killing vegetation and crops. This leads to further soil erosion and increased salinity in rivers and streams. In some areas of the Murray–Darling Basin, groundwater levels are rising at a rate of 20 centimetres a year as a direct result of irrigation making the soil unproductive and killing many of the orange orchards.

In areas where irrigation salinity occurs, saline groundwater is forced into local waterways, causing extensive damage to the environments and ecosystems along the river system. Recent studies have also shown that in excess of 2.5 tonnes of salt flow down the Murray River near the South Australian border every minute. It is estimated that 80 rural towns in the Murray–Darling Basin have been affected by salinity, with an estimated damage cost of hundreds of millions of dollars.

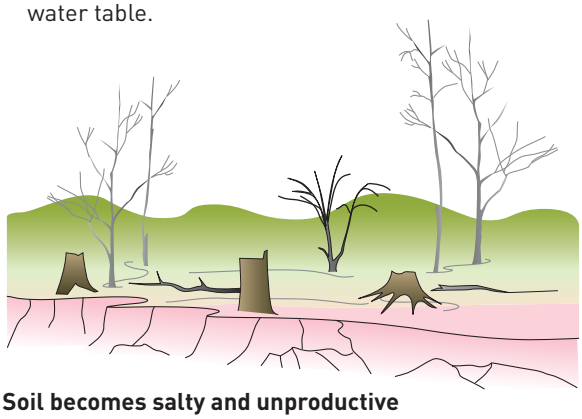
Strategies to ensure environmental sustainability in water used for primary food production

One of the major concerns about farming that uses irrigation water is that it reduces the productivity of the land, so that crop yields decrease. Preventing the creation of saline land will have a major influence on the long-term sustainability of food-production in Australia.



Natural landscape
- The water table is a layer of water within the soil and below the surface.
- Native trees and grasses have deep roots that go down into the water table.

Land prepared for farming
- Farmers clear the land of native trees and grasses to grow crops, so less water is taken from the water table.



Soil becomes salty and unproductive
- The water table rises and brings with it salt from the soil.
- The sun evaporates the water from the soil and the salt remains on the surface of the soil.

How dryland salinity occurs

Alamy Stock Photo/Excitations

The impact of salinity on agricultural land

Today, farmers work with government authorities and their local communities to develop plans to manage the water they use to produce food efficiently, as well as to minimise the impact of farming on the natural environment. Some of the strategies used to ensure effective water use are:

- monitoring water quality regularly to test for salinity
- using new technologies, such as GPS for laser levelling, to flood paddocks quickly
- using only just enough water for maximum growth and good health of the crop or pasture; for example, using drip-irrigation systems controlled and monitored by sophisticated computer systems to deliver only the water needed for optimal growth of the plants
- maintaining and repairing breaks in channels and banks to avoid water loss
- enclosing open-channel irrigation systems or using pipelines to prevent evaporation
- using irrigation layouts that reduce water use on a farm by not watering unnecessary areas
- capturing irrigation water in channels and dams and reusing it

Alamy Stock Photo/Tony Hertz

Using GPS for precision farming – laser levelling

- installing sensors to analyse the soil moisture and therefore determine the amount of water needed for the crop.

Science Photo Library/Mitch Kezar/AgStockUSA

Using sensors to analyse water requirements of the crop

Some examples of improvements in the management of water were demonstrated by recent developments in the rice and dairy industries. In Australia, rice can only be approved as a crop on heavy clay soils. This type of soil minimises any seepage of irrigation water into the water table. Containing the water on top of the clay layer of soil stops the water table from rising and reduces the threat of salinity. Having a clear understanding of the soil profile means that the farmer minimises the use of water required to grow rice. It also reduces the risk of salinity in rice-growing areas because the characteristics of the soil selected mean that

Getty Images/Claver Carroll

Irrigating a rice crop in New South Wales

water is less likely to leak into the groundwater and raise the water table. Using the appropriate soil for growing rice will lower the cost of water and make more water available for other uses.

In the Gippsland region of Victoria, experiments are underway to design systems that reuse effluent and drainage water from dairy sheds. Results indicate that a well-managed reuse system can make significant water and nutrient savings on dairy farms. The nutrients can be added to the irrigated water and used as fertiliser on the pasture instead of being washed away into natural water systems; and the water can be reused to grow pasture, rather than being lost in drainage.

Understanding the text

11 Based on the information in the graph on 'Sources of agricultural water in Australia in 2013–14', page 214, list the four most important sources of water in order of importance.

12 Draw a mind map to demonstrate some of the problems associated with traditional forms of irrigation.

13 Explain why the development of the Wimmera Mallee Pipeline has been such an important project for farmers in this region.

14 What is salinity and why is it a problem for primary producers?

15 Explain the main causes of dryland salinity.

16 Draw a flow chart to show how irrigation salinity occurs.

17 Outline how the use of irrigation has impacted on the river systems and groundwater supplies in the Murray–Darling Basin.

18 Describe four strategies that farmers who rely on irrigation could use to ensure a sustainable water supply.

19 Outline three benefits to rice farmers of the development of electromagnetic induction surveys.

20 Describe a strategy that Gippsland dairy farmers have developed to manage the use of water on their properties.

CHOICE OF CROPS AND ANIMALS

Australia is well recognised as producing some of the world's best wheat, beef and sheep. Now our milk is sought after in many Asian countries, where it is seen as being of high quality and produced using world's best practice. However, it is clearly evident that our climate is changing, with increased land temperatures and more variable rainfall in many of our traditional farming areas. As a consequence, primary producers are being forced to reconsider the types of crops and animals they use to ensure the sustainability of these important primary food products.

Sustainable crop production

While a wide variety of cereal crops are grown in Australia, the country is especially well known for producing high-quality wheat. Wheat is Australia's largest grain crop, though a wide range of other crops is also grown, including barley, sorghum, oats, rice and pulses such as lentils, lupins, fava beans and chickpeas. The grains grown in Australia are for both domestic and export markets, where they are used in the food processing industry to produce products for consumers and for livestock feed.

Making the decision about the types of crops to plant is complex and farmers must consider a number of competing factors. Soil health, water availability, production costs, risks to production such as pests and diseases, and the current market price are all factors the farmer will take into consideration.

Wheat production

Because Australian soils are fragile, during the past century, cereal producers have relied on high inputs of chemical fertilisers, particularly phosphorus and nitrogen, to increase crop yields. Traditionally, farmers cleared the land to grow their cereal crops and this, along with the high use of chemical fertilisers, has led to the development of dryland salinity and soil acidification. Another key problem facing wheat farmers is that wheat is a winter crop and grows best when the maximum air temperature does not exceed 23 °C. However, on five days in October 2015, the temperatures rose above 30 °C. These days of above average temperature coincided with a critical period for grain formation and devastated the wheat crops. Associated with this, wheat is grown as a dryland broadacre crop that is reliant on natural rainfall to grow rather than irrigation. Early rain is needed in autumn to sow the crop and then follow-up rain during spring is also necessary for the grain to develop and form the head containing the wheat grains. However, as land temperatures rise and the frequency of drought increases as a result of climate change, many of the traditional wheat varieties are becoming less viable.

iStock.com/Orientaly

Harvesting wheat

Today, wheat farmers rely on the advice of agronomists and agricultural scientists to assist them in deciding on the most suitable varieties of wheat to grow on their farms. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has undertaken research to examine a range of data, including weather conditions, soil types and the geography of the land, to determine the most suitable varieties of wheat to grow in Australia's changing climate. Plant breeding and research into genetically modified organisms has enabled scientists to develop wheat breeds that are more drought, frost or salt tolerant. Some of the most interesting developments in wheat research are into varieties that are more water efficient and use less water as they grow. This reduces the amount of foliage that the plants produce and enables the soil to retain more water that can then be used by the plants as the wheat ears or grains begin to develop.

Activity 12.1

Choosing crops for sustainability

Prepare a PMI (plus, minus interesting) chart on the use of wheat as a sustainable food crop in Australia.

WHEAT AS A SUSTAINABLE FOOD CROP		
Plus	Minus	Interesting

Rice

Rice growing in Australia is very water dependent and rice growers rely on flood irrigation to supply the water necessary to grow their crop. Rice, which can only be grown on certain soil profiles, is grown in the summer months in Australia and rice growers use a system of crop rotation to plant wheat or pasture crops for animals at other times of the year. Most rice growers will plant one of these crops to use the water that is retained in the soil after the rice crop has been harvested.

While Australian rice growers use 50 per cent less water than the global average, the water for irrigation is dependent on the health of our river systems and the amount of water they hold. During periods of drought, less water is available for irrigation and so the amount of rice that can be grown decreases. Severe drought across much of Australia during the past century has meant that many rice farmers received only a small fraction of the water they would normally have been allocated for irrigation of their rice crops. As a result, many farmers in the Riverina were forced to cut their planting by between 30 and 50 per cent because of the limited availability

of irrigation water. Another impact of the drought conditions has been that many farmers have relied on using groundwater supplies, and after years of drought these precious supplies, which take a long time to replenish, have been severely diminished. Despite the progress many rice farmers have made in reducing the amount of water they use in producing a rice crop, the changing climate and unpredictable rainfall has put into question the sustainability of rice production in Australia.

Future crops

As drought and increasing land temperatures affect the viability of many of the crops that have traditionally been grown, agricultural scientists are trying to identify crops that will be successful in a hotter and drier Australia. The Future Farm Industries Cooperative Research Centre (CRC) has been working on identifying native plants that could increase the sustainability of sheep and beef production in Australia. The introduction of native plants such as **saltbush** and some acacias and native grasses to the diet of these animals has been shown to provide a more nutritionally balanced diet and to reduce the amount of methane (a greenhouse gas) that sheep and cattle produce. The development of these types of crops as a source of animal pasture will also improve the biodiversity and sustainability of the ecosystem.

Alamy Stock Photo/Pete Titmuss

Cattle grazing on saltbush

Research has also shown that other perennial legume pastures such as **tedera** are likely to be a useful pasture crop in the future. Tedera is native to the Canary Islands where it grows in the hot, desert-like climate. A current research project shows that tedera is very drought tolerant and is likely to be a useful animal fodder crop as the climate becomes hotter and drier.

Messina is another pasture legume that research has shown to be tolerant to both saline soils and to those that are waterlogged, and may therefore provide a more sustainable crop in the future. Another advantage of messina is that, as it is a legume crop, it will be useful in improving nitrogen levels in these types of degraded soils.

Dr Daniel Real, Department of Agriculture and Food Western Australia

Sheep grazing on tedera

Other enterprising farmers are exploring the way some of Australia's indigenous plants such as samphire, karkalla, sea parsley and warrigal greens can be developed as sustainable food crops. Many of these plants are salt tolerant, and trial crops are being developed to explore their use in some of the country's salt-degraded agricultural land. They are also proving to be useful as a feedstock for cattle, adding to their value as a sustainable food crop.

amanaimages/Paul Tomlins/flowerphotos.com/Corbis

Samphire – a salt-tolerant indigenous food crop

Sustainable animal production

Australia produces a wide range of animals that are used as meat for human consumption and for the production of milk and dairy products such as cheese, butter and yoghurt. Cattle, sheep, pigs, goats and poultry are the animals most widely farmed to meet the food needs of Australian consumers. Other native fauna such as kangaroo, crocodile and emu are also finding their way into our food markets and supermarkets and onto our dinner plates.

Cattle and sheep production has been the backbone of the Australian livestock industry since the arrival

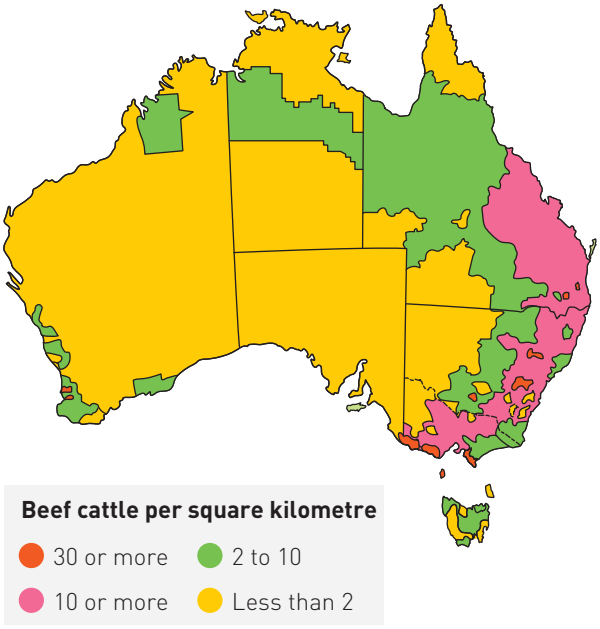
of the First Fleet. As well as providing meat, wool or dairy products for the Australian market, beef and sheep are now an important commodity in the export market and add considerable value to the Australian economy.

All producers of animal products in Australia select the type of animals and breeds they will use based on those that are most suited to the farming area and also the purpose of their production – meat, milk or fleece.

Australian livestock producers and their industry bodies are concerned about ensuring the environmental sustainability of the industry. A significant amount of research has been undertaken into reducing methane emissions, particularly in cattle, developing strategies to improve water use and maintain the health of soils. Livestock producers also monitor the density and frequency of grazing livestock on their property; that is, how many cattle they can run in a particular paddock and how long they leave the paddock free from grazing animals so that the pasture can regenerate. Using strategies such as these, livestock producers are endeavouring to manage the environment in a more sustainable manner.

Cattle production in Australia

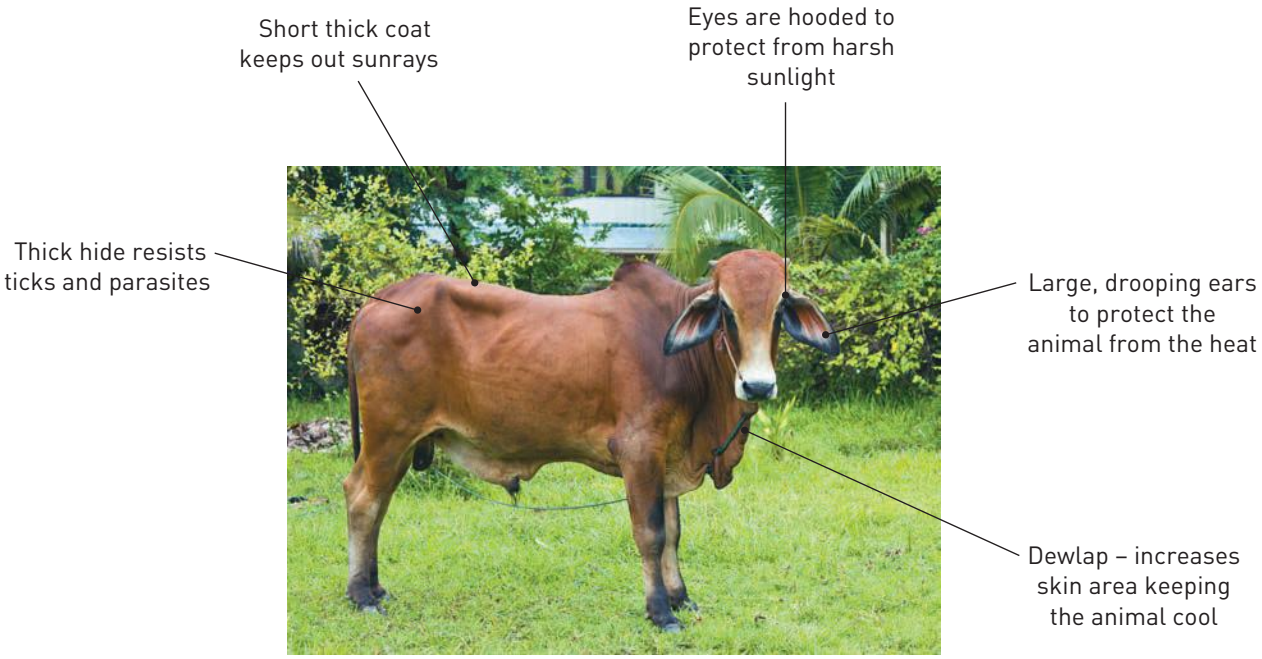
Cattle production in Australia falls into two key categories: those used for the production of meat for Australian consumers and for export, and the production of dairy cattle for liquid milk and dairy products.



The density of beef-producing regions in Australia

Source: Australian Bureau of Statistics, 2001

Beef cattle production in Australia takes place in two key zones, the north and the southern states. Cattle produced in the north, including Northern Territory, Queensland and the northern part of Western Australia, typically forage for food on the native pastures of large outback properties. Stock densities in these arid areas is generally low due to a harsher climate and limited access to pasture and water. The breeds most commonly kept in these



Characteristics of Brahman cattle

regions, such as Brahman and the Santa Gertrudis, are selected because they are hardy and are able to survive the high temperatures and harsh, humid conditions of northern Australia.

Brahman cattle are particularly well suited to the hot, dry climate of northern Australia. They are heat tolerant, and their short, thick, dark coat helps to keep out much of the intense rays of the sun. Their thick hide also makes them resistant to ticks and other parasites, so they are less likely to succumb to parasitic diseases. Their dewlap, or the loose folds of skin around their neck, helps them to keep cool by increasing the surface area of the body exposed to cooling. They have very large, drooping ears and their eyes are shielded to protect against the harsh sunlight and high temperatures.

Brahman and Santa Gertrudis cattle meat is generally of lower quality than that produced by cattle in the southern states. Much of the meat produced in northern Australia is exported to the Asian market, including Indonesia, to supplement their local meat supply. Some of the cattle may be sent to the southern states for fattening on grain before they are slaughtered and used as export for 'hamburger' meat.

iStock.com/John Kirk

Brahman cattle grazing in northern Australia

By contrast, beef produced in the southern states is of higher quality because the animals have access to better quality pasture. Stocking densities are also higher than in the northern areas of the continent. Aberdeen Angus, Hereford and Charolais are among the breeds most widely used by beef producers in the southern states.

Dairy farmers also base their decision about the choice of animals on the local farming conditions and the breeds that are likely to give them the greatest milk production. Dairy cattle usually graze on irrigated pasture all year round. Holstein cows are the most popular dairy cows used in Australia because they produce large volumes of milk suitable for the liquid milk market. The milk from Jersey cows, though, is often used to produce butter because it has a high fat content and is very creamy.

iStock.com/sarah1810

Hereford cattle grazing in Victoria

One of the greatest challenges for beef and dairy cattle producers is that the animals are great emitters of methane, a greenhouse gas. Evidence from the UN Food and Agriculture Organization shows that there is a strong link between the production of meat for human consumption and the amount of greenhouse gas in the atmosphere. However, the cattle industry, through the National Livestock Methane Program, is exploring ways of reducing this impact by developing feeds that are easier for the cattle to digest. Research is also taking place into the use of genetic profiling to identify those breeds that emit lower amounts of methane, carbon dioxide and nitrous oxide.

Dorper sheep

Just as Australia is recognised for producing high-quality wheat, we have a strong reputation for being one of the world's leading producers of high-quality fine wool. Merino sheep have been the backbone of the Australian wool industry, while 'fat lambs' for the lamb meat market have traditionally been produced from British sheep breeds such as Border Leicester sheep. However, high labour costs, a fluctuating market and the impact of a changing climate have caused a decline in the Australian sheep flock.

In 1996, the first Dorper sheep were imported into Australia from South Africa where it has been bred for its lamb meat. The Dorper sheep is a white sheep with a black head, while the White Dorper is an all-white breed. They are low-maintenance sheep because they shed their fleece, so do not require shearing or crutching, the removal of wool around the tail area of the sheep to prevent fly strike.

Dorper sheep are recognised as being a hardy breed that is able to adapt to a range of climates. They have shown they can thrive in the harsh terrain in some of the arid and semi-arid regions of Australia where there is very low rainfall. The breed is also adaptable and can also be successfully raised in semi-tropical regions. They are now one of the fastest growing sheep breeds in Australia and are rapidly spreading across the country as part of both conventional and organic farming systems.

Dorpers are considered to be a very sustainable breed of sheep because they graze on a wide variety of pasture including saltbush, which is commonly found in many arid areas. Most arid land is not suitable for conventional crop farming so grazing sheep on the saltbush in what is considered to be 'marginal' land, provides farmers with a valuable source of income.

The Mallee has very low rainfall and is often subjected to drought. Dorper sheep have enabled Mallee farmers to develop a sustainable business by providing diversification, especially in drought years. Dorper sheep grazing on saltbush are now a common sight in the Mallee.

One of the key benefits of Dorper sheep is that they gain weight rapidly and can be produced for both the conventional and the organic market. The meat that is produced from lambs that graze on saltbush is very tender, lean meat and is considered to be very flavoursome. Dorper saltbush lamb is now highly prized by consumers and is more readily available through farmers' markets across the country.

Alamy Stock Photo/Agencja Fotograficzna Caro

Dorper sheep

Goat production and sustainability

Goats are a feral pest in outback Australia where over 2 million of them range throughout central and northern Australia. However, livestock producers are now considering goats as a sustainable source of meat and milk. Rangeland goats are becoming an animal of choice for livestock producers in Central Australia where they have replaced sheep in many areas. Goats are able to tolerate very hot, dry conditions and adapt well to drought conditions that are too harsh for sheep. They are scavengers that graze on a wide range of plants, including pests or noxious weeds.

Goat-proof fences are an essential feature to ensure the animals do not escape and degrade the surrounding natural environment. Goat meat too has the potential to be a valuable export commodity, with markets opening up in China , India and North America.

Understanding the text

21 Draw up a diagram like the one below to demonstrate the types of crops most widely grown in Australia and the factors farmers must consider when deciding which crops to plant.

TYPE OF CROPS	FACTORS TO CONSIDER

22 List four key problems facing wheat farmers in Australia today.

23 Outline two developments in wheat breeding that will assist wheat farmers in the future.

24 Explain why rice must be grown in clay-based soils in Australia.

25 Outline the advantages that the introduction of future crops, such as saltbush, tedera and messina, will have for the sustainability of Australia's food supply.

26 Outline three strategies Australian livestock producers are using to ensure the environmental sustainability of their industry.

27 Draw a mind map to demonstrate the features of the climate and animals used in the northern Australian cattle industry.

28 Explain why the production of dairy cattle has a major impact on environmental sustainability. How is the dairy industry addressing this problem?

29 Make a list of the key advantages of using Dorper sheep for the production of sheep meat in Australia.

30 Why are goats becoming a more popular animal for many livestock farmers?

Biosecurity, climate change and loss of biodiversity as risks to sustainability

The environmental sustainability of the Australian food supply rests not only on improving agricultural practices such as the use of water or chemicals, but also ensuring that strategies to address other risk factors such as biosecurity, climate change and a loss of biodiversity are developed and implemented.

WHAT IS BIOSECURITY?

Biosecurity is the protection of people, animals and the environment from infectious disease, pests and other biological threats. Rabbits, now recognised as one of Australia's most invasive pest animals, arrived with the First Fleet and were originally intended as a source of food for the new colonists. However, their release into the Australian countryside caused their population to explode because they have no local natural predators. Similarly, the introduction of the cane toad to control cane beetles in the Queensland sugar cane industry in 1935 has led to widespread destruction of much of Australia's small indigenous animal species. Having learnt from these lessons of the past, Australia now has a much more rigorous approach to biosecurity.

Weblink

The primary responsibility for managing Australia's biosecurity system lies with the federal Department of Agriculture and Water Resources. As an island nation, Australia has been one of the few countries in the world to remain free from some of the most severe pests and diseases that can affect our agricultural and pastoral industries. As part of the immigration information collected, travellers entering Australia from overseas are required to state whether they have been in contact with farms or farm animals in the previous 30 days. However, with the increased ease of travel and international trade our ability to remain free from these risks is becoming more challenging.

One of the key responsibilities of the Department of Agriculture and Water Resources is to ensure any risks to Australia's biosecurity are minimised before goods arrive in the country and inspect goods as they arrive at our airports, seaports or through our mail centres. Staff use trained detector dogs, X-ray machines and surveillance strategies to detect and prevent any exotic pests and diseases from entering the country.

Department of Agriculture and Water Resources

Biosecurity detector dog

Biosecurity and imported pests and diseases

Australia is relatively free from a range of pests and diseases that threaten the sustainability of primary food production in many other countries; for example, foot-and-mouth disease, fire blight and many exotic pests and diseases that reduce the viability of cereal crops.

However, in 1997 the biosecurity of the Australian banana industry was breached when Panama disease was first detected in Cavendish banana plantations in the Northern Territory. Panama disease is a destructive disease that is spread through soil and water and can survive for up to 40 years in fungal spores in the soil. In 2015, an outbreak of Panama disease was detected in one plantation in Tully in northern Queensland. This most recent outbreak is of great concern to biosecurity specialists who aim to minimise the impact of this disease on the banana industry and on the sustainability of banana production in the future.

Threat of foot-and-mouth disease to Australian livestock

Foot-and-mouth disease (FMD) is one of the greatest threats to the Australian livestock industry. At present, Australia is free of this highly contagious disease that has been found in many countries, especially in Asia, the Middle East, South America and Africa. Foot-and-mouth disease is a viral infection that affects animals with cloven hoofs, including cattle, sheep, pigs, goats, deer, buffalo and camels. The disease spreads rapidly, especially

when animals are housed closely together or when they are moved between properties or countries. The impact on the health of the animal is severe. Affected animals develop huge blisters in between their toes and on their heels, which can develop into painful ulcers leaving them unable to walk to find water or food. Blisters on their lips and in their mouth also mean they are unable to eat or drink and so young animals can die. The effect of the disease on farmers can be devastating. An outbreak of foot-and-mouth disease in the United Kingdom in 2001 was eventually contained after approximately 10 million pigs, sheep and cattle were destroyed.

Any outbreak of foot-and-mouth disease could have a dramatic impact on the sustainability of Australia's livestock industry and therefore on our primary food production. In September 2015, the Department of Agriculture and Water Resources estimated the costs involved in destroying infected animals and the loss of production of an outbreak of food-and-mouth disease, stating that 'a small foot-and-mouth disease outbreak, controlled in three months, could cost around $7.1 billion, while a large 12-month outbreak would cost $16 billion'.

Fire blight in the apple and pear industry

The Australian apple and pear industry also faces a biosecurity risk to its future sustainability. While apples and pears are two of Australian consumers' favourite fruits, our access to locally grown fruit could be at risk if fire blight breaches our biosecurity system. Fire blight originated in the United States and has been detected in New Zealand, the United Kingdom, Europe and the Middle East. Fire blight is not present in Australia, but the challenge for biosecurity authorities is to ensure that it does not find its way into the country.

Fire blight is a bacterial disease that can destroy apple and pear orchards within one growing season if they become infected. Fire blight gets its name from the effect it has on the blossom, shoots, fruit, branches and limbs of the affected fruit trees that can appear to be blackened as though they have been scorched by fire. Fire blight eventually kills the fruit trees and therefore has a devastating effect on apple and pear production, threatening the livelihood of fruit growers and robbing consumers of locally grown fruit.

The apple and pear industry has a value of approximately $500 million to the Australian economy. Victoria produces approximately 46 per cent of Australia's apples and 84 per cent of pears. According to the Plant Biosecurity Cooperative Research Centre, a fire blight outbreak in Australia could cost the apple and pear industry approximately $830 million over a 5-year period. This includes the cost of destroying the infected fruit orchards as well as the loss of income for the fruit growers. Approximately 80 per cent of the Victorian pear-growing region alone could be destroyed by the introduction of fire blight. As the domestic market consumes almost 95 per cent of all apples and pears produced in Australia, any infection by fire blight could severely affect the sustainability of the industry.

Shutterstock.com/Grandpa

Fire blight in an apple tree

Activity 12.2

Australian apple growers warn of biosecurity threats from more New Zealand imports

Read the article that follows, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. Explain why New Zealand apple growers are keen to access the Australian market.
3. Outline the risks to Victorian apple growers of allowing New Zealand apples to be imported into Australia.
4. Write a short paragraph to outline the consequences to the sustainability of the Australian apple and pear industry if it was infected with fire blight.

AUSTRALIAN APPLE GROWERS WARN OF BIOSECURITY THREATS FROM MORE NEW ZEALAND IMPORTS

There is strong lobbying in New Zealand to change export protocols to make it cheaper to export apples to Australia.

New Zealand growers say they will do better on biosecurity and are eyeing off a bigger part of the Australian shopping basket.

But the Kiwis will have to convince Australian shoppers and growers to accept apple imports.

Kevin Sanders, an apple grower in the Yarra Valley in Victoria, says there are a number of risks with weaker protocols.

'The last thing we want in Australia is another disease and in particular fire blight,' he said.

'They have a number of diseases over there that are quarantine issues for us.'

Mr Sanders says it was inevitable that New Zealand would look to send more fruit across the Tasman.

'I think that we've all known that they were going to come.

'It only took some relaxation in the Import Risk Analysis (IRA) conditions then they would ship fruit.'

Australia only imports a fraction of the New Zealand apples exported each year.

But Chief Executive of Pipfruit New Zealand, Alan Pollard, believes there is great value in the Australian market.

Mr Pollard released this comment in a statement.

'Australia is not a commercially attractive market at the moment but that will likely change in the future and we still expect it to become a significant export destination,' he said.

'In the meantime demand for our high-quality fruit has been strong in all other markets with one consequence being limited availability for Australia.'

Mr Sanders says New Zealand growers will be looking at different markets to maximise value out of the apple cart.

'Over the last few years they haven't had the opportunity for better prices elsewhere and that's particularly the reason they haven't been sent here.'

The major concern for Australian growers is not the impact imported apples will have on prices but the biosecurity threat posed by New Zealand apples.

Mr Sanders says New Zealand's exporting history is a significant concern.

'The first time they attempted to ship in larger volumes they failed the protocol on a number of occasions; in fact they failed it miserably,' he said.

'There would be an enormous risk, and that was basically what the inspectors found in their boxes.

'They found leafy material and wooden parts of the plant; clearly they were never allowed to ship those along with the apples.'

In an interview with Radio New Zealand, Mr Pollard said he doesn't expect the strong export protocols to remain in place for long.

'So, exporters who have proved they have no risk with their fruit will go straight back to what was originally agreed with Australia, which was a much lower inspection regime.'

Australian apple growers warn of biosecurity threats from more New Zealand imports, by James Jooste, © ABC, http://www.abc.net.au 14 August 2014.

Threats to Australia's cereal production

Cereal farmers also face many risks to the sustainability of some of our most widely grown crops including wheat, barley and triticale. It is estimated that approximately 80 per cent of Australia's barley varieties could be at risk if it was infected with barley stripe rust. Similarly, Australian wheat varieties are at risk of severe damage from a variety of 'wheat rust' prevalent in Uganda or from Russian wheat aphid. Soybeans, a crop widely grown in Australia, could be severely affected by soybean cyst nematode, which affects the roots and stunts the growth of soybean plants.

Biosecurity on Australian farms

Biosecurity is a major threat to the Australian agricultural and pastoral industries. Pests and diseases can be spread unintentionally between farms through contaminated soil or plant material. Friends, family, neighbours or other farm workers or contractors can carry traces of contaminated soil or plant seeds on their boots and clothing when they call to visit or to undertake farm maintenance. Contaminated organic material can also be carried on vehicles or farm equipment when people move between farms or between farming regions.

Therefore, preventing the entry and spread of pests and diseases through on-farm biosecurity is the best approach for farmers.

Farmers can develop a range of biosecurity protocols to minimise the opportunity for pests and disease entering their property, for example:

- Place signs at the entrance to the property to raise the awareness of visitors to on-farm biosecurity.

- Request that visitors to the farm contact the owner or farm manager before entering the property.
- Use vehicles that are specifically dedicated for use on the property, for example quad bikes that are only used on the farm and not taken off the property.
- Develop strategies such as providing a dedicated area for vehicles and farm machinery to be washed before starting work on the property.

By developing biosecurity protocols, Australian farmers and livestock producers can minimise the possibility of introducing exotic pests or diseases onto their property and jeopardising the sustainability of their primary food production.

Alamy Stock Photo/Suzanne Long

Farm biosecurity notice

CLIMATE CHANGE

The Australian Academy of Science defines **climate change** as being 'a change in the pattern of weather, and related changes in oceans, land surfaces and ice sheets, occurring over time scales of decades or longer'.

It is widely recognised that Australia and Australian farmers in particular are very vulnerable to the changes in climate that will occur over the next century. We live on a continent that has a very variable climate and we are often exposed to extreme weather events such as cyclones, floods, droughts and bushfires.

Across the globe, both land and sea temperatures have risen significantly over the past century. Australia has been no exception, with evidence showing that the temperature of Australia's land mass and surrounding oceans has increased by approximately 1 °C during this time.

Climate scientists predict that climate change will have a significant impact on the Australian continent. They forecast that temperatures across the continent will increase and the southern states in particular will become far hotter. There is also evidence to suggest that we will experience altered rainfall patterns and the north of Australia will become wetter while southern states will become drier. The levels of carbon dioxide in the atmosphere will increase and this too will have an effect on our primary food production systems.

A report released in October 2015 by the Climate Council entitled *Feeding a hungry nation: climate change, food and farming in Australia* listed a number of key findings including:

- 'Climate change is making weather patterns more extreme and unpredictable, with serious consequences for Australia's agricultural production.
- More frequent and intense heatwaves and extreme weather events are already affecting food prices in Australia.
- Climate change is affecting the quality and seasonal availability of many foods in Australia.'

Effect of climate change on Australian agricultural and livestock production

As Australia's climate continues to change, the agricultural sector in Australia will suffer and this will impact on the sustainability of our agricultural, livestock and dairy industries.

One of the most significant impacts of climate change in Australia is that rainfall will diminish in many of our most important food-producing regions such as the Murray–Darling Basin and there will be less water available for irrigation. Irrigated beef, sheep and grain producers will be among the most affected and many, by necessity, will become more dependent on groundwater supplies. As more water is extracted from these supplies, they will be at risk of increased salinity, which will reduce the quality of the water and ultimately the health of crops and animals.

Another consequence of a lack of water is the risk of increased acidification of the soil. A major drought that hit Australia between 2002 and 2007 led to significantly reduced water levels in the Murray–Darling Basin and resulted in increased levels of soil acidity in the region.

The rate of land degradation and soil erosion is also likely to increase as the soil becomes drier and is able to hold less carbon. As the soil degrades, plant coverage reduces, exposing the soil to wind and water erosion.

As the temperature across the continent increases and rainfall decreases, the moisture in the soil will

iStock.com/susie_h_24

The impact of drought on farming land

decline, making it difficult for crops to grow. In 2015, Victorian wheat farmers faced a year of low rainfall, which caused their crops to fail. Unseasonably high temperatures in October reaching over 35 degrees combined with a lack of rain, scorched the crops, wiping out the harvest. In order to recoup some costs, wheat farmers stripped the paddocks early, making hay out of the failed crop. However, the financial impact on the farmers was enormous and they were expected to lose grain worth millions of dollars. Along with decreased yields, cereal producers will have to contend with new pests and diseases that could attack their crops. This may lead to an increased use of pesticides, which could impact on the environment.

A changing climate also means that some crops may no longer be viable or suited to some of the areas in which they have been traditionally grown. Berry crops that require cool climates in which to grow may be pushed further south to Victoria or Tasmania. Similarly, with a changing climate, stone fruits such as peaches that need a cold winter to grow successfully might only be viable in Tasmania. Vegetable crops are also likely to suffer from sunburn or pests such as powdery mildew as a result of extreme heat, forcing producers to move to areas where the climate is cooler. In Victoria, cropping has moved further southwards into areas that were once the domain of sheep and cattle graziers.

Aquaculture too is at risk from climate change. As sea temperatures rise, many fish species have been observed moving further southwards to cooler waters. In addition, the increasing acidification of our oceans, rising sea levels, increasing storm surges and the run-off from agricultural land into the oceans are having a detrimental impact on the sustainability of fish populations.

Newspix/John Andersen/News Ltd

A banana plantation destroyed by Cyclone Yasi

Effect of climate change on Australian food supplies

Extreme weather events are becoming more common and are affecting the sustainability of our food supply. Cyclone Yasi, which hit north-east Queensland in 2011, had a devastating effect on both the banana and sugar cane industries. Approximately 75 per cent of the banana crop was lost and the price of bananas skyrocketed from $2 per kilogram to $12, putting them beyond the budget of many Australian families. More than 20 per cent of the sugar crop was also lost, costing the industry more than $500 million in infrastructure and crop losses. Following Cyclone Yasi, world sugar prices hit record prices.

Scientists predict that climate change will mean that there is more carbon dioxide in the atmosphere. Increased carbon dioxide has been shown to reduce the protein content of many plants so this will have a significant impact, not only on the nutrient content of many of our cereal crops, but on their functional properties in food production. For example, reduced levels of protein in wheat will mean that less gluten will be developed in making bread dough, meaning that loaves will not have the same capacity to rise during the proving process.

Another impact of increasing temperatures will be on milk and meat production. Cattle are prone to heat stress and dairy cattle in particular have been shown to produce up to 25 per cent less milk during hot weather and up to 40 per cent less milk during a heatwave. This will have a flow-on effect for milk producers and may lead to reduced availability of milk supplies for consumers. Beef producers too are facing major problems as the climate changes. A lack of pasture, high temperatures and a lack of water all impact on the health of beef cattle. Beef and sheep producers are looking to develop breeds that are more heat tolerant, but the eating quality of meat produced from these breeds may be reduced and may therefore be less appealing to consumers. Some of these animals also have lower fertility rates than current breeds.

Poultry and pigs produced using intensive farming systems are more likely to suffer from heat stress. Pigs do not have sweat glands and so are at particular risk of heat stress, which will affect the quality of their meat. Similarly, the quality of the eggs and poultry meat will be reduced if hens are heat stressed.

The availability, quality and price of fresh food following a devastating cyclone or flood is a major concern. Most households shop for fresh fruit, vegetables, meat and milk on a regular basis and only keep enough of these items in their refrigerator or pantry for about three to five days. Fresh food markets and supermarkets also keep limited supplies of fresh food, operating on a 'just in time' basis. When a flood or cyclone hits one of Australia's main fresh food producing areas, such as our fruit growing or vegetable growing regions, these foods may be unavailable for several months or even years. Consumers are then reliant on imported fresh produce, with the concerns of quality, health, cost and safety of this imported produce.

Activity 12.3

What will climate change do to your loaf of bread?

Read the article on page 230, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. Explain the effect agricultural scientists say that elevated carbon dioxide levels will have on plants.
3. How will the research the AgFace scientists are undertaking be of benefit to grain breeders and cereal farmers in the future?
4. Outline how the levels of carbon dioxide in the atmosphere have changed since pre-industrial times and the projection for the future.
5. Using the information in this article and in this chapter, write a brief paragraph to explain the impact that a change in the protein content of cereals will have on consumers in the future.

WHAT CLIMATE CHANGE WILL DO TO YOUR LOAF OF BREAD

Simone Dalton

The loaf on the left was grown in high carbon dioxide conditions. The larger loaf on the right was made with wheat grown in today's conditions.

If the promise of higher temperatures, rising sea levels and more frequent natural disasters doesn't convince you of the urgent need for the world to act on climate change, maybe the picture above will.

This is what global warming will do to your loaf of bread.

On the right is a loaf made from grain grown in today's climate conditions. On the left is a loaf made from grain that sprouted in concentrations of carbon dioxide that are expected by mid-century if greenhouse gas emissions aren't reduced significantly.

So this is 2050 bread. It was baked at the Australian Grains Free Air CO_2 Enrichment facility (AgFace) in Victoria by a research group studying the effect elevated carbon dioxide will have on crops such as wheat, lentils, canola and field peas.

AgFace leader Glenn Fitzgerald said the effect of high carbon dioxide on grains is complex. On the one hand, it makes plants such as wheat and canola grow faster and produce greater yields but, on the other hand, they contain less protein. Elevated carbon dioxide also alters the ratio of different types of proteins in wheat, which, in the case of bread, affects the elasticity of dough and how well a loaf rises.

'We don't understand completely why that's the case,' said Dr Fitzgerald, a senior research scientist with the Department of Economic Development, Jobs, Transport and Resources.

The group is now conducting research to see whether it can reverse the protein decline through the selection of new varieties of wheat. Grain breeders might then be able to develop new wheat strains with traits that can overcome this problem.

'It can take 10 to 15 years for a new trait to be worked into a new variety [of grain] so if we're looking ahead at 35 years, that means we can do several generations of testing. It gives us lots of time,' Dr Fitzgerald said.

'There are positives, and we're trying to accentuate those,' he said.

For instance, yields increase by about 25 per cent, on average, under elevated carbon dioxide.

Since pre-industrial times, carbon dioxide has risen 110 parts per million to reach 400 ppm last year. It is expected to rise to 550 ppm by 2050.

At AgFace, experimental crops are grown in the open, surrounded by thin tubes that eject carbon dioxide into the air around the plants.

'We can do this under very natural conditions, as close as you can get to an environment that crops would see in a farmer's field in the future,' he said.

The project is a collaboration with the University of Melbourne and is funded by the Grains Research and Development Corporation.

What climate change will do to your loaf of bread, by Nicky Phillips, 22 June, 2015, *The Sydney Morning Herald*

LOSS OF BIODIVERSITY

Biodiversity – or biological diversity – is a term used to describe the vast array of living organisms that inhabit the planet and the interactions between them. Biodiversity includes not only all the different species of animals, plants, bacteria, virus and fungi that live on the earth but also their genetic make-up and entire ecosystems.

The importance of biodiversity to primary food production

Biodiversity is essential to sustain agricultural food production. The production of healthy crops and pastures relies on the billions of microbes present in the soil that help cycle nutrients and break down organic matter to ensure the soil is fertile and crops can grow. Other animals such as native frogs and bats live on insects and therefore help to reduce crop pests. Bees and birds are essential in pollinating many crops. More than 60 per cent of Australia's food crops, especially fruit trees including apples and avocado trees, and seed crops such as wheat and canola, rely on the wild bee population to fertilise the plants. Like bees, many bird species play a critical role in our agricultural production acting as pollinators and helping to minimise the destructive impact some insect pests can have on food crops.

Biodiversity is also important in ensuring the health of the water in all river systems, lakes, dams and groundwater that is used in the production of our food supply. Microbes such as algae, fungi, bacteria and plankton, as well as the plants, fish, water birds and frogs that live in and near waterways, maintain the health of the water systems used in agricultural production by controlling the nutrients in the water and filtering out pollutants.

Threats to biodiversity

One of the greatest threats to biodiversity has been the increase in human population growth. The increasing population and a growing demand for food have led to the development of more intensive food production systems. The move to large-scale production has resulted in increased land clearing of forests, wetlands and marginal land to make way for farming, and this has caused a significant loss of biodiversity. As habitats are lost or degraded, native fauna and flora cannot survive and this can result in the complete loss or extinction of some species.

Biodiversity has also been lost through the use of excessive quantities of herbicides and pesticides that have polluted waterways and caused a loss of ecosystems that thrive in the river and lake systems.

The introduction of species that are not native to the region can also have a devastating impact on biodiversity. Introduced or alien species such as rabbits, foxes, cane toads and the prickly pear have become invasive and crowded out or replaced native species, changing entire habitats and destroying native ecosytems. For example, the cane toad was introduced into Queensland in 1935 to help control the cane beetle, which was affecting the Queensland sugar industry. However, the cane toad has no natural predators in Australia and their population has now exploded to more than 200 million. The cane toad has populated large areas of Queensland, the Northern Territory and is moving into New South Wales, and in doing so has wiped out many native species including the northern quoll, many native frog populations, goannas and snakes.

The danger of loss of biodiversity was also clearly evident when severe drought hit Australia in 2014, reducing the wild bee population by approximately 30 per cent. This had a major impact on agricultural production and particularly on canola crops that rely on bees for their pollination. As well as being an important oil seed crop, canola is widely used by farmers as part of their crop rotation system and any reduction in its use in these systems could lead to a reduction in the variety of the nutritious foods available to all Australians.

Loss of genetic diversity

An equally great threat to the sustainability of the primary food production in Australia is the loss of crop and livestock diversity and the genetic make-up of these species. A loss of genetic biodiversity or 'genetic erosion', has occurred because farmers have limited the variety of crops such as wheat and corn and animals they use in primary food production to those that produce the greatest yield and will therefore produce the most grain, milk or meat. An FAO report on the state of the world's plant genetic resources estimates that '75 per cent of crop diversity was lost between 1900 and 2000. A recent study predicts that as much as 22 per cent of the wild relatives of important food crops of peanut, potato and beans will disappear by 2055 because of a changing climate'. This report also states that '90 percent of our energy and protein comes from only 15 plant and 8 animal species'.

This loss of biodiversity in our food supply has serious implications for our future food security. A lack of crop biodiversity and reliance on a few species of crops may prove to be disastrous in future years should some of these crops fail because of onset of drought, severe flood, cyclonic conditions or disease. Many countries, including Australia, are now establishing gene banks as a way of preserving the genetic diversity of their crops and some of the wild plants that are closely linked to food crops. The genetic material found in animal sperm and eggs is also stored as insurance for future generations.

Horsham in Victoria is the location of Australian Grains Genebank, which houses the seeds from

iStock.com/ClarkandCompany

Australian heritage poultry

hundreds of wild indigenous crops that are the ancestors of many of today's most commonly grown cereal crops. These indigenous seeds were collected from the Kimberley, Arnhem Land and Cape York to act as insurance or a safety net for the future. In 2014, 943 of these wild seeds were sent to the Svalbard Global Seed Vault in Norway to add to the global bank of genetic material.

Heritage animals are an important source of genetic diversity, which is essential to ensure the sustainability of breeding stock into the future. For example, as the climate becomes hotter, some of these heritage animals will be able to provide the genetic material for breeding animals suited to an altered climate or those that are more tolerant to certain conditions. Characteristics such as the resistance to disease or high milk production might also become valuable to ensure sustainability and food security in the future. Many small-scale farmers, especially those using organic and free-range systems, are choosing to use rare and heritage breeds, especially heritage breeds of pigs, sheep and poultry. Some of the heritage poultry breeds have also been shown to be more heat tolerant and to have a stronger body structure as well as being disease resistant.

Understanding the text

31 Explain the meaning of the term 'biosecurity'. What department is responsible for Australia's biosecurity and how does it reduce the risk of any breach to our biosecurity protocols?

32 Briefly outline the impact that foot-and-mouth disease can have on affected animals. Explain why it is important to ensure this disease does not enter Australia.

33 Explain how an infestation of fire blight could affect the sustainability of the Australian apple and pear industry.

34 Draw up a flow chart like the one below to demonstrate some of the strategies farmers could use to ensure they maintain biosecurity on their property.

35 List three effects of climate change that are predicted to impact on the Australian continent in the future. Briefly explain how a reduced water supply as a consequence of climate change will affect farmers in the Murray–Darling Basin.

36 Explain how climate change will affect the production of berry crops, aquaculture and livestock production in Australia.

37 Describe how the availability and price of food will be affected by climate change.

38 Explain the meaning of the term 'biodiversity' and explain why biodiversity is essential to the sustainability of primary food production in Australia.

39 Outline three key threats to biodiversity in Australia.

40 Explain why the loss of genetic diversity is a threat to the sustainability of the food supply and outline the way governments are addressing this issue.

PREPARING FOR EXAMS

Applying knowledge

Develop a graphic organiser that demonstrates the effects of climate change on primary food production.

Analysing information

Prepare a SWOT analysis on the use of chemicals in primary food production.

Worksheets

USE OF CHEMICALS IN PRIMARY FOOD PRODUCTION	
Strengths	Weaknesses
Opportunities	Threats

Evaluating concepts

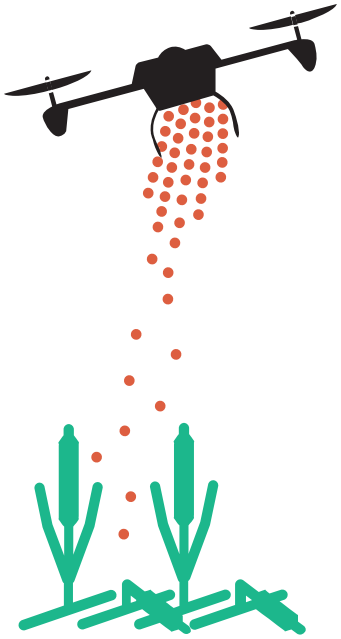
Predict the effect that relaxing biosecurity protocols might have on the sustainability of the production of fresh food in Australia.

CHALLENGES FOR AUSTRALIAN AGRICULTURE

Food production across the globe will need to increase by 60–70 per cent.

The world population will increase by approximately 2.1 billion people by 2050.

ADVANCEMENTS IN ALL FORMS OF TECHNOLOGY, INCLUDING GENETIC MODIFICATION AND DIGITAL TECHNOLOGY, WILL ALLOW FARMERS TO IMPROVE FOOD PRODUCTION SYSTEMS.

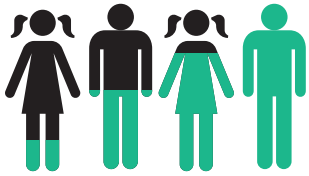


Consumers will be far more knowledgeable and will expect their food to be highly nutritious and to be produced ethically and in a sustainable manner.

Farmers will need to develop strategies to overcome the risks associated with climate change.

GENETIC MODIFICATION

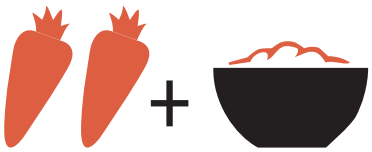
- 124 million children throughout the world suffer from vitamin A deficiency.



- Nearly 2 million children in developing countries will die as a result of a vitamin A deficiency.

- More than 500 000 children will become blind as a result of a vitamin A deficiency.

- Beta carotene + rice = possible solution.



- Beta carotene is consumed in food. The body is able to convert it into vitamin A as needed.

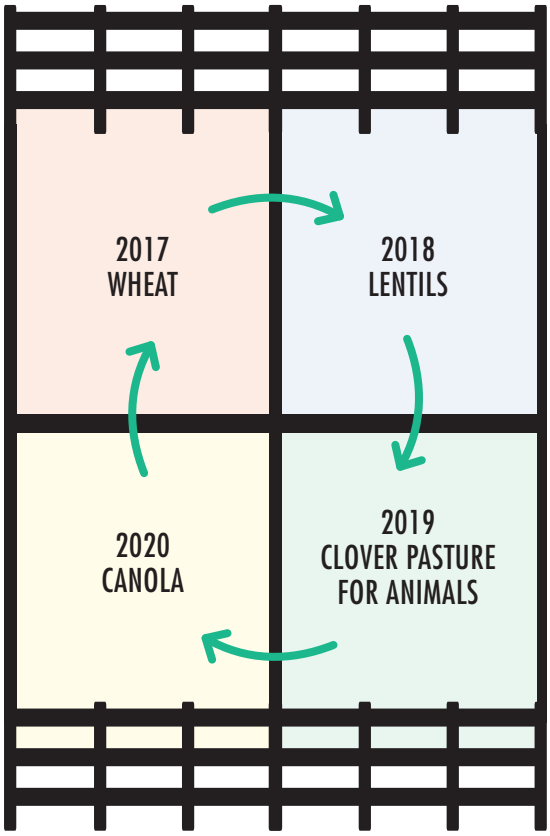
- Rice is a staple food in many developing countries throughout the world.

13

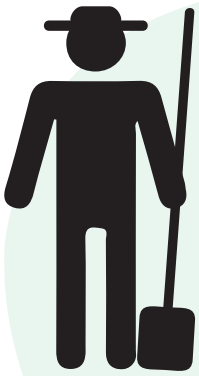
DEVELOPMENTS IN SUSTAINABLE FARMING

LOW-IMPACT FARMING

CROP ROTATION



ORGANIC FOOD PRODUCTION



AUSTRALIA HAS OVER **12 MILLION HECTARES** OF LAND USED FOR ORGANIC FOOD PRODUCTION – APPROXIMATELY A THIRD OF THE LAND USED TO PRODUCE ORGANIC FOOD ACROSS THE WORLD.

KEY TERMS

Genetic modification is a process that alters the genetic material of plants or animals by duplicating, removing or inserting one or more new genes to improve its characteristics.

Low-impact farming is farming practices that conserve the soil and the capacity of the soil to retain water, thereby improving the conditions for plant growth.

Organic foods are foods that are produced without the use of artificial fertilisers, herbicides, pesticides, antibiotics, growth regulators or hormones.

Transgenic organisms are organisms produced as a result of genetic modification in which the DNA from a plant or animal is transferred to another plant or animal to which it is not directly related.

Challenges for Australian agriculture

In 2015, the Rural Industries Research and Development Corporation and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) released the results of joint research into the opportunities and challenges for Australian agriculture over the next few decades. They identified the following key trends:

- The world population will increase by approximately 2.1 billion people by 2050, which means that food production across the globe will need to increase by 60–70 per cent.
- Consumers will be far more knowledgeable and will expect their food to be highly nutritious and produced ethically and in a sustainable manner.
- The use of advancements in all forms of technology, including genetic modification and digital technology, will allow farmers to improve food production systems.
- Farmers will need to develop strategies to overcome the risks associated with climate change.

Australian farmers are very innovative and have developed a range of strategies to overcome some of the issues linked to the environmental sustainability of our primary food production, including minimising the use of water and artificial chemicals. Today, agricultural scientists are working with the farming community to develop a range of different approaches and methods in farming and primary food production to ensure the sustainability of our food supply and to address the challenges that lie ahead. The use of genetic modification is one of the approaches that has been identified to increase agricultural production to feed an increasing world population. By using low-impact farming methods and organic farming systems, the agricultural sector will be able to address consumers' needs for food that is ethically and sustainably produced. These food production systems will also enable farmers to address some of the risks associated with climate change.

Genetically modified food production

Genetic modification is a process that alters the genetic material of plants or animals by duplicating, removing or inserting one or more new genes to improve its characteristics.

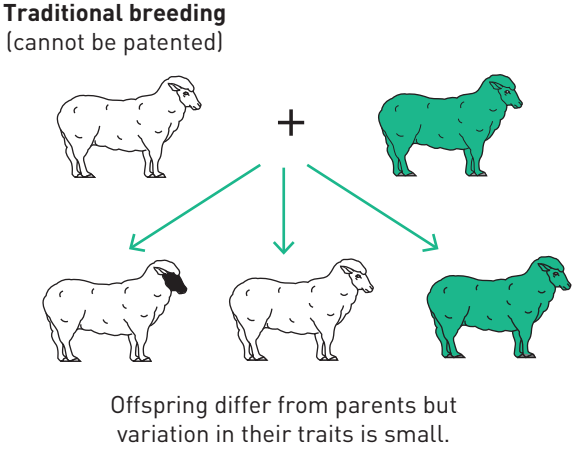
In nature, every time a bee transports pollen from one plant to another, heredity information is being transmitted. This transfer of information is natural and random. When scientists transfer genetic material from one organism to another, the genetic transfer is neither random, nor natural. It is controlled and deliberate. It can cross the natural boundaries between species, and even between the biological kingdoms of plants, animals and microorganisms.

Some genetic scientists argue that our ecosystems have always been able to respond to and control newly evolved species. But natural evolution occurs slowly over time and usually in small isolated environments. Genetic modification has the potential to introduce large numbers of organisms into an ecosystem in a very short time. An advantage of genetic modification is that the direct genetic manipulation of crops can be precisely tailored, unlike the haphazard processes of traditional crossbreeding practices.

CHARACTERISTICS OF GENETICALLY MODIFIED FOOD PRODUCTION

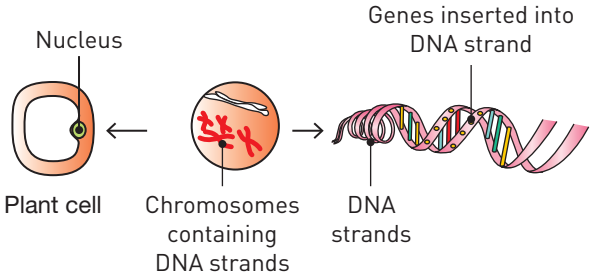
In ancient times, people were hunter-gatherers and collected food as they moved from place to place. Eventually they settled in one place and began to grow crops and breed animals. During this time, they learnt to save the seeds from plants that gave the best yield, and crossbreed them so gradually the yield from the crops increased. Improvements also happened in the breeding of animals – as they became domesticated, farmers began to select and breed animals that were large, had plenty of muscle and could produce more milk. This process of selection is slow and can be a bit random. For example, farmers can carefully choose a ewe and a ram that have desirable muscle characteristics to produce good meat. However, there is no guarantee that their offspring will have a new combination of features that are better than their parents.

All living things are made up of cells – from single-cell bacteria to complex organisms with billions of cells, such as human beings. Inside each cell are genes, or strands of DNA, shaped like threads of a spiral staircase. They are the codes of life that control the form and function of the cell, the organ and the whole organism. A gene tells a cell to build the proteins that create certain characteristics of a plant or animal. The make-up of each living thing is determined by different combinations of genes, which form a complex system of control, something like a computer program.



Traditional breeding

When scientists genetically modify an organism, they identify and isolate a specific gene from the cells of a plant, animal or microbe and make a copy of it. The gene will express a desired characteristic; for example, being high-yielding, insect tolerant, herbicide tolerant or drought tolerant. The gene is then redesigned and spliced into the DNA of another organism. The trait is then expressed in the organism that receives the gene and passed on to future generations.



Inside the nucleus of a cell

Transgenic organisms

Some forms of genetic modification involve the DNA from a plant or animal being transferred to another plant or animal to which they are not directly related. These are called **transgenic organisms**. For example, a gene from an Arctic flounder that enables it to survive in the cold can be transferred into strawberries so they are frost-resistant and can grow in cooler conditions; and in order to produce herbicide-resistant soybeans, corn and cotton, scientists took a herbicide-resistant gene from bacteria and inserted it into the DNA of soybean, corn and cotton.

FOODS PRODUCED USING GENETIC MODIFICATION

Genetically modified (GM) canola

Shutterstock.com/Fotokostic

A canola crop

In Australia, the Office of the Gene Technology Regulator has approved the use of herbicide-resistant GM canola to be grown commercially in Australia.

The first GM canola crops were planted in Victoria and New South Wales in 2008 after a moratorium or ban on their use was lifted in November 2007. A moratorium on growing GM canola remains in place in Western Australia, South Australia and Tasmania. No moratorium exists in Queensland or the Northern Territory, but conditions are not suitable for growing canola in these areas.

In Victoria, GM canola is grown around Ararat, Strathmerton/Yarrawonga, Horsham and in the Wimmera. More cereal producers are now turning to GM canola and it is expected that even more farmers will plant GM varieties of canola over the next decade. Most of the GM canola in production in Victoria, New South Wales and Western Australia is Monsanto's transgenic canola, Roundup Ready canola. GM canola producers state that its genetic make-up gives it many advantages over non-GM canola, including:

- It can be dry-sown so there is no need for the farmer to wait for early rain.
- It has superior weed control because it grows more vigorously and so out-competes weeds.
- It is estimated to produce a yield 20 per cent greater than non-GM canola.
- It only needs one spraying of herbicide, compared with three sprays required for non-GM canola, which saves the farmer money.

Non-browning potatoes

More than 50 per cent of potatoes grown in Australia are processed into chips and fries. During mechanical harvesting and transportation for secondary processing, a large percentage of a conventional crop can become damaged with black spot bruising. Potatoes, like many fruits and vegetables, release the enzyme polyphenaloxidase (PPO) when they are damaged or bruised. The discolouration doesn't change the nutrient content of the potato, but the appearance is not appealing to consumers.

CSIRO researchers identified the gene that creates PPO and were able to create a 'back-to-front' version of the gene. They then inserted this back into the DNA of the potato. This method of producing the non-browning potato (PLRV) relies on altering the genes naturally present within the potatoes.

The PLRV potatoes are now grown commercially and don't brown during harvest, transporting and processing. The appearance of the chips and fries has improved, and consumers cannot detect any differences between the conventional potatoes and GM potatoes.

Other features of potatoes that have been altered by genetic engineering are resistance to caterpillars and beetles; water content (some have a lower water content so they absorb less fat during the cooking process, producing low-fat chips); and fertiliser requirements (some now require less fertiliser than conventional potatoes, so are more economical to grow).

Black spot bruising caused by mechanical harvesting and transportation.

↓

More than 50% of potatoes grown in Australia are processed into chips and fries.

↓

Discolouration doesn't appeal to consumers. Potatoes, as with many fruits and vegetables, release the enzyme polyphenaloxidase (PPO) when they are bruised or damaged.

↓

CSIRO identified the gene that creates PPO. They created a 'back-to-front' version of the gene and inserted it back into the potato's DNA.

↓

Potatoes grown commercially don't brown during harvesting, transportation or processing. The quality of chips and fries improves and the non-browning GM potatoes taste like conventional potatoes.

Creating non-browning potatoes

Genetically modified rice

A major development in the genetic modification of rice that will improve the health of millions of people throughout the world is a rice variety that is high in vitamin A, golden rice.

UNICEF has estimated that approximately 124 million children throughout the world suffer from vitamin A deficiency. This vitamin is essential for growth, eyesight and a healthy immune system. Vitamin A deficiency can lead to blindness and even death – the World Health Organization (WHO) estimates that between 250 000 and 500 000 children become blind each year as a result of vitamin A deficiency.

As rice is a staple food in many developing countries throughout the world, scientists thought this major health issue could be addressed by adding the essential nutrient betacarotene to rice. Once betacarotene is consumed in food, the body is able to convert it into vitamin A as it needs it. By consuming the nutrient-enriched rice, many millions of children in developing countries, particularly in Asia and Africa, could overcome this deficiency in their diet.

Betacarotene is found in yellow-coloured vegetables and plants, including carrots and daffodils. In developing the nutritionally enhanced golden rice, scientists implanted three new genes into the rice DNA – two genes from daffodils and the third from a bacterium, making it a transgenic organism. It is the betacarotene added to the rice that gives it its golden colour and hence its name.

Field trials are currently underway in the Philippines, Indonesia and Bangladesh to ensure that the rice will not only have an increased vitamin A content but will be high-yielding.

Further information on genetically modified food production can be found in chapter 10 page 184.

The genetic make-up of golden rice

iStock.com/123ArtistImages

Golden rice

Erik De Castro/Reuters/Picture Media

A traditional rice variety compared with golden rice

Other GM food crops

FOOD CROP	NEW CHARACTERISTICS AS A RESULT OF GENETIC MODIFICATION
Broccoli	Ripens more slowly so the flower heads stay greener for longer and don't open into yellow flowers
Strawberries	Frost resistant so can be grown earlier in the season and in cooler climates
Tomato	Resistant to viruses, so increases the yield; slower ripening, so less chance of rotting after harvest and before transportation; lower water content so more suitable for making pastes and sauces
Celery	Retention of crispness
Bt cotton	Cotton oil is produced from Bt cotton. This transgenic crop is insect resistant and is used in edible oils, in margarines, mayonnaise and salad dressings

Genetically modified livestock

Livestock have been genetically modified to increase growth hormone levels to produce faster-growing animals. Feed costs are reduced because the animal reaches maturity more quickly; there is more lean meat and less fat on the carcass. The growth hormones are destroyed during cooking, so do not pose a threat to consumers.

Genetic modification is being used to manipulate the quantity and quality of milk produced in animals. Growth hormones produced by modified microorganisms have been used to increase the yield of milk from cows and increase the protein content in cow's, goat's and sheep's milk.

ADVANTAGES OF GENETICALLY MODIFIED FOOD PRODUCTION

Some of the benefits that genetic modification can provide to both producers and consumers are discussed below.

Benefits to producers

- The reduction in the use of pesticides and herbicides in crop production is one of the main benefits to producers. When growing crops, farmers use pesticides to kill specific pests, insecticides to kill insect pests, fungicides to kill fungal pests, and herbicides to kill weeds that compete with the crop for nutrients from the soil. Some genetically modified crops, such as soybeans, have been given a gene from a bacterium that gives them resistance to herbicides. This means farmers can spray their crops for weeds and the soya plant continues to grow unaffected. Reducing the use of chemicals can aid the environment by reducing the risk of run-off into waterways. Modifying crops to be resistant to attack by pests or disease would also result in less wastage, greater yields, more economical production and would in turn lower the cost of food.
- Some vegetables have been genetically modified so that they have a longer shelf life and less food is wasted. To extend the shelf life of some vegetables, the enzyme that is responsible for ripening is altered so the ripening process is slowed down and growers have more time to get their produce to market. GM tomatoes ripen more slowly than traditional tomatoes, remain firm for longer and have much less water so are easier to transport.

- GM crops designed to provide a higher yield may mean that a greater production per hectare of land is possible and this will provide a greater economic return for farmers.
- Some plants may be designed to be tolerant to drought, high-salt soils, or to be resistant to extreme cold, enabling farmers to grow crops in soils that were previously infertile or unsuitable for farming.
- The desired changes can be achieved within a few generations, therefore GM foods can develop faster and this method is more precise in selecting desired characteristics.

Benefits to consumers

- Genetic modification could help increase the nutrient content of some foods. For example, increasing the protein and betacarotene levels in golden rice will help overcome the vitamin A deficiency that leads to blindness.
- It may improve the sensory properties of some foods; for example, tomatoes that are redder in colour and have an improved flavour or texture.
- Some foods could be modified to provide edible vaccines, making large-scale immunisation against disease easier, painless and more accessible.
- Producing drought-resistant or high-yielding crops can benefit communities in developing countries, providing much-needed crops to assist in areas that are subject to famine; for example, GM corn has been introduced in India and the Philippines. These crops may also assist in providing a stable food supply for a rapidly growing world population.

CHALLENGES OF GENETICALLY MODIFIED FOOD PRODUCTION

There is concern that genetic modification can have a detrimental impact on the farming community and consumers.

- Some farmers are concerned that GM crops could affect Australia's access to European markets that want to purchase 'clean, green foods'.
- Farmers who grow traditional crops are concerned that contamination of roads and roadside verges by trucks carrying GM grain could lead to contamination of non-GM crops.
- Some scientists are concerned about the effect of GM foods on human health. For example, the effectiveness of antibiotics could be reduced if genes coded for antibiotic resistance cross from cattle fed on crops containing these genes to bacteria in the human digestive tract.
- People who are allergic to certain foods will have no way of knowing if GM foods have been altered with proteins to which they are allergic.
- People who follow a vegetarian diet may have concerns about foods that are developed through transgenic modification, especially if there is the possibility of genetic material from animals or fish being used in their production.
- Consumers have concerns that many of the world's food resources could be controlled by a few multinational corporations, leaving small producers with little ability to make decisions about the types of crops they will farm.
- Animals such as pigs and cattle, genetically modified to produce increased levels of growth hormones, can suffer from health problems such as arthritis and diabetes, and can become lame.

POSSIBLE IMPACT OF GM FOODS ON THE ENVIRONMENT

The production of GM crops raises many environmental concerns.

- It may not be possible to segregate GM and organic crops, leading to 'genetic pollution'. Genes from genetically modified organisms have the potential to move from their original point of release to affect other plants and animals. Once GM crops are planted outside the laboratory, there is little that can be done to stop them cross-pollinating with conventional crops and other plants in the local area. This occurs when the pollen from genetically modified crops such as canola drifts onto crops of conventional and organic farmers, contaminating their crops. In the United States, the United Kingdom and Australia, for example, pollen from canola has drifted up to 10 kilometres, threatening certified organic crops. In some parts of Europe, only vegetables grown under cover to avoid pesticide drift can be classified and sold as organic. In other places, there are buffer zones between GM plants and non-GM plants of the same type.
- If genes that code for the resistance to chemical herbicides 'flow' from GM plants to weeds, it could produce tougher weeds or 'super' weeds. These 'super' weeds may be more difficult to kill and will become more widespread, which would

have a negative impact on the environment. This could also lead to increased use of herbicides as well as contamination of groundwater.

- Some people are concerned that the spread of transgenic crops threatens the natural crop diversity. Crops may lose their natural resistance to other diseases, which could lead to future problems. On the other hand, some scientists believe that adding new genes into the total gene pool can only add to the overall diversity, rather than detract from it.
- Growing GM crops on a large scale may adversely affect biodiversity, the balance of wildlife and the environment. For example, environmentalists are concerned that the viability of some bird populations may be threatened. Insect larvae that eat GM crops containing pesticides could be toxic for the birds that eat them, causing some species to be wiped out. However, in some areas in the United States where GM crops have been grown over a period of years, there has been an increase in birdlife around crops. This is because less herbicides and pesticides are used on the farms, so more insects feed around the crops, providing food for insect-eating birds.

Activity 13.1

GM wheat

Read the article, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. What benefits would GM wheat have for consumers?
3. Explain how wheat has been genetically modified for this trial.
4. Outline the main challenge facing the CSIRO team in developing a new GM strain of wheat.
5. Why do the CSIRO scientists say that genetic modification is more effective in producing a new strain of wheat than conventional breeding?

CSIRO DEVELOPING WHEAT WITH CHOLESTEROL-LOWERING QUALITIES

Alamy Stock Photo/Tribune Content Agency LLC

Genetically modified wheat trial

The CSIRO is hoping to breed wheat with similar health benefits to oats and barley.

Barley and oat grains contain high levels of a soluble fibre called betaglucan that can reduce cholesterol and lower the risk of heart disease.

However, many people prefer bread made with wheat, which unfortunately has less betaglucan that is also insoluble and lacking cholesterol health benefits.

CSIRO principal research scientist Dr Steve Jobling is part of the team which recently discovered the key difference between betaglucan in oats and wheat.

'There are very small differences in the enzyme that makes betaglucan in wheat and oats. In fact, there is a single amino acid difference in the protein and we have found that single amino acid difference can change the structure and make it more soluble,' he said.

The team is currently growing trial wheat crops that have been modified to include the gene that gives oats their cholesterol-lowering qualities.

'These plants are genetically modified because they have a gene from oat in wheat and we're growing them in a controlled field trial at the moment to get enough grain to test their bread making qualities, as well as to determine if they actually do have cholesterol lowering properties,' he said.

Dr Jobling was confident the team would be able to make the wheat into tasty bread with the health benefits of oats.

He said the next step was breeding the variety naturally, a process a little like looking for a needle in a haystack.

'This will be much more difficult, but we think with the new knowledge that we have got about betaglucan structure it is possible, although that is going to be several more years yet,' he said.

'With a genetic modification approach it is a very precise technology and you can just take the gene that you know controls the trait and put that into the wheat crop and you know it will have the effect.

'With the conventional breeding, you have to search for changes in the gene of interest and it'll take a lot lot longer.'

Dr Jobling said it would take at least five years to get the wheat to the market.

CSIRO developing wheat with cholesterol lowering qualities by Lucinda Jose, © ABC, http://www.abc.net.au 6 July 2015.

Understanding the text

1 Draw a mind map to demonstrate the challenges that lie ahead for Australian agriculture over the next few decades.
2 Define the term 'genetic modification'.
3 Explain the process scientists use to genetically modify a plant or animal.
4 What does the term 'transgenic organism' mean? What are the benefits of transgenic organisms?
5 Identify three examples of GM food crops and discuss their improved characteristic as a result of GM technology.
6 Describe two benefits to producers of breeding livestock with genetically modified growth hormone levels.
7 Explain how GM crops can reduce the amount of chemicals used in primary production.
8 Outline why GM vegetables with an extended shelf life are a valuable food for some consumers and producers.
9 Outline two possible health benefits to consumers of the development of genetically modified foods.
10 Describe four major concerns that genetic modification may have on the environment.

Low-impact farming

Given the risks to Australian agriculture from climate change, agricultural scientists along with the agricultural community are developing strategies to ensure that our primary food production systems are sustainable into the future. **Low-impact farming**, or conservation agriculture, is the term used to describe farming practices that conserve the soil and the capacity of the soil to retain water, thereby improving the conditions for plant growth. Many low-impact or conservation farming techniques use stubble to help retain moisture and to minimise soil erosion. These systems also plant crops directly into the soil to minimise soil tillage. No-till farming, pasture cropping and crop rotation are examples of conservation or low-impact farming.

CHARACTERISTICS OF LOW-IMPACT FARMING

Low-impact farming uses a range of strategies to ensure environmental sustainability. Today, farmers try to avoid the over-irrigation of their crops by monitoring soil moisture levels to accurately determine the amount of moisture needed to produce a healthy crop, or they use drip irrigation where appropriate. Ensuring good crop selection is also important so farmers might try to use deep-rooted plants to maximise the amount of water extracted and therefore minimise the development of salinity in the soil. They also adopt good soil management practices such as monitoring the pH level of the soil and minimising tillage to encourage good crop growth and soil coverage. Mulching is also widely used to help retain soil moisture and to reduce erosion.

NO-TILL FARMING

No-till farming is a method of low-impact farming that involves leaving the stubble from the previous year's crop to enrich and stabilise the soil. The new crop is planted by direct drilling in between the rows of the previous crop without tilling the soil. Retaining crop stubble helps to mulch the soil, which is then able to retain more moisture. The crop residue stays on the land and eventually decomposes, and nutrients are returned to the soil enriching the soil and improving its carbon profile. This keeps the soil friable (loose), uncompacted and moist.

Retaining the stubble also prevents exposure to the wind and rain and helps to prevent soil erosion.

Alamy Stock Photo/Grant Heilman Photography

Sowing seed by direct drilling

Combined with precision seeding and the use of GPS technology, specially designed machinery deposits fewer seeds during planting, which in turn allows larger, healthier plants to grow. This ensures improved yields, particularly in canola crops, and especially in dry years. Farm machinery such as harvesters also use designated traffic lanes or tramlines so that there is minimal compaction of the soil. No-till farmers often rotate crops including wheat, canola, fava beans and lentils. However, herbicides and pesticides are still used when necessary.

Alamy Stock Photo/Bill Barksdale/AgStock/Design Pics Inc

Retaining stubble in no-till farming

Advantages of no-till farming

Farmers who use the no-till farming system find there are significant advantages for soil health and crop yields. As up to 4 years of stubble can remain in the soil, the nutrients contained in the stubble are returned to the soil as it breaks down, building the structure of the soil and improving its health. The stubble also acts as mulch, ensuring that moisture is retained, especially in dry years, and also prevents moisture run-off from the property. The roots of the stubble also hold the soil in place and prevent wind erosion. Farmers who use a no-till or low-till agricultural system also state that crops yields are higher, especially during dry years. Another advantage of no-till farming is that fuel and labour costs are reduced because the use of heavy farm machinery is minimised.

Challenges of no-till farming

As with all forms of agriculture, low-impact farming provides challenges for farmers and for the environment. One of the most significant of these is that it takes time for farmers to develop the skills and knowledge necessary to run a successful conservation farming system. Farmers need to learn new techniques in farm management practices, including the sustainable use of fertilisers, pesticides and herbicides and how to apply these most effectively.

Another problem facing farmers using no-till farming systems is that herbicides may be less effective because some of the chemicals can be 'tied up' in the organic matter or mulch that is left on the surface of the soil. In addition, in no-till systems, the stubble that is retained can harbour diseases or pests that can infect or attack the emerging crop. However, many farmers find that they are able to overcome this problem by using a crop rotation system along with no-till farming.

PASTURE CROPPING

Pasture cropping is a low-impact system that combines both grazing and cropping into one system. It involves sowing an annual cereal crop into an existing perennial pasture by direct drilling. Some pasture or perennial crops are dormant in winter so a cereal crop can be sown into it without killing the pasture.

Growing a cereal crop is combined with allowing cattle to graze at relatively high stocking levels but for a short time. Cattle are allowed to graze in one paddock for about 4–6 days before they are moved onto another paddock. The stock is rotated through a large number of paddocks so that the pasture is allowed to rest for up to 3 months to recover and to prevent erosion by cattle movement before the cattle are allowed back to re-graze. Today, over 2000 farms across Australia practise pasture cropping.

Advantages of pasture cropping

Farmers who follow a pasture cropping system find that once the system is well established, the natural grasslands recover and the diversity and density of perennial grasses are improved. In addition, the ground is well covered throughout the year rather than lying in fallow, which occurs with traditional cropping systems. This improves the structure of the soil by increasing the nutrients in the soil and the levels of soil carbon. As the health of the soil improves, so too does the soil's ability to hold and retain water. Another advantage of pasture cropping is that the use of fertilisers is reduced significantly as a result of the increased soil fertility. Farmers have also been able to reduce the amount of herbicides they use, particularly where sheep are used to graze on the pasture. As sheep have less impact on the soil, they can graze on the pasture until the new cereal crop is sown. This means that there are fewer weeds and therefore a reduced need for herbicide control. One of the key benefits of pasture cropping is that it is very economical to run once established. In a pasture cropping system, fewer workers are required because there are fewer herds to move through the various paddocks even though the size of the herd is larger than in a conventional pasture grazing system.

Challenges of pasture cropping

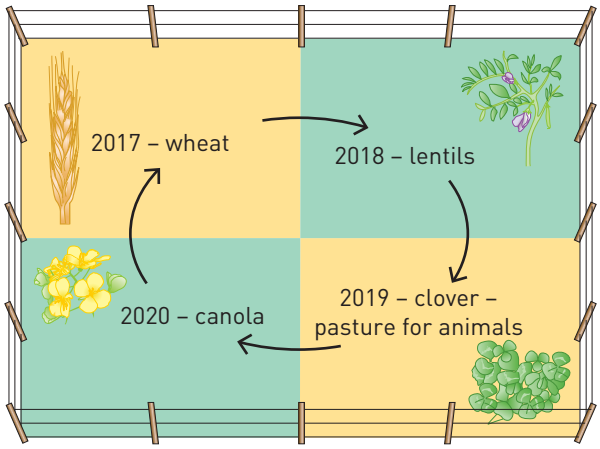
Pasture cropping, like other forms of low-impact farming, is highly technical. Farmers who want to use a pasture cropping approach require very good scientific and technical knowledge of the types of pastures that regenerate annually after rain.

Farmers may also be faced with additional costs in the early years of establishing the new farming system, particularly if specialised or modified machinery is required. Farmers may lack the capital to invest in new methods or technologies. Developing a new pasture-cropping system also takes time, so farmers embarking on a new method of farming may find it takes many years before the soil improves in health. When farmers first introduce pasture cropping, they might find that they have a problem with weeds, which may reduce their crop yield.

CROP ROTATION

One of the major problems associated with growing some of Australia's main cereal crops, including wheat, barley and sorghum, is that they all require a large amount of nitrogen from the soil. Crop rotation helps to overcome this problem by using a series of different crops that are planted in a specific order in the same field. A crop rotation system generally includes lentils or pulses such as fava beans or chickpeas to fix the nitrogen in the soil, making it available to assist growth of cereal crops such as wheat. To be most effective, a successful crop rotation system should use some crops that are deep rooted and others that are shallow rooted. In addition, farmers need to consider rotating the crops that will allow nutrients such as nitrogen to accumulate in the soil as well as those that will deplete nitrogen. It is also important for farmers to consider the types of pests and diseases that will be attracted to specific crops to ensure that no one pest or disease is allowed to thrive.

As well as building up the nutrient levels in the soil, crop rotation reduces weed and pest problems and reduces the need for artificial chemicals. Grazing pastures can also be improved by implementing rotational grazing techniques.



Crop rotation

Advantages of crop rotation

Crop rotation provides farmers and the environment with many benefits. One of the most important is that crop yields, particularly for cereal crops, are improved because the soil contains higher levels of nitrogen than would be available if cereals were grown in a monoculture system. In addition, the high carbon emissions that are linked to grain growing are reduced in a crop rotation system. This is because the farmer does not need to transport and use nitrogenous fertilisers as the nitrogen is fixed in the soil by the pulses and legumes used in a crop rotation system.

All forms of low-impact farming have been shown to improve biodiversity with increased numbers of insects and soil microorganisms present. This has the advantage of farmers experiencing fewer problems with insect or fungal infestation of their crops as they are controlled by natural predators.

Challenges of crop rotation

One of the biggest challenges in using a crop rotation system is ensuring that farmers keep good records to ensure that the most effective crop rotation cycle is followed and that the same crop is not planted in the same field in successive years.

Farmers might also need a greater variety of machinery to plant or harvest particular crops, which could add significantly to the cost of production. The farmer might also need greater knowledge of growing a variety of crops than would be needed if they continued to use a monoculture system. Farmers might also need to vary the types of crops planted depending on the weather conditions, because certain climates may favour some crops over others.

Activity 13.2

Preparing a summary frame for low-impact farming

Select one method of low-impact farming and prepare a summary frame under the following headings:

- What are the characteristics of the low-impact farming?
- What plants and/or animals are produced using this method of farming?
- What are the benefits of using this method of farming?
- What are the challenges of using this method of farming?

Organic food production

Organic foods have been available for many years; and in the past, they were mainly sold through specialist health food shops and fresh food markets. Today, these products are more mainstream and all supermarkets stock organically produced foods. Australian consumers have become big consumers of organic produce and Australia has the largest area of land used for the organic food production in the world. The latest data from the Australian Organic Market Report states that the organic industry in Australia is now worth more than $1.72 billion.

The development of farmers' markets and direct marketing schemes through the use of organic produce websites has led to an increase in consumer interest. Supermarkets have also responded to increased consumer interest in organic produce and now stock a wide variety of organic foods.

CHARACTERISTICS OF ORGANIC FOOD PRODUCTION

Organic farming uses farming practices that produce crops and animals without the use of artificial chemicals, instead using natural systems. These natural systems can include the use of organic fertilisers, composting, crop rotation and biological pest control. The use of these natural systems minimises any damage to the land and helps to ensure the future productivity of the land.

Organic food production is a 'whole system' of growing and handling food. This means that organically produced foods:

- are produced, processed, packaged and transported without the use of herbicides, pesticides, fungicides and synthetically produced fertilisers or other products
- use methods such as natural fertilisers
- are not treated with preservatives, hormones, other synthetic chemicals or irradiation
- cannot use genetically modified organisms in any stage of their production.

'Certified organic' means that the product has been produced in accordance with a specific organic standard established by a certifying agency. Organic certification ensures that a product can be traced through the food production system from 'paddock to plate', and covers not only the producer, but the retailer, wholesaler or exporter of the product. This system of traceability is designed to protect consumers and producers of organic food products from false claims or misleading labelling.

Annual inspections ensure audit trails of the food. To receive certification, the farmer has to demonstrate the strategies they use for soil fertility management, crop rotations, weed control, pest and disease management, windbreaks and buffer zones, biodiversity, animal health and water management.

It takes 3 years to change over from regular farming practices to certified organic production. During this changeover period, farmers are still able to sell their

food, as it would be impossible for them to survive without income for so long. The food produced in this period is labelled 'certified in conversion', so that consumers know it is not completely organic and the price reflects this status.

Christodoulou

Australian certification label

ADVANTAGES OF ORGANIC FOOD PRODUCTION

Organic farming provides a wide range of benefits to producers, consumers and to the environment.

Benefits to producers

The benefits to the producer of implementing organic farming methods include:

- The use of sustainable practices, such as crop rotation, enables farmers to improve soil fertility while reducing the impact of pests and weeds.
- Livestock can be raised in a stress-reduced environment without the use of growth hormones or antibiotics.
- The use of traditional seed varieties helps to preserve the diversity of crops for future generations.
- High-quality production standards that are assessed through a rigorous audit system are achieved.
- Crop yields can be stabilised and increased, particularly on land that has been considered marginal for food production.

Benefits to consumers

Many consumers believe that organic produce:

- provides health benefits, particularly higher levels of nutrients such as vitamins and antioxidants
- treats animals used for food in a more humane and ethical manner, for example the production of free-range poultry and pigs
- provides them with security that the food is not genetically modified
- contains fewer artificial ingredients and lower chemical residues so is better for health
- some consumers believe that they taste better than non-organic produce.

iStock.com/RonyZmiri

Organically produced free-range pigs

Benefits to the environment

Organic farming benefits to the environment include:

- Artificial pesticides and herbicides are prohibited; the use of organic and sustainable methods of pest and disease control ensures that plant health is maintained.
- Sustainable farming practices that can prevent salinity and soil erosion and improve the ability of the soil to take up and retain water are implemented.
- Organic fertilisers and natural methods to reduce insect infestation and control weeds are used, leading to healthier waterways because chemical run-off into streams does not occur.
- The use of non-renewable resources is minimised; for example, organic fertilisers can be produced from organic waste from the farm.
- Biodiversity is maintained – organic farms are required to retain a minimum of 5 per cent of native vegetation or plant windbreaks to provide homes for wildlife and protection for livestock. Naturally occurring wetlands such as dams, creeks, swamps and riverbanks may be incorporated into farm design as a way of maintaining biodiversity.

Alamy Stock Photo/Jack Hobhouse

Certified organic vegetables

CHALLENGES OF ORGANIC FOOD PRODUCTION

Like all forms of agricultural production, organic food production provides challenges for producers and consumers.

Organic foods are often more expensive to produce and this increased cost flows on to consumers. For some consumers, the higher cost may mean that they simply can't afford to purchase the organic produce even though they may want to.

There are many reasons that organic produce is more expensive to produce. The process of gaining organic certification is long and expensive and requires farmers to undergo annual inspections, initially to gain certification and registration and to continue their certification in future years. Organic farms are typically smaller in size and usually involve a greater level of management to maintain their certification. These farms are labour intensive and therefore more expensive to operate as they have higher labour costs.

Organic farmers are also restricted in the types of fertilisers and pest control methods they can use so the yield from a crop is often lower and more slow-growing than if traditional farming methods were used. In addition, organic farmers may face higher transport costs because they can only use trucks that are specifically designated to carry organic food and they cannot be transported in a truck used for non-organic produce.

Pest control can also be a challenge for organic farmers, as their crops may have more blemishes than food that is not produced organically. These blemishes may detract from the overall appeal of the produce and consumers may be reluctant to buy the produce even though it will still taste good and have the same nutritional value.

Case study

Hakubaku – producing organic noodles

Read the Hakubaku case study then answer these questions:

1. Why did Japanese company Hakubaku decide to set up a production plant in Ballarat?
2. Why is good supply of organic Rosella wheat important to the manufacturing of Hakubaku noodles?
3. Explain why noodles made from buckwheat are popular in Japan.
4. Why are organic ingredients important in the production and marketing of Hakubaku?
5. How does the company guarantee its noodles are made from organic ingredients?
6. Based on the information in this chapter, describe the key features of an organic food production system.

Hakubaku Australia Pty Ltd is a leading manufacturer of dried noodles. In 1996, Hakubaku was established in Ballarat, Victoria, using a fully automated system to produce a high-quality product range that includes five varieties of dried noodles. The company uses organically grown wheat produced in the Wimmera region of Victoria in the production of its noodles.

Australian wheat has long been recognised as having the specific characteristics needed to produce the long strands demanded by discerning Japanese consumers. Each year, Japanese noodle manufacturers import approximately one million tonnes of Australian wheat to use in the manufacture

of their products. However, Hakubaku had found that the pure organic Rosella wheat, which was best suited to the production of noodles, was difficult to obtain in Japan. Hence, the company decided to establish its own production plant, Hakubaku Australia Pty Ltd, in Victoria where the organically grown Rosella wheat could be obtained.

Weblink

Hakubaku selected Ballarat as the site for its production facility because of its close proximity to the area where the organic Rosella wheat, a Prime Hard wheat, and other high-quality organic wheat varieties are grown. This would provide access to freshly milled flour, allowing it to make a superior quality product. Hakubaku was also able to develop a partnership with an organic flour miller located in the same vicinity as its production facility.

Organic buckwheat, another key ingredient used in the production of its famous soba noodles, is also grown in the Ballarat district, giving Hakubaku another incentive to establish its noodle processing company in this regional city. Buckwheat noodles are a summer delicacy in Japan, with the flavour and texture of these premium noodles being preferred to other noodles.

Unlike other wheats, buckwheat is not a cereal, but a legume that grows in a 12 to 15-week period. The triangular buckwheat seeds are harvested on maturity when 90 per cent of them are black in colour. Buckwheat is also recognised as providing considerable health benefits to people suffering from coronary heart disease and high levels of cholesterol. At present, Japan requires approximately 110 000 tonnes of buckwheat annually to meet its needs for noodle production, but only 10 000 tonnes can be grown there per year. As the buckwheat grown in Australia is considered to be of premium quality, production here complements that of Japan and provides considerable export opportunities.

Australia has over 12 million hectares of land used for organic food production – approximately a third of the land used to produce organic food across the world. The farmers who supply Hakubaku with organic Rosella wheat and buckwheat are an important part of this growth in organic food production.

Hakubaku is certified by Australian Certified Organic as producing organic noodles. As a result, Hakubaku promotes its products to niche markets in Japan, the United States and Malaysia as being 'clean and green' products from Australia.

Hakubaku produces approximately 3600 tonnes of noodles per year. Its product range includes soba noodles made from organic wheat flour and organic buckwheat, and also includes udon, ramen and somen, all of which are made from organic wheat flour. Hakubaku also produces cha soba noodles that are made from organic wheat flour, buckwheat and organic green tea powder. No artificial preservatives are used in the manufacturing process and the noodles have an 18- to 24-month shelf life.

Source: http://www.hakubaku.com

Christodoulou

Hakubaku organic noodles

Shutterstock.com/Soru Epotok

A buckwheat crop

Activity 13.3

Worksheets

Taste testing a warm noodle salad

1 Work with a partner to complete the following taste test of warm chicken and noodle salad.

2 One person should make the salad using organic somen noodles such as Hakubaku somen noodles and one person should make the salad using regular somen noodles.

3 Each student should prepare the salad following the recipe instructions. Remember to set aside a few of each type of noodle after they have been boiled and before they have been mixed with the salad ingredients and dressing.

4 Complete the following sensory analysis table.
- Taste test the plain organic noodles and the plain regular noodles and describe their appearance, aroma, flavour and texture.
- Taste test both salads and describe their appearance, aroma, flavour and texture.

5 Was there a noticeable difference between the sensory properties of the plain organic and plain regular noodles? Explain your answer.

6 Which salad did you prefer? Why?

7 Write a brief description of the warm chicken and noodle salad made with organic noodles to post on a food blog.

	APPEARANCE	AROMA	FLAVOUR	TEXTURE
Plain organic somen noodles				
Plain regular somen noodles				
Warm chicken and noodle salad made with organic noodles				
Warm chicken and noodle salad made with regular noodles				

Warm chicken salad

- 1 tablespoon oil
- ½ chicken breast, thinly sliced
- 90 grams or 1 individually wrapped serve of organic or regular somen noodles
- ½ Lebanese cucumber
- 1 spring onion, sliced
- ¼ red capsicum, finely sliced
- 2 tablespoons canned corn kernels
- ½ small carrot, peeled and cut into julienne strips
- ¼ cup coriander leaves to garnish

Dressing

- 1 teaspoon ginger, finely grated
- 1 teaspoon sesame oil
- ½ lemon, juiced
- 1 tablespoon soy sauce
- ½ tablespoon rice vinegar
- ½ teaspoon sugar

Method

1 Heat the oil in a small frying pan over a moderate heat. Pan-fry the sliced chicken fillet until just cooked. Remove from the pan, cover with foil and set aside.

2 Bring a saucepan of water to boil. Cook the noodles according to the manufacturer's instructions on the packet. Drain the noodles and set aside.

3 Slice the Lebanese cucumber in half lengthwise. Remove the seeds from the cucumber using a teaspoon. Slice the cucumber into thin slices.

4 Put all salad ingredients in a large bowl and combine.

5 Mix the dressing ingredients together then mix with the noodles.

6 Add noodles to the salad and toss well.

7 Top with the pan-fried chicken and garnish with the coriander.

Serves 1

Activity 13.4

SWOT analysis of organic food production

Prepare a SWOT analysis (strengths, weaknesses, opportunities and threats) of organic food production. Consider all aspects of organic production including the impact on organic food producers, consumers, retailers and the environment.

Worksheets

SWOT ANALYSIS OF ORGANIC FOOD PRODUCTION	
Strengths	Weaknesses
Opportunities	Threats

Understanding the text

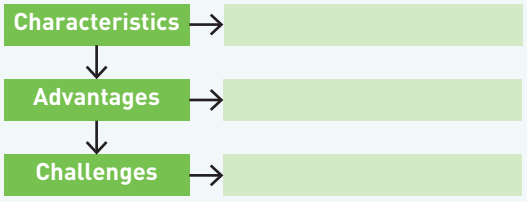
11 Write a definition for low-impact farming. Your definition should include three examples of this type of agriculture.

12 Explain why many farmers are now introducing low-impact farming technologies.

13 Draw a knowledge map of the characteristics of no-till farming.

14 Outline two advantages and two challenges of no-till farming.

15 Draw a diagram like the one below to summarise the key information on pasture cropping.



16 What is crop rotation and why is it considered a valuable form of low-impact farming? Outline two challenges to farmers who use a crop rotation system.

17 Explain what is meant by the term 'organic food' and how a primary producer can achieve the label 'certified organic'.

18 Outline two benefits to producers and consumers of adopting organic farming methods.

19 Draw a knowledge map to demonstrate the benefits to the environment of organic farming methods.

20 List four reasons why organic food is more expensive to produce than if the farmer used traditional farming methods.

PREPARING FOR EXAMS

Applying knowledge

Identify three facts relating to each of the following aspects of organic food production:

- the characteristics of organic farming
- the advantages of organic farming to producers, consumers and the environment
- the disadvantages of primary food production.

Analysing information

Prepare a PMI (plus, minus and interesting) chart of low-impact farming as an environmentally sustainable method of farming. Use examples to support your answer.

LOW-IMPACT FARMING AS AN ENVIRONMENTALLY SUSTAINABLE METHOD OF FARMING		
Plus	Minus	Interesting

Evaluating concepts

Develop arguments for and against genetically modified (GM) foods. Focus the arguments 'for' on:

- how GM foods are an improvement on nature
- how GM technology can help ensure sustainability of primary food production
- the environmental benefits of GM farming
- the medical benefits to consumers of GM foods.

Focus the arguments 'against' on:

- health concerns
- environmental concerns
- ethical concerns.

FOOD MILES

1 Rice grown in the Riverina in New South Wales travels 380 kilometres to Melbourne consumers. This compares with basmati rice grown in India that travels more than 12 500 kilometres to Sydney.

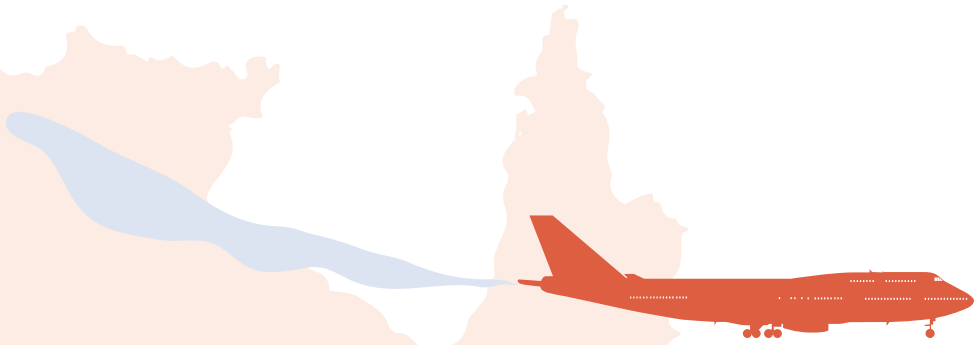
2 In summer, locally grown tomatoes in Victoria travel 165 kilometres on average.

3 In winter, most tomatoes are grown in Queensland and trucked to Melbourne, a distance of approximately 3000 kilometres.

4 The bananas available to Melbourne consumers are grown in Queensland so the average distance they travel is approximately 2700 kilometres.

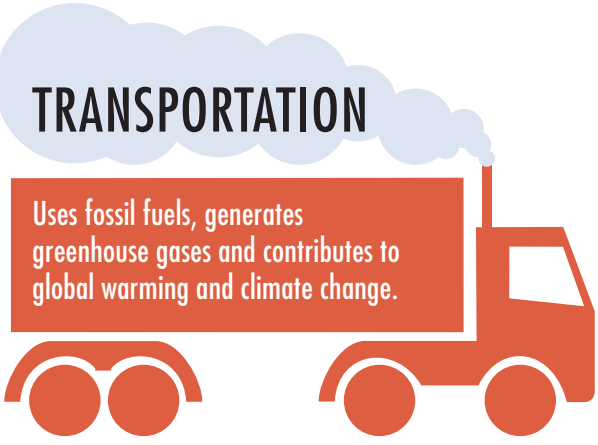
5 Lettuce is grown on the outskirts of Melbourne so the average distance it travels to Melbourne is 55 kilometres.

6 Oranges grown in the Riverina in New South Wales travel approximately 450 kilometres to Melbourne's fruit and vegetable markets.



TRANSPORTATION

Uses fossil fuels, generates greenhouse gases and contributes to global warming and climate change.



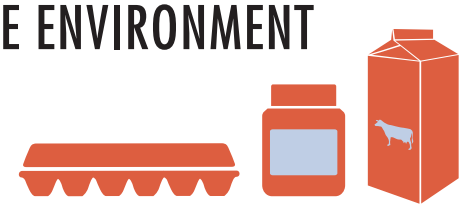
14

ENVIRONMENTAL SUSTAINABILITY IN FOOD PROCESSING

FOOD WASTE

- 30 per cent of all food produced globally is never consumed, but instead is wasted.
- Australians throw away more than 20 per cent of the food – or one in five of every bag of fresh food – purchased every year.
- Food that is wasted is estimated to be worth over $8 billion. This equates to every Australian household spending more than $1000 on food that is wasted.
- For each Australian, approximately 360 kilograms of food is put into the rubbish bin every year.

FOOD PACKAGING AND THE ENVIRONMENT



- In Australia, about 60 per cent of packaging is used to protect and preserve food.
- Every year more than 1.9 million tonnes of packaging is thrown away rather than being recycled.
- Approximately 85 per cent of all litter collected on 'Clean Up Australia Day' is packaging.
- Renewable and biodegradable bioplastics are made from plant material such as corn and wheat.
- Bioplastics use 65 per cent less energy than conventional methods.
- Bioplastics produce 68 per cent less greenhouse gas emissions than conventional plastic production.

KEY TERMS

Aseptic packaging is a process whereby the food product and the package are sterilised separately and brought together in a sterile environment.

Biogas is a gas that is produced by the action of bacteria on organic material such as corn or wheat.

Carbon footprint measures all of the carbon dioxide produced during the manufacture of a food product.

Food miles is the term used to estimate the distance food travels from its point of production through to consumption; that is, from paddock to plate.

Modified atmosphere packaging (MAP) is a system of packaging that changes or modifies the atmosphere of gas inside a package (from air) in order to extend the shelf life of food.

The impact of food processing on the environment

Today, food manufacturers and retailers are well aware of the importance of working towards establishing environmentally sustainable food-processing systems. As food moves through the entire food chain, from manufacture to sale at a retail outlet and until it is finally consumed, it has an impact on the environment. The production of any food item, regardless of whether it is a container of fruit juice, a packet of fresh salad mix, a frozen pizza, a litre of milk or a jar of peanut butter, uses energy and water and adds to its **carbon footprint**. Most of the food we purchase is also packaged and must be transported safely from the producer to the point of sale. The amount of carbon dioxide (CO_2) produced during the production, packaging, transportation and sale of the food product is used to calculate its carbon footprint. An equally challenging environmental issue is that food waste is generated at almost every point along the food supply chain. As a result, food processors, food retailers and consumers must all look for strategies to minimise the environmental impact of food processing, food retailing and food consumption to ensure the long-term sustainability of our food supply.

ENERGY USE

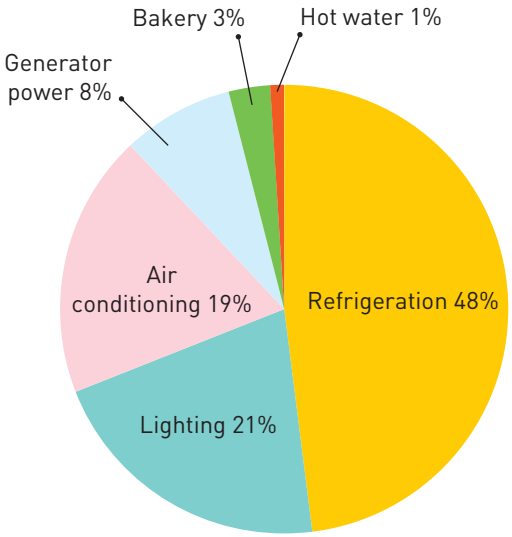
Research has shown that all sectors of production, distribution and consumption of food generate greenhouse gases. In the processing and retailing sectors, most greenhouse gas emissions are the result of energy use or the release of emissions such as methane and nitrous oxide during different stages of the production system.

In food processing plants, energy is used for a wide range of purposes, including:

- refrigeration
- heating ovens for all cooking processes
- food packaging conveyor belts and assembly lines
- lighting, heating and air-conditioning facilities
- warehouse and storage facilities
- company computer systems for stock inventories, ordering systems, collating sales figures and so on
- staff facilities
- transportation.

Food retailers, such as large supermarkets and fresh food markets, use vast amounts of energy to keep food safe for consumption as well as to display it so that it is appealing to consumers.

In a report entitled *Doing the right thing – Sustainability Strategy 2007–2015*, Woolworths Supermarkets outlined its strategy to ensure the company manages its business in a sustainable manner. The report states that the company reduced its carbon emissions by 18.7 per cent compared to projected growth levels for 2014. Energy consumption for Woolworths, like other major supermarkets, is a major contributor to greenhouse gas emission.



Woolworths 2006 CO_2 emissions by end use

Some of the ways energy is used in food retailing include:

- large banks of refrigerated and freezer cabinets to store fresh and frozen products
- lighting to ensure products are highly visible and the supermarket environment is safe for consumers
- keeping the supermarkets at an ambient temperature – that is, not too hot and not too cold – so that customers can shop in comfort

Alamy Stock Photo/martin berry

Lighting in Australian supermarkets uses lots of energy.

- operating the checkout system and other computer systems essential for running the supermarket, such as stock control, ordering systems and accounting systems
- providing fuel for transporting grocery items between the bulk storage facility and the chain of supermarkets. Some supermarkets also provide a home-delivery service to customers.

Strategies to improve energy use in food processing and retailing

A wide range of energy-efficient strategies is being developed by mechanical, electrical and process engineers to help food producers and retailers reduce the environmental impact of their food production and retailing processes.

Food processors

- Australian food processors can manage the use of equipment much more efficiently by installing engineering controls that enable the equipment to switch off automatically when it is not being used.
- The development of waste-heat recovery systems is a new area of mechanical engineering that is reducing carbon emissions. This involves capturing heat that would normally be lost in the exhaust system of the processing equipment and using it for other heating purposes. Heat recovery units can be retrofitted to most processing equipment such as diesel engines and gas turbines. This recovered heat can then be used to produce heat for cooking and machinery for drying, or to provide heating for staff work areas.
- Food processors are encouraged to minimise the heat that is lost from cooking and pasteurising equipment so that they can reduce the level of air conditioning required in production areas.
- Ensuring that refrigeration units, hot water systems and air-conditioning units are well insulated will reduce the amount of energy used and will, therefore, reduce greenhouse gas emissions.
- It is essential that all equipment is well maintained and that refrigerator and cool rooms are regularly checked to ensure that seals are intact.
- Refrigeration and compressed air systems used in food processing can be upgraded to more energy-efficient systems.
- Food processors can use fuel sources that produce lower carbon dioxide emission such as biomass and process by-products.
- Solar panels can be installed to heat water for staff facilities.

Food retailers

- Supermarket buildings can be retrofitted with more energy-efficient lighting systems such as LED lights.
- Master switches can be installed and timed to turn off the power overnight.
- Inefficient open freezers can be replaced with self-closing door freezers.
- Ovens can be well insulated to prevent heat loss; this will also reduce the need for air conditioning.
- Outdated equipment can be replaced with more energy-efficient equipment, such as solar hot water systems.
- Staff can be educated about the importance of turning off light switches, air-conditioning units and exhaust fans when they are not use.
- Automated blinds can be installed on open refrigerator cabinets.

Alamy Stock Photo/Martin Diebel/fStop Images GmbH

Self-closing refrigerator cabinets are more energy efficient.

WATER USE

Water is a significant resource in food processing. In fact, the processing of food uses more water than any other Australian industry – approximately 34 per cent of all the water used by industry.

Water is used in a variety of ways in food processing. A small proportion of the water used is added as an ingredient to the processed foods and in washing or preparing the raw foods. However, most of the water used in food processing does not come into direct contact with the food; it is used in cleaning and sterilising equipment and premises, or in cooling processes to ensure that the food produced is safe to consume.

Food processors and food retailers are examining strategies for more sustainable water use in Australia. Community pressure, the cost of treating water for use in the factory and the cost of disposing of wastewater

are also driving food processors and food retailers to reduce their water use. Consequently, both the volume of water used in the production and processing of food, and the ability to recycle water within their production area have become important considerations for food processors. In food retailing the use of water to clean the supermarket premises and to maintain the safety and hygiene of food service areas is essential.

Sustainable water use

Both food producers and food retailers are actively developing strategies to reduce their use of water.

Kraft Foods is one of many Australian companies that has developed a range of strategies to reduce the amount of water it uses in food processing. The company is committed to sustainable water use and has reduced water use at its Port Melbourne food processing plant by 39 per cent. Some of the strategies used by Kraft and other food processing companies to reduce consumption of potable water include:

- ensuring equipment that requires the use of water is working as efficiently as possible
- recirculating used water for cooling processes or for suppression of dust
- improving cleaning practices in the production area, for example using alternative cleaning processes such as vacuuming and high-pressure trigger hoses
- reducing water pressure to minimise the amount of water lost through leakage
- undertaking regular maintenance on water pipes to prevent any blockages, leaks or overflows
- developing more environmentally sustainable uses of wastewater, for example through developing a partnership with a road construction group that uses some of their wastewater when building roads.

In 2015, Coles Supermarkets was the first company to gain a Green Star rating of four stars for the design and development of a new supermarket in Hallam, south-east of Melbourne. One of the contributing factors was reducing water consumption by 70 per cent compared with traditional supermarkets. Water efficiency strategies included the use of water-efficient fixtures and fittings, such as taps and dual-flush toilets. A 150 000-litre water tank was also installed on site.

Woolworths is also taking steps to improve water efficiency in its supermarkets by auditing where water is used in its stores so that water efficiency can be identified and improved. It has also ensured that all water fittings in its stores have a four-star efficiency rating and that taps are fitted with flow restrictors. Woolworths also uses water-efficient ultra-rinse spray guns for cleaning in its stores. In addition, the company has installed rain-harvesting systems on the roof of its large distribution centres so that rainwater can be collected and stored, and reused on site.

WaterGroup Pty Ltd

Water tanks at Woolworths' distribution centre

Case study

Ferguson Plarre Bakehouses

Read the case study, then answer these questions.

1 Outline the main factors that influenced Ferguson Plarre to take a more sustainable approach to manufacturing its bakery products.

2 Draw a knowledge map to highlight the strategies Ferguson Plarre has used to minimise use of non-renewable resources.

3 Explain how the development of the new hybrid truck will assist Ferguson Plarre to become more environmentally sustainable.

4 Describe how Ferguson Plarre has been able to offset any greenhouse emissions that can't be reduced at its production facility.

5 How has minimising the amount of packaging material used in Ferguson Plarre's production areas been of benefit to the environment?

Ferguson Plarre is an Australian-owned bakery company that has operated in Victoria for more than a century. All of the products sold through Ferguson Plarre stores are baked in its central bakery at Keilor Park and delivered to its stores throughout Victoria. Some of its most popular products are small cakes

such as vanilla slices, dessert cakes such as flourless chocolate cake and celebration cakes for birthdays, Christmas or anniversaries. Ferguson Plarre also produces a range of savoury products such as pies, pasties, vegetable pies and sausage rolls.

Ferguson Plarre 'going green'

Weblink

The production of manufactured food products is energy intensive and has a significant impact on the environment because considerable amounts of gas, electricity and water are used, and waste generated. At Ferguson Plarre, energy is required for most of the key operations, including heating the ovens to bake the cakes and savoury products, refrigerating some ingredients and supplying hot water for washing and cleaning. The management team at Ferguson Plarre recognised the impact their food production system was having on the environment and made a commitment to developing an environmentally sustainable system for producing their products. Their aim is to become carbon negative.

Ferguson Plarre spent 10 years monitoring its emission of greenhouse gases and researching more sustainable food production methods both within Australia and internationally. In November 2007, Ferguson Plarre opened its new state-of-the-art bakery in Keilor Park, Victoria, which incorporates best practice in sustainable food production.

Ferguson Plarre Bakehouses

The Ferguson Plarre manufacturing plant in Keilor Park

Strategies for reducing water and energy use

The new Ferguson Plarre factory has incorporated a wide range of environmentally sustainable strategies to minimise use of energy and water, including:

- harnessing the waste heat from refrigeration systems and using it to heat the water required for cake production
- using recovered heat from freshly baked products to heat the main production areas during winter. Ferguson Plarre has installed exhaust fans to take the heat from cooling tunnels and recycle it in production areas
- eliminating 'heat bleed' into refrigerated and production areas such as cake decoration that require a cool temperature, by improving insulation
- using solar-heated hot water for all staff and office requirements
- installing high-efficiency air conditioning in both production areas and staff facilities
- installing a system to monitor total use of electricity and gas in 'real time' so that carbon dioxide emissions can be measured. This information is displayed on a screen in high-traffic areas to raise the awareness of all staff to the energy used
- installing high-capacity rainwater tanks for staff facilities such as toilets and for washing trucks.

Ferguson Plarre Bakehouses

New production areas in the factory

Reducing energy used for transporting products

Ferguson Plarre has worked with Sustainability Victoria to develop Victoria's first hybrid truck. The new hybrid delivery truck distributes products to stores throughout Victoria. It has demonstrated that it can cut greenhouse gas emissions by approximately 25 per cent by reducing exhaust emissions and improving fuel economy. The new hybrid truck returns power from the brakes to the engine and also emits less diesel particle pollution.

Ferguson Plarre Bakehouses

The Ferguson Plarre hybrid truck

Other environmental strategies

As the aim of Ferguson Plarre is to be carbon negative, the company has made a commitment to offsetting any greenhouse emissions that can't be reduced at its production facility through planting native trees to restore native forests that can store high levels of carbon. Ferguson Plarre has planted more than 22 000 trees that will store 6000 tonnes of carbon dioxide.

In working towards a lower carbon future, Ferguson Plarre has also established more efficient bulk-handling equipment, reducing the greenhouse gases used in producing packaging for its raw materials. This has the added benefit of halving the amount of cardboard sent for recycling or to landfill.

While Ferguson Plarre has a strong commitment to reducing their carbon footprint, it has not been at the expense of producing a high-quality product range. The company has also found that the strategies it has implemented to become more sustainable and environmentally aware have not had an impact on their profit margin – in fact, the company is optimistic that its 'clean green' approach to food manufacturing will attract more consumers who are equally environmentally conscious.

Source: Ferguson Plarre Bakehouses

Understanding the text

1 Why is the amount of energy used in food manufacturing considered to be an environmental issue?

2 Draw a knowledge map to demonstrate some of the uses of energy in a food manufacturing plant.

3 Identify the three uses of energy that produce the highest CO_2 emissions in Woolworths Supermarkets. Explain why Woolworths uses energy to fulfil each of these functions.

4 Outline three strategies that food producers could use to become more sustainable in their use of energy.

5 Draw a diagram to explain how food retailers could become more energy efficient.

6 Why is water an important resource in food processing?

7 List three of the main driving forces behind food producers' search for more sustainable methods of using water.

8 Draw a knowledge map to identify some of the strategies that Kraft Foods has used to minimise their use of water.

9 Outline two strategies Coles Supermarkets has used to reduce water consumption in its new supermarkets.

10 Draw a flow chart like the one below to demonstrate some of the strategies Woolworths Supermarkets has used to improve water efficiency in its supermarkets.

Food packaging and the environment

It is well recognised that packaging plays a key role in the food supply chain. Packaging helps to ensure that the food we eat is safe to consume by reducing spoilage and preventing contamination, as well as providing consumers with important labelling information. Packaging also helps to contain the product, as well making sure that the food is protected and transported efficiently.

TYPES OF PACKAGING

Different types of food have different properties and therefore different packaging requirements. For example, salad vegetables have a high water content and continue to respire after they have been harvested, while cheese is likely to develop mould if it is not packaged appropriately. Therefore, selecting the most suitable type of packaging is important if food is to reach the consumer in good condition and is not wasted.

The materials selected to package food should provide a barrier that either allows or excludes the passage of water vapour, carbon dioxide and oxygen. The package must be sealable, so that it is airtight; that is, hermetically sealed so there can be no chance of cross-contamination from the outside environment. Packaging that is in direct contact with food must be chemically inert and must not allow any odours, flavours or other substances, such as printing ink, to be absorbed by the food. Another consideration when packaging food is whether the materials need to be puncture resistant to prevent damage during transportation.

Modified atmosphere packaging

Modified atmosphere packaging (MAP) has been an important development in extending the life of fresh food. MAP is a system of packaging that changes or modifies the atmosphere of gas inside a package (from air) in order to extend the shelf life of the contents.

The objective of MAP is to retard the microbial growth that naturally leads to food spoilage. Modifying or changing the environment inside a container in which food is stored can extend its shelf life by protecting it from microbial and chemical contamination, oxygen, water vapour and light. When packaging food for retail, food manufacturers select the most appropriate type of packaging for each food to maintain its sensory and nutrient properties and maximise its shelf life. Using a MAP system, the ideal mixture of gases – oxygen, nitrogen and carbon dioxide – can be designed for the inside of a package to ensure that the food reaches consumers safely and in optimum condition.

Modifying the atmosphere surrounding food can be done using a variety of systems where the ratio of gases and packaging material are matched to particular foods:

- barrier-specific packaging
- vacuum packaging
- gas packaging
- active packaging.

Salad mix is packaged using barrier-specific packaging.

Cheese is packaged using vacuum packaging.

Shutterstock.com/Juan Aunion

Gas packaging is used to package meat such as sausages.

Active packaging is used for tortillas.

Aseptic packaging

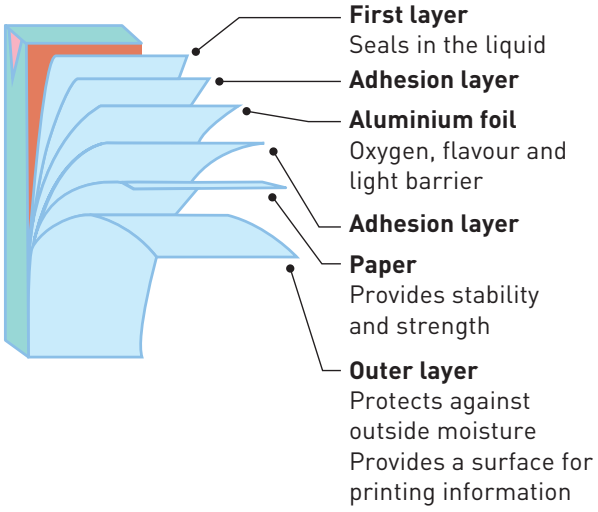
Aseptic packaging is a process whereby the food product and the package are sterilised separately and brought together in a sterile environment.

Aseptic packaging is a system that has been designed to extend the shelf life of foods without the use of preservatives, food additives and refrigeration.

Aseptic packaging has the advantage of extending the shelf life of many food products and thereby helps to reduce food waste. Aseptic packaging is made from lightweight materials that can be easily stacked, making packaging and transportation more efficient and easier. This reduces the energy consumed and minimises the production of greenhouse gases.

However, aseptic packaging also poses problems for the environment. This is because a multi-layered material is often used to construct the containers for an aseptic system, making it more difficult to recycle. Aseptic packaging is made up of:

- **70 per cent paper** – The paper gives strength and rigidity.
- **24 per cent plastic** – Plastics are inert, which means that they do not react with food. This makes it possible to hermetically seal the container and make it liquid tight.
- **6 per cent foil** – A very thin layer of aluminium foil increases the tensile strength of the packaging, making it resistant to tearing, and forms a barrier against oxygen and light. After the heat treatment, the foil layer also eliminates the need for refrigeration and prevents spoilage without the need for preservatives.



Layers in an aseptic package

Foods packaged using the aseptic system

Aseptic packaging is used for UHT milk, cream and custard, fruit juices and purées, soy drinks, liquid stocks, soups and sauces, diced tomatoes, tomato paste in a tub and olive oil.

Examples of aseptic packages

ENVIRONMENTAL ADVANTAGES OF FOOD PACKAGING

Food packaging is an essential component in today's food system. Without it, handling food would be messy, inefficient and costly. By protecting food from damage or spoilage during transportation, while in storage, in the supermarket and before consumption, packaging prevents more waste than it creates. In Australia, about 60 per cent of packaging is for protection and preservation of food.

Food processors use a range of packaging systems and strategies to minimise the impact that packaging has on the environment. Modified atmosphere packaging and aseptic packaging are two systems that extend the shelf life of food and, in doing so, enable retailers and consumers to keep food for longer before it begins to deteriorate.

Food processors also package foods in varying sizes to cater to the changing consumption patterns of consumers. For example, family-sized packets are available in many products while single-serve products are becoming more popular with consumers who live alone or who want a small serve of a product to take to school or work for lunch.

PROBLEMS OF PACKAGING

Food packaging creates a range of problems for the environment. Various types of packaging materials are made from non-renewable resources, including petroleum in the production of plastics, and timber to manufacture paper and paperboard. The production of packaging also uses significant amounts of water, coal and natural gas – other vital non-renewable resources that cannot be replaced once they have been used. Furthermore, much of the food packaging produced in Australia ends up in landfill. According to Environment Victoria, every year more than 1.9 million tonnes of packaging is thrown away rather than recycled. Plastic packaging creates specific problems because, while it is cheap to produce, it is not always biodegradable and can take hundreds of years to break down. As it degrades, plastic packaging produces greenhouse gases, particularly methane, damaging the environment further.

Another concern with food packaging is the issue of over-packaging. While many companies have now recognised the economic and environmental benefits of minimising the amount of material used to package their products, this still remains a problem with some food products. Do foods such as lemons, for example, that come in their own sturdy, environmentally friendly package (their peel) really need to be wrapped further by placing them on a polystyrene tray and covering them with plastic cling wrap? More and more fresh foods such as salad vegetables are now being packaged and the trend to producing individual or single packs also generates additional packaging. Single cheese slices, individual snack packs of chips and tiny tubs of yoghurt, all generate far more packaging than is used to package larger quantities of the same product.

A large single pack of yoghurt and a four-pack of yoghurt

The low level of recycling packaging is another environmental concern. According to research conducted for the Australian Conservation Foundation and Environment Victoria, only about 20 per cent of all packaging is sent for recycling. If food packaging is not reused or recycled, it is often discarded, creating environmental concerns about the amount of waste that is sent to landfill or creating litter that pollutes the environment. Approximately 85 per cent of all litter collected on Clean Up Australia Day is packaging. This rubbish pollutes our rivers, streams and landscapes, and can be hazardous for marine life and freshwater mammals such as the platypus.

These problems have been well recognised by both industry itself and all levels of government in Australia. The National Packaging Covenant, which includes more than 900 Australian business and industry groups, was established with the aim of increasing the level of packaging sent for recycling. It has achieved considerable success with the rate of recycling of used packaging, which has increased from 39 per cent in 2003 to 63.8 per cent in 2012.

Achieving this target means that an additional 3.5 million tonnes of used packaging is diverted from landfill. By 2015, the National Packaging Covenant aimed to achieve a 70 per cent recycling rate of used packaging.

Understanding the text

11 Outline three important factors food processors should consider when selecting a packaging material for their products.

12 Define the term 'modified atmosphere packaging (MAP)'.

13 What are the benefits of using the MAP system of packaging?

14 Identify three types of MAP systems and give one example of a type of food packaged using each system.

15 Explain the process of aseptic packaging.

16 Why is aseptic packaging widely used in food processing?

17 Outline one advantage and one disadvantage of aseptic packaging.

18 Outline the role of each of the materials used in aseptic packaging.

19 Explain how food packaging can benefit the environment.

20 Draw a knowledge map to identify the main environmental problems associated with food packaging.

MAKING PLASTIC PACKAGING GREENER

The scientific community, along with packaging engineers, has developed a range of new packaging materials that are more environmentally friendly and therefore more sustainable. Many of these new packaging materials, called bioplastics, are from plant material such as corn and wheat, and are renewable and biodegradable. The new packaging materials are beginning to replace traditional plastic packaging made from diminishing fossil fuel resources.

The production and use of bioplastics for food packaging has many environmental advantages over traditional petroleum-based plastic. For example:

- Bioplastics are made from plant material, which is a renewable resource.
- The process for making bioplastics uses 65 per cent less energy than conventional methods.
- The production of bioplastics produces 68 per cent less greenhouse gas emissions than conventional plastic production.

Bioplastic packaging in Australia

Plantic Technologies, an Australian-based company, has developed an environmentally friendly 'green' bioplastic suitable for use as a food packaging material from a cornstarch with a high amylase content.

Elizabeth Hunter/Plantic Technologies Ltd

Plantic bioplastic packaging is used to package meat.

Plantic bioplastic packaging has several environmental benefits:

- The cornstarch used as the main material is a completely renewable and sustainable resource.
- Every stage in production is completely organic; from the growing and harvesting of the corn to the final product.

The new Plantic bioplastic can be used to make both rigid and flexible packaging. Several major food manufacturers have chosen Plantic packaging for their food products – chocolate manufacturers Haigh's and Cadbury Schweppes use this new packaging for many of their chocolate products. Plantic bioplastic is used to package fresh product including meat, fish, fresh salads and fresh pasta.

Case study

BioPak

BioPak is one of Australia's leading producers of sustainable packaging. BioPak has developed a range of single-use packaging products for the food-service industry. The products are plant based, biodegradable and environmentally sustainable. One of BioPak's key aims is to reduce carbon emissions by using sustainable raw materials to produce packaging products rather than relying on fossil fuel resources that are used to make conventional plastic packaging.

The production of bioplastics made from corn is environmentally friendly as a form of packaging because corn is renewable and sustainable as it is replanted yearly.

Bioplastics also produce 75 per cent less greenhouse gas during manufacture compared with petroleum-based PET plastic. Furthermore, some bioplastics are compostable, reducing the waste sent to landfill, ultimately reducing greenhouse gas emissions.

BioPak makes a wide range of single-use products from environmentally friendly materials, including paper cups for both hot and cold drinks, plates, bowls, trays, takeaway food containers, cutlery and supermarket checkout bags. The company uses a range of materials.

- Plant starch, such as cornstarch, is used to produce the bioplastic polylactic acid (PLA, which is biodegradable).
- Sugarcane pulp (bagasse) is used in the production of BioPak's takeaway containers, clamshells, plates, bowls and trays. The sugarcane pulp is produced by crushing the stalks of the sugar cane after the juice has been extracted. Bagasse is renewable and biodegradable and is able to be composted, biodegrading at the same rate as garden waste; that is, in approximately 60–90 days. It can also be regrown each year.

Weblink

One of BioPak's most popular products is the BioCup. These cups are made from PLA, a starch-based material made from corn. The BioCups and lids can be recycled.

Source: BioPak

BioPak

BioPak cups

BioPak

BioPak products

BioPak

BioPak plates

MINIMISING PACKAGING WASTE

To minimise the environmental impact of packaging waste, food processors, retailers, and consumers must adopt strategies to reduce, refuse, reuse and/or recycle packaging material.

Reduce, refuse, reuse, recycle

Reduce

Food producers have worked in conjunction with packaging manufacturers to minimise the amount of material used to package food products. Developments in packaging have led to a reduction in the total amount of material used to package food by:

- reducing the wall thickness of containers
- using light but strong packaging materials
- producing products in concentrated form
- producing larger unit sizes to reduce the package-to-product ratio
- using Computer Aided Design (CAD) systems to redesign and create new containers.

George Weston Foods is an Australian food manufacturing company that has successfully reduced its use of cartons to package food by re-engineering its packaging operations; this was achieved by improving the design of cartons, reducing headspace and improving pallet configuration. The company also increased the percentage of recycled content in the cardboard for cartons, without increasing its thickness or density. The result has been reduced freight and storage costs.

Refuse

Plastic shopping bags are used in the final stage of the supply chain. They are used by many consumers to transport food products from the supermarket or retail outlet to their homes. Although the cost of each plastic bag is only a few cents, the economic cost of collecting them once they have been discarded is extremely high.

Australians have a great appetite for plastic shopping bags – we use more than 6 billion bags per year, 4 billion of which are supermarket bags. That means that every Australian uses 175 shopping bags each year. However, the tide is changing. As consumers have become aware of the environmental damage caused by single-use polyethylene shopping bags, many people now refuse these bags and instead have embraced the practice of using reusable shopping bags.

In May 2009, South Australia became the first Australian state to ban plastic shopping bags, introducing a policy to prohibit single-use lightweight polyethylene shopping bags from all stores. In 2011, both the Northern Territory and the Australian Capital Territory followed the lead of South Australia and banned the use of single-use lightweight bags. With the help of Planet Ark, the Victorian towns of Birregurra, Cannons Creek, Murtoa, Metung, Timboon, Cohuna and Leitchville have become plastic bag free towns. Several New South Wales towns have now also banned the use of single-use plastic bags.

Alamy Stock Photo / ZUMA Press, Inc

Reusable shopping bags

Recycle

Recycling is easy and, according to Sustainability Victoria, we are all getting better at it! Household recycling rates have increased significantly over the past decade. Victorians now recycle more than 290 kilograms of packaging material such as paperboard, glass, steel cans and milk cartons.

Recycling bins in supermarkets have also increased the convenience of recycling plastic shopping bags.

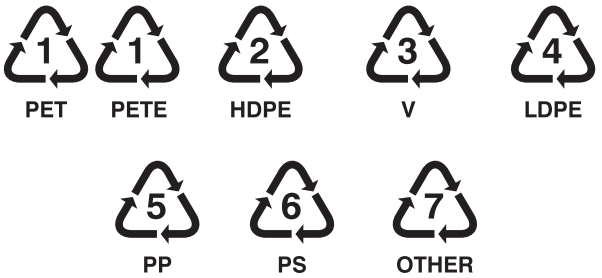
Christodoulou

Recycling plastic shopping bags

Businesses have also improved their level of recycling and many food processing businesses now have strategies in place to recycle packaging material used in their production areas.

Research by the Packaging Council of Australia shows that approximately 2 million tonnes or 50 per cent of the paper and paperboard used for packaging is now collected for recycling. Similarly, almost 63 per cent of all aluminium cans are recycled. One of the benefits of aluminium as a packaging material is that it can be continuously recycled. This is a real environmental advantage because the production of new aluminium cans from recycled material uses only 5 per cent of the energy required to produce the same cans from new material.

The level of recycling for plastic packaging materials, however, is currently only 20 per cent of all plastic packaging that is produced. This low level of recycling of plastic is linked to the wide range of plastic packaging materials, some of which can be recycled and some of which can't. Plastic packaging that can be recycled will carry the numbers 1, 2 or 3, while items marked with 4, 5 or 6 may not be suitable in some areas. Where new plastics can be manufactured from recycled materials they use only 30 per cent of the energy used to make plastics from fossil fuels.



Shutterstock.com/NoPainNoGain

Recycling symbols

Problems of recycling

Plastic packaging materials present recovery and recycling problems. They are usually lightweight – one of the reasons they are used to package food in the first place. However, they are often contaminated with food residues such as fats and yoghurt, as they are not washed before disposal. Their light weight makes them difficult to collect and transport for recycling because they blow around and take up a lot of space. Lightweight plastic film, bags and pouches are usually produced from a combination of materials and are therefore difficult to isolate and reprocess. Incinerating and harnessing the energy may be an alternative use for these materials, although this is not yet widely used.

Containers such as those used in aseptic packaging have multi-layers of metal foil, plastic and card or paper and are very difficult to separate. Although they can be recycled in a process called 'hydropulping', it is an expensive process and not available at all recycling depots.

While recycling centres and the kerbside collection of packaging materials has reduced the use of raw materials in the production of the packaging, the environmental benefit may be outweighed by the emissions, air pollution and energy consumption involved in the recycling process.

Reuse

The Australian food processing industry has taken up the challenge to reuse packaging material reclaimed as a result of the recycling process. Approximately 83 per cent of all paper that is recycled is now used to make new packaging material. Reusing recycled cartonboard to make new packaging not only reduces the amount of packaging going into the waste stream, but also reduces the need for timber from forest harvesting. It has the additional benefit of saving vast quantities of non-renewable resources such as timber, gas, electricity, oil and water.

The Australian Recycled Cartonboard Campaign (ARC) has been established so that consumers can learn which products are packaged in recycled packaging material. Food manufacturers who are signatories to the ARC campaign are able to use the ARC logo. Some well-known companies that have joined the ARC campaign include Kellogg's, Arnott's and Uncle Toby's.

Australian Recycled Cartonboard

Australian Recycled Cartonboard logo

The Envirotray is an example of eco-designed food packaging made of 100 per cent recycled paper that is biodegradable and recyclable. The Envirotray has good insulating properties and a grease-resistant coating so it is non-stick and is strong and rigid. The outside surface is suitable for printing high-quality graphics.

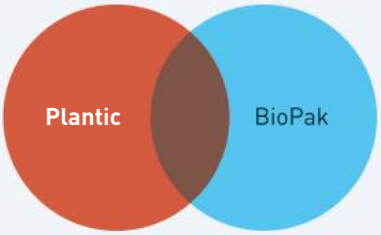
Another method of reusing packaging is used in South Australia where a deposit system is imposed on some aluminium, glass and plastic beverage containers. The aim of the program is to reduce litter and solid waste, and to conserve non-renewable resources. The deposit is refundable and is designed to encourage consumers to return the containers to receive their refund. The containers are then reprocessed or recycled. Approximately 80–90 per cent of all containers covered by this strategy are returned.

Understanding the text

21 What are bioplastics?

22 Outline the main environmental advantages of using bioplastics to produce food packaging.

23 Draw a Venn diagram to demonstrate the similarities and differences between the bioplastics produced by Plantic and those produced by BioPak.



24 List four examples that demonstrate how food packaging can be reduced.

25 Why is it important for Australian consumers to continue to refuse to use single-use polyethylene shopping bags?

26 What strategies have some communities used to address the issue of the use of these bags?

27 Prepare a SWOT (strengths, weaknesses, opportunities, threats) analysis of recycling.

28 Explain how the use of recycling symbols can assist consumers to recycle packaging.

29 Explain how food manufacturers are minimising their use of non-renewable resources by reusing packaging materials for their products.

30 Outline the advantages of using a deposit system on beverage containers.

Food transportation

Much of the food we purchase as consumers in Australia is grown in farming communities in regional areas throughout the country. It is then transported to a food producer or distributer before entering the retail supermarket or fresh food market when we shop. This may mean that some of our fresh food is grown in states a long way from the consumer. For example, bananas grown in Queensland must be transported to consumers in southern states such as Victoria or Tasmania to enjoy. However, more of our processed food is being imported, increasing the distance it is transported.

Moving food through the food supply chain, from 'paddock to plate', is based on logistics; that is, the management and control of goods from their point of origin to the customer. In Australia, most food is transported by truck because it is the most

efficient and reliable method of transporting goods quickly between the food processor, supermarket distribution centre and their stores. Some rail transport is also used in Australia to move food between the food producer and food processor, but this makes up a much smaller proportion of the food transportation system.

Processed food products with a long shelf life that are imported may be shipped on large container ships. Air transport is often used to transport products from overseas that have a short shelf life, such as fresh vegetables.

Clockwise from top left: iStock.com/Elina_L; Shutterstock.com/Nick_Nick; Shutterstock.com/mandritoiu; Getty Images/Quinn Rooney; Alamy Stock Photo/Dave & Les Jacobs/Blend Images.

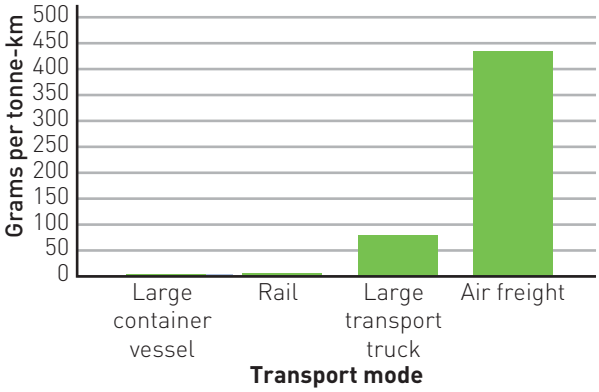
Overview of the food supply chain

ENVIRONMENTAL EFFECTS OF FOOD TRANSPORTATION

Regardless of the mode of transport – road, rail, sea or air – each has a negative impact on the environment. All transport uses fossil fuels – oil, petrol, diesel or gas – to provide energy. The burning of this fuel for transportation generates greenhouse gas emissions, the majority of which is carbon dioxide (CO_2). The production of greenhouse gases has been shown to contribute to global warming and climate change.

In Australia, transporting food along the supply chain by large trucks generates approximately 28 per cent of our national CO_2 emissions. All perishable food in Australia, such as milk, dairy products and meat, is transported in refrigerated trucks. These trucks use additional energy to run the refrigerated storage unit and so emit an even greater volume of CO_2 into the atmosphere.

While road transport generates a significant amount of greenhouse gas emissions, the use of air freighting uses far more energy than other forms of transport and therefore creates far more CO_2 emissions.



A comparison of the CO_2 emissions of different modes of transport

However, there is some good news! The use of new forms of technology, particularly the ability for consumers to place their supermarket food order online and have the order home delivered may help to cut CO_2 emissions considerably. A study undertaken in the United States in 2013 found that the use of a supermarket delivery service could cut food transport-related greenhouse gas emissions by approximately 50 per cent compared with individual household trips to the store. The report stated that fully laden trucks that delivered to homes in nearby neighbourhoods were far more energy efficient than shoppers driving their own car to and from the supermarket.

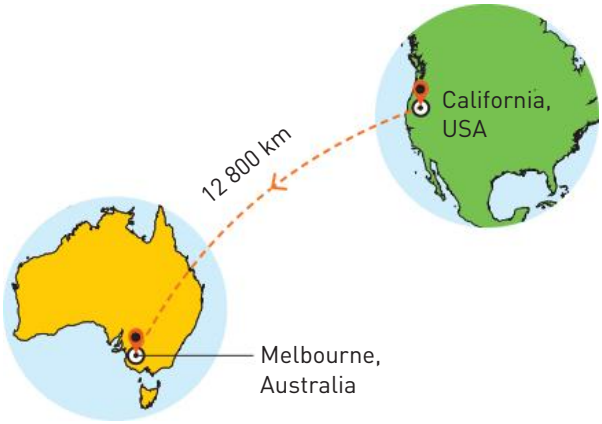
FOOD MILES

The distance their food has travelled from where it was produced to the point of purchase is another issue linked to sustainability that is of concern to many consumers. The concept of **food miles** is one that is often used to estimate the distance food travels from its point of production through to consumption, that is, from 'paddock to plate'.

Calculating the distance food travels is an indicator of how environmentally friendly the food is. Therefore, the fewer kilometres (or miles) a food has to travel, the better it is for the environment. Increasing globalisation had led to most countries importing food that is not easily produced by their own farming communities.

Consider the following examples:

- Rice grown in the Riverina in New South Wales travels 380 kilometres to Melbourne consumers. Compare this with basmati rice grown in India, which travels over 12 500 kilometres to Sydney.
- Milk produced in Australia travels an average of 550 kilometres to reach consumers.
- In summer, locally grown tomatoes in Victoria travel on average 165 kilometres. However, in winter most tomatoes are grown in Queensland and trucked to Melbourne, a distance of 3000 kilometres.
- Bananas available to Melbourne consumers are grown in Queensland, so the average distance they travel is approximately 2700 kilometres.
- Lettuce is grown on the outskirts of Melbourne, so the average distance it travels to Melbourne is approximately 55 kilometres.
- Australian-grown oranges from the Riverina travel approximately 450 kilometres to Melbourne fruit and vegetable markets. In comparison, oranges imported from California travel 12 800 kilometres.



The food miles that oranges travel

However, most environmental scientists now think that we should not only consider the distance food travels, but also how it is processed and packaged to get a more complete picture of its energy footprint. Research has shown that food transportation is really only a small part of the greenhouse gas emission picture and that growing, processing, storing and shopping for food all make a far greater contribution than transportation.

Food waste

Food waste is recognised as having both economic and environmental implications throughout the world. The United Nations Food and Agriculture Organization (FAO) estimates that approximately 30 per cent of all food produced globally is wasted.

Like other developed nations, Australians waste a large proportion of the food we produce. According to an RMIT study titled *Watch my waste*, Australians throw away more than 20 per cent of the food – or one in five of every bag of fresh food – we buy every year. As every family knows, food is not cheap and the food that is wasted is estimated to be worth over $8 billion. Annually, this equates to more than $1000 for every Australian household that is being spent on food that is wasted.

In terms of the volume of food we send to landfill, it is estimated that for each Australian, approximately 360 kilograms of food is put into the rubbish bin every year. The majority of food that we waste is fruit and vegetables, but leftovers from family meals are another major contributor to food waste. In a research project undertaken in 2015, the Queensland University of Technology found that there are three main reasons people throw food away: 'People throw food away because of a lack of food supply knowledge (what's in

Shutterstock.com/simez78

Food scraps make up a large percentage of the waste sent to landfill.

my kitchen), food location knowledge (what's in my fridge and pantry) and level of food literacy (how to use it and judge its edibility)'.

Supermarkets also find they are faced with wasting food when, for example, a product is discontinued, labelling regulations change, or a fresh product such as bread or cheese passes its 'use-by' or 'best-before' date. Another major cause of food waste is that major supermarkets reject entire crops of perfectly edible fruit and vegetables even before they reach the supermarket shelf because they don't meet the consumer demand for unblemished produce and market standards of size, shape and appearance. Furthermore, sales promotions encourage consumers to purchase excessive quantities of perishable food because it seems to be cheap, but is then often wasted.

Like supermarkets, restaurants also have a problem with food waste because approximately 25 per cent of all the food purchased for restaurant meals is either not used or is not eaten by the customer and ends up being thrown away. Other food waste occurs when we buy food from takeaway outlets and don't eat it all.

ENVIRONMENTAL PROBLEM OF FOOD WASTE

As well as having financial implications for individual families and commercial food businesses, food waste also creates problems for the environment. It is estimated that every year 13.6 million tonnes of organic waste is disposed of in landfills.

As stated in the Australian Institute of Health and Welfare report *Australia's food and nutrition 2012*, 'household waste is responsible for 5.2 megatonnes of carbon dioxide emissions from landfill, equivalent to total emissions involved in the manufacture and supply of iron and steel in Australia'. Food waste that is sent to landfill also produces methane, a greenhouse gas that is 25 times more damaging to the environment than carbon dioxide and therefore makes a significant contribution to global warming.

However, greenhouses gases are not only released when organic material such as food breaks down. When food is grown, processed, refrigerated, stored and transported, energy is used. This energy releases greenhouse gases that are damaging to the environment and so when we throw food away, the energy used to produce the food is simply wasted.

The methane is released into the atmosphere, giving off a very strong and unpleasant smell; it also leaches into the soil where it can contaminate groundwater.

The transportation of food waste to landfill sites also contributes to greenhouse gas emissions. Significant amounts of diesel fuel, a non-renewable resource, are used to fuel the trucks that transport waste to landfill. This is another factor driving food producing companies to look for more sustainable methods of reducing their solid waste.

Food production also uses large amounts of nutrients from the land, energy, fertilisers and water, and so these valuable resources are also wasted when food is thrown away.

Activity 14.1

Recognising and addressing food waste

Work in a small team to brainstorm answers to the following questions about food waste.

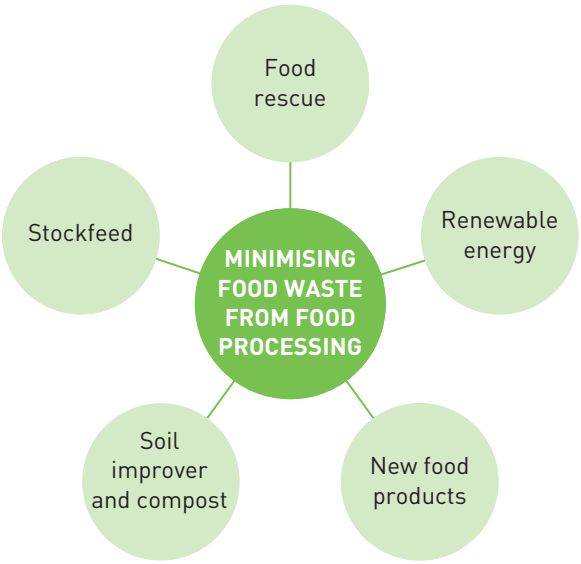
1. What types of food are most commonly wasted among 16–18-year-olds?
2. What types of food would most commonly be wasted in your home?
3. What are the reasons that families waste food?
4. What strategies could families easily implement to minimise food waste?

STRATEGIES TO MINIMISE FOOD WASTE FROM INDUSTRY

The manufacture of food products inevitably results in some waste being created as an end result of food processing. Fruit and vegetables, for example, used in the manufacture of other food products such as

fruit juice, canned soups or frozen meals, must be peeled, cored and trimmed. These processes create 16 kilograms of solid waste for every tonne of finished product that is made. Furthermore, as the availability of land to use for the disposal of solid waste is limited, this practice is not sustainable.

Minimising waste and developing by-products from the waste generated during the production of food makes economic and environmental sense.



Minimising food waste from food processing

Food rescue

More than 2 million people in Australia struggle to afford enough fresh food each day to stay healthy. Instead, they rely on the services of four main food rescue agencies: Foodbank, SecondBite, OzHarvest and Fare Share. These organisations accept donations from a wide range of organisations in the food supply chain including primary producers, food processing companies, food distribution companies, supermarkets, restaurants and caterers. Food rescue agencies then redistribute the food to people who struggle to find enough money to purchase their basic food needs through welfare agencies or community food programs. These food rescue organisations not only help people in need but, through the provision of these services, they assist the environment by diverting food from landfill.

Foodbank is Australia's largest food relief organisation and operates in all states in Australia. It acts as a warehousing and distribution centre for more than 2500 national charities. In 2014, Foodbank provided welfare organisations with sufficient food to produce 40 million meals.

SecondBite supports over 1200 community food programs that provide assistance to families in crisis, homeless people, young people at risk, Indigenous communities and asylum seekers. In 2011, Secondbite developed a partnership with Coles Supermarkets to supply it with food that would normally be considered as waste but was still perfectly safe to be consumed and could be reused by SecondBite.

In October 2013, SecondBite reported that its food recovery program had rescued and redistributed more than 3.9 million kilograms of fresh food. This food was used to prepare more than 7.8 million meals, preventing the food from entering the waste stream and ending up in landfill. Its report states that this equates to saving 'over 74 million litres of water, more than 6 million kilowatts of energy and over 6 million kilograms of greenhouse gas (CO_2 equivalents)'.

SecondBite food van

Sian Bradfield/Cengage Learning Australia

Renewable energy production

The production of **biogas** from the solid waste diverted from landfill is a new strategy developed to minimise the impact of waste on the environment. Waste material from food processing such as meat, fish and vegetable processing, fruit canning and the production of confectionary can all be used as an energy source for biogas.

McCain Foods is currently converting food waste from its Ballarat plant to biogas. The production of biogas has the twofold advantage of reducing the solid waste sent to landfill and replacing approximately 10 per cent of the natural gas used in its processing plant with biogas. McCain blends the biogas with natural gas, which is then used in a boiler to produce steam to generate hot water.

Tesco, one of the largest food retailers in the United Kingdom, decided to become more sustainable and

developed a strategy to divert waste produced by its business away from landfill by reusing waste meat to generate renewable electricity that is then put back into the national grid.

Activity 14.2

Brisbane inventor turns food factory waste into free fuel

Read the article below, then answer these questions:

1 Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.

Worksheets

2 Prepare a PMI (plus, minus, interesting) chart on the information in the article.

BRISBANE INVENTOR TURNS FOOD FACTORY WASTE INTO FREE FUEL		
Plus	Minus	Interesting

BRISBANE INVENTOR TURNS FOOD FACTORY WASTE INTO FREE FUEL

A Brisbane inventor has developed an 'environmentally friendly' modular system of turning food factory waste such as fruit, vegetables, bakery and fat into free energy that can be used for heating, electricity or as an engine fuel.

Ron Lakin has developed the BioBowser, a small scale, affordable and practical biodigester that produces methane gas. After the gas is extracted the leftover material can be used as a nutrient-rich fertiliser – although Mr Lakin said oils and fats should be mixed with other material.

Mr Lakin said the BioBowser, which he has been developing for eight years, not only results in energy cost savings, but it also has 'significant environmental benefits' as methane is a highly destructive greenhouse gas that is rated as 25 times more destructive than CO_2.

The principle of converting waste to methane has been known for centuries. On his journey in the 13th century Marco Polo commented that the Chinese were tapping gas from the sewers and using it for cooking.

Large intensive farms in Australia like piggeries have long been harvesting methane to use as an energy source. But these require large one-off systems that can cost millions to build even though they pay back the capital outlay in energy savings in a few years.

Ron Lakin inventor of the BioBrowser

Mr Lakin said small-scale biogas digesters are popular in China, India, Germany, Sweden and Norway, but not yet in Australia.

With the BioBowser, Mr Lakin said methane bio-digesting was now accessible to smaller scale operations such as food factories.

'It's like having your own bowser, but the fuel is free,' Mr Lakin said. 'All we need to know is the quantity of waste available on a regular basis and the energy requirements of the business and in what form and we can tailor the BioBowser to suit the needs of the individual customer. If the amount of waste increases, or more gas is needed, we can put in more units as the system is modular,' he said.

'A food factory with 20 cubic metres of waste a week could produce methane of the equivalent heat value of 60 kilograms of LPG, which would be more than sufficient for cooking, heating and lighting, while a larger facility producing 5 tonnes of waste a day could provide sufficient energy to power a generator to produce electricity for the entire plant,' Mr Lakin said.

Mr Lakin said a small unit could cost from $6000 to $8000, depending on requirements, such as whether the methane needs to be converted to electricity or motor fuel. A larger BioBowser could cost over $300000, but Mr Lakin said the machine 'could save that amount in energy costs in less than four years'.

'The biodegradable waste material could range from bakery, kitchen or restaurant waste or fruit and vegetables,' Mr Lakin said.

AUSTRALIAN FOOD NEWS ausfoodnews.com.au

AUSTRALIAN FOOD NEWS ausfoodnews.com.au

Diverting solid food waste from landfill

Minimising waste and developing by-products from the waste generated during the production of food makes economic and environmental sense. Food manufacturers are always looking for opportunities to increase their profits and to demonstrate that they are good corporate citizens who are concerned about the environment.

Australian Harvest, a company located in Coldstream, Victoria, produces a range of delicious organic fruit pastes including a plum and grape paste and a fig and grape paste from the waste produced as a result of its wine production process. These pastes are made from skins and seeds removed from the grapes after they have been crushed to make wine. The organic fruit pastes made by Australian Harvest are becoming popular to serve as a part of a cheese board.

Australian Harvest Fine Foods

Bio-grape products

The processing of fresh pineapples into cans and juice produces a large amount of effluent, which is like mud. The mud is made up of fine particles of pineapple skin, core and so on, as well as other waste from fruits used on the production line. Golden Circle is one company that collects and transports the mud by-product back to the farms to be used as a soil improver. Recycling the nutrients from plant waste is proving to be more economical to farmers than purchasing traditional soil improvers such as gypsum. This waste management strategy has reduced the disposal cost of the mud from the pineapple processing plant as well as contributing to the ecological sustainability of the pineapple growing industry.

Many companies now use what would in the past have been considered the 'waste stream' to produce new products for consumers.

- Waste from vegetable processing, bread baking and dairy processing is used to produce stockfeed, providing a source of fibre, protein and energy for the dairy, cattle and pig production industries.
- The peel and pulp from processing fruit such as apples and oranges into fruit juice are used to produce cattle feed and fertiliser.
- The trimmings from processing meat are used as an ingredient in pet food and to make fertiliser.
- The heads and internal organs of fish are used as an ingredient in pet food and as fish bait.
- The heads of poultry are used to produce animal feed and as an ingredient in pet food, while chicken feet are used in the preparation of gelatine.
- The shells of packaged nuts are made into mulch for mushroom growing and to produce fertiliser.

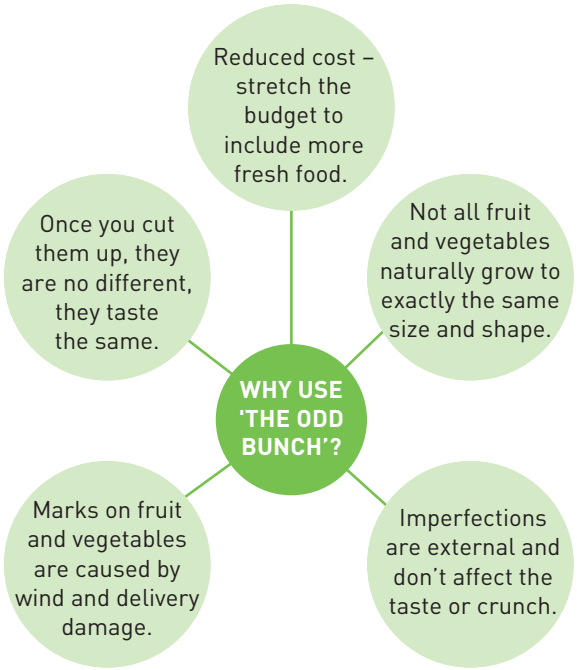
Woolworths 'The odd bunch' initiative

In November 2013, Woolworths introduced its 'The Odd Bunch' initiative. The aim of this marketing strategy is to provide customers with fruit and vegetables that previously might have ended up as waste at a reduced price. According to Woolworths, approximately 25 per cent of fresh produce is rejected because of imperfections or cosmetic damage.

Woolworths

Woolworths 'The odd bunch'

Woolworths see this strategy as providing advantages not only for the consumer, who is able to buy perfectly nutritious, fresh produce at a reduced price, but it means that farmers are able to sell more of their produce. The advantage to the environment is that less food ends up in the waste stream and sent to landfill.



Why use 'the odd bunch'?

Understanding the text

31 Identify the five key stages in transporting food from 'paddock to plate'.

32 Prepare a PMI (plus, minus interesting) chart on the impact of food transportation on the environment.

IMPACT OF FOOD TRANSPORTATION ON THE ENVIRONMENT		
Plus	Minus	Interesting

33 Explain the meaning of the term 'food miles' and explain why many consumers are becoming concerned about this issue.

34 Draw a mind map to summarise the issues associated with food waste in Australia.

35 Outline three reasons food waste is an environmental concern.

36 Explain how organisations involved in 'food rescue' can reduce food waste and benefit the community. Use examples to support your answer.

37 What is biogas and how can its production be environmentally sustainable?

38 Why do food manufacturers seek out opportunities to develop by-products when processing food?

39 Identify two examples of by-products that are manufactured from processing food waste and explain how these products can benefit the environment.

40 Outline the advantages to producers, consumers and the environment of the Woolworths 'The Odd Bunch' campaign.

PREPARING FOR EXAMS

Applying knowledge

Write six questions to ask a food processor about their use of non-renewable resources in their production processes. Focus your questions on the sustainability issues highlighted in this chapter.

WS Worksheets

Analysing information

Summarise the advantages and disadvantages of sending food waste to landfill.

Evaluating concepts

The recycling symbol is often found on cartons and other packaging used in the food industry. Present an argument for and against the usefulness of these symbols to consumers when they are considering the environmental impact of food packaging.

HOW TO SPOT A FAD DIET

- Is it based on healthy eating and exercise?
- Does it offer rapid weight loss?
- Is the long-term maintenance of the diet sustainable?
- Are there likely problems with the diet?

ANALYSING WEIGHT LOSS CLAIMS

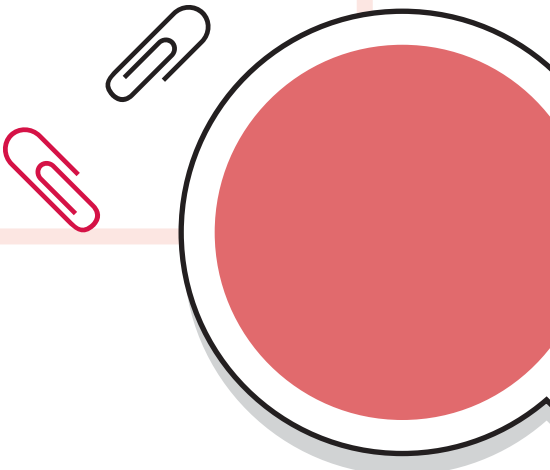
- Exaggeration
- Lack of evidence
- Use of the fear factor
- Ethics versus financial gain
- Language used

ASSESSING THE VALIDITY OF INFORMATION

- Author and source
- Authority
- Accuracy
- Currency
- Reliability
- Objectivity
- Coverage

PUTTING THE AUSTRALIAN GUIDE TO HEALTHY EATING INTO PRACTICE

- Correct proportions of food groups
- Food from each of the five food groups
- Energy balance
- Reducing salt
- Reducing sugar
- Reducing fat



15

BECOMING AN INFORMED FOOD CONSUMER

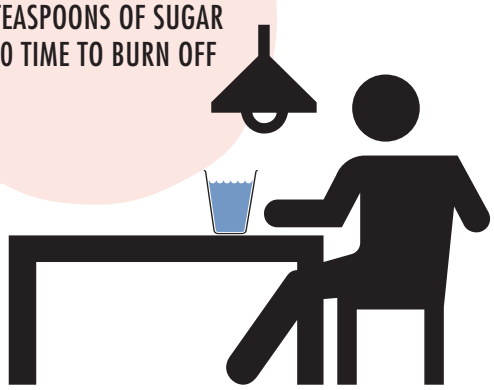
SOURCES OF FOOD INFORMATION

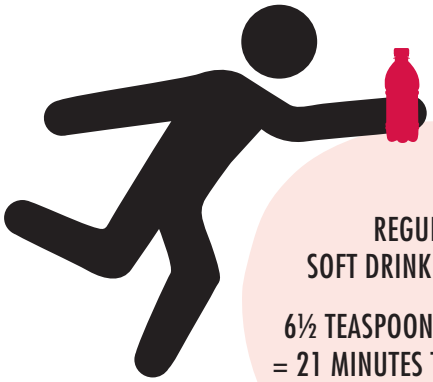
- Academic or scholarly articles
- News items in newspapers
- Magazine articles
- TV news reports

WATER V. SOFT DRINKS

WATER = 0 kJ

0 TEASPOONS OF SUGAR
= 0 TIME TO BURN OFF





REGULAR
SOFT DRINK = 437kJ,

6½ TEASPOONS OF SUGAR
= 21 MINUTES TO BURN OFF

KEY TERMS

Currency refers to how valuable the information is to the topic.

Fad diets are weight-reduction diets that either eliminate one or more of the essential food groups, or recommend consumption of one type of food.

Food fad refers to a food or ingredient that people are interested in for a short period of time, such as chia, quinoa, teff or kale.

Nutrient supplement provides concentrated nutrients, usually vitamins and minerals that may not otherwise be consumed in sufficient quantities.

Objective refers to information that is fair, impartial and independent.

Reliability refers to the dependability or consistency of information.

Scholarly or academic articles are by academics or specialists in the field who reference and check the information and verify the facts. Articles include references, footnotes and bibliographies.

Contemporary contexts in which we learn about food

We develop food education and enhance our skills and knowledge about food in many ways. Our earliest knowledge about food is learnt within our immediate family and our extended family network. Depending on family circumstances, we may be exposed to other people who help to teach us about food through childcare facilities or kindergarten programs. School health programs and Food Studies classes provide a more formal setting for learning about food. The Kitchen Garden Program that operates in many primary schools, for example, teaches young children about the importance of eating fresh food for good health.

National, state and local governments play an invaluable role in providing material to educate Australians of all ages about the importance of good nutrition, and national and state governments play a key role in higher education where institutions train food industry professionals and dietitians. Non-government agencies, such as the Australian Nutrition Foundation, the Heart Foundation and Cancer Council of Australia all provide a wide range of easily accessible nutrition information for consumers.

Food websites are also an important vehicle for learning about food; they provide a range of video clips that enable consumers to learn new food preparation techniques. News reports about healthy eating are often found in food and health magazines, newspapers, television current affairs programs or on many of the social media platforms.

Individual and family responses to food information

In Australia, there is an abundant and diverse food supply, but people still do not always choose foods that provide nutrition for good health.

Food knowledge is valuable for consumers to assist them in making healthy food choices. However, even with sound food and nutritional knowledge, an individual may ignore what they know about nutrition when they go shopping or are choosing what to eat when they are out. Often nutritional knowledge is not always followed by good dietary habits, particularly when individuals and families are unsure or cannot apply their knowledge. This uncertainty can be compounded for some people because nutritional information often comes from a number of channels and may be viewed as conflicting and is therefore mistrusted.

For some people, the main barrier to selecting nutritious foods is cost. If the cost of healthy food is beyond a person's budget, they may need to choose cheaper, more filling foods to satisfy their hunger, leading to an unbalanced diet, even though they have knowledge of healthy eating. For others, accessibility to shops that sell healthy food may be difficult so these people may be forced to buy less-healthy foods closer to their home or work.

Another key barrier for some people is limited food preparation facilities in their homes or the lack of food skills to prepare healthy food. A lack of time is often a reason why people resort to unhealthy fast-food meals – it can seem too hard to prepare a meal if you arrive home late from work or are juggling school and sports commitments. For people who live alone or for those who are elderly, cooking for themselves may not seem worthwhile; they may find it cheaper and more convenient to purchase a ready-made meal for one.

However, one of the key reasons some people choose to ignore their own knowledge about good nutrition is sensory appeal. Sometimes we are tempted to eat food even if it is unhealthy because it smells and looks appetising! Sweet and high-fat foods have an undeniable sensory appeal. This means that people make poor food choices even if they have the knowledge of healthy eating. Overconsumption of energy-dense foods, such as cakes, biscuits and confectionary, also occurs when we eat without thinking. For example, mindless eating often occurs when we are watching television or when we are stressed or unhappy.

Cultural influences of an individual or family that involve the consumption of certain foods and the elimination of others such as meat or dairy products, for example, may be a stronger influence than nutritional knowledge.

Young people's peer groups have a significant influence on their eating habits. Even when young people have nutritional knowledge learnt from school or modelled in their families, the 'pull' of the social group may encourage them to consume unhealthy foods. On the other hand, the support of their social group can also have a beneficial effect on eating behaviours because the individual may adopt a new,

The ways we develop food education

healthy eating strategy. The peer group can provide support and encouragement and help young people sustain the new eating patterns.

Food marketing, particularly to children, can also have a direct influence on food choice because children are encouraged to purchase foods that are energy dense through persuasive marketing, such as through the use of television advertisements, giveaways or social media.

THE LIVELIGHTER CAMPAIGN

LiveLighter

LiveLighter

LiveLighter is a program developed in Western Australia that aims to encourage adults and families to lead healthier lifestyles and make changes to what they eat and drink and how much they exercise.

Weblink

LiveLighter has a number of resources that encourage individuals to respond to the call to LiveLighter today.

iStock.com/MaElena1

Plan for exercise and healthy snacks.

Planning

The LiveLighter Meal and Activity Planner allows the person to take the first step towards a healthier future. People who sign up can access healthy recipes, plan meals, schedule and record exercise activities and track their progress.

Calculate your risk

Resources are provided on the website to allow a person to determine any nutritional risks their lifestyle may expose them to. Information on the website allows them to calculate their body mass index (BMI), then determine if their weight puts them in a normal or risk category. Healthy tips are also provided, such as 'Watch your portion size', with information about recommended serving sizes, and 'sit less'.

LiveLighter

Information on the LiveLighter campaign can be accessed through a variety of electronic devices.

Avoid sugary drinks

Information is presented about the kilojoule content of sugary drinks. Recommendations are made to drink water and avoid drinks such as fruit drinks, cordials, sports drinks, energy drinks and flavoured milk. To reinforce this information, the website provides a comparison between water and a soft drink.

Access information

The LiveLighter website also allows consumers to access information and facts about issues relating to food, such as toxic fat and information for parents. Toxic fat is fat or adipose tissue stored throughout the body that produces chemicals that can be poisonous to the body.

Consumers can also view television advertisements for products such as LiveLighter Snack foods.

LiveLighter

A poster for the LiveLighter campaign.

Shutterstock.com/somchaij

Plain water = 0 sugar

iStock.com/Lee Rogers

A 600 mL soft drink = 16 teaspoons of sugar = 3-kilometre run

Community responses to food information

Throughout Australia, the community has responded to food knowledge and information by introducing programs that assist individuals and families to make healthy food choices. Community members have responded positively to these initiatives and made significant changes in their eating behaviour, particularly their food choices, and these changes have become evident.

HEALTHY TOGETHER VICTORIA

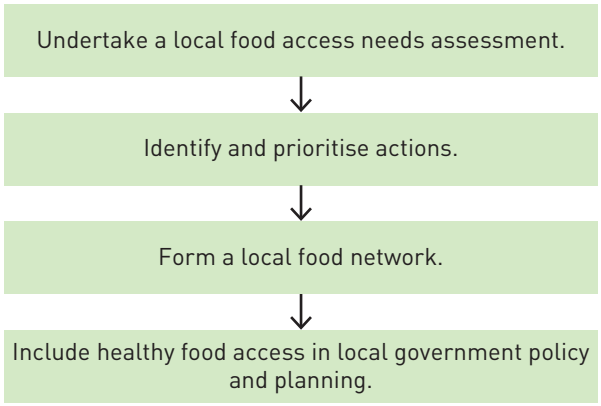
Weblink

Healthy Together Victoria is a preventative initiative aimed at driving changes necessary to support good health and wellbeing throughout the state. The approach is a large-scale initiative across Victoria and is taking action on systems that affect the health of individuals, families and communities, to create health-promoting environments in workplaces, schools and food outlets. The main aims of this initiative are to:

- build on community food systems
- focus on increasing the consumption of fruit and vegetables
- promote and achieve a healthy weight for adults and children.

Healthy Together Communities

Locally led Healthy Together Communities operate in 14 communities in 12 areas across Victoria, including Hume, Wyndham, Knox, Whittlesea,

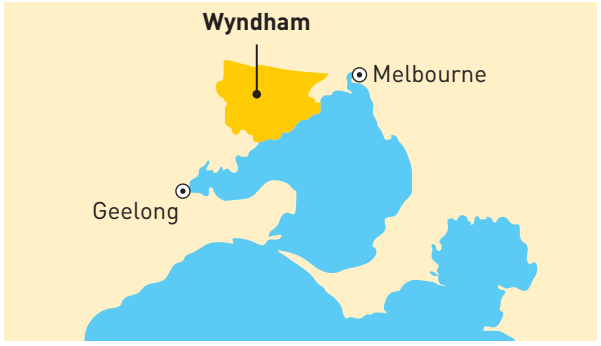


The Healthy Together Communities model

Greater Dandenong, Cardinia Shire, Mildura, Bendigo, Wodonga, Latrobe, Geelong and Grampians Goldfields.

These communities use the following model to address local food system change and to plan and develop actions best suited to local needs. These particular needs have been established based on evidence and health promotion experiences.

Wyndham is one of the communities that was selected for the Healthy Together Communities project. This area includes Werribee and Point Cook and has two major retail precincts, intensive vegetable growing areas and grazing lands. In a 'Snapshot of Wyndham 2015', 53 per cent of people were identified as being overweight or obese.



Wyndham, Victoria

Healthy Together Wyndham is a community health initiative that aims to improve the health outcome of people living in the Wyndham City Council. Their website provides a wide range of nutrition and health information to local residents. The Eating Well section of the website gives the community access to information on issues such as 'Rethink sugary drinks', 'Eating fresh and healthy' and 'Where to buy fruit and vegetables in Wyndham'.

Healthy Together Wyndham

'Healthy Together' page on Wyndham City Council's website

Wyndham is an important food bowl situated near Werribee South, a major vegetable growing area, where 85 per cent of the state's cauliflowers are grown, 55 per cent of broccoli and 34 per cent of lettuce. Unfortunately, there is little direct access to these vegetables for local consumers. To address this issue, the website provides information for locals about where to access fruit and vegetables. The location of farmers' markets, community garden swaps and farm-gate fresh food sales, such as apples from the nearby Bacchus Marsh apple orchards, are all identified on the website.

Jamie's Ministry of Food Mobile Kitchen was also set up in Wyndham as part of Healthy Together Wyndham. The mobile kitchen gave local residents the opportunity to access and participate in a community-based cooking program. As a part of the program, they learnt how to cook tasty, healthy food for the family and how to save money while improving their health.

GREEN LIGHT, EAT RIGHT

Weblink

The Green Light, Eat Right (GLER) project aims to improve the range of nutritious foods available to consumers and their access to these foods, and to help consumers make informed food choices in the City of Melbourne municipality. This program refers to the Victorian Government's *Healthy Choices: food and drink classification guide*, a traffic light classification system, to assess and code food and drinks.

A pilot project for Green Light, Eat Right began at the Queen Victoria Urban Market retail centre in 2009. The eight small to medium food businesses that took part in the initial project were required to have their menus assessed and classified according to the Green Light, Eat Right classification. They had to label all food items at the point of sale with this information.

COLOUR	CLASSIFICATION	EXAMPLES
Green	Best choice	Wholemeal bread, raw nuts, water, flavoured reduced-fat milk
Amber	Choose carefully	Small sized muesli bars, vegie crackers, flavoured popcorn
Red	Limit	Normal-sized muesli bars, biscuits and slices, sports drinks

Vending machines are an additional focus of this project, with the aim of increasing the availability of healthy foods and drinks in the machines. The City of Melbourne, which partnered with Snack Savvy Vending machines, the company that stocks and services the machines, initially engaged Nutrition Australia to provide nutritional advice on the classification of healthy foods.

The next step was to include vending machines stocked with healthy options classified according to the traffic light system. Three GLER vending machines are currently located at the Royal Dental Hospital, Royal Park Golf Club and the North Melbourne Recreation Centre. The community has responded favourably to this project and the increased availability of healthy snack foods in community spaces.

A PUBLIC HEALTH CAMPAIGN IN ARARAT

In 2012, population survey data identified Ararat, a regional city in Western Victoria, as one of Australia's most overweight towns. Ararat, like many regional communities in Australia, had higher rates of overweight and obesity in their community than their city counterparts. In the case of Ararat, 68 per cent of the adult population were identified as being overweight or obese.

The Biggest Loser, a popular reality television show produced by Shine Australia for Channel Ten, responded to news reports about Ararat being named Victoria's heaviest town. Fourteen local contestants were selected to join the television program with the aim of not only helping the individual contestants to lose weight, but also to motivate the whole town to support them and to join in the weight-loss challenge. Kirsty Vallance, the casting agent for *The Biggest Loser* said, 'We want the people of Ararat to show Australia that making a healthy change to their lifestyle can be achieved'.

Social media played a big part in encouraging people to lose weight by chatting about their weight-loss progress on Facebook and encouraging others to join in. In January 2014, after casting and filming the program in 2013, Channel Ten aired *The Biggest Loser: 2014 Ararat Challenge Australia*.

A groundbreaking public health campaign was put in motion in the town, focusing on education and physical activity, and the television program *The Biggest Loser* came to town.

Splash Archive

The Ararat community rises to the challenge of Channel Ten's *The Biggest Loser*.

The community joined in physical activity programs and focused on nutrition. After the arrival of *The Biggest Loser* team, extraordinary health gains were made. It was not only the contestants in the program who lost a dramatic amount of weight; community members across the shire also lost significant amounts of weight. After 6 months, the average body mass index (BMI) was better than the national average.

Most importantly, the Ararat Council and the contestants got together to develop strategies to ensure that the health gains made as a result of *The Biggest Loser* program are maintained. Some of the new health strategies include:

- providing healthier options in many of the town's food outlets
- introducing free health checks at two of the town's largest businesses
- including healthier food alternatives in the canteens of large businesses
- a review of school canteen menus.
- the formation of Ararat Active 8 – a group that aims to ensure the community improves its health and fitness.

Newspix/Robert Leeson

A member of the Ararat community taking part in an exercise program

Understanding the text

1 Outline how national, state and local authorities help to educate Australians about the importance of nutrition.

2 Explain why some people may not always use their knowledge of nutrition when selecting food.

3 Prepare a PMI (plus, minus, interesting) chart on how the cost of food, food preparation skills and the peer group can influence food choices.

PMI CHART – FACTORS THAT INFLUENCE FOOD CHOICES		
Plus	Minus	Interesting

4 Outline three strategies used in the LiveLighter campaign that help consumers develop knowledge and skills about food and how to improve their health.

5 What is Healthy Together Victoria and how can it help to improve the health of Victorians?

6 Outline two strategies the Wyndham City Council has developed to support members of their community.

7 Explain the main aims of the Green Light, Eat Right project.

8 Draw a diagram to demonstrate the way foods are classified according to the Green Light, Eat Right project.

9 Explain why Ararat was chosen to be the focus of the Biggest Loser 2014 Challenge.

10 Prepare a SWOT analysis of the Biggest Loser Weight Loss challenge in Ararat.

SWOT ANALYSIS OF THE BIGGEST LOSER WEIGHT LOSS CHALLENGE IN ARARAT	
Strengths	Weaknesses
Opportunities	Threats

The research underpinning the Australian Dietary Guidelines

The Australian Dietary Guidelines were reviewed in 2013 to ensure that the dietary advice provided to Australians reflects the latest scientific evidence on nutrition, diet and health.

The review of the dietary guidelines was overseen by the National Health and Medical Research Council (NHMRC). The Dietary Guidelines Working Committee was established under the auspices of the NHMRC to review the latest scientific research on nutrition and health. This committee included leading Australian and international experts in nutrition, public health and the food industry.

The review of the Australian Dietary Guidelines was based on objective scientific data that had been rigorously tested. It involved a review of over 55 000 pieces of published scientific research that had been peer reviewed. This systematic literature review created the huge body of evidence that became the basis for the development of the guidelines.

The committee also considered 218 submissions made through a public consultation process. This included submissions from a range of organisations including state and territory departments of health and non-government organisations such as Nutrition Australia and the Victorian Health Promotion Foundation. A large number of individuals and industry groups such as Meat and Livestock Australia and Sanitarium Health and Wellbeing also made submissions during the consultation process.

In addition, the committee also considered scientific evidence from the 2003 Dietary Guidelines that is still current and an identification of the daily nutritional needs of individuals (Nutrient Reference Values for Australia and New Zealand 2006). Another source of scientific data used in the development of the 2013 Australian Dietary Guidelines was a report by the NHMRC that identified the serving sizes and minimum number of serves required to meet nutritional needs of individuals. Other reports recognised throughout the world for their scientific rigour, such as the World Cancer Research Fund report, were also taken into consideration during the development of the guidelines.

Principles of research

It is essential that we understand how to assess the reliability of the information we receive about nutrition and health issues or the effectiveness of weight loss programs and nutrient supplements. Applying sound research principles such as being able to recognise credible sources of information and how to analyse data will enable us to become more informed consumers of health information.

ASSESSING THE VALIDITY OF FOOD INFORMATION

Just as the development of the Australian Dietary Guidelines has been based on reliable, verifiable, accurate scientific data, it is essential that we as consumers apply similar rigour in assessing health information. When carrying out a research project, the selection of appropriate information is a very important research principle. With so much information now available on the Internet from so many different sources, each piece of information must be carefully reviewed to ensure:

- authority
- accuracy
- **currency**; that is, how valuable the information is to the topic.

Sources of information

Articles providing food information fall into three broad categories.

- **Scholarly or academic articles** are written by academics or specialists in the field who reference and check the information and verify the facts, and they include references, footnotes and bibliographies. These articles are usually published by reputable institutions such as universities or organisations, for example government bodies or Nutrition Australia or the Cancer Council of Australia. These articles are found in academic publications and websites and non-biased news journals such as *Food Australia*. These articles are often validated by peer reviews; that is, colleagues who have a similar professional standing or qualifications.
- **Popular periodicals**, such as newspapers and food magazines and web-based news feeds, provide articles that usually do not reference their sources, but may mention sources of information in the text.

- **Newspaper or popular magazine articles**, unlike scholarly articles, often do not contain any reference to sources of information, so it is important to take a critical approach to the contents of these article.

It is important to consider whether the intended audience is the general population or a specialised audience. Also, determine whether the article is written in language that is easy to follow or if the language is technical and more advanced.

Reliability

Reliability refers to how dependable, trustworthy or consistent the information is. When asking the question 'Is the information presented reliable?', you should check whether additional articles have been written on the same topic, or if other sources can verify the information to determine consistency, quality and accuracy of reporting.

Author and source

Knowing about the author and the source of the information can also help to assess its validity. Some questions to ask include:

- Is the author an expert or professional in the field of study?
- Is the author affiliated with a reputable educational institution such as a university or a government agency or organisation?
- Has the author published other articles or books?
- Has the author provided any contact information?
- Is the publisher well known and reliable, such as a government agency or educational institution?

Accuracy

It is important to to assess the accuracy of the information you are reading and relying on.

Consider:

- Is the information correct and based on proven facts?
- Are the facts cited and verified in references, footnotes or a bibliography?
- Is the article illustrated with graphs and tables that present research data?
- Does the article report facts or does it offer personal opinions?
- What is the purpose of the information? Is it intended to inform or to entertain?
- Is the information objective or biased?

Currency or value of the information

Currency refers to how valuable the information is to the topic. Information that was published 20 or 30 years ago may be less reliable because new research may have been undertaken in the area. It is important to seek answers to the following questions.

- Is the information up to date? Check the publication date.
- Is there evidence of newly added or updated information?
- Is the information outdated or is it still relevant to the topic under research?

Objectivity

It is important that information presented is **objective** if it is to be of value to consumers. That is, the information must be fair, impartial and independent. To assess the objectivity of an article you should consider the following questions.

- Is the article based on fact, opinion or propaganda? Make sure the facts presented can be found in another source.
- Does the information appear to be valid and well researched, or is it questionable and unsupported by evidence? Check to see if you can find similar information in another source.
- What is the purpose or intention of the article? Is it to inform or teach, or to sell or persuade? Is there a social or commercial or political agenda?
- Make sure that the article is not biased and is free of personal opinions – authors who include their own opinions often do not consider opposing views and are often biased.

Coverage

You are more likely to be able to verify information that is widely covered by a range of sources than if there is little coverage of the topic under investigation.

Consider:

- Does the article update or support other information on the topic?
- Is the information comprehensive and meant to give all information on a subject or does it only present a narrow aspect of the topic?
- Take care when choosing newspaper or magazine articles.

ASSESSING A SCHOLARLY ARTICLE

Promoting a Healthy Australia produced an evidence brief entitled *Obesity: Sugar-Sweetened Beverages, Obesity and Health*, in April 2014. This forms part of the Australian Government's National Preventative Health Agency's evidence brief series, which aims to present information relating to high-priority preventative health issues.

Drinking sugary beverages has now become a significant trend among the Australian population and the amount consumed has increased dramatically over the last few decades. Australia is now in the top 10 global markets for sugary beverages based on per capita consumption.

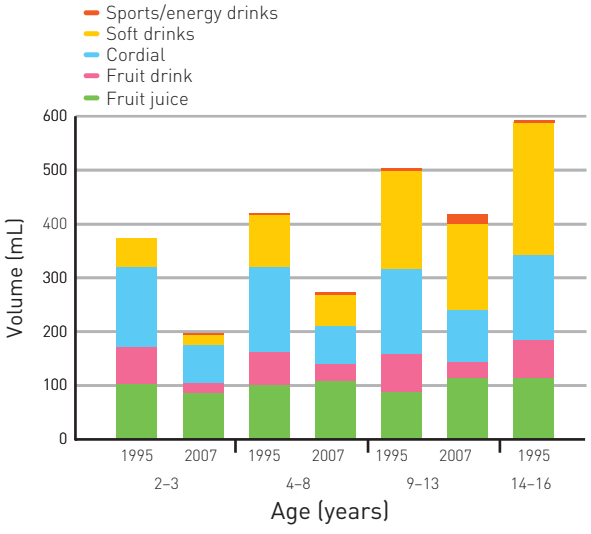
This evidence brief provides a credible source of information about the issues relating to sugary beverages and their consumption rates and health impact.

Why are the sources of information credible?

- A government agency commissioned the brief.
- The brief was prepared by the Boden Institute of Obesity, Nutrition, Exercise and Eating Disorders and the Menzies Centre for Health Policy, University of Sydney.

Evidence-based information

Information is presented in data, graphs and statements and is supported by evidence, and the sources are referenced. For example: According to the Australian Dental Association, people who drink sugar-sweetened beverages are more likely than others to have a greater risk of developing diabetes.



Source: 1995 National Nutrition Survey and 2007 Children's Survey

Children's consumption (mL per day) of sugar-sweetened beverages

Terminology

Language and terms used in the brief are clearly explained in a section called 'Terminology'. An example of this clarification of terms, is, 'Consumption is expressed as either "per capita", meaning the average intake per person on a whole population basis, or "per consumer", referring to only those who consume the drink in question'.

Accurate analysis of data

The evidence was used to present an accurate conclusion that 'the high consumption of sugar-sweetened beverages represents a significant nutritional problem within Australia and that action to reduce their consumption is warranted'.

ANALYSING AN ARTICLE IN A DAILY NEWSPAPER

This section provides an example of an analysis of a newspaper article. First read the following article, then read the analysis on the next page.

BURGERS, CHIPS, SOFT DRINK: TEENAGE BOYS EAT MORE FATTY AND SUGARY FOOD THAN THE REST OF US

Shock, horror, teenage boys are shunning a healthy diet in favour of scoffing burgers, soft drinks and chips.

We all know poor diet and obesity are a problem in Australia but it seems our young males are particularly at risk.

In particular, teen boys are making a meal of the classic take-away combo – a burger, chips and soft drink – more than any other demographic in the country, according to the latest research by the Australian Bureau of Statistics.

The bureau surveyed groups of Australians across a range of age groups and asked what they had eaten in the previous 24 hours.

One in four boys aged 14 to 18 had eaten a burger. That was compared to one in 14 people in the general population.

One in five boys in the same age group had also eaten chips the day before, compared to one in seven people across the country.

'While just under three-quarters of teenagers and young adults consumed vegetables on the day prior to interview, almost half of this consumption was potatoes (including chips),' said ABS director of health Louise Gates.

Although teenagers like sugar in their drinks, they don't seem to like the kind that comes in fruit. Just 40 per cent of teenage boys and 50 per cent of teenage girls had eaten fruit the day before the survey, compared to 60 per cent of the total population.

The insights come despite suggestions that Australians as a whole are turning away from sugar-sweetened drinks.

The largest and most comprehensive health survey in Australia, conducted in 2012, found 42 per cent drank sugary drinks. This was down 14 per cent from the previous survey in 1995.

But National Heart Foundation chief executive Mary Barry said the findings were 'not yet a victory'.

'We cannot ignore the fact that regular and excessive consumption of (sugary drinks) particularly in children and young adults, is continuing to exacerbate Australia's obesity epidemic and remains one of our greatest public health priorities,' she said.

'It is vital that government policy and tough regulatory action echoes community concern over the role (sugary drinks) play in Australia's growing obesity crisis.'

Ms Gates said that people in the survey who drank sugary drinks consumed 54 grams of sugar – the equivalent of 13 teaspoons – from the drinks in the 24 hours prior to being surveyed.

Again, teenage boys were worse.

'The average intake for males aged 14–18 years who consumed sugar-sweetened beverages was 16 teaspoons, or 68 grams,' she said.

The figures come days after a report by Fairfax Media disclosed that more than 1000 children were put under general anaesthetic at the Royal Dental Hospital of Melbourne last year, including 178 aged three or younger, mostly to get multiple decayed teeth removed.

Burgers, chips, soft drink: Teenage boys eat more fatty and sugary food than the rest of us, by Marc Moncrief, 17 October, 2015, The Age

Shutterstock.com/Hans Geel

Hamburgers – a favourite food of young boys

Assessing the validity of the article

- **Who is the author?**
  Marc Moncrief, data editor of the *The Age* newspaper. Marc's specialty is to use technology to tell stories that can be hidden by a world of 'data overload'.
- **Who is the publisher?**
  The Age newspaper – a daily newspaper, published by Fairfax Media.
- **What is the food information or topic and/or focus of the article?**
  Obesity rates in young people, teenage boys' poor diets, the consumption of sugary beverages and the health implications of these diets.
- **Validity and sources of evidence**
  The article refers to data from research carried out by the Australian Bureau of Statistics, a statistical agency of the Australia Government. It provides key statistics on a wide range of issues, including social issues such as health. These statistics allow informed decisions to be made by the government and the community.

  Further sources include a reference to 'A comprehensive health survey in 2012'; a statement by a reputable organisation, the National Heart Foundation; and a political reference to the government's responsibilities - 'one of our greatest public health priorities'. This reference also suggested that 'government policy and tough regulatory action echoes community concerns about the role of sugary drinks in Australia's obesity crisis'.

- **Context of information**
  Information in the article about diets of young people today is aimed at parents and government policymakers.
- **Language used**
  The article is non-technical and easily understood by the 'general coverage' group of readers it is aimed at; that is, parents and school canteens. It gives practical, real-life examples, such as 'people in the survey who drank sugary drinks consumed 54 grams of sugar – the equivalent of 13 teaspoons of sugar'.
- **Cross-checking to validate information**
  In the article, a reference was made to a news report by the Royal Dental Hospital of Melbourne, published in an article by Fairfax Media, focusing on the number of children that needed to have their decayed teeth removed. This information can be cross-checked against the article 'Tooth decay, full extractions common: Toddlers pay the price of diet full of sugar'.
- **Conclusions and recommendations**
  The author used a statement by the chief executive of the National Heart Foundation to sum up and draw a conclusion about the 'regular and excessive consumption of sugary drinks' and the statement from Ms Gates from the Australian Bureau of Statistics was put forward as a recommendation for future action on this issue.

Understanding the text

11 Explain the research principles on which the Australian Dietary Guidelines were developed.

12 Why is it important for consumers to understand how to evaluate information about nutrition and health issues?

13 Explain why scholarly articles are considered to be a valid source of information.

14 Why are newspaper articles not considered to be as reliable a source of information as scholarly articles?

15 Explain how you can assess the reliability of information.

16 How will determining whether an author has an affiliation with a university help to determine the reliability of their research?

17 Outline three ways you can determine whether information is presented objectively.

18 Explain why only presenting a narrow aspect of a topic might be considered to be an unreliable source of information.

19 Draw a diagram or flow chart to demonstrate why the brief of evidence about the consumption of sugary drinks was considered to be reliable.

20 Outline two ways the validity and sources of information can be used to assess the newspaper article on 'Burgers, chips, soft drinks: teenage boys eat more fatty and sugary food than the rest of us', on pages 285–6.

Food fads and fad diets

Following the latest food fad, food trend or diet can sometimes cause consumers to make poor food choices by restricting the intake of certain healthy foods or encouraging them to focus on consuming a specific food. **Fad diets** are of particular concern because they are weight-reduction diets that either eliminate one or more of the essential food groups, or recommend consumption of one type of food.

A **food fad** can also be detrimental to health because they focus on a food or ingredients that people are interested in for a short period such as chia, quinoa, teff or kale.

Following a fad diet or food fad can be challenging for consumers because the information provided by health food 'gurus' often clashes with nutritional experts who give mainstream advice. As a result, consumers become very confused when this new information is different from current health knowledge.

According to University of Sydney Professor of Dietetics Margaret Allman-Farinelli, messages such as those contained in the Australian Dietary Guidelines, including 'eat five serves of vegetables a day' or 'limit processed meats like ham and salami', are not based on a few unsupported papers that may appear on the Internet or through Facebook or Twitter. Instead, health messages such as these are the result of hundreds of scientific studies and painstaking research that has been peer reviewed. These health recommendations are based on the

A small study links consumption of xyz seeds with the longevity of an indigenous tribe – *the grain of truth.*

↓

Add a segment reporting this study and its health benefits on a celebrity's website or doctor's column in a popular magazine.

↓

Celebrity writes a new recipe book with recipes for the seeds and advertises it on their website.

↓

Social media spreads the word about weight losses resulting from eating the xyz seeds.

↓

The supermarket begins stocking the xyz seeds.

The pathway to creating a food fad

best-quality evidence that scientific research can provide.

Health journalist Paula Goodyer, in an article entitled 'Fad or fact: fashionable diets get a reality check', writes that 'new diet is born from a grain of truth, a small study and suddenly a new diet can be created, especially when a celebrity is involved'. Goodyer further states that new trends in foods or new diets can be started by linking a particular 'superfood' or health food to a less-than-important health benefit. Disturbingly, some of these claims might question the validity of well-recognised health messages such as the importance of including wholegrains in a well-balanced diet. What may have been pure speculation can soon become 'fact' if the celebrity author's book becomes a bestseller. The final stage in this fiction-to-fact pathway is the development of new products, recipes and recipe books based on the new superfood – and a new food fad is born!

Therefore, it is important that consumers understand the types of questions they need to ask to negotiate the information about food fads and fad and diets.

UNRAVELLING THE GLUTEN DEBATE

Regardless of whether information is presented in online reports, or in magazines, newspapers or books, consumers find it challenging to negotiate the information that is presented by celebrities on the benefits of a particular trend or diet or fad.

Gluten-free diets are a perfect example of where science clashes with the popular belief that gluten is bad for people.

- ✓ It is true that gluten is a protein found in cereals such as wheat, barley and oats.
- ✓ Coeliac disease, an intolerance to the gluten in wheat, is diagnosed by a doctor.
- ✓ In Australia, the number of people who need to avoid gluten for medical reasons is 1 per cent of the population.

- ✗ In some people's minds, the term 'gluten-free' has become another term for 'healthy' and they eliminate valuable grains from their diet for misinformed reasons.
- ✗ If these people avoid gluten, many gluten-free foods may not be their best food choices.
- ✗ Gluten-free grains such as rice have a very high glycaemic index and many gluten-free breakfast cereals have added sugar to boost the palatability of the cereal.
- ✗ Many people self-diagnose this disease and therefore avoid foods containing gluten.
- ✗ These people often say they feel unwell after eating bread or pasta, but their misdiagnosis may mean they are suffering from a food allergy or intolerance to other foods such as fructans found in some vegetables and fruit.

Gluten-free pasta is suitable for people with coeliac disease.

RESTRICTIVE, FAST WEIGHT-LOSS DIETS BASED ON 'LOW CARBS'

Fast weight-loss diets based on 'low carbs' restrict or totally eliminate the consumption of carbohydrate foods and should be considered carefully, particularly as a long-term diet.

✓ Fast weight-loss.
✓ This is the approach used by the CSIRO Total Wellbeing Diet, but with modestly lower carbohydrates and modestly higher proteins, not low or no carbohydrates.
✗ Not recommended for use after 6 months.
✗ If used long term, problems may create greater risks of mortality from cardiovascular disease and a higher risk of type-2 diabetes.

Analysing claims made by weight-loss or nutrient supplement companies

Weight-loss and nutrient supplement companies use a variety of strategies to promote their products and convince the consumer that they will be healthier and feel better if they embark on the new diet or purchase the supplements. Some of these strategies include:

- Exaggeration – the health benefits of a certain plan or product may be exaggerated to sound more convincing about its benefits.
- Lack of evidence – often these claims are not supported by strong scientific evidence, as research is often carried out on a small number of people or for a short amount of time.
- Using the 'fear factor' and demonising foods – often a company's ethics are questionable as they promote their products and plans by using the 'fear factor' to demonise certain ingredients in foods, or they discuss the likely unpleasant outcomes of supposed deficiencies. These deficiencies are often not determined by medical tests, but are put forward as possible reasons, for example feeling tired or being a busy mother. A 'miracle fix' statement is often promoted as the answer to these issues. The words 'natural' versus 'artificial' are used to create positive and negative feelings about foods.
- Use of scientific language – this technique is often used in marketing these products by adding plausibility to health claims. They 'woo' the consumer into feeling they need them for good health, which persuades them to purchase the products. These claims are often presented in a narrative form in news reportage, making it possible to use convincing terms such as 'could', 'would' or 'maybe', as exaggeration sells well!
- A feeling of uniqueness – consumers often want to create a feeling of 'uniqueness' by adopting a certain diet or by avoiding certain foods. They are also sometimes drawn to a product by nostalgia or a desire to return to former times when food was healthier and diets and supplements were not needed.

CRITERIA USED TO ASSESS THE VALIDITY OF WEIGHT-LOSS CLAIMS

Before deciding on a diet or endeavouring to assess the validity of food information, it is important to ask a series of questions to assess claims and verify information.

1 Is it a diet or a healthy eating and exercise plan? Is it safe and does it have a maintenance plan to protect long-term health?

   Remember, choosing a healthy way of eating becomes a path to follow for the rest of life. It may take a little longer to lose weight this way, but weight and health will benefit greatly in the long term.

2 Is the diet or plan based on scientific evidence-based information?

   Remember, some diets claim to be based on scientific studies. Often these studies are based on small samples or no research at all and have no evidence-based recommendations. Personal testimonials from people who have used the diet successfully are often used to 'sell' the diet.

3 How does the diet work? Does it restrict certain foods or food groups or severely limit energy intake?

   Restricting certain foods or severely limiting energy intake are hard to maintain over the long term and the unbalanced diet may have further health implications.

4 Are there any likely adverse health outcomes from this diet?

   A restrictive diet may leave a person feeling tired, dehydrated or constipated and often constantly hungry. Fast (crash) diets often cause a loss of water from the body or muscle and fat. Losing muscle may slow down metabolism, making the body less efficient at burning up kilojoules, which slow down weight loss.

5 Does the diet offer rapid weight loss rather than sustainable steady weight loss?

Remember, the key to healthy weight loss is not just to lose excessive weight, but to keep it off.

6 Does the diet plan come with regular consultation or counselling services?

Counselling, in addition to a diet plan, assists in helping to change eating and lifestyle habits. Monitoring, support and feedback of progress are important to maintain both the plan and personal motivation. Teaching new food selection and food preparation skills and regular reinforcement of the change in eating behaviours are important if the individual is to change eating behaviours that lead to weight gain. Equally important is support for changes to lifestyle factors, such as increasing the level of exercise and overcoming emotional issues such as mindless or emotional eating.

7 Has the promotional material used scientific language, small print or 'before and after' photos?

Beware of plans that include 'before and after' photos. Remember, these can be misleading. Scientific language is often used to promote a perception of a sound scientific backing for the plan. Question the use of words that promote weight loss such as 'fat-burners', or statements about containing herbs and amino acids that have not been scientifically proven to have any weight-loss or health benefits. Often critical information regarding the success rate and conditions of the plan is written in very small print. Beware of signing a long-term contract. Are the sales staff acting as untrained 'counsellors', or are they only trained on the particular program or plan or the company's product?

8 What is the cost of the program?

Remember to calculate the total costs of the plan, including meal replacements, special foods, supplements or other home meals to be provided. Compare these costs with an eating plan that includes a wide variety of nutritious foods from the five food groups, in amounts to achieve and maintain a healthy and sustainable weight loss.

Finally, consumers should talk to a health professional or dietitian if they are unsure of the plan or program and to make sure it suit their needs.

Evidence shows that following the advice from the Australian Dietary Guidelines, particularly Guideline 1: 'To achieve and maintain a healthy weight, be physically active and choose amounts of nutritious food and drinks to meet your energy needs', and Guideline 2: 'Enjoy a wide variety of nutritious foods from these five food groups every day', is the best way to approach weight loss. By adopting a nutritious eating pattern and including physical activity each day so that the total energy (kilojoule) needs for the day are slightly less than needed, a slow steady weight loss will occur. This weight loss can then be maintained with further healthy eating and appropriate food choices. Weight-loss diets rarely work in the long term, particularly those that restrict kilojoules, or are contrary to the recommended intake from some of the five food groups.

ASSESSING CLAIMS MADE BY WEIGHT-LOSS PROGRAMS

The weight-loss industry is big business and is growing rapidly because the number of Australians who are overweight or obese increases. The research company Ibis World reported that during 2015–16, Australian consumers spent $613.6 million on low-fat and low-kilojoule foods and on seeking professional weight-loss advice.

There is a vast array of weight-loss programs designed to help consumers lose weight, including WeightWatchers, Jenny Craig, The Biggest Loser Club, Michelle Bridges' 12-week Body Transformation, Dietlicious and Lite n'Easy.

Lite n' Easy

Lite n' Easy is a weight-loss program that delivers kilojoule-controlled meals to a person's home. The program is designed for weight loss, weight maintenance and convenience.

The Lite n' Easy website states that it provides 'a range of calorie-controlled, nutritionally balanced and perfectly portioned meal plans to help people either lose weight or simply enjoy a convenient way of eating well without the time-consuming need to shop and cook'.

The Lite n' Easy 7 Day Meal Plan is designed for optimum weight-loss results and can be ordered in a variety of ways, such as breakfasts and lunches, or consumers can purchase dinners only. The 5 Day Meal Plan is also designed for weight loss and maintenance, or for those who want to purchase the meals as a convenient way of eating healthy meals.

The Lite n' Easy website provides consumers with healthy eating tips; for example, about portion control

and developing healthy eating habits to maintain weight loss throughout life. The website gives consumers information about how to calculate their body mass index (BMI) to identify the most suitable plan for their energy needs. Alternatively, consumers can contact the Lite n' Easy consultants, who will help them determine how much energy they should consume for good health, but also to achieve weight loss. The Lite n' Easy website also allows consumers to track their success in losing weight.

Is there commercial gain?

Lite n' Easy is an Australian-based company that has been in operation for more than 25 years. Based on the longevity of the company, it is reasonable to presume that they are profitable and that they achieve significant commercial gain from the Lite n' Easy program. The cost of the meal programs is high, particularly when two people purchase the meals. This type of diet plan may well be more expensive for a consumer than preparing their own meal from scratch using fresh ingredients.

Is this weight-loss program ethical?

Throughout the information provided on the Lite n'Easy website, the energy value referred to is calories, although in the detailed nutritional breakdown of meals, kilojoules are also included. The food calorie, or large calorie, is part of the metric system, but is not an SI unit. It is being phased out in favour of the kilojoule, which is an SI unit. Also, a food calorie does not represent a quarter of a kilojoule; 1 calorie = 4.18 kilojoules. This could be confusing for consumers and make comparisons difficult because most Australian food labels use kilojoules as the measurement of energy in their nutrition panels.

In order to select the right meal category, the consumer must calculate their personal kilojoule or calorie requirements. However, this seems to be challenging for consumers to do with any degree of certainty. In addition, there is direction on the website that they should establish this information first, before selecting a meal plan. It is critical that BMI is carefully calculated to ensure that the diet is suitable for a person's requirements. Without this information, there is a risk that people may choose a weight-loss plan with a low level of kilojoules in order to lose weight more quickly, but then feel hungry and resort to unhealthy high-kilojoule snacks.

Another ethical issue is that diet plans that supply kilojoule-controlled meals encourage dieters to become dependent so they do not develop the personal skills and knowledge to guide their food choices for a healthy weight loss and to maintain their desired weight throughout life. In addition, marketing the plan as a convenient and easy way to lose weight appeals to consumers who are 'time poor', rather than encouraging them to evaluate the nutritional properties of the plan. Consumers pass over the responsibility for their weight loss to a paid plan without taking personal responsibility for it themselves.

How effective is the program?

The Lite n' Easy program is based on the restriction of energy or the reduction of kilojoules in order to lose weight and can be an effective tool in weight loss.

However, the plan can be easily disrupted if a person becomes hungry and resorts to additional high-energy snacks. Eating out is also difficult, because it is unlikely, as suggested on the website, that restaurants would agree to a diner bringing their own meal to the restaurant!

Maintenance of weight loss may be a problem because the person has not been educated in selecting foods that will enable weight loss, and they can easily revert to old habits. While the website does state that they teach consumers about portion control and that the program encourages healthy eating, unless people learn to choose foods and prepare meals themselves, these lessons are often not effectively learnt.

Meal-replacement shakes

Meal-replacement shakes, or diet shakes, are low-kilojoule drinks that are used to replace up to two meals a day and are consumed in addition to one regular healthy meal each day. Meal-replacement shakes are designed to keep the person feeling full without consuming a large quantity of kilojoules. The shakes usually contain a combination of fibre, proteins, vitamins and minerals and other additives in a flavoured milk or water-based drink.

Often people who have failed at other attempts to lose weight may turn to meal-replacement shakes as a last resort. Other consumers use them because they are tasty and convenient. The shake powders are easy to pack in a bag and only need to be mixed with water and shaken.

Is there commercial gain?

Shakes are expensive and usually come in large packs to last for several weeks at a time. Some of these products have celebrity endorsements and this form of advertising will add to the cost of these products. It

Aldi Slim and Trim meal replacement shakes

is important to judge the cost of this form of diet plan by calculating what you would spend on lunch each day – if lunch cost $10 a day, then diet shakes may be economical if the cost of purchasing shakes for a week is $30.

Are meal-replacement shakes ethical?

As meal-replacement shake products are bought over the counter, they do not come with any maintenance assistance after weight is lost. Often weight is regained quickly because dieters return to their normal eating behaviour. Sometimes the additional ingredients found in a product are difficult to identify and understand because they are labelled with additive numbers and long technical names. The product, to its credit, is generally promoted as being used as part of a healthy diet and exercise regime.

How effective are meal-replacement shakes?

It is recommended that meal-replacement shakes replace up to two meals a day for 6–8 weeks, but should be used along with a healthy diet and exercise routine. If shakes are used, they are only effective in weight loss if are used according to the guidelines of the program. However, some people are tempted

Matt Golding, *The Age*

to use them as a snack in addition to regular meals. These two meal-replacement shake meals could just as easily be replaced with a light, healthy meal such as a salad based on fruit and vegetables. A salad would act in the same way in kilojoule reduction as that provided by the shake.

In the initial stages of using a meal-replacement shake program, there can be significant weight loss due to the reduction in kilojoules and this can be very motivating for many people. The ingredients in these products usually contain a high proportion of both soluble and insoluble fibres that have a filling effect and allow dieters to feel satisfied and not hungry between meals. However, one of the side effects of using meal replacement shakes is that their low energy content may cause dizziness, bad breath and tiredness. Another disadvantage of using shakes is that socialising with friends over shared meals becomes difficult, because it isn't necessary to set a table and take time to relax and eat a meal, sharing conversation.

Meal-replacement shakes are not the single, instant solution to weight loss. While they do provide a short-term solution, this method is not sustainable. Without choosing, cooking and preparing healthy foods and adopting the correct portion control, people often end up gaining weight again. Although meal-replacement shakes are a meal replacement, nothing replaces the benefits of eating fresh fruits and vegetables, grains, lean meats and dairy foods.

Understanding the text

21 Explain the difference between a fad diet and a food fad.

22 Explain why following a fad diet or food fad can be confusing for consumers. Give examples to support your answer.

23 What is gluten and why may some gluten-free products be poor food choices?

24 Explain how the CSIRO Total Wellbeing Diet differs from other diets based on 'low carbs'.

25 Draw a diagram to highlight the strategies used by some weight-loss companies in promoting their products.

26 Draw a mind map to demonstrate the important criteria to use when assessing the validity of weight-loss programs.

27 Explain why counselling is an important feature of successful weight-loss programs.

28 Outline two advantages and two disadvantages for consumers of following a weight-loss program such as Lite n' Easy.

29 Describe how meal-replacement shakes are designed to help consumers lose weight.

30 Outline four disadvantages of using meal-replacement shakes to lose weight.

ASSESSING CLAIMS MADE BY NUTRIENT SUPPLEMENT COMPANIES

Eating a well-balanced diet based on the five food groups will mean that most consumers are able to obtain all of the essential nutrients needed for good health. However, it seems that many people are now being lured into feeling that they should take vitamins and other nutrient supplements to ensure they remain healthy. This is despite the fact that there is no evidence to suggest that there is widespread dietary deficiency among the general population.

A **nutrient supplement** provides concentrated nutrients, usually vitamins and minerals that may not otherwise be consumed in sufficient quantities.

A recent study published in *Australian and New Zealand Journal of Public Health* found that almost 20 per cent of all Australians and New Zealanders are consuming over-the-counter vitamins as part of their daily routine, often without any specific medical advice about the health benefits of doing so.

However, it is important to remember that some people are strongly advised to take a nutrient supplement at particular times in life. For example, there is an essential need for women planning pregnancy to increase their consumption of folic acid, to reduce the likelihood of having a child with spina bifida. Similarly, people who are at risk of developing osteoporosis are strongly advised to take high doses of vitamin D.

Apart from vitamin supplements, many consumers are now being encouraged to use protein powders and dietary supplements that help to promote relaxation and sleep. Supplements high in antioxidants or omega-3 fatty acids are also becoming more popular because they receive support from so-called weight-loss experts.

Dietary supplements for children

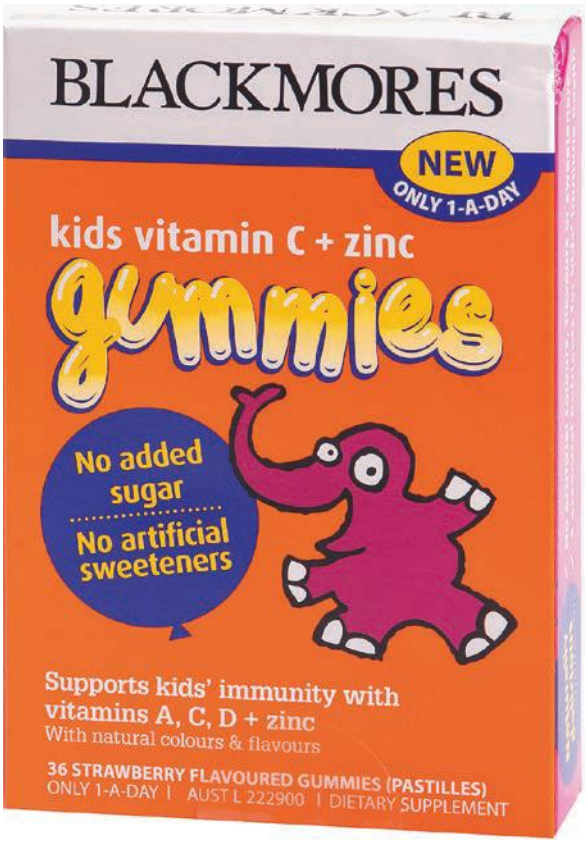
The trend towards using dietary supplements is particularly evident among parents of young children. Some parents find it difficult to get their child to eat a wide range of foods, particularly vegetables and meat, and so they may become concerned that their children are not obtaining all the nutrients they need to sustain their growth and development at a young age.

Blackmores promotes its Kids Vitamin C and Zinc Gummies as boosting children's immunity and their general health and wellbeing. This product is designed for children over 2 years of age and comes in the form of strawberry-flavoured pastilles. The Blackmores website does state that vitamin supplements should not be used as a replacement for a balanced diet in children.

Is there commercial gain?

In 2015, Blackmores was one of the fastest growing companies on the Australian stock exchange, with its share price rising 280 per cent over 12 months. According to economic analysts, this rise in the company share price was because of a 70 per cent increase in the sale of their vitamins through chemist outlets and to overseas buyers, especially in China. Obviously, the sale of vitamin supplements is big business.

While the recommended dose for a child is only one pastille a day and would therefore seem to be relatively inexpensive, dietary supplements such as Kids Vitamin C + Zinc Gummies do provide a significant commercial gain for the company. It can be argued that gummies are expensive when any additional nutrients supplied by them, particularly the water-soluble vitamins, will be flushed down the toilet!



Blackmores Kids Vitamin C + Zinc Gummies

Is the product ethical?

There is no doubt that most children would be very happy to take one gummy a day because they are flavoured and coloured like a lolly. This dietary supplement will satisfy some parents' concerns if their children are fussy eaters or have suffered from one of the numerous infections that young children develop when they are in contact with other children. The product seems to emphasise that they contain 'no added sugar and no artificial colours, flavours or sweeteners and are a delicious option to support immunity'. However, these nutrients can all be obtained by encouraging the child to eat a wide variety of foods as can be seen in the following table.

If parents follow Australian Dietary Guideline 2: 'Enjoy a wide variety of nutritious foods from these five food groups every day such as fruit, vegetables, lean meat, dairy and whole grain cereals', supplements are unnecessary, because children obtain all the active ingredients in the gummies from their diet. One orange and half a cup of capsicum will supply all the vitamin C required for a day. Building good eating habits will support good health and immunity and establish healthy eating behaviours for life.

Is the product effective?

The nutrients in the gummies will no doubt supply valuable active ingredients with an emphasis on vitamin C and zinc. There is also nutritional evidence to support the role of each of the active ingredients and their functions in the body. However, the human body is unable to store the water-soluble vitamins such as vitamin C, so this supplement is likely to provide much more of these nutrients than can be used at one time.

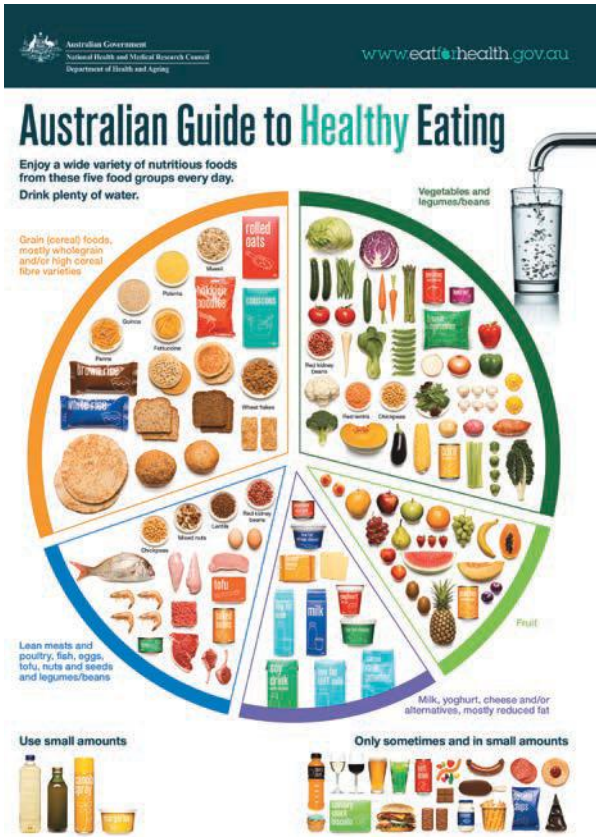
NUTRIENT/INGREDIENT	FUNCTION	NATURAL FOOD SOURCES
Ascorbic acid (vitamin C)	Vitamin C is a water-soluble antioxidant nutrient used for many body processes.	Capsicums, blackcurrants, oranges and strawberries
Zinc	Zinc is essential for every living body cell. 300 enzymes need zinc for healthy functioning.	Meat, eggs, seafood, oysters, whole grains and seeds
Vitamin A	Vitamin A is a fat-soluble antioxidant used for a large number of biological processes.	Red meat, eggs and dairy products
Vitamin D	Vitamin D is a fat-soluble vitamin that regulates calcium and phosphate metabolism for bone health and maintenance.	Most children obtain sufficient vitamin D from sunlight.

Practical ways to apply the Australian Dietary Guidelines in everyday life

As discussed in chapter 2, the Australian Dietary Guidelines and the Australian Guide to Healthy Eating have been developed as a practical guide to enable all Australians to select food for good health.

It is very easy to gain weight. Having larger portion sizes than necessary, eating too many snacks or discretionary foods that are high in saturated fat, salt and sugar, or drinking carbonated soft drinks that are high in sugar and therefore high in kilojoules instead of water, are all easy traps to fall into. The hard part is changing our everyday food behaviours and habits to reduce and then maintain weight.

Losing weight sounds easy but, in reality, it is hard to do. The only way weight is lost is if we eat and drink fewer kilojoules in our daily meals than we expend.



National Health and Medical Research Council

The five food groups make up the central plate in the Australian Guide to Healthy Eating.

USING THE FIVE FOOD GROUPS

Following the Dietary Guidelines and choosing food from the five foods groups is the first step to eating well. Foods in the five food groups are grouped according to their type and the contribution they make to our diet. Foods listed in each of the groups are those that are lowest in saturated fats and have little added sugar or salt. It is important to choose foods from each group daily, although it is not necessary to include all the groups at each meal.

FOOD GROUP	NUMBER OF SERVES
Vegetables	5–6
Fruit	2
Wholegrains	6
Lean meat and poultry, fish, eggs and/or plant-based alternatives	2–3
Milk, yoghurt and cheese – reduced fat	2½

The five food groups

USING A PORTION CONTROL PLATE

The Australian Portion Perfection plate is a practical way to assist Australians who wish to lose weight. It guides consumers to judge the amount of food eaten at a meal and helps them to regulate the potion size of their meal in a visual way. Maintaining effective portion control is an easy way to regulate the amount of food eaten at a meal. It helps consumers to adjust the size of their meal portions, because oversized food portions will mean that more kilojoules are taken in than are actually needed, which will lead to weight gain.

The portion plate is designed to guide the amount of food eaten at a main meal while also ensuring that the meal contains a balance of nutrients but is controlled in kilojoules. The Australian Portion Perfection bowl gives portion guidance for cereals, soups, stews and desserts.

The plate and the bowl are divided into sections that represent the recommended portions for each food type to be eaten at a particular meal. Each section has illustrations as a guide to the types of foods in that section. Inspirational words are written around the edge of the plate to prompt the ways to enjoy food.

The Portion Perfection Plate, courtesy of Great Ideas in Nutrition www.greatideas.net.au

The Australian Portion Perfection plate

PLANNING AHEAD

One of the most practical ways to integrate the Australian Dietary Guidelines into everyday food behaviours is to plan daily, and even weekly, meals and snacks based on the five food groups. This gives you a plan to follow so that you are not tempted to choose foods that are considered discretionary or indulgences. Planning for snacks also stops you from overeating later in the day.

Use a simple chart like the one below, based on the five food groups, to help you plan your meals. Ensure that you include the appropriate number of serves from each food group across the day. Remember to include snacks in your daily plan.

IMPROVING EVERYDAY FOOD BEHAVIOURS AND HABITS

Tip 1: Prepare more of your own meals at home rather than eating out. Planning and cooking your own meals allows you to make the decisions about what ingredients are included.

Tip 2: Plan ahead so that you are well prepared for the day or the week to come. Planning ahead makes shopping for food easier and stops you from being tempted to pick up those very tempting snacks!

Tip 3: When planning meals, select vegetables from a wide variety of colours and types, because these will help you feel fuller for longer. Vegetables should

FOOD GROUP	NUMBER OF SERVES	BREAKFAST	LUNCH	DINNER	SNACKS
Vegetables	5–6				
Fruit	2				
Wholegrains	6				
Lean meat and poultry, fish, eggs and/or plant-based alternatives	2–3				
Milk, yoghurt and cheese – reduced fat	2½				

make up one-third of a meal plate, or half if someone is trying to lose weight; this will help to significantly reduce the number of kilojoules consumed.

Tip 4: Add fruit to at least two meals or use in desserts or as a swap for discretionary foods. Low-fat milk, cheese or yoghurt can also be used as snacks to replace discretionary foods.

Tip 5: Don't be tempted to skip breakfast thinking this will help you lose weight. Eating breakfast, especially breakfast based on low GI foods, will help to sustain you until later in the morning and will stop you from reaching for a high-fat, high-sugar muesli bar.

Tip 6: Focus on how you feel both while you are eating and after you have finished eating a meal. Eating a meal that is based on the five food groups will include more vegetables and wholegrains and fewer high-fat foods and will make you feel far better than one that is high in fat or sugar. Eating a meal that is based on discretionary foods, that are high in fats, sugar and salt will leave you feeling over-full and uncomfortable and even quite tired.

Tip 7: Read the labels of products while shopping so that you are aware of the fats, sugars and salt that are often hidden in processed foods. Also, remember to examine the kilojoule content of processed foods and to compare products – compare the amount per 100 grams rather than per serving to get an accurate comparison.

Tip 8: Drink plenty of water to keep your body hydrated. Being dehydrated can leave you with a lack of energy and therefore feeling tired and listless. This is when you are more likely to make poor food choices and to reach for a high-energy snack.

Tip 9: It is better to reduce the number of snacks you eat and to try not to eat discretionary foods as often rather than removing them from your diet altogether. Banning certain foods may increase their desirability and lead you to 'crave' them. An occasional or smaller treat is preferable to bingeing on foods that you have been denied.

Tip 10: Get support – it is easier to stick to a healthy eating plan if others are doing it with you.

REDUCING THE CONSUMPTION OF FAT, SALT AND SUGAR

Australian Dietary Guideline 3 recommends 'Limit intake of foods containing saturated fats, added salt, added sugar and alcohol'. When planning meals, it is important to limit the intake of saturated fat, added sugar and added salt. Reducing these even by small amounts cuts the risks of serious disease such as type 2 diabetes, heart disease, stroke, high blood pressure, some cancers and kidney disease, and makes the management of weight easier.

Practical ways to reduce the consumption of saturated fat

As well selecting foods based on the five food groups, modifying traditional recipes and altering the cooking techniques used in preparing meals can both help to maintain a healthy weight.

- Increase your intake of vegetables and salads as a part of main meals because these are high in fibre and low in fat.
- Choose lean meats.
- Trim the visible fat from meat and remove the skin from poultry.
- Avoid cooking by frying and roasting where possible and use grilling, steaming, stir-frying or microwaving as methods of cooking instead.
- Make cakes, biscuits and slices with a low-fat spread instead of butter and only use the egg white rather than the egg yolk where possible.
- Use a non-stick wok or frying pan and only grease lightly for shallow frying or stir-frying.
- Try cooking in olive oil, which contains monounsaturated fatty acids, instead of butter, which is high in saturated fatty acids.
- Avoid using cream as an enriching ingredient in soups and desserts – try a little low-fat yoghurt instead.
- Make salad dressings with low-fat yoghurt, vinegar and herbs.
- Use roasted vegetables as a topping on pizza instead of ham, salami or extra cheese.
- Spread sandwiches with a low-fat cream cheese spread or low-fat vegetable dip, rather than butter and margarine, then top with a low-fat filling such as tinned tuna and salad vegetables.
- Snack on fat-free fruit and vegetables such as apples, oranges, celery and carrots, instead of high-fat and sugar snacks such as sweet biscuits, doughnuts, pastries, potato crisps and muesli bars.

Practical ways to reduce the consumption of sugar

- Start by slowly reducing your sugar intake – cut down on the amount of sugar you add to tea and coffee and avoid adding sugar to breakfast cereals.
- Cut down on the number of carbonated drinks you consume. Have one can of soft drink or sports drink a day rather than two or three. It won't be long before you will be able to cut them out of your diet altogether. Drink plenty of tap water – it's free!
- Share a cake, muffin or biscuit with someone so that you are not tempted to eat the whole thing yourself. Often the only snacks available in a café are those that are high in sugar and fat and they are usually so large they can easily be shared.
- Serve only one scoop of ice-cream for dessert rather than two, and top it with a few strawberries or blueberries rather than a high-sugar syrup.
- Read labels carefully when shopping because many foods that are labelled 'low fat' or 'reduced fat' are often high in sugar to mask their bland flavour.

iStock.com/GooDween123

Reduce your intake of snack foods high in salt, such as potato chips.

- Cut celery, carrot and cucumber into sticks and keep them in the refrigerator so that you have some fresh, healthy vegetables that you can snack on instead of reaching for a biscuit, cake or muffin.

iStock.com/DNY59

Choose fresh fruit as snacks.

Practical ways to reduce the consumption of salt

- Try adding fresh herbs such as parsley, oregano, thyme and coriander to enhance the flavour of meals or use freshly ground black pepper instead of salt. Garlic, the rind and juice of lemons and cayenne pepper are all tasty flavouring ingredients that can be used instead of salt.
- Remember to plan your meals before shopping so that you can substitute foods high in salt such as bacon or ham with other alternatives. Lightly sautéed mushrooms are a great alternative to bacon and are delicious with an egg on toast for breakfast or brunch.
- Reduce the amount of processed meats such as ham or salami you use as fillings in sandwiches. Try using a can of low-salt tuna in a salad sandwich instead.

- Download an app such as FoodSwitch to your smartphone to help you select foods that are low in salt when you are shopping. This app contains a SaltSwitch function that allows you to scan the barcode of products to identify their salt content. This information is presented in a very simple traffic light format – foods that are low in salt have a green light while those with a high salt content have a red traffic light. This app also provides shoppers with a list of low-salt alternatives if these products are available. FoodSwitch also allows consumers to check the fat, sugar and energy content of foods so that they can make healthier food choices.

Weblink

- Push the saltshaker to the back of the cupboard and don't put it on the table when you are having a meal.

Understanding the text

31 Outline the reasons some parents give their children a vitamin supplement.

32 Write up a menu suitable for a child's lunch that would provide a good source of vitamin C, zinc and vitamin A.

33 Explain whether, in your view, a vitamin supplement is necessary for children. Justify your answer.

34 Outline the way most people gain weight.

35 Explain how foods in the five food groups are categorised.

36 Outline the similarities between the five food groups model and the Australian Guide to Healthy Eating.

37 Explain the advantages of using a portion control plate for consumers.

38 Draw a mind map of what you consider to be the top six practical tips to improve food behaviours.

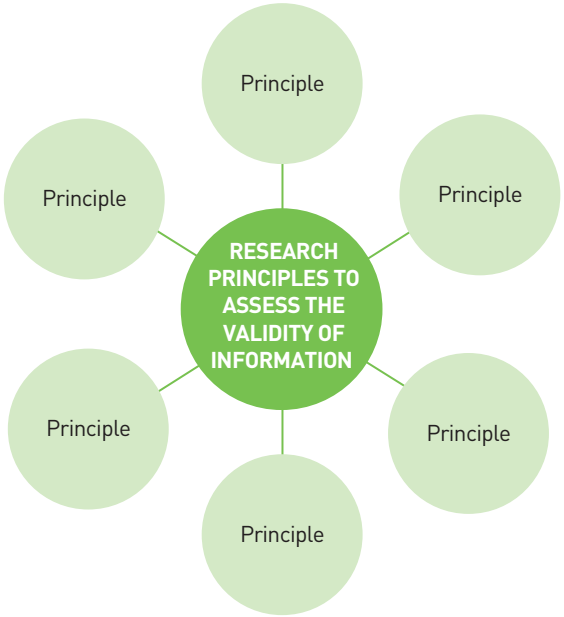
39 Explain why reducing the amount of saturated fat, added sugar and salt is important for good health.

40 Outline four strategies to reduce the consumption of saturated fats, sugar and salt in your diet.

PREPARING FOR EXAMS

Applying knowledge

Complete the following diagram to demonstrate the research principles used to assess the validity of information.



Analysing information

Prepare a PMI (plus, minus interesting) chart on the Lite n' Easy weight-loss program.

Worksheets

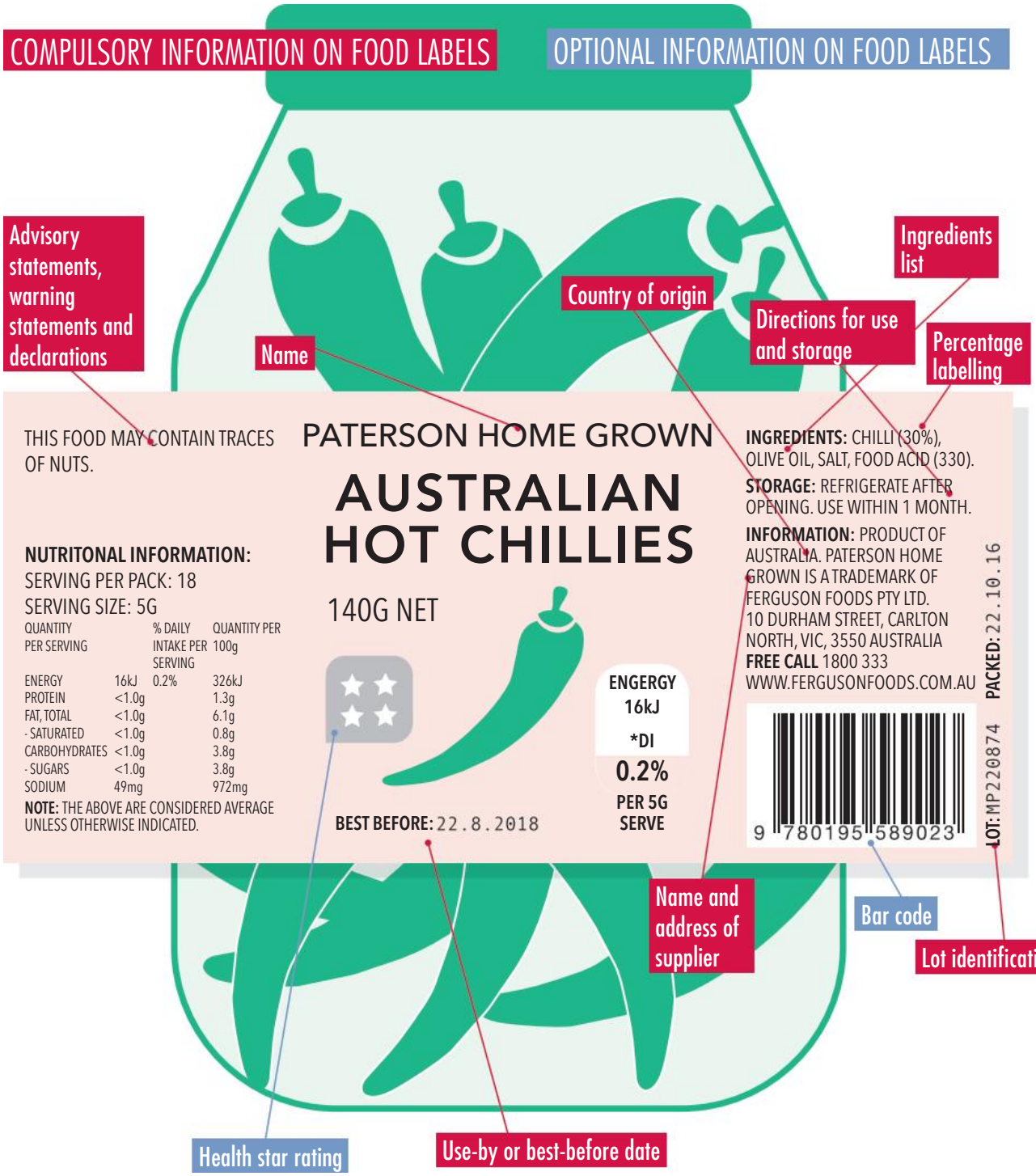
LITE N' EASY WEIGHT-LOSS PROGRAM		
Plus	Minus	Interesting

Evaluating concepts

Compare the health benefits and effectiveness of a community health project such as the LiveLighter campaign with a dietary supplement used to support children's health and wellbeing.

Worksheets

FOOD LABELS HELP TO ENSURE THE HEATH AND SAFETY OF CONSUMERS



16

FOOD LABELLING

INFORMATION THAT MUST NOT APPEAR ON FOOD LABELS

- Anything false, misleading or deceptive
- Any claim that a particular food can cure a specific illness or disease
- A claim such as 'vitamin enriched' or 'vitamin fortified' or a comparison of the vitamin or mineral content with any other food
- The word 'health' when used in conjunction with the name of the food
- Any statement or claim that the food has slimming or weight-reducing properties

THE VALUE OF FOOD LABELLING FOR THE CONSUMER

- Food safety
- Health
- Allergy information
- Shopping decisions and comparisons
- Ethical purchasing

KEY TERMS

Biomarker is a measurable biological parameter that indicates the risk of a serious disease when present at an abnormal level in the human body.

General level health claims refer to a nutrient or substance in a food and its effect on a health function.

Health claim refers to a relationship between a food and health rather than a statement of content.

Health halo effect is the overestimation of the healthfulness of a food item, or the ingredients contained in it.

High level health claim refers to a nutrient or substance in a food and its relationship to a serious disease or biomarker of a serious disease.

Nutrition content claims are claims about the content of certain nutrients or substances in a food, such as 'low in fat' or 'good source of calcium'.

Food labelling in Australia and New Zealand

Food labels provide a wide range of information to help food consumers make healthier and safer food choices. One of the main aims of the Australia New Zealand Food Standards Code produced by FSANZ (Food Standards Australia and New Zealand) is to ensure the labels on food give consumers sufficient information relating to food to allow them to make informed choices so that they can select healthier foods and plan nutritious meals for their families. Food labels provide information about the nutrient content and the proportion of these nutrients. They warn consumers about food allergens and inform the purchaser if the food is fresh or out of date. The labels list the ingredients present in the food and give helpful information on how to store, prepare and cook the food. The labels also show consumers what country the product has come from, allowing them to make informed choices about the origin of the food they buy, and the manufacturer's name and contact details.

Shutterstock.com/Dirty_about_summer

Food labels contain a lot of helpful information

COMPULSORY INFORMATION ON A FOOD LABEL

In Australia, all food labels must conform to the Australia New Zealand Food Standards Code. Chapter 1 of the code sets out the standards that apply to all food, including labelling requirements. These labelling regulations are found in Standard 1.2 and apply to food for sale in Australia and New Zealand, and food imported into both countries. Food labelling regulations apply not only to food for sale through the retail market, but also to food that is prepared in restaurants, schools and canteens or by catering institutions.

All products that are not weighed and packaged in front of the purchaser must display the following information, written in English and clearly visible to the consumer:

Prescribed name of the food

- The name of the food must indicate the true nature of the product and must not mislead consumers.
- If a name is prescribed within the Food Standards Code, then that name must appear on the label, for example 'honey' or 'formulated supplementary food for young children'.

Lot identification

- The lot mark identifies the packaging premises and job lot and must be included on a package. Exceptions include individual portions of ice-cream and small packages inside bulk packages, such as single-serve individual packets of potato crisps within a large packet.
- The lot mark may be coded in numbers and/or letters. This information is to assist with recall if it should be necessary.

Name and business address of supplier

- The supplier could be the manufacturer, packer, seller or importer.
- The address must be shown with sufficient detail to ensure that a person can go direct to the premises without further inquiry. The information must be clear and legible.

Advisory statements, warning statements and declarations

If a food contains ingredients likely to be a risk to the health and safety of consumers, it must include a prescribed statement (including warning statements), an advisory statement or a specific declaration, such as the following:

- **Mandatory warning statements** – These are prescribed statements that must be included on the label, using the exact words listed in the standard. For example, food for infants between the ages of four and six months must be labelled with the words 'not recommended for infants under the age of 4 months'.

- **Statements on food produced using gene technology** – These are also mandatory warning statements and must include the words that the food or ingredient has been 'genetically modified'. An ingredient, processing aid or additive that has been genetically modified must be listed on the label along with the specific ingredient. However, this labelling requirement does not apply if the ingredient, processing aid or additive has been highly refined and does not contain any new or novel DNA.
- **Advisory statements** – Unlike prescribed statements, the manufacturer is not required to use the exact wording, but must indicate the impact that the food will have on the health of consumers. For example, food containing added phytosterols must include words to the effect that the food may not be suitable for children under 5 years of age, or pregnant or lactating women. Food containing aspartame must include the statement to the effect that 'this food contains phenylalanine' because this information is essential for people who suffer from PKU (phenylketonuria).
- **Declarations** – These must be made if the food contains potential allergens, regardless of how small the amount. Foods that are likely to trigger a reaction in some consumers must be declared, for example gluten, egg, milk, nuts or sesame seeds.

Ingredients listing

- All ingredients, including food additives, used in the manufacture of a food should be listed in descending order by ingoing weight. The ingredient listed first is present in the greatest quantity, and the ingredient listed last is present in the least quantity.
- Food additives must be included in the list of ingredients and listed by class name, such as colour, preservative, emulsifier, followed by chemical name or number. An example is colour additive (tartrazine) or colour (102).

Percentage labelling, characterising ingredient(s)

- The characterising ingredient is one that is mentioned in the name of the food or is apparent by its inclusion in words, a picture or graphics on the label.
- The percentage is based on the ingoing weight of the characterising ingredient.
- The percentage declaration may be the actual amount or a minimum amount.

Date marking

- The most common form of date marking is a **best-before** date. This applies to foods with a shelf life of less than 2 years – food that has a shelf life of 2 years or more is exempt from date marking. If food is labelled with a best-before date, it does not mean that the food is unsafe after the date; it means that if the food has been stored in the recommended way, it will be of good quality until that date.
- A **use-by** date must be stated on a label if, for health or safety reasons, the food should be consumed before a certain date. For example, milk carries a use-by date, whereas yoghurt and cream carry a best-before date as their manufacturing processes extend their shelf life. Food must not be sold past its use-by date.
- Bread that has a shelf life of less than 7 days may carry a baked-for or baked-on date, but the date shown must not be more than 12 hours after baking.

Nutrition information

- A nutrition information panel must be included on the label and must identify the amount of energy (kilojoules), protein, fat, saturated fat, carbohydrate, sugars and sodium (salt), as well as other nutrients about which a claim is made, for example fibre, iron and calcium.
- The panel must indicate the number of servings contained in the package.
- The information must be presented in a standard format, showing the amount per serving and per 100 grams (or 100 millilitres if liquid) of the food.
- If claims are made about the nutrient content of the food, for example 'low in sodium or salt', the label must include information about the sodium and salt content per serving of food.
- There are several exceptions to nutrition labelling, including very small packages and food with no significant nutritional value, such as single herbs and spices and tea or coffee.

Directions for use and storage

- The food label must include information about any special storage conditions necessary to ensure that the food keeps for the time indicated by the best-before or use-by date, for example 'refrigerate after opening'.
- Where a food may pose a risk to consumers if it is not used or stored correctly, it is mandatory for the manufacturer to include directions about the best method to use or store the food. For example, infant formula must include directions for use to reduce the chance of microbial contamination and to ensure that the correct proportions are used.

Country of origin

On 1 July 2016, a new country of origin food labelling system came into force in Australia. The new labelling regulations are applied to food offered for retail sale in Australia, including stores or markets, online or from vending machines. Companies have been granted a 2-year period to phase in the new labelling requirements during which time they can sell their existing stock. At the end of the transition period any food products that still have the old labels can still be sold until the end of their shelf life. The new regulations apply to all food labelled after the end of the transition period.

The aim of the labelling requirements is to allow consumers to tell at a glance where the food they are purchasing is grown, made and packed. The labels will show what percentage of the ingredients are produced in Australia. The new labels will give consumers fast access to information that will allow them to make informed decisions about the food they purchase.

Under the new food labelling system, most foods grown, produced or made in Australia will be required to display a label with:

- the kangaroo logo
- a statement indicating that the food was grown, produced or made in Australia
- the minimum proportion, by ingoing weight, of Australian ingredients, indicated by a percentage amount shown in a bar chart.

The new requirements will make it clearer that 'made in' 'an imported product can't claim it was 'Made in Australia' if it has only undergone minor processing, such as slicing, canning, crumbing, reconstitution or repackaging in Australia.'

Foods that are not required to use the new labels with the additional information are:

- seasonings
- confectionary
- biscuits and snack foods
- soft drinks and sports drinks
- tea and coffee
- alcoholic beverages.

Source: http://www.foodlabels.industry.gov.au/

© Department of Industry, Innovation and Science 2016

'Country of origin' food labels enable consumers to tell at a glance where the food they are purchasing is grown, made and packed.

Weight or measure of contents (quantity measures)

- The weight or measure of the contents is not an FSANZ labelling requirement, but it is a legal requirement under fair trading regulations.
- Accurate minimum metric weights and measures must be listed on the label.
- The word 'NET' must be placed near all weight statements.
- The information must not be false, misleading or deceptive.

Information on a food label

Understanding the text

1 Draw a mind map to demonstrate why food labels are an important source of information for consumers.

2 Why is the lot identification of a product included on a food label?

3 Explain why some food labels include a mandatory warning and others include an advisory statement.

4 Describe how the ingredients on a food label must be listed.

5 Use the table below to identify the differences in the two forms of date marking that appears on food products.

BEST-BEFORE DATE	USE-BY DATE

6 Identify three types of nutrition information that must appear on a food label.

7 What is meant by a 'characterising ingredient', and how must it be expressed on a label?

8 What is the value of the bar chart on the country of origin food label?

9 Explain the difference between a 'Product of Australia' and 'Made in Australia' claim on a food label.

10 What is the value to the consumer of a quantity measure on food packaging?

OPTIONAL INFORMATION ON A FOOD LABEL

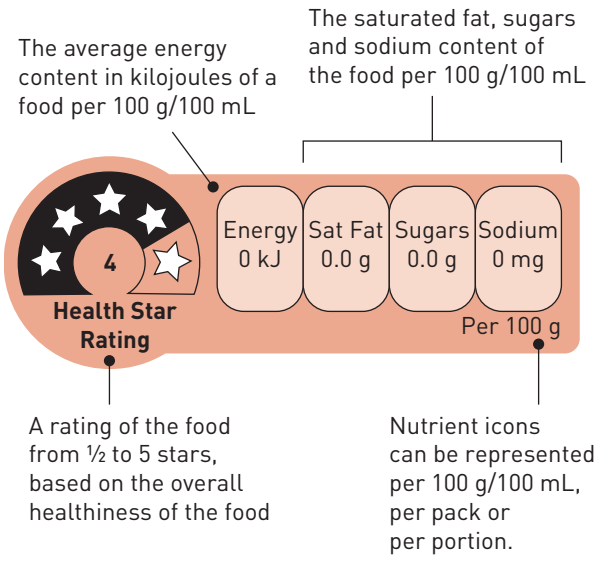
The following information may appear on a label.

Bar codes

Although not specified as a part of the FSANZ labelling requirements, bar codes have become an essential labelling feature for both food manufacturers and food retailers. The bar code on a food product is an important feature of the scanning technology used in most supermarkets throughout Australia. It contains computerised information about the product, including country of origin, pricing, date of manufacture and batch number. This information has become increasingly important to both manufacturers and retailers because it provides them with accurate information on stock control, sales figures and reordering.

Health Star Rating

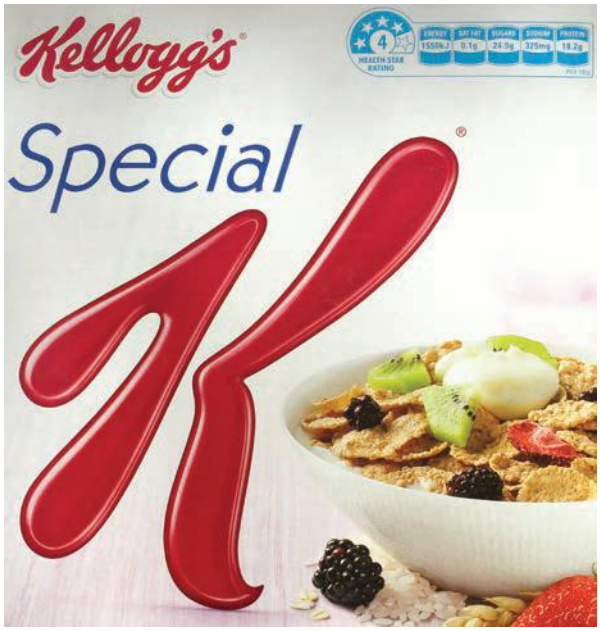
The Health Star Rating system is a voluntary scheme that has been developed by federal and state governments in collaboration with the food industry and public health and consumer groups. Companies apply a rating system of between half a star and five stars to the front of their food product packets to assist consumers in making healthier food choices. The star rating takes into account the energy, saturated fat, sodium and total sugar as these are the components of food that have been associated with the greatest risk factors for chronic disease. It can also modify points for positive aspects of the food such as containing fruit, vegetables, nuts and legumes, and in some cases dietary fibre, protein and calcium.



Example of a Health Star Rating label

Serving suggestions

Sometimes a food manufacturer will include serving suggestions on the label to guide consumers in how to use the product. For example, the label on a packet of soba noodles might include a recipe for a quick chicken noodle stir-fry.



Christodoulou

Health Star Rating on Kellogg's cereals

INFORMATION THAT MUST NOT APPEAR ON A LABEL

The following information must not appear on food labels:

- anything false, misleading or deceptive, such as a picture of a strawberry on confectionary that only has strawberry flavouring
- any claim that a particular food can cure a specific illness or disease
- a claim such as 'vitamin enriched' or 'vitamin fortified' or a comparison of the vitamin or mineral content with any other food
- the word 'health' when used in conjunction with the name of the food
- any statement or claim that the food is a slimming food or has weight-reducing properties.

FOODS THAT DO NOT NEED TO BE LABELLED

Not all foods have to be labelled. Some exceptions to food labelling are:

- unpackaged foods such as fresh meat, fruit, vegetables and nuts, or food sold in a restaurant
- food that is made and packaged on the premises where it is sold, for example at a bakery
- food that is packaged in the presence of the customer, for example at a delicatessen, greengrocer's or butcher's
- packaged whole or cut fresh fruit and vegetables (but not bean sprouts) where the fruit or vegetables can be seen through the package
- food delivered and packaged at the customer's request, for example home-delivered pizza
- individual serve packages that are sold in a large package, such as a 12-pack of potato crisps, although the information has to be on the outer package.

Activity 16.1

Comparing food products

Worksheets

Select two pre-prepared frozen dinners from a food manufacturer's website such as McCain (mccain.com.au). One dinner should come from the traditional range and one from a 'healthy range'.

1 At first glance, which product did you think was the healthiest? Give reasons for your choice.

2 Compare the Health Star Rating of each product. Was there a difference? Are these ratings the same? If not, give reasons for the difference.

MEALS	HEALTHY CHOICE LEMON CHICKEN	ROAST CHICKEN
		Dibrary
Weight and serves		
Front of pack information – Health Star Rating, health messages		
Energy • per serving • per 100 grams		
Protein • per serving • per 100 grams		
Fat (total) • per serving • per 100 grams		
Saturated fat • per serving • per 100 grams		
Dietary fibre • per serving • per 100 grams		
Sodium • per serving • per 100 grams		

3 Draw up a table similar to the one shown to record the information from the nutrition information panel on both labels. Read each label carefully.

4 Which product was higher in:

- kilojoules per serve
- percentage of the daily energy intake
- total fat
- saturated fat
- sodium?

5 If a consumer is choosing a dinner meal that would support weight loss, which meal would you recommend? Justify your answer.

6 Write a paragraph to explain the value of reading food labels carefully.

Nutrition content claims and health claims

On 18 January 2013, the new food standard to regulate nutrition content claims and health claims on food labels and in advertisements became law. Nutrition content claims and health claims are voluntary statements made by food manufacturers on labels and in advertising about a food they have manufactured. Food businesses must now comply with the new standard (Standard 1.2.7).

NUTRITION CONTENT CLAIMS

According to Food Standards Australia New Zealand, a **nutrition content claim** is a claim about the content of certain nutrients or substances in a food, such as 'low in fat' or 'good source of calcium'.

Before making these claims, a food manufacturer will need to make sure its product meets the criteria set out in the new standard. For example, with a 'good source of calcium' claim, the food will need to contain more than the amount of calcium specified in the standard. Comparative claims are sometimes made by companies to compare the nutrition content of their product, either directly or indirectly, with another brand, using words such as 'reduced', 'increased' or 'light'. In these cases, the company must identify the reference food and show the difference between the amount claimed in its food and the reference food.

A comparative nutrition content claim – 65 per cent less saturated fat than butter

Examples of criteria for nutrition content claims:

- No added sugar – the product must not contain any added sugar, but it may contain natural sugars.
- Reduced fats or salt – the product should have at least a 25 per cent reduction from the original or traditional product.
- Low fat – the product must contain less than 35 per cent fat for solid foods and less than 1.55 per cent for liquid foods.
- Fat free – the product must contain less than 0.15 per cent fat.

A product labelled 'a good source of' must contain no less than 25 per cent of the recommended daily intake.

Dlibrary

A nutrition content claim – fat-free yoghurt

HEALTH CLAIMS

A **health claim** refers to a relationship between a food and health rather than a statement of content. There are two types of health claims: general level health claims and high level health claims.

General level health claims

General level health claims refer to a nutrient or substance in a food and its effect on a health function. An example of a general health claim is 'calcium is good for bones and teeth'. There are 200 pre-approved claims set out in Schedule 3 of the standard. Alternatively, a business can also self-substantiate a food-health relationship, in accordance with the standard.

General level health claims must be supported by scientific evidence. This must occur whether they are pre-approved by FSANZ or substantiated by a food business putting its own claim forward. Health claims will only be permitted on foods that meet certain nutrient content. For example, health claims will not be allowed on foods high in saturated fat, sugar or salt.

Vaalia lactose free yoghurt – 'Helps naturally regulate your digestive system' – is an example of a general level health claim

Logical – 'Lowers cholesterol absorption' – is an example of a general level health claim

High level health claims

A **high level health claim** refers to a nutrient or substance in a food and its relationship to a serious disease or biomarker of a serious disease. A **biomarker** is a measurable biological parameter that indicates the risk of a serious disease when it is present at an abnormal level in the human body. Its effect on the human body could include a biochemical, functional or physiological process, an effect on growth and development, physical or mental performance or a disease or condition. Only those claims based on a pre-approval from FSANZ can be used. There are currently 13 pre-approved food-health relationships for high level health claims listed in the standard. Examples of some of the permitted high level health claims include 'diets high in calcium may reduce the risk of osteoporosis in people 65 years and over' and 'folic acid reduces the risk of foetal neural tube defects'. An example of a biomarker health claim is 'phytosterols may reduce blood cholesterol'.

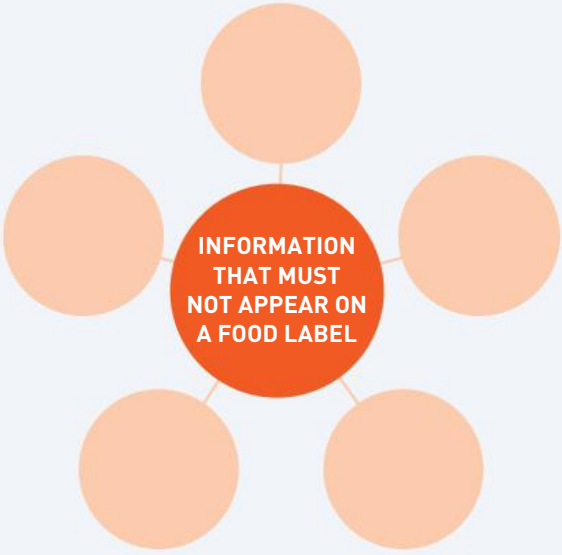
Understanding the text

11 List four important advantages to food manufacturers of including a bar-code on their food label.

12 Explain why the Health Star Rating system has been developed.

13 What factors do food manufacturers need to take into account when applying the star rating to their food products?

14 Draw a diagram like the one below to summarise the information that must not appear on a food label.



15 List three examples of foods that do not need to be labelled.

16 What is a nutrition content claim? Give two examples of nutrition content claims.

17 What is a comparative nutrition content claim? Outline the evidence the manufacturer would need to provide to be allowed to use this claim.

18 Define the term 'health claim'. Include an example in your answer.

19 Explain the difference between a general level health claim and a high level health claim.

20 Outline the safeguards that FSANZ has put in place for the use of high level health claims.

Advantages of accurate food labelling information

Consumers want to be informed about the food products they are about to purchase and food labels provide them with a wide range of valuable information.

The value of food labelling for the consumer

FOOD SAFETY

The prescribed name of the food, the lot mark, and the name and business address of the manufacturer or supplier will help the consumer identify if there is a safety issue with the food product they are about to purchase. The consumer will be able to contact the manufacturer or supplier if they have any questions or concerns about the product. The lot mark will identify the packaging premises and job lot, and this information, together with the bar code, will be vital in the event of a food recall.

Date marking, either the use-by or best-before date, will ensure that the product is safe to eat or in its best possible condition. The use-by date will ensure that the product is not sold after this date for health or safety reasons.

Directions for use and storage are essential to inform the consumer about special storage conditions, such as 'refrigerate after opening'. Directions about proportions are also important when reconstituting food such as baby formula.

GUIDANCE FOR HEALTHY FOOD CHOICES

Nutrition information panels make it easier for the consumer to choose foods with less saturated fat, less added salt, sugars or kilojoules. It is also valuable to help determine if the serving size is similar to the Australian Guide to Healthy Eating recommendations, particularly for discretionary foods. The panel is also helpful to compare similar food products and to decide which product is healthiest. This panel will assist people who wish to lose weight and make decisions about whether a food is 'kilojoule worthy'. Once the kilojoules are stated, the consumer can decide whether their enjoyment of the food is worth the extra kilojoules.

The **Health Star Rating** system is a form of percentage front-of-pack labelling and provides consumers with a quick method of evaluating how healthy the food is. This makes it simpler for consumers to make an informed choice and to make easy comparisons with alternative foods when choosing healthy food options. The Health Star Rating should always be considered in conjunction with the nutrition information panel, the ingredients list and the Australian Dietary Guidelines.

Age Fotostock/VOISIN/PHANIE

Comparing food products using the nutrition information panel

NUTRITION INFORMATION (Average)

Serving Size: 30g (2 biscuits) Servings Per Pack: 24

	PER SERVE	PER 100g
Energy (kJ)	447	1490
(Cal)	107	355
Protein (g)	3.7	12.4
Fat, Total (g)	0.4	1.3
- Saturated Fat (g)	0.1	0.3
- Trans Fat (g)	0.0	0.0
- Polyunsaturated Fat (g)	0.2	0.8
- Monounsaturated Fat (g)	0.1	0.2
Carbohydrate, Total (g)	20.1	67.0
- Sugars (g)	0.9	2.9
Dietary Fibre (g)	3.3	11.0
Sodium (mg)	81	270
Potassium (mg)	102	340
Magnesium (mg)	32 (10% RDI)*	107

Christodoulou

Nutrition information panel

The food label also **lists the quantity of the ingredients** in descending order, from highest to lowest. This enables the consumer to clearly identify the quantity of the ingredients in the product. This takes the guesswork out of shopping for packaged and processed foods and also allows for the comparison with other products to see which one is healthier.

Some labels will include statements or **nutrition content claims** such as 'low fat', 'reduced salt', 'high in fibre'. These claims are a guide to healthier food choices, but a claim made in relation to 'low fat' must be checked carefully with the nutrition panel because these foods may be high in total energy (kilojoules), when compared with other products.

Labelling laws also allow companies to include information about the **glycaemic index** (GI) rating of the food. This information is helpful for consumers who wish to choose low GI foods in order to control the glucose levels in their bloodstream. Low GI foods will also help consumers to maintain a feeling of satiety for longer.

Health claims link a food or nutrient or substance in food to a health effect and help consumers make the best choice for their health condition.

Some labels list the nutrients present in a food as a percentage of the recommended daily intake (RDI). This can be used to compare nutrients in one serve of food with what an 'average adult' needs. However, it is only a rough guide to individual needs, particularly kilojoules.

INFORMATION FOR CONSUMERS WITH ALLERGIES

Mandatory warning and advisory statements and declarations are critical for people who are likely to be at risk by consuming certain ingredients. A prescribed warning statement may appear on some products ensuring that the consumer is not put at risk by consuming the product. Advisory statements inform the consumer that certain ingredients may have an impact on their body, such as sorbitol, which may have a laxative effect. Ingredients such as gluten, nuts and sesame seeds must be identified on the label to alert consumers affected by these foods, so that they can avoid them and prevent a serious reaction, such as anaphylactic shock.

Food additives, which are used in food manufacturing to improve the flavour and appearance of food and to increase its keeping qualities and stability, must be listed on the label. Each food additive is given a short code number. Some people have adverse reactions to food additives such as monosodium glutamate and tartrazine. The labelling of food and the listing of the additives' code number enables them to determine which additives are present in food so they can avoid these additives.

SHOPPING DECISIONS

The **weight** or measure of the contents is listed on labels to assist shoppers to determine the quantity of food in a package and indicate how much they need to purchase. The **serving size**, number of serves or number of slices, is also important information for the consumer when purchasing a packaged food product.

Packaged foods must carry the **percentage of the characterising ingredients**. This will enable consumers to compare similar products.

The new country of origin information in graphic form will enable consumers who wish to make an **ethical food choice** and purchase Australian grown or manufactured products to tell at a glance which products these are. Many consumers are also looking to food labels to give them information on the welfare of animals and on foods that have been produced sustainably. New labelling regulations in relation to free-range eggs require egg producers to list the outdoor stocking density of hens laying free-range eggs, allowing consumers to easily compare the practices of different egg producers.

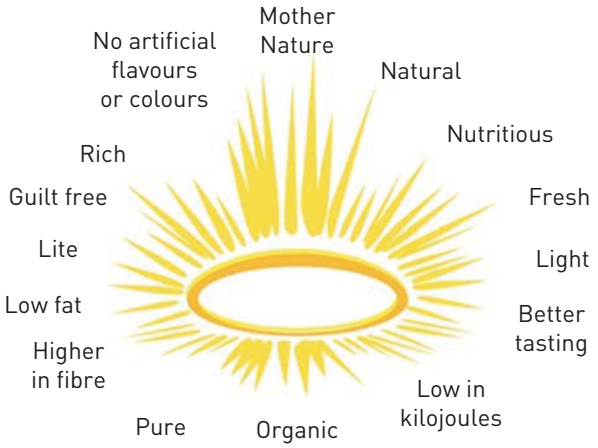
Weblink

Identifying the halo effect

In order to survive in a fast-paced world, many consumers rely on mental shortcuts when shopping. These shortcuts enable them to make quicker and more efficient decisions, particularly when choosing between products. These mental shortcuts are what researchers often call the 'health halo effect'.

The **health halo effect** is the overestimation of how healthy a food item might be. An example of this overestimation of the health benefits of a food product is the manufacturer's claim that their product is 'low in fat'. Consumers often confuse this with 'low in kilojoules', which could lead the consumer to consume too much of the food. The halo effect gives the consumer the 'green light' to eat more of the product and not feel as guilty because it is described as low in fat.

The halo effect is also described as 'health washing' and is quite commonly used to make the food appear to be more healthy than it really is. Often consumers are willing to pay more for products that are not any more nutritious, but are packaged and labelled with words that give the perception of health.



Health halo

How to avoid the health halo trap

Dietitian Sharon Natoli warned consumers about falling into the health halo trap and suggested a strategy consumers could use: 'Shop around the perimeter of the supermarket first and fill most of the trolley with fresh foods – fruit, veg, lean meats, poultry, fish, nuts, eggs, milk, cheese, yoghurt'.

As consumers, it is important not to rely on branding and marketing messages but make informed choices about how healthy a food product is after reading all aspects of the label information carefully. Remember, the healthiest food does not usually come in packages.

Use of words on food labels

What does the term 'natural' mean? Is 'natural' a good thing? Currently, there is no regulated definition of the term 'natural' in the food labelling standard. Other terms such as 'wholesome', 'pure', 'trim' and 'lean' also fall into this category and although they cannot be used deceptively, they are not always relevant. Other words such as 'organic' and 'gluten-free' are used to persuade consumers that their product is healthier than similar products. In the case of 'gluten-free', this term is often added to the packaging of products that are not likely to contain gluten anyway. Sometimes food manufacturers use the term 'lite' in the name of a product or when describing it, to ease the consumer's sense of guilt. The term 'premium' is also used to give the impression to the consumer that their product is 'ahead of the rest' and so they can also charge a 'premium' price for it.

Consumers should also be very wary of products that claim to be 'fat free' or contain no artificial colours or flavours. The manufacturer's intention is to distract the consumer from looking too closely at the label and examining its overall nutritional value, and to simply focus on a single nutrient. For example, irrelevant statements such as 'marshmallows are fat free' and a block of chocolate 'contains 1½ cups of full-cream milk' are distractions from the fact that both of these foods contain a high quantity of sugar and kilojoules. Lollies are another trap; while the manufacturer may claim they contain no artificial flavours or colours, their key ingredient is sugar.

It is also important to learn and become familiar with the many terms that can be used to describe the same ingredient or additive. Sugar, fat and salt can all be listed on a food label under different names. There are 43 different names that can be used on labels for the term 'added sugar'.

Labels of food products often make reference to issues of social responsibility; for example, country of origin, loyalty to Australia and consideration for the environment, such as packaging made from recycled cardboard. These messages give a more positive perception of the product's worth and encourage consumers to purchase it.

choice.com.au

Names for 'added sugar'

Case study

Stripping back the health halo

Read the case study below, then then answer the questions that follow.

1. Explain why 'all natural' or '100 per cent natural' are considered to be a health halo.
2. Do these statements assist consumers in their food choice? Justify your answer.
3. Why has Tuckers included the information on the front of the pack 'made with rice bran oil'? Discuss the perception the company is trying to create.
4. The package of the crackers has a clear window that allows consumers to see the crackers. From what you can see in the picture, is the statement 'yeast free' relevant? Why has the company included this statement?
5. The label of the package does not have a Health Star Rating. Why do you think the company omitted this guide?
6. Write a paragraph using the information about the company and the labels to describe the consumer perceptions the company is trying to promote in order to market the crackers.

About Tucker's Natural Company

Tucker's Natural Company is an Australian-owned company that produces snack foods such as crackers, snacks and fruit pastes. On its website the company states that it uses only natural ingredients to create products that taste delicious, are of high quality and provide nutritional benefits to consumers. It also states that it does not use any artificial ingredients such as preservatives, yeast, MSG, soy or GMO (genetically modified organism) ingredients. The company states that

90–100 per cent of the ingredients it uses are sustainably sourced from Australian suppliers.

The packaging of Tucker's Rosemary & Rock Salt Natural Gourmet crackers states that they are:

- oven baked, not fried
- yeast free
- 100% GMO free
- made with rice bran oil
- australian made
- naturally better for you.

Weblink

Tucker's Rosemary & Rock Salt Natural Gourmet Crackers

Activity 16.2

Child aged 10 dies after drinking coconut milk as importer admits label charges

Read the article, then answer these questions:

1. Evaluate the validity of this news article. Consider the reliability of the sources of information used in the article, the context and presentation of evidence.
2. Outline the circumstances that led to the death of the 10-year-old child.
3. Explain how the coconut milk breached the food labelling regulations.
4. What action did the Department of Agriculture take following the recall of the coconut milk?
5. Outline three concerns that Maria Said, President of Allergy & Anaphylaxis Australia, has about the handling of this food labelling incident.
6. Write a brief statement to explain the importance of accurate food labelling for consumers.

CHILD AGED 10 DIES AFTER DRINKING COCONUT DRINK AS IMPORTER ADMITS LABEL CHARGES

A 10-year-old child died from an allergic reaction after drinking a 'natural' coconut drink imported by a Sydney firm.

The canned product from Taiwan, Greentime Natural Coconut Drink, is sold in most states and was recalled just over a month later, following the tragedy in December 2013. But it was never revealed that it was blamed for causing the fatal anaphylactic reaction in the child from Melbourne.

The NSW Food Authority said importer Narkena Pty Ltd, based in western Sydney, pleaded guilty in September to three labelling charges and will be sentenced later this month.

The authority said the company entered pleas of guilty to two charges that the drink was labelled in a way that falsely described the food and to one charge of selling food in a manner that contravened the Food Standards Code.

The child is understood to have had an allergy to dairy products. The NSW Food Authority said at the time that the recall was because the milk content was not declared on the label.

Five coconut drinks have been recalled in the last four weeks, all because they contained undeclared cow's milk according to Allergy & Anaphylaxis Australia.

Last month, *The Sun-Herald* reported Aiden Henderson, nine, who is allergic to dairy products, went into anaphylactic shock after drinking the flavoured drink Coco Joy. It is also imported by a Sydney firm and was recalled after the incident.

The Department of Agriculture subsequently began inspecting the labels of all imported coconut milk drinks. All products with labels that do not declare milk will be sent to labs for testing it said. Under Australian law, an importer who knowingly brings in

food that poses a risk to human health can be jailed for 10 years.

Maria Said, President of Allergy & Anaphylaxis Australia, said she was dismayed that although the coconut drink the child consumed immediately before the anaphylaxis that took his life was found to contain cow's milk, it had taken almost two years for other similar products to be investigated.

'Surely someone in the food science industry would have known the cow's milk was used for a functional purpose in the coconut drink and if that was the case, it would likely be in other coconut drinks,' she said.

'Another child's near-death experience after drinking a different coconut drink in July 2015 prompted NSW Food Authority to test other coconut drink products, some of which have now also been recalled due to undeclared cow's milk. The spate of coconut drink-related recalls continues as it should have from Jan 2014'.

Child aged 10 dies after drinking coconut drink as importer admits label charges, by Tim Barlass, 4 October 2015, *The Sydney Morning Herald*

Understanding the text

21 Outline two features of food labelling that will ensure food is safe to consume, and explain how this information is of benefit to consumers.

22 Explain how the nutrition information panel can assist people who want to lose weight.

23 Why is listing the information on a food label in descending order of input considered to be a valuable tool for consumers?

24 Why would some food producers include information about the glycaemic index rating of the food on the label?

25 The percentage of the characterising ingredients must be included on a food label. Explain how this information benefits consumers.

26 Why is it important that food additives are listed on a food label?

27 List three pieces of information on a food label that would assist consumers while they are shopping.

28 What is meant by the term 'health halo'? What impact can health halos have on consumers' health?

29 Identify six words that are often used to create a health halo.

30 Explain why consumers should be wary if they see the words 'low in fat' or 'fat free' on a food label.

PREPARING FOR EXAMS

Applying knowledge

Draw up a comparison chart similar to the one below to compare the features of each type of health claim.

Worksheets

Nutrition content claims

↓

General level health claims

↓

High level health claims

Analysing information

Write a short statement to promote the value of food labels in promoting consumer's health.

Evaluating concepts

Examine the label on a food product and consider whether it communicates the geographical origin of the food. Explain why this information would be an important factor in a consumer's purchasing decision.

RECIPES

iStock.com/Askold Romanov

Monkey bread

Monkey bread is delicious, slightly spicy bread. Shaping the dough into small balls before layering the two elements – dough and flavourings – in the baking tin creates a visually interesting loaf. Yeast leavens the dough and the dry heat of baking produces a golden brown crust as a result of **dextrinisation** and the **Maillard reactions**. It also makes the loaf easy to eat, because each section breaks off without the need of a knife for cutting. Monkey bread provides a good source of carbohydrate, and the addition of cracked wheat increases the proportion of dietary fibre in this bread. The sunflower kernels provide a source of iron, vitamin B6 and magnesium, as well as a good source of polyunsaturated fat. However, the butter used in the layering of this bread means that it is higher in saturated fat than other white breads.

DOUGH

2 cups white bread flour

1½ teaspoons freeze-dried yeast

1 tablespoon powdered milk

1 teaspoon sugar

½ teaspoon salt

2 tablespoons cracked wheat

2 tablespoons sunflower kernels (not seeds)

1 cup warm water

1 tablespoon olive oil

LAYERING MIXTURE

30 grams butter, melted

1 tablespoon sesame seeds

1 tablespoon poppy seeds

2 cloves garlic, crushed

1 tablespoon coriander, finely chopped

1 fresh chilli, deseeded and finely chopped

METHOD

Making the dough

1 Sift the flour, yeast, powdered milk, sugar and salt.
2 Add the cracked wheat and sunflower kernels and mix well.
3 Combine the warm water and olive oil. Make a well in the centre of the flour and then add three-quarters of the liquid and mix. Gradually add the remaining liquid, using just enough to make a soft dough.
4 Turn the dough onto a floured bench and knead until smooth and elastic – this may take about 5 minutes. Return to the mixing bowl.
5 Cover the dough with oiled cling wrap and leave in a warm place to prove – the dough should double in size.

Making the layering mixture and preparing dough for oven

1 Make the layering mixture by combining all the ingredients in a small bowl.
2 Grease a small log tin or ring tin.
3 Turn the proved dough onto a floured bench and knead until smooth.
4 Break off pieces of dough about the size of a golf ball and pack into two parallel rows on the base of the tin. Spread half of the melted butter mixture over the balls of dough.
5 Top with another row of dough balls down the centre of the tin. Spread the remaining butter mixture over the top.
6 Cover with cling wrap and allow to prove for 10 minutes or until doubled in size. Spray with cold water.
7 Bake at 200 °C for approximately 15–20 minutes. The bread should be golden brown and make a hollow sound when tapped.

Monkey bread

EVALUATION

1 Describe the sensory properties of appearance, aroma, flavour and texture of the monkey bread.
2 Explain how yeast works as a raising agent to aerate the bread.
3 Identify the protein in the flour and explain the changes that occur to it during the mixing process.
4 Why is the mechanical action of kneading an important process in the production of the monkey bread?
5 Explain why proving the dough is an essential stage in bread making.
6 How is heat transferred through the oven to cook the bread?
7 Describe the effect the dry heat of the oven has on the bread dough during cooking and identify the chemical processes that occur.
8 Outline the tests that can be carried out to determine if the bread is cooked.
9 List two safety features to observe when using the oven to bake the bread.
10 Describe the accompaniments that could be served with the monkey bread to make it a healthy lunch-time meal for children and families.

Eggs Florentine

The recipe for eggs Florentine demonstrates the **coagulation** of egg protein by **changing the pH** of the cooking liquid and applying heat. Poaching is a gentle wet method of cooking the egg. The preparation of a béchamel or cheese sauce uses the ability of starch to gelatinise and thicken the sauce. The process of dextrinisation and the Maillard reaction are also evident in this product. The spinach in this recipe provides a good source of iron, vitamins A, C and B6 and the mineral magnesium. The eggs are also a good source of protein, although the egg yolk does contain saturated fat and cholesterol. The cheese sauce served on the eggs provides a source of calcium from the milk and cheese.

---

50 grams baby spinach leaves

15 grams butter

1 tablespoon plain flour

½ cup milk

1 tablespoon grated cheddar cheese

½ English muffin

1 egg

1 tablespoon vinegar

2 teaspoons grated parmesan cheese

METHOD

1. Preheat grill to high or oven grill to 200 °C.
2. Wash the spinach leaves thoroughly.
3. Microwave spinach in a covered bowl for 30 seconds until just wilted.
4. Melt the butter in a small saucepan.
5. Add the flour and stir over a low heat for 1 minute.
6. Remove from the heat and gradually stir in the milk. Return to the heat and stir constantly with a wooden spoon until the mixture boils and thickens.
7. Add the cheese and stir until melted. Remove from the heat.
8. Toast the muffin and set aside.
9. Poach the eggs until the yolk is set to suit taste. To poach an egg in the classic style, heat water to just below boiling point in a saucepan or frying pan and add the vinegar. Then stir the water briskly with a wooden spoon to create a whirlpool. Gently lower the egg from a small dish into the swirling water. The swirling water will ensure the egg forms a neat shape.
10. Reduce the heat and poach the egg until the yolk is set to suit your taste.
11. To serve, place half a muffin on a serving plate and top with spinach.
12. Carefully lift the poached egg onto the spinach and spoon the cheese sauce over the top of the egg.
13. Sprinkle with parmesan cheese and flash under a grill until the cheese is melted. Serve immediately.

SERVES 1

EVALUATION

1 Describe the sensory properties of the eggs Florentine – appearance, aroma, flavour and texture – and comment on the overall appeal.
2 Identify and describe the process that causes the sauce to thicken.
3 In what way(s) is heat energy transferred to cook the sauce?
4 Identify the processes that cause the muffin to brown when toasted.
5 Explain how these processes cause starch-based products such as muffins to brown when exposed to dry heat.
6 How does adding vinegar to the water when poaching assist the egg to retain its shape?
7 Describe how the process of coagulation changes the form of the egg protein during poaching.
8 List all the methods of cooking used in this recipe. Explain one important safety consideration for each cooking method used in this recipe.
9 Why would consumers choose free-range or organic eggs over cage eggs?
10 Plot the ingredients for eggs Florentine onto a diagram of the Australian Guide to Healthy Eating and explain how well this meal meets the guidelines of this food selection model.

Eggs Florentine

Vegetable frittata

Frittata is an Italian-style omelette that can be eaten hot or served at room temperature. It is ideal to be served in the pan in which it is cooked and cut into wedges at the table. The variety of vegetables can be altered, although most need to be cooked to tenderise and remove some of the moisture content. The production of this recipe clearly demonstrates the denaturation of protein in egg – **coagulation**. It also includes two dry methods of cooking food – shallow frying and grilling. A heavy-based frying pan is best for this recipe to ensure the heat is evenly distributed. The vegetable frittata contains a wide range of vegetables that provide a good source of dietary fibre, vitamins and minerals. There is a small amount of saturated fat in the bacon, eggs and cheeses.

½ zucchini (150 grams)

salt

3 chat potatoes, steamed

½ medium brown onion, finely diced

½ leek (100 grams), diced

2 rashers bacon, finely diced

¼ cup frozen peas, defrosted

2 eggs

50 millilitres milk

freshly ground black pepper

50 grams tasty cheese, cubed

1 tablespoon grated parmesan cheese

2 tablespoons olive oil – one for sautéing and one for cooking the frittata

METHOD

1. Wash and coarsely grate the zucchini onto a plate and sprinkle with a little salt. Allow to stand for 10–15 minutes.
2. Cut the cooked potatoes into four pieces.
3. Squeeze excess water from the zucchini.
4. Heat 1 tablespoon of oil in a frying pan and sauté the onion, leek and bacon. When onion is transparent, add the zucchini and peas and cook gently until it is slightly wilted. Do not brown. Remove from pan and allow to cool. Wipe the pan clean.
5. In a separate bowl, whisk the eggs, milk and black pepper. Then combine all the ingredients, except the oil.
6. Preheat the grill on high.
7. Heat 1 tablespoon of oil in the cleaned pan and, when very hot, pour in the egg and vegetable mixture. Reduce to low heat.
8. When the frittata is almost set, place under grill until set and light brown on top. Remove the pan from the heat and rest for 5 minutes before cutting to serve.
9. Serve with crusty bread and a salad.

SERVES 1–2

EVALUATION

1 Describe the sensory properties of the vegetable frittata – appearance, aroma, flavour and texture.
2 Why is the zucchini grated and salted in the early stages of the recipe?
3 Why is it important to cook the potatoes before adding to the frittata?
4 Explain why it is important to cool the cooked bacon and vegetable mixture before combining with the milk and eggs.
5 Suggest two other vegetables that could be substituted in this recipe and describe how they should be prepared.
6 If you did not have a suitable frying pan, describe other methods you could use to cook the mixture.
7 Why must the frying pan be preheated before adding the frittata mixture? How can you tell if the pan is hot enough?
8 Identify the ingredient and the process that are responsible for the setting of the frittata.
9 Describe four safe work practices you followed during the preparation and cooking of the frittata.
10 Plot the ingredients for the vegetable frittata on a diagram of the Australian Guide to Healthy Eating and explain how well this meal meets the guidelines of this food selection model.

Vegetable frittata

Teriyaki pork cutlets and spicy slaw

Pork cutlets are a lean cut of pork; retaining the rib bone assists in flavour development and keeps the meat moist during cooking. Mirin is a Japanese vinegar. It is made by fermenting rice wine and has a pH value of 3.8 so is classified as an acidic ingredient. The **denaturation** process tenderises the pork and flavours the marinade. The dressing for the spicy slaw is a **temporary emulsion**. The pork cutlet used in this recipe is a good source of protein; however, it is also high in saturated fat. The marinade includes soy sauce, which is high in salt and sugar. The spicy slaw contains many nutritious vegetables as well as apple, providing dietary fibre and a wide range of vitamins and minerals.

Teriyaki pork cutlets

¼ cup soy sauce

1 tablespoon mirin

2 teaspoons caster sugar

2 teaspoons grated fresh ginger

1 clove garlic, crushed

2 thick pork cutlets

olive oil cooking spray

2 portions udon noodles, cooked according to manufacturer's instructions

METHOD

1. To make the marinade – combine the soy sauce, mirin, caster sugar, grated ginger and crushed garlic. Add the pork cutlets, coat with the marinade, cover and refrigerate for 30 minutes.
2. Remove the pork cutlets from the marinade. Retain the marinade.
3. Spray a large frying pan with oil. Heat over medium heat. Cook cutlets for 5 minutes each side. Transfer to a plate and cover loosely with foil.
4. Add reserved marinade to frying pan. Bring to the boil. Reduce heat to low. Simmer for 3–5 minutes, scraping base of frying pan to prevent the mixture from sticking.
5. Place noodles on serving plates and top with cutlets. Drizzle with marinade.

SERVE WITH A SIDE OF SPICY SLAW.

Spicy slaw

1½ cups white cabbage, shredded

1½ cups red cabbage, shredded

½ small carrot, finely shredded or thickly grated

½ red onion, finely sliced

½ cup mint, chopped

½ cup coriander, chopped

½ Granny Smith apple, peeled and cut into strips

½ long red chilli, seeds removed and chopped finely

DRESSING

2 tablespoons rice vinegar

2 teaspoons caster sugar

1 tablespoon soy sauce

1 tablespoon lime juice

1 tablespoon fish sauce

METHOD

1. In a large bowl, combine the cabbage, carrot, onion, mint, coriander, apple and chilli.
2. In a jar, combine the rice wine vinegar, sugar, soy sauce, lime juice and fish sauce.
3. Place the lid on the jar and shake to combine.
4. Toss the slaw with the dressing until well coated.

SERVES 2

EVALUATION

1 Describe the sensory properties of the three elements of the meal: pork cutlets, noodles and slaw.
2 Explain why a meal is often designed with different elements.
3 Identify the acidic ingredients used in the recipes and explain their functional roles.

ACIDIC INGREDIENTS	FUNCTIONAL ROLE OF THE ACIDIC INGREDIENT

4 Why is it essential to cook the marinade before serving it as a sauce on the pork cutlet?
5 The protein in the pork cutlet has been denatured by acid and heat – describe the changes that have occurred from its raw state.
6 Explain why the dressing for the spicy slaw is described as a temporary emulsion.
7 Identify the process that would have taken place if the grated apple was not coated with the dressing immediately.
8 Analyse the meal using the Australian Guide to Healthy Eating and explain why it would be considered to be a healthy food choice.
9 What recommendation would you make for improvements in the sensory and/or nutritional properties of this meal?
10 Identify the ingredients and suggest alternatives that could be substituted by someone purchasing more ethical or sustainably produced ingredients.

Teriyaki pork cutlet and spicy slaw

Chicken noodle salad

This Asian-style salad makes a delicious summer meal. Just before serving, it is dressed with a mix of ingredients that are an example of a **temporary emulsion**. Pan-frying the chicken demonstrates the **denaturation** of protein that occurs when dry heat is applied. The recipe also incorporates the wet cooking methods of boiling and blanching. This recipe includes a wide range of vegetables including red capsicum and carrot, which provide a source of vitamins C, A and B6 and dietary fibre. The chicken fillet is also an excellent source of protein; however, it does contain a small amount of saturated fat. The noodles provide carbohydrate.

SALAD

1 small chicken fillet

vegetable oil spray

¼ red capsicum, thinly sliced

50 grams snow peas, julienned

½ carrot, thinly sliced diagonally

2 spring onions, sliced

½ cup fresh bean shoots, brown tails removed

125 grams fresh Hokkien noodles

2 teaspoons fresh mint, chopped

2 teaspoons fresh coriander, chopped

DRESSING

¾ teaspoon sesame oil

1 teaspoon vegetable oil

½ lemon or lime, juiced

1 tablespoon kecap manis (Malaysian-style soy sauce)

2 tablespoons sweet chilli sauce

METHOD

1. Remove the skin from the chicken fillet. Place chicken between cling wrap and roll with a rolling pin until even thickness. Spray or brush lightly with vegetable oil.
2. Prepare chargrill pan or frying pan and cook fillet until just cooked.
3. Remove from heat, wrap in foil and allow to rest for at least 10 minutes before slicing thinly across the grain of the fillet.
4. Prepare the vegetables. Blanch and refresh the capsicum, snow peas and carrot individually in fresh water.
5. Separate the noodles and place in a large bowl. Cover with boiling water and stand for 5 minutes. Drain and rinse under cold water. Drain well.
6. Mix all the dressing ingredients in a screw-top jar and shake, or whisk in a small bowl until combined.
7. In a large bowl, combine all the vegetables, chopped chicken, noodles, spring onions, bean shoots, mint and coriander with dressing. Toss gently so the dressing coats all the ingredients. Serve immediately in a bowl or takeaway noodle box.

SERVES 1

EVALUATION

1 Describe the sensory properties of the chicken noodle salad – appearance, aroma, flavour and texture.
2 Explain how you would assess the quality of the ingredients when selecting the chicken and vegetables for this recipe.
3 Describe the changes that occur in the protein molecules of the chicken fillet while it is being pan-fried.
4 Discuss the effect on the sensory properties of resting the chicken before cutting and slicing it across the grain in step 3.
5 Why were the capsicum, snow peas and carrots blanched in this recipe?
6 What might happen if the noodles were boiled on the cooktop, rather than just covered with boiling water?
7 The dressing is an example of a temporary emulsion. What is a temporary emulsion and why is it added just before serving?
8 Suggest some alternative vegetables you could use if spring onions, red capsicum, snow peas, carrot and bean shoots were not available.
9 Describe the safe work practices you followed to prevent cross-contamination between ingredients when preparing this recipe.
10 Analyse the chicken noodle salad using the Australian Guide to Healthy Eating and explain whether this recipe is suitable to serve as a healthy meal for children and families.

Chicken noodle salad

Ruby red jam

Cooking a saucepan of jam on a rolling **boil** helps to maximise the flavour, texture and colour of the end product. A short cooking time ensures the jam is clear and minimises any damage to the pectin in the fruit, which could affect its ability to form a gel. Ruby red jam uses fruits that have medium levels of pectin and acid. Lemon juice (citric acid) is added to raise the acid levels and to assist in the gelling of the cooked jam. One of the main ingredients in jams is sugar so spreads such as this should be used sparingly.

---

3 × 250-millilitre lidded jars

250 grams blueberries

250 grams boysenberries

250 grams raspberries

2½ cups sugar, approximately

1½ tablespoons lemon juice

METHOD

1. Clean the jars and sterilise them.
2. Combine the berries in a large saucepan and stir gently over a low heat for 5 minutes.
3. Measure the fruit mixture and allow 1 cup of sugar to each cup of fruit mixture.
4. Return the fruit mixture and sugar to the pan. Add the lemon juice and stir over the heat, without boiling, until the sugar is dissolved.
5. Bring to the boil, and boil uncovered, stirring frequently for about 15–20 minutes or until jam gels when tested.
6. Pour into hot sterilised jars, and seal and label when cold.

MAKES 2–3 CUPS

Ruby red jam

EVALUATION

1 Describe the cooking method of boiling and explain why it is used to cook jam.

2 Discuss two functional roles of sugar in ruby red jam.

3 Explain how you tested the fruits to determine the levels of pectin present.

4 Why is the amount of pectin and acid in fruit used for jam-making an important consideration?

5 Describe a test that you carried out to determine whether the jam was cooked.

6 Why is it important to sterilise the jam jars before filling them with cooked jam?

7 List the important safety considerations when cooking and bottling jam.

8 How should jars of jam be sealed and stored?

9 Complete a comparison of the sensory properties of the homemade ruby red jam with a similar commercially produced jam.

Worksheet

10 Write a brief report explaining which jam you prefer.
- Justify your choice by making reference to the sensory test you have carried out comparing the two products.
- Explain reasons for any differences in the jams, including details about the ingredients in each product.

SENSORY PROPERTIES	RUBY RED JAM	MIXED BERRY JAM
Appearance • Colour • Clarity		
Aroma • Intensity of berry-like aromas		
Flavour • Fresh berry-like sweetness		
Texture • Spreading consistency • Evidence of real fruit • Mouth feel		

2C jam – capsicum and chilli

This recipe is a beautiful, bright red savoury jam. Vegetables and spices are **boiled** then **simmered** to remove moisture and to concentrate flavours. A little vinegar is added to balance the acidic, spicy and sweet flavours in the jam. The jam can be served as part of a cheese platter, with cold meats, as an accompaniment to a noodle soup or a stir-fry, or can be spread on pastry for finger food. While, like other jams, this spread has a high sugar content, the capsicums provide an excellent source of vitamins C and A, and are a good source of dietary fibre.

3 red capsicums

3 long red chillies, chopped

2 centimetres fresh ginger, chopped

3 cloves garlic, sliced

150 grams canned diced tomatoes

300 grams sugar

100 millilitres red wine vinegar

METHOD

1. Sterilise 3 × 250-millilitre jam jars.
2. Wash, de-seed and chop the capsicum into roughly 2-centimetre pieces.
3. In a food processor, place the capsicum, chillies, ginger and garlic and pulse until finely chopped and forms a thick paste.
4. In a large saucepan add the capsicum paste, diced tomatoes, sugar and red wine vinegar. Bring to boil over medium heat, reduce heat and simmer uncovered for 40–50 minutes. Stir the jam often, especially as it thickens and becomes very sticky. The 2C jam is ready when it is thick and has a consistency similar to jam.
5. Cool slightly before pouring into sterilised glass jars.
6. Seal while hot.
7. The 2C jam can be stored, unopened, for 3 months in a cool, dark cupboard. Refrigerate after opening.

MAKES 3 × 250-MILLILITRE JARS

EVALUATION

1. Describe the sensory properties that red capsicums and red chillies contribute to this product.
2. Boiling and simmering are the two cooking methods used in this recipe – how are they similar and how are they different?
3. Why are the ingredients boiled then simmered for a long time in this recipe?
4. Identify the two ingredients that assist in preserving the savoury jam.
5. How does the cooking process help to preserve the product?
6. Explain the function of the red wine vinegar in this recipe.
7. Outline two safety procedures you observed when cooking the 2C jam on the cooktop.
8. Explain how you would sterilise the jars for storing the 2C jam.
9. Making preserves is a good way to include children in cooking at home. Identify the steps in the recipe a young person could assist with.
10. Why might some consumers choose to use organically grown capsicums and chillies in this recipe?

2C jam – capsicum and chilli

Dried apricot and almond conserve

Fresh apricots are only available for a very short time during summer. Using dried apricots in this conserve recipe means the tangy flavour of apricots can be produced at any time of the year. This recipe provides an opportunity to use the wet cooking techniques of **boiling** and **simmering**. This conserve is high in sugar so should only be eaten occasionally and in small amounts.

1 × 250-millilitre screw-top jar

125 grams dried apricots, use Australian varieties for an intense flavour

¾ cup water

1 teaspoon grated lemon rind

½ cup orange juice

1 tablespoon lemon juice

⅔ cup sugar

¼ cup slivered almonds

METHOD

1. Cut the apricots into thin strips. Combine with water in a bowl, cover and stand overnight.
2. Sterilise a 250-millilitre jam jar.
3. Combine the apricots, water and lemon rind in a saucepan. Bring to the boil and reduce the heat. Simmer uncovered for 10 minutes or until the apricots are soft.
4. Add the juices and sugar, stir constantly over the heat without boiling until the sugar is dissolved.
5. Bring to the boil, and reduce heat. Simmer uncovered for 30 minutes or until the jam gels when tested on a cold saucer.
6. Remove from the heat. Add the almonds.
7. Pour into hot sterilised jars. Seal immediately.

MAKES ABOUT 1 CUP

Dried apricot and almond conserve

EVALUATION

1. Why is it important to soak the apricots in water overnight?
2. Describe the physical changes to the dried apricots after soaking overnight.
3. Why is it important to boil the fruit for 10 minutes before adding the sugar and juices?
4. Select a similar commercially prepared product and compare the ingredients listed in each jam.

DRIED APRICOT CONSERVE	COMMERCIALLY MADE APRICOT JAM
Sugar Dried apricots Water Orange juice Lemon juice Slivered almonds Lemon rind	

5. Which ingredient is in greatest proportion in each jam?
6. What flavouring ingredients are used in the commercially made jam?
7. How does the percentage of apricot compare in each type of jam?
8. What is the role of the vegetable gums and added pectin in the commercial variety? Why are these not necessary in the homemade variety?
9. Explain the importance of the extra information included on the commercial jam label.
10. What very important information would be necessary to include on the label of the homemade jam if it was to be sold at a community market stall?

Fresh ginger cake

Bicarbonate of soda is an **alkali** and is the chemical the raising agent in this light, moist cake. Fresh ginger rather than dry, ground ginger is the main flavour and it is supported by the other spices to mask some of the bitterness of bicarbonate of soda. As oil is used instead of butter in this recipe, it contains monounsaturated fat rather than saturated fat, making it a better choice for good health. However, as it also contains sugar in the cake and icing sugar in the lemon icing, it should only be eaten as an occasional treat.

CAKE BATTER

1 cup plain flour

½ ground cinnamon

pinch of ground cloves

½ cup golden syrup

⅓ cup caster sugar

⅓ cup vegetable oil

1 teaspoon bicarbonate of soda

1 large egg, lightly beaten

50 grams fresh ginger, peeled and grated

LEMON ICING

zest and juice from ½ lemon

1 cup soft icing sugar, sifted

20 grams butter, softened

1 – 2 teaspoons boiling water, if needed

METHOD

Making the cake

1 Grease and line the base of an 18-centimetre round cake tin. Preheat oven to 170 °C.
2 Sift the flour, cinnamon and cloves.
3 In a large bowl, combine the golden syrup, sugar and oil. Stir the ingredients until thoroughly mixed, although they will separate while they stand.
4 Bring half a cup of water to the boil in a covered saucepan. Add the bicarbonate of soda and then pour into the large bowl containing golden syrup, caster sugar and oil. Stir through the grated ginger.
5 Use a whisk to beat in the sifted dry ingredients and the egg.
6 Pour the cake batter into the prepared cake tin and bake for approximately 35 minutes. The cake will be cooked when a skewer inserted into the cake comes out clean.
7 Stand the cake for 3 to 5 minutes then turn out onto a wire rack. Cool before spreading on the icing.

Making the icing

1 Zest and juice the lemon.
2 Combine the sifted icing sugar, softened butter and lemon zest. Stir to combine then gradually add the lemon juice until a spreadable consistency is achieved. Add a little boiling water if extra liquid is needed.

EVALUATION

1 Describe the sensory properties of the fresh ginger cake – appearance, aroma, flavour and texture.
2 Why is it necessary to line the base of the cake tin as well as grease with melted butter or oil spray?
3 List the flavouring ingredients in the cake that counterbalance the bitter flavour of the bicarbonate of soda.
4 Explain how bicarbonate of soda is responsible for a large proportion of the aeration that occurs in the cake?
5 Describe the aeration and structural role the egg has in the cake.
6 Apart from inserting a skewer into the cake, what other indicators could be used to determine if the cake is cooked and ready to take out of the oven?
7 Why is it important to rest the cake in the tin for a few minutes before turning it out onto a cake rack?
8 Explain why vegetable oil is a healthy choice of fat for a cake compared with butter.
9 Suggest some ingredients that could be added to the cake batter or used to decorate the cake to improve its nutrient value. Justify your suggestions.
10 Describe how to remove the cake from a hot oven safely.

Fresh ginger cake

Gingernut biscuits

Video

Gingernut biscuits are popular, old-fashioned biscuits that use the **alkali** bicarbonate of soda. This ingredient contributes to the aeration of the mixture, the spread of the biscuit and flavour and colour development. The butter, sugar and golden syrup in these biscuits mean that they are high in fat and sugar so should only be eaten sometimes and in small amounts.

60 grams butter

½ cup caster sugar

2 teaspoons golden syrup

½ teaspoon bicarbonate of soda, dissolved in 2 teaspoons water

1 small egg (size 55 grams), beaten

1 cup self-raising flour

1¼ teaspoons cinnamon

1 teaspoon ground ginger

2 tablespoons caster sugar, extra

METHOD

1. Preheat oven to 180 °C.
2. Lightly grease an oven tray, or cover the tray with baking paper.
3. Melt butter, sugar and golden syrup together in a medium saucepan. Remove from heat.
4. Add the dissolved bicarbonate of soda, mix well and allow to froth and then cool.
5. Pour the cooled butter mixture into a bowl and add the beaten egg. Mix well with a wooden spoon.
6. Sift the flour, cinnamon and ginger, and add to the butter mixture to form a soft dough.
7. Spread mixture onto a plate and allow to cool further in the refrigerator or until it becomes firm to the touch.
8. Roll into small balls and then roll the balls in the extra caster sugar.
9. Place the sugared balls on the baking tray, spacing them well, then flatten with a fork.
10. Bake for 10–15 minutes until golden brown and biscuits have changed from a puffed shape to a slightly flattened one.
11. Allow the biscuits to cool on the tray, remove carefully and store in an airtight container when completely cold.

MAKES 24 BISCUITS

Gingernut biscuits

EVALUATION

1. Describe the sensory properties of the gingernut biscuits.
2. Bicarbonate of soda is classified as an alkali. What does this mean?
3. Describe the chemical reaction you observed when bicarbonate of soda was added to the hot butter and sugar mixture. How does this contribute to the aeration of the biscuits?
4. Which ingredients mask the unpleasant flavours left after the reaction of the bicarbonate of soda in this recipe?
5. Explain the effects of the bicarbonate of soda on the properties of the cooked biscuits.
6. Which ingredients and processes contribute to the browning of the biscuits?
7. Explain the purpose of rolling the biscuits in sugar before cooking.
8. What would happen if the biscuits were removed from the tray before they had cooled?
9. Outline two important safety rules you followed when making gingernut biscuits.
10. Outline how the gingernut biscuits should be stored to retain the crisp texture.

Caramelised hazelnuts

Making toffee involves using a high proportion of sugar which, when heated, undergoes the process of **caramelisation**. Using the hot toffee to coat the roasted hazelnuts makes praline, which can be broken into pieces or crushed to be used to decorate sweet products. This recipe includes hazelnuts, which are a good source of monounsaturated fat, iron, vitamin B6 and magnesium. However, sugar is a key ingredient in the toffee, which makes this recipe high in sugar and should therefore be considered a sweet treat and only eaten sometimes and in small amounts.

---

100 grams hazelnuts

200 grams sugar

¼ cup water

METHOD

1. Preheat oven to 180 °C.
2. Place hazelnuts on an oven tray and roast for 10 minutes.
3. Remove the hazelnuts from the oven and transfer to a clean tea towel.
4. Rub the hazelnuts with the towel to remove the skins, then place on a lightly oiled oven tray.
5. Combine the sugar and water in a small saucepan and stir over heat until the sugar has dissolved. Brush down the sides of the pan with a pastry brush dipped in water to remove any sugar crystals.
6. Once the sugar has dissolved, increase the heat slightly and cook until pale golden in colour. Do not stir at this stage.
7. Pour immediately over the hazelnuts on the oiled tray and allow to cool.
8. When cool, break into shards for decorating cakes and desserts or crush to form praline for adding flavour and texture to truffles and ice cream.

Caramelised hazelnuts

EVALUATION

1. How does roasting the hazelnuts alter their sensory properties?
2. Refer to the stages of caramelisation and the confectionary thermometer on page 84. At what temperature does the toffee reach the 'hard crack' stage and begin to develop a caramel colour?
3. Why is it important to brush the sugar crystals from the sides of the saucepan and not to stir the boiling mixture when cooking the toffee?
4. Very high temperatures are reached during the process of caramelisation. Identify two special safety considerations that are necessary when cooking this recipe.
5. Considering that sugar is the major ingredient, why should praline be stored in an airtight container?

Mini lemon tarts

In these delicious little tarts, the **coagulation** of egg protein thickens the lemon curd filling, and egg whites are beaten to **aerate** the meringues. Mini meringues are used to top the tarts and give them extra visual appeal. The meringues and lemon curd could be made before making the tarts and stored. These mini lemon tarts should be considered a sweet treat and only eaten occasionally and in small amounts because they contain significant amounts of butter, and both caster sugar and icing sugar, and are therefore high in fat and sugar.

MINI MERINGUES

1 egg white

¼ cup caster sugar

LEMON CURD

1 large lemon

2 eggs (size 55 grams), lightly beaten

60 grams butter

⅓ cup sugar

SHORTBREAD PASTRY

125 grams butter

½ cup icing sugar

1 cup plain flour, sifted

extra icing sugar for dusting

METHOD

Making the meringues

1 Preheat oven to 110 °C. Cover the base of an oven tray with baking paper.
2 In a small bowl, beat the egg white until stiff peaks form.
3 Gradually add the sugar, beating all the time until mixture is thick and glossy.
4 Fill a piping bag with the mixture and pipe 18–20 small twirls on the tray, using a teaspoon to press down any peaks on the meringues.
5 Bake for 20–30 minutes until the meringues are dry and leave the baking paper easily.
6 Store in an airtight container lined with greaseproof paper until required.

Making the lemon curd

1 Finely grate the zest of the lemon and squeeze the juice.
2 Strain the beaten eggs through a sieve to remove the chalaza.
3 In a double saucepan or a basin over a saucepan of simmering water, combine the butter, lemon juice, zest and sugar.
4 Stir over the heat until the ingredients are well mixed.
5 Remove the basin or top section of the double saucepan from the heat and stir in the beaten eggs, mixing well.
6 Place the top section or the basin back over the boiling water and stir constantly with a wooden spoon until the mixture has thickened. Test the thickness of the curd – the mixture will coat the back of the spoon or it will separate when you run your finger down the back of the wooden spoon.
7 Pour into a bowl and allow to cool, or store in a sterilised jar in the refrigerator for 2–3 weeks.

Making shortbread pastry

1 Grease a 12-hole mini muffin tray and preheat the oven to 180 °C.
2 Cream the butter and icing sugar until fluffy and creamy in colour.
3 Add the sifted flour and mix to a soft dough.

Assembling the tarts

1 Divide the dough into 12–16 portions and roll each portion into a ball.
2 Place a ball in each muffin tray hole and, with a floured finger, make an indent in the centre of each ball to take a teaspoon of lemon curd.
3 Spoon a teaspoon of lemon curd into each hole, taking care not to overfill it, and bake for 20 minutes.
4 When cooked, allow to cool slightly before removing from the tin. Add a little extra lemon curd if necessary. Dust with icing sugar and top with a baby meringue.

MAKES 12–16 MINI TARTS

EVALUATION

1 Explain how the process of beating denatures the protein in egg whites and increases their volume.
2 Outline important rules when preparing egg whites for beating and ensuring their maximum volume is reached.
3 Why is it necessary to store the meringues in an airtight container?
4 Identify the ingredient and process used to thicken the lemon curd.
5 Explain why cooking the lemon curd in a double saucepan is the recommended cooking method.
6 What safety precautions are necessary when making the lemon curd if storing to be consumed later?
7 Explain the role of the butter in the pastry for the tarts.
8 Discuss the functional role of sugar in the pastry, lemon filling and the meringues.
9 Identify and describe the changes that occur in the pastry during baking.
10 Suggest an alternative filling for the tarts.

Mini lemon tarts

Lemon curd

Apple Tarte Tatin

Video

In this recipe, the process of **caramelisation** is used to create a delicious French-style apple dessert. The production of this recipe also involves baking, a dry method of cooking. The traditional flaky pastry could be prepared in a previous lesson and frozen, or for a time-saving alternative, buy frozen sheets of butter puff pastry from the supermarket. Apples are used as the basis of this dessert, providing a good source of vitamin C and dietary fibre. However, the sugar and butter used to make the toffee syrup increases the fat and sugar content of the recipe. Covering the apple with butter puff pastry also significantly increases the fat content of the dessert. It should therefore be considered a sweet treat, and only eaten sometimes and in small amounts.

Tarte Tatin

3 Golden Delicious apples

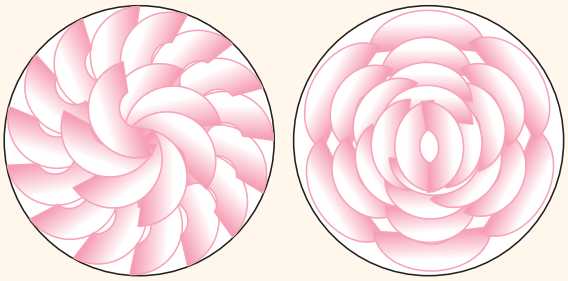
100 grams vanilla sugar

1 tablespoon lemon juice

¼ cup water

15 grams unsalted butter

1 sheet butter puff pastry



Possible arrangements of apple in cake tin

METHOD

1. Preheat oven to 200 °C. Grease and line an 18-centimetre round cake tin with baking paper.
2. Peel and core apples and cut into eight pieces each.
3. Combine 50 grams of sugar with lemon juice and toss the apple pieces through the mixture until they are completely coated.
4. In a large saucepan or frying pan, add the remaining 50 grams of sugar and ¼ cup of water. Stir over low heat until the sugar dissolves. During this process, wash down any sugar crystals on the side of the pan using a pastry brush dipped in cold water.
5. When the sugar has dissolved, increase the heat to medium and cook for about 5 minutes, or until the sugar caramelises to a light golden brown.
6. Stir in the butter and the apple mixture and cook gently for 10–12 minutes until apple is partially cooked and still retains its shape. After 5–6 minutes, turn the apples once so that the other side takes on colour and the apples become tender.
7. Use tongs to arrange the hot apple in the lined tin, then pour the remaining liquid over the top. Allow to cool.
8. Trim the pastry so it is slightly larger than the cake tin. Lay the pastry over the apple, fold in the excess and press lightly so the pastry is touching the apple.
9. Place cake tin on a baking tray in case the caramel bubbles over during baking.
10. Bake for approximately 20 minutes or until the pastry is golden brown.
11. Remove from oven and rest for 5 minutes. Turn onto a serving plate, keeping the apple on the top.
12. Serve warm with ice-cream or cream.

SERVES 4

EVALUATION

1 What type of ingredient is lemon juice and why is it mixed with the apple pieces in step 3 of the recipe?
2 Explain why a low heat is used to dissolve the sugar for the caramel.
3 Why is it important to brush the sugar crystals from the side of the pan in step 4?
4 There are two factors in this recipe that help to ensure the slices of cooked apple retain their shape. What are they?
5 Describe the outcome that may occur if the caramelised apple is not cooled before being covered with the pastry. Suggest an appropriate method of cooling the caramelised apple quickly.
6 Identify and describe the changes that occur when the pastry is baked.
7 Why is the Tarte Tatin rested before it is turned out of the tin?
8 Describe two safe work practices you followed during production.
9 Explain when and how this recipe could be included as part of a meal according to the guidelines of the Australian Guide to Healthy Eating.
10 Explain why some consumers might choose to purchase organic apples and organic butter to make this recipe.

Apple Tarte Tatin

Choux pastry

Success with this pastry relies on complete **gelatinisation** of the starch when cooking in the saucepan and gradually beating in the eggs so they are completely absorbed into the paste. Cooking at a high temperature will ensure maximum production of steam to raise the pastry. Like other pastries, choux pastry has a high proportion of butter so is high in fat. This recipe, however, does provide a source of protein because it uses eggs in its preparation.

¾ cup flour

60 grams butter

¾ cup water

3 × 60-gram eggs

METHOD

1. Preheat oven to 220 °C.
2. Sift flour onto a piece of baking paper.
3. Cut butter into small chunks and place in a medium saucepan. Add the water, cover with a tight-fitting lid and bring to the boil.
4. As soon as the water boils, remove lid and add all the flour at once. Stir vigorously with a wooden spoon until mixture leaves the side of the saucepan and forms a smooth ball.
5. Transfer the mixture to a large bowl and spread up the side of the bowl to cool the mixture quickly.
6. When the mixture reaches room temperature, begin beating in the eggs a little at a time. The mixture should be smooth and glossy between each addition. The final choux pastry will be very thick, smooth and glossy. Sometimes there may be a little unused egg.
7. Spoon or pipe onto a greased baking tray, allowing space for expansion.
8. Sprinkle the tray with cold water and bake for 15 minutes at 220 °C, then reduce temperature to 180 °C until the puffs or éclairs are golden brown and firm to the touch.
9. Remove from oven, split the pastry shapes and remove excess raw dough with a teaspoon.
10. Return to oven to dry out.
11. Fill and decorate as required.

EVALUATION

1. Identify the process that occurs when the flour is stirred into the boiling water and butter.
2. Explain how you know when the process identified in step 1 is complete.
3. Three mechanical methods of aeration contribute to the leavening of choux pastry. Identify each method and explain how it assists in producing a light-textured pastry with good volume.

MECHANICAL METHOD OF AERATION	HOW THE METHOD LEAVENS THE PRODUCT

4. Explain how the paste looks when sufficient egg has been beaten into the mixture.
5. Identify the main process responsible for the browning of the choux pastry.
6. Outline how the process of browning occurs.
7. Why is the water sprinkled onto the tray before baking?
8. Explain why the oven temperature is decreased during the baking of choux pastry.
9. Why is the choux pastry cut, cleaned and dried in the last steps of the recipe?
10. Suggest ideas for sweet and savoury fillings that would be suitable for the choux pastry.

iStock.com/Magone

Cream puffs and éclairs use choux pastry.

Okonomiyaki with mayonnaise

Video

Mayonnaise is a thick creamy dressing that is an **emulsion** of oil droplets suspended in a base of egg yolk, lemon juice or vinegar and seasonings. It is an interesting recipe from a food science point of view because is demonstrates how much oil egg yolks can absorb in an emulsion. The success relies on the temperature and acidity of the ingredients. All the ingredients should be at room temperature because warmth accelerates the transfer of the emulsifiers in the yolk particles to the surface of the oil droplets. The oil should be added gradually to avoid splitting or curdling the emulsion. Mayonnaise can be made by hand or in a food processor – mayonnaise made in a food processor will have a lighter texture because more air can be incorporated during beating.

Okonomiyaki is a Japanese savoury pancake. The word is often translated as an 'as you like it pancake' because it can contain a wide variety of ingredients. It is made from a batter containing a combination of vegetables such as cabbage, potato and spring onions, and is topped with bacon or seafood and garnished with mayonnaise, Japanese soy sauce and pickled ginger. As the okonomiyaki is made with vegetables including cabbage, potato and bean shoots, it is a good source of dietary fibre and some vitamin C. It also provides some protein found in the egg. The mayonnaise provides monounsaturated fat in the olive oil; however, the egg yolk also includes a high proportion of cholesterol.

MAYONNAISE

2 egg yolks

3 teaspoons lemon juice or white wine vinegar

salt and pepper to taste

200 millilitres olive oil

OKONOMI SAUCE

¼ cup tomato sauce

1 tablespoon Worcestershire sauce

½ teaspoon fresh ginger, grated

OKONOMIYAKI

1 cup plain flour

¼ teaspoon baking powder

½ teaspoon salt

1 egg, lightly beaten

250 millilitres cold water

2 leaves of savoy cabbage, shredded

2 spring onions, thinly sliced

½ small potato, grated

½ cup bean shoots

1 tablespoon pickled ginger, chopped

4 pieces of short bacon

1–2 tablespoons oil

2 tablespoons mayonnaise

2 tablespoons okonomi or tonkatsu sauce

extra pickled ginger, chopped for garnish

extra spring onion, thinly sliced for garnish

METHOD

MAKING MAYONNAISE

1 Ensure the ingredients are at room temperature.
2 Place a folded damp cloth under the bowl to prevent it slipping during whisking.
3 Whisk the yolks, 3 teaspoons lemon juice, or vinegar, salt and pepper together.
4 Add a few drops of oil to begin with, whisking in a circular motion. Gradually whisk in a third, about 60 millilitres of the oil, drop by drop. Ensure the mixture has emulsified after each addition.
5 Gradually pour in the remaining oil in a thin, steady stream while continuing to whisk in a circular motion.
6 When all the oil has been absorbed, adjust the flavourings. If the flavour is correct but the mixture is too thick, dilute the mayonnaise with a little warm water until the consistency is correct.
7 Cover with cling wrap and refrigerate.

Note: If the mayonnaise curdles during preparation, take a clean bowl, whisk an extra egg yolk into a smooth paste and slowly add it to the curdled sauce. Whisk well after each addition of egg yolk.

MAKING OKONOMI SAUCE

Combine all the ingredients – tomato sauce, Worcestershire sauce and grated ginger – and mix well. Set aside until required.

MAKING OKONOMIYAKI

1 Sift flour, baking powder and salt into a large bowl.
2 Make a well in the centre and add the egg. Then add the water gradually and mix to a smooth batter using a wooden spoon.
3 Stir in cabbage, onion, potato, bean shoots and pickled ginger, and allow to stand for 15–20 minutes.
4 Fry the bacon in a non-stick frying pan until lightly brown and crisp, drain on absorbent paper and place in a warm oven.
5 Wipe out the frying pan and add half the oil and heat over medium heat. Add half the batter mixture to the frying pan and spread out to a 14-centimetre diameter.
6 Cook the pancake until golden brown on the base and beginning to set on the surface (6–8 minutes). Turn and cook for a further 6–8 minutes or until cooked through.
7 Keep warm in the oven and cook the remaining pancake mixture.
8 Top the okonomiyaki pancake with half the bacon and drizzle with the mayonnaise and okonomi sauce (or Japanese soy sauce). Garnish with chopped spring onions and pickled ginger.

EVALUATION

1 Describe the sensory properties – appearance, aroma, flavour and texture – of both the mayonnaise and the okonomiyaki pancake.
2 Explain why mayonnaise is described as an emulsion.
3 Why is egg yolk critical to the success of the mayonnaise?
4 Predict what might occur if the eggs used to make mayonnaise were taken straight from the refrigerator.
5 Why is mayonnaise often described as a high-risk food?
6 The pancake is cooked by frying. Describe how heat is transferred during this cooking method. Include a diagram in your answer.
7 Using technical terminology, explain the functional role of the egg in the pancakes.
8 Identify the processes that take place inside and outside the pancake as it cooks – consider the changes to the starch in the flour and the protein in egg.
9 Describe an important safety rule to remember when frying the pancakes.
10 Analyse the okonomiyaki with mayonnaise using the Australian Guide to Healthy Eating and explain whether this recipe is suitable to serve as a healthy meal for children and families.

Okonomiyaki with mayonnaise

Fresh pasta

Pasta is a very versatile food that has a moderately low GI rating of between 30 to 60. Pasta made with wholemeal flour is also high in dietary fibre. When making pasta it is important to add only sufficient liquid to the dry ingredients to achieve the correct consistency so the dough can be rolled through the pasta machine without sticking. When fresh pasta is cooked in boiling water, the starch **gelatinises** and it is ready to eat when it is 'al dente' or soft to the bite. Fresh pasta can be stored for use later by dehydrating or freezing.

Shutterstock.com/Tyler Olson

Rolling pasta

200 grams high-gluten flour

1 teaspoon salt

2 eggs, lightly beaten

METHOD

Making pasta dough

1 Combine the flour and salt in a food processor and pulse to combine the ingredients.
2 With the motor running, add the eggs. Process for 1–2 minutes until the dough clings together and feels springy.
3 Turn the dough onto a floured bench and knead until smooth.
4 Cover with cling wrap and allow to rest at room temperature for 20–30 minutes.
5 Roll into thin sheets using a pasta machine.

Cooking pasta

1 Fill a large saucepan with water – there should be at least 1 litre of water per portion and one for the pot.
2 Add some salt to the water and bring to the boil.
3 Cook the pasta for 2–3 minutes only – until it is al dente. The pasta should be firm, not soft, and not have a hard, chalky centre.
4 Drain and serve.

SERVES 2–3

Shutterstock.com/Viktor1

Cooked fresh pasta

FLAVOUR VARIATIONS FOR PASTA

Ingredients	Quantity suggestions for flavour variation
Poppy seeds	2–3 teaspoons
Spinach	Dried – 2 tablespoons Fresh – cooked and squeezed dry and pulse with flour, omit 1 egg white
Beetroot	Purée drained cooked beetroot and pulse with flour – reduce the amount of egg OR Dehydrate puréed cooked beetroot and grind into powder – 1 to 2 tablespoons
Black pepper	1 tablespoon coarsely ground black pepper
Fresh herbs	Add chopped herbs with flour Whole leaves can be rolled through in the last stage of rolling

EVALUATION

1 Describe the sensory properties of the cooked pasta – appearance, aroma, flavour and texture.
2 Explain why flour with a high gluten content is recommended instead of regular plain flour for this recipe.
3 Outline the functional roles of eggs in the pasta dough.
4 Why is the pasta dough rested before rolling out?
5 What are the benefits of gradually rolling the pasta dough thinner stepping down each notch in the pasta machine?
6 Fresh pasta must be surrounded by plenty of boiling water during cooking. Why?
7 Identify the process that takes place when fresh pasta is cooked in boiling water.
8 Describe the main stages in this process.
9 Describe how you determined if the pasta was cooked and ready to serve with a sauce.
10 Pasta has a low GI rating. Explain why this is a health benefit to consumers.

Spring vegetable pasta sauce

Green vegetables are the hero in this pasta sauce. Their different shapes, textures and tones of green indicate spring is coming. Blanching, boiling and sautéing are the cooking techniques used to produce this dish.

½ zucchini, sliced

1 piece (120 grams) broccoli, broken into florets and stem sliced

6 snowpeas

2 tablespoons frozen peas

¼ teaspoon salt

4 cherry tomatoes

2 teaspoon olive oil

1 clove garlic, crushed

salt and pepper

1 tablespoon parsley, chopped

3 mushrooms, sliced

¼ cup tomato passata

2 tablespoons chicken stock

1 tablespoon basil, chopped

20 grams grated parmesan cheese

½ quantity fresh pasta (see page 344) or 100 grams of dried pasta

METHOD

1. Fill a large saucepan with water and bring to the boil. Add the sliced zucchini, florets and sliced stem and blanch for 1½ minutes then add the snowpeas and peas and cook for a further 30 seconds.
2. Drain and refresh vegetables in cold water. Set aside.
3. Refill the large saucepan with water, add ¼ teaspoon salt and bring to boil. Cook the pasta until al dente. Drain.
4. Meanwhile in a small fry pan add 2 teaspoons olive oil. Sauté the garlic and mushrooms. Add the cherry tomatoes and sauté for 1 minutes then stir in the chopped parsley. Set aside.
5. Heat a pan big enough to hold the pasta and vegetables over low heat. Add the tomato passata, stock, cheese and basil. Simmer gently until the cheese has melted.
6. Add the drained pasta and toss to coat with the sauce. Add the blanched vegetables and toss again.
7. Serve the pasta and vegetables into a broad, flat bowl. Finally add the cooked mushrooms and cherry tomatoes.
8. Season with salt and pepper and serve.

SERVES 1

EVALUATION

1. Describe the sensory properties – appearance, aroma, flavour and texture – of the spring vegetable pasta sauce. Consider all elements of the recipe in your answer.
2. Why is consuming a wide range of green vegetables an important part of eating a healthy diet?
3. Describe the process of blanching.
4. Explain why the vegetables are blanched in step 1 of the recipe.
5. Pasta is always cooked in boiling water. Describe the method in which the heat is transferred to the food when it is boiled.
6. Two wet methods of cooking – boiling and simmering – are used in this recipe. Explain the difference between simmering and boiling.
7. Identify the process that occurs to starch when pasta is cooked.
8. Describe that process and explain how it changes the sensory properties of raw or dried pasta.
9. Outline two safe work practices that you followed when blanching and boiling ingredients in this production.
10. Plot the ingredients of the spring vegetable pasta sauce and the pasta on a diagram of the Australian Guide to Healthy Eating. After classifying the ingredients, comment on how well the dish meets the recommendations of the model.

Broccolini and bean salad

Blanching vegetables heightens the colour and sets the flavour of vegetables. The goal for this green salad is to have all the vegetables bright green and 'al dente' so the cooking times are critical. The broccolini, beans and snow peas used in the preparation of this salad provide a good source of vitamins, especially vitamins A and C, with some folate, vitamin E and potassium. The vegetables are also high in dietary fibre and contain some protein. This salad complements meat, fish and poultry dishes with Asian flavours.

VEGETABLES

2 stalks broccolini

6 green beans

6 snow peas

1 teaspoon black sesame seeds

1 sprig coriander leaves

DRESSING

1 tablespoon tahini paste

1 tablespoon water

½ small garlic clove, finely chopped

½ teaspoon honey

2 teaspoons apple cider vinegar

3 teaspoons mirin

pinch of salt

METHOD

Preparing the vegetables

1 Trim the broccolini and cut lengthways to create stems that are the same size as the green beans.
2 Fill a medium saucepan with water and bring to the boil. Add the green beans first. Add the broccolini 30 seconds later. One minute later, add the snow peas and cook for another 30 seconds.
3 Drain and refresh in iced water.
4 Drain well again before serving.

Preparing the dressing

Combine all the ingredients in a small bowl and whisk together. Add extra water if it is too thick – the dressing should be a pouring consistency.

To serve

Place the mixed green vegetables on a serving plate. Drizzle with the dressing and then sprinkle with black sesame seeds and coriander leaves.
Serve immediately.

Note: If black sesame seeds are not available, then substitute with toasted sesame seeds.

EVALUATION

1 Describe the sensory properties of the two elements of this recipe – the green vegetables and the dressing.
2 Explain why the broccolini stems were cut to the same thickness as the green beans.
3 Describe the steps in the process of blanching ingredients.
4 Explain why the vegetables were blanched and not boiled.
5 Why are the cooking times for the vegetables critical to the success of this recipe?
6 Suggest some other vegetables that could be blanched and added to the salad to introduce some different colours into the presentation.
7 Identify the acidic ingredients in the dressing and give their approximate pH value.
8 Explain how acidic ingredients contribute to the sensory properties of the dressing.
9 If the salad was dressed 2 or 3 hours before being served, predict the impact this would have on the sensory properties of the dish.
10 Why might some consumers select organically grown vegetables over conventionally produced vegetables for this salad?

Sticky chicken wings

By **boiling** before **baking**, the chicken wings are partially cooked by moist heat. This starts the process of denaturation, and the next step of marinading continues to denature some of the proteins in the chicken wings so they become more tender and flavours develop. The final step of baking completes the cooking process – the **Maillard reaction** and **caramelisation** result in a dark brown colour and a delicious complex flavour profile in the chicken wings. The chicken wings provide a good source of protein; however, the honey and soy sauce add sugar and salt to the diet.

---

4 chicken wings

MARINADE

1 clove garlic, crushed

2 cm fresh ginger, peeled and grated or finely diced

¼ teaspoon ground coriander

pinch of cinnamon

¼ teaspoon smoked paprika

¼ teaspoon dried chilli flakes

1 tablespoon honey

1 tablespoon soy sauce

1 tablespoon vegetable oil

½ lemon, juiced

pinch of salt

1 tablespoon coriander, chopped

1 tablespoon mint, chopped

METHOD

1 Remove the tips from the chicken wings then cut them in half at the joint.

2 Fill a large saucepan with salted water and bring to the boil. Add the chicken wings and simmer for 10 minutes. Drain and lay the wings out on paper towel and pat dry.

3 Combine the marinade ingredients in a large bowl. Add the chicken wings and toss them through the marinade and leave to rest at room temperature for 30 minutes.

4 Preheat the oven to 200 °C and line a baking tray that has an edge on all sides with baking paper.

5 Remove the chicken wings from the marinade and place on the tray in single layer. Place in the oven to bake for 10 minutes – turn after 5 minutes. The wings will caramelise and may char on the edges. The juices of the chicken should be clear.

6 Pour the marinade into a small saucepan and bring to the boil. Reduce the heat to simmer until the marinade starts to thicken. Brush over the cooked chicken wings.

7 Sprinkle with chopped coriander and fresh mint.

SERVE WITH RICE AND ASIAN GREENS.

EVALUATION

1 Describe the sensory properties of the sticky chicken wings – appearance, aroma, flavour and texture.
2 Explain why a moist and dry cooking method – boiling and baking – were used in this recipe.
3 Predict how the sensory properties of the chicken wings would have been different if they were only boiled.
4 Predict how the sensory properties of the chicken wings would have been different if they were only baked.
5 Identify the acidic ingredient in the marinade and explain how it altered the properties of the chicken wings.
6 In step 3 of the recipe the chicken wings were left to marinate at room temperature for 30 minutes. Why was that not a health and safety concern?
7 The leftover marinade was boiled and then simmered before being brushed onto the chicken wings after they were cooked. Why was this necessary?
8 Describe the work practices that you followed during production to prevent the possibility of any cross-contamination occurring.
9 Why would consumers select chicken wings from free-range chickens over wings produced by conventional means?
10 Plot the ingredients used in sticky chicken wings and rice with Asian greens on a diagram of the Australian Guide to Healthy Eating. Evaluate the nutritional value of the meal according to the guidelines of this food selection model.

Sticky chicken wings

Paprika meatballs

Paprika is a main flavouring in Hungarian cuisine – there are many varieties of this aromatic spice – sweet, hot and smoked. Each adds to the depth of the flavour profile of the meatballs. Care needs to be taken when mixing the meatballs so the proteins are not overdeveloped, and the final meatballs hold their shape and are tender inside. **Boiling** and **simmering** are the two moist cooking methods used to produce the rich mushroom sauce. Full-fat sour cream is recommended so it doesn't separate in the sauce. The beef and pork in this recipe provide an excellent source of protein, while the vegetables provide a range of vitamins and minerals.

MEATBALLS

100 grams minced beef
100 grams minced pork
1/3 cup wholemeal breadcrumbs
¼ cup milk
½ egg, beaten
½ garlic clove, finely chopped
½ teaspoon sweet paprika
¼ teaspoon dried chilli
¼ teaspoon caraway seeds
¼ teaspoon smoked paprika
¼ cup parsley, finely chopped
salt and pepper to taste
2 tablespoons oil, for cooking the meatballs

MUSHROOM SAUCE

1 tablespoon olive oil
½ onion, finely diced
1 clove garlic, finely diced
½ red chilli, finely diced
4 mushrooms, sliced
3 teaspoons sweet paprika
½ teaspoon hot paprika
½ teaspoon smoked paprika
1/3 cup water
1 cup beef stock
1 cup chopped canned tomatoes
1 tablespoon parsley, finely chopped
1 teaspoon thyme, finely chopped
1 teaspoon rosemary, finely chopped
1/3 cup sour cream

METHOD

To make the meatballs

1. Combine all the ingredients (except the oil) for the meatballs and mix lightly by hand. Do not overwork the mixture.
2. Roll into walnut-size balls, cover and rest in the refrigerator for 30 minutes.
3. To cook the meatballs: heat 2 tablespoons of olive oil in a large frying pan over medium-high heat. Brown all over – this will take 3–4 minutes. Transfer to the mushroom sauce.

To make the mushroom sauce

1. Heat the oil in a medium saucepan and sauté the onion, garlic and chilli until soft.
2. Add the sliced mushrooms and sauté for 2 minutes until just tender,
3. Add the paprika and sauté until fragrant, about 30–40 seconds then deglaze the pan with the water.
4. Add the stock, chopped tomatoes and herbs. Bring to boil then reduce to simmer.
5. Add the meatballs and simmer for 15–20 minutes until the meatballs are just cooked through. Turn off the heat.
6. Remove the meatballs and set aside. If there is too much liquid remaining, evaporate over high heat before adding the sour cream.
7. Whisk the sour cream into the mushroom sauce then return meatballs to the sauce. Keep warm.
8. Serve with soft polenta, mashed potatoes or buttered egg noodles.

SERVES 2

EVALUATION

1 Describe the sensory properties of the two elements of the recipe – the meatballs and the mushroom sauce.
2 Discuss why it is recommended to serve the paprika meatballs with a product such as polenta, potatoes or noodles.
3 Predict how overworking the meat could affect the final sensory properties of the meatballs.
4 When making the mushroom sauce, why are the onion, garlic and chilli sautéed before the liquids are added?
5 Explain the term 'deglaze' and how this process contributes to the final sensory properties of the recipe.
6 Why are the meatballs simmered in the mushroom sauce rather than boiled?
7 If you didn't want to cook the meatballs in the sauce on the cooktop, what other cooking methods could you use?
8 If you wanted to reduce the fat content of the mushroom sauce, suggest some ingredients that could be substituted for the full-fat sour cream.
9 Plot the ingredients used in the paprika meatballs on a diagram of the Australian Guide to Healthy Eating. Evaluate the nutritional value of the meal according to the guidelines of this food selection model.
10 Describe accompaniments that could be served with the paprika meatballs to ensure that they are able to better meet the guidelines of this food model.

Paprika meatballs

Pide with two fillings

Pide is a Turkish-style bread roll with a savoury filling. Traditionally, the **yeast** dough was shaped like an open canoe, but smaller ones made in squares and triangles make great finger food. Care should be taken to ensure the dough is not too moist because this will prevent the dough holding its shape after filling and shaping. The cheese and spinach pide contain both ricotta and feta cheese, which are high in calcium. The spicy meat pide provides a good source of protein found in the meat and pine nuts as well as vitamins and minerals in the vegetables.

Prepare one quantity of dough per person. Work in pairs to prepare one quantity of each filling, then share the two types.

DOUGH

1½ cups bread flour (high gluten)

½ teaspoon dried yeast

½ teaspoon salt

½ teaspoon olive oil

125–150 millilitres hot water

METHOD

Making the dough

1 Sift the dry ingredients together into a large bowl.
2 Stir in olive oil and hot water to make a moist but firm dough.
3 Turn onto a floured bench and knead until smooth.
4 Return the dough to the bowl, brush lightly with oil, cover with cling wrap and leave in a warm place to prove until the dough has doubled in size.

CHEESE AND SPINACH FILLING

¼ box frozen spinach, defrosted

1 egg

70 grams ricotta cheese

70 grams feta cheese

pinch of nutmeg

pinch of pepper

SPICY MEAT FILLING

1 tablespoon olive oil

½ onion, finely diced

1 clove garlic, crushed

½ teaspoon ground fennel

¼ teaspoon chilli powder

150 grams minced beef

200 grams canned, diced tomatoes

2 tablespoons pine nuts, toasted

2 tablespoons flat-leaf parsley, finely chopped

30 grams mozzarella, grated

METHOD

Making the cheese and spinach filling

1 Squeeze excess moisture from the spinach.
2 Lightly beat the egg in a small bowl.
3 Combine all the filling ingredients and mix well.

Making the spicy meat filling

1 Heat oil in pan and sauté onion and garlic with the fennel and chilli.
2 Add the mince, stirring until it breaks up and changes colour.
3 Add tomatoes and simmer uncovered, stirring occasionally until the liquid reduces by half.
4 Remove from heat, stir in toasted pine nuts and parsley. Cool before using as filling in the pide.
5 Sprinkle the mozzarella cheese on top of the filled pide before baking.

Assembling the pide

1 Preheat oven to 200 °C.
2 Lightly knead the dough and divide the mixture into four portions.
3 Roll each portion of dough into a thin oval, approximately 20 centimetres × 12 centimetres.
4 Place a quarter of the filling down the centre of the dough.
5 Pinch the ends of the dough together and leave the filling slightly exposed along the centre.
6 Place on an oiled tray and leave to prove for 10 minutes.
7 Bake for approximately 15 minutes or until golden brown.

Pide with cheese and spinach or spicy meat filling

EVALUATION

1 Describe and compare the sensory properties of the three elements of the pide, the dough and the two fillings. Your response could be presented as a Venn diagram or in a table.

2 Why is the water temperature critical to the success of the pide when mixing the dough?

3 Explain why the dough for the pide is covered in cling wrap during the proving process.

4 Describe, in detail, the process that caused the dough for the pide to double in size.

5 Why is the egg an essential ingredient in the cheese and spinach filling?

6 Predict how the quality of the final product may be compromised if the spicy meat filling is not cooled before it is used in the pide.

7 Identify the process that causes the mozzarella cheese to brown during baking.

8 Plot the ingredient for the pide on a diagram of the Australian Guide to Healthy Eating and explain whether they could be served as a healthy meal for children and families.

9 What accompaniments could be served with the pide to improve the nutritional properties of the meal. Justify your answer.

10 Complete the following table by identifying suitable sustainable or ethical food choices that could be substituted for each of the following ingredients in this recipe.

RECIPE INGREDIENT	SUSTAINABLE OR ETHICAL FOOD CHOICE
Flour	
Egg	
Oil	
Minced beef	

Chocolate, pear and almond cake

A combination of aeration methods – chemical and mechanical actions – are used to create a light texture in this cake. The golden brown colour and delicious aroma of the finished product are a result of the **Maillard reaction** and **dextrinisation** when exposed to dry heat during baking. Like other cakes, this recipe for chocolate, pear and almond cake is made with significant amounts of butter and sugar and also includes chocolate, which means that it is high in saturated fat and sugar. The raw almonds provide a good source of protein and monounsaturated fat, as well as dietary fibre and magnesium.

⅓ cup (50 grams) whole raw almonds

100 grams dark chocolate (50 per cent cocoa solids)

1 pear

100 grams of butter

½ cup raw caster sugar

2 eggs

⅔ cup (100 grams) self-raising flour, sifted

METHOD

Preparing the almonds

1. Preheat oven to 160 °C.
2. Place the almonds on a baking tray and roast for approximately 10 minutes until the skins begin to split. Set aside to cool for 5 minutes.

Making the cake

1. Increase the oven temperature to 180 °C.
2. Line and grease a 20-centimetre ring tin with melted butter and dust with flour.
3. Roughly chop the chocolate then process chocolate and the cooled almonds in a food processor until they resemble coarse crumbs.
4. Peel and core the pear and chop into 1 cm dice.
5. Cream the butter and raw caster sugar until the mixture is light and fluffy.
6. Add eggs one at a time, beating well after each addition.
7. Stir in the sifted self-raising flour, then fold through the chocolate and almond mixture and diced pear.
8. Pour the mixture into the prepared ring tin. Bake in the preheated oven for approximately 30 minutes or until well risen and firm to the touch.
9. Cool in the tin for 10 minutes. Turn out onto a wire rack and cool to room temperature.
10. Dust with icing sugar to serve.

EVALUATION

1 Describe the sensory properties of the chocolate, pear and almond cake – appearance, aroma, flavour and texture.

2 Discuss how the following ingredients contribute to the aeration of the cake:

- eggs
- self-raising flour.

3 Discuss how the following processes contribute to the aeration of the cake:

- sifting
- beating
- folding.

4 Identify the process that occured when the raw almonds were roasted before being used in the cake mixture, and explain how this process improves the sensory properties of the cake.

5 How does the inclusion of the fresh diced pear contribute to the properties of the cake?

6 Identify and describe the processes that cause the cake to brown when baked in the oven.

7 How would cooking the cake at 220 °C rather than 180 °C impact on the physical and sensory properties of the cake?

8 Outline two tests you could use to check if the cake is cooked other than those listed in step 8 of the recipe.

9 Why is it important to cool the cake in the tin for 10 minutes before turning out onto a wire rack?

10 Explain how a cake such as this could be included as part of a healthy meal for children and families.

Chocolate, pear and almond cake

Chicken, lemon and pea risotto

The chicken is gently poached in hot stock and water – the protein denatures and coagulates during cooking. The arborio rice is tossed through oil to keep the grains separate during the simmering process. The starch in the rice **gelatines** burst during cooking and care should be taken not to over-stir because this breaks down the rice grains and has a negative impact on the final texture of the product. This recipe is low in fat with only a very small amount of saturated fat present in the poached chicken fillet. The olive oil provides a source of polyunsaturated fat. Protein is provided by the chicken fillet and the vegetables are a good source of dietary fibre, vitamins C and B6, and magnesium. The rice is an excellent source of carbohydrate and has a medium GI rating.

¾ cup chicken stock

¾ cup water

1 skinless chicken fillet

2 teaspoons olive oil

½ brown onion, finely diced

½ red capsicum, diced

½ cup arborio rice

¼ cup dry white wine

¼ cup frozen peas

2 tablespoons shredded parmesan cheese

½ lemon, zest and juice

salt and pepper

METHOD

1. Bring the stock and water to a gentle simmer in a small saucepan.
2. Place the chicken fillet in the simmering stock. Simmer for approximately 10 minutes or until the chicken is cooked through.
3. Remove the chicken from the stock and cover with foil to keep warm.
4. While the chicken is cooking, heat the oil in a medium saucepan and add the finely diced brown onion. Sauté for approximately 2 minutes.
5. Add the diced capsicum and continue to cook for a further 3–4 minutes or until soft but not brown.
6. Add the arborio rice and stir over the heat until the grains are well coated with the oil.
7. Pour the dry white wine over the rice and cook until evaporated.
8. Add half a cup of the simmering stock and stir well. Cover firmly with a lid and simmer over a very low heat until the rice grains have absorbed the stock.
9. Add a further half cup of simmering stock. Stir well, then cover with the lid. Allow to simmer until the stock has been absorbed.
10. Add the remaining stock and simmer gently until all of the stock has been absorbed and the rice is tender. Add more stock if necessary. The rice will take approximately 20–25 minutes to cook.
11. Add the frozen peas and simmer 3–4 minutes.
12. Cut the chicken into thin slices and add to the risotto. Stir through the parmesan cheese.
13. Stir in the lemon juice and zest and season with salt and pepper.
14. Cover the risotto and allow to rest for 5 minutes before serving.

EVALUATION

1 Describe the sensory properties of the chicken, lemon and pea risotto – appearance, aroma, flavour and texture.
2 Explain why it is important to cook the chicken by poaching rather than boiling in this recipe.
3 Why are the onions and capsicum sautéed in step 5 before the rice is added?
4 Explain why the rice is stirred over the heat and coated with oil before the liquid is added.
5 What impact would the addition of cold stock, rather than simmering stock, have on the rice mixture?
6 Why is it important to simmer the risotto rather than boil it?
7 Identify the process that takes place when the stock is absorbed into the rice.
8 Why is stirring an important process in cooking the risotto?
9 Explain why the lemon juice is added in the last stages of cooking the risotto.
10 Plot the ingredients on a diagram of the Australian Guide to Healthy Eating and explain whether the risotto would be suitable to serve as a healthy meal for children and families.

Chicken, lemon and pea risotto

Summer quiche

Eggs **coagulate** and set when exposed to heat, and this functional property allows the filling of the quiche to set. Sour cream is used in the pastry to develop a short, flaky texture and to contribute to the rich mouthfeel of the egg filling. Roma tomatoes, which have a lower moisture content compared to traditional tomatoes, provide an interesting colour contrast to the quiche. Like other pastry-based dishes, this quiche is high in saturated fat because the pastry and filling both contain fat in the butter and sour cream. The bacon included in the filling is another source of saturated fat. The filling of the quiche provides a good source of protein from the eggs as well as a range of vitamins and minerals in the onion, lettuce and tomato. It would be advisable to serve this quiche with a green leafy salad to improve its nutritional properties as a healthy meal.

SOUR CREAM PASTRY

1¼ cups plain flour, sifted

125 grams butter, chopped into small pieces

2 tablespoons thick sour cream

FILLING

20 grams butter

3 rashers bacon, rind removed and cut into fine strips

1 large white or red onion, thinly sliced

⅓ iceberg lettuce, finely shredded

2 eggs (size 55 grams)

½ cup thick sour cream

TOPPING

1 Roma tomato, cut into thin slices

salt, pepper and sugar

2 tablespoons parmesan cheese, grated

METHOD

Making the pastry

1 Rub the chopped butter into the flour until it resembles breadcrumbs. This can be done in a food processor.
2 Add the sour cream and mix with a spatula until the mixture comes together. Knead lightly.
3 Carefully roll out the pastry and line a 20-centimetre quiche tin with a removable base or a takeaway foil tray. Chill for 15 minutes.
4 Preheat oven to 200 °C.
5 Blind bake the pastry case. For an open tart, prick the base well with a fork to keep it level, or line with baking paper and load with dried beans before baking in a preheated oven at 200 °C for 7–10 minutes. Remove baking paper and beans, reduce temperature to 180 °C and bake uncovered for a further 10 minutes or until pale golden.

Making the filling and adding the topping

1 Melt the butter in a pan and add the sliced bacon. Sauté for 2 minutes then add the onion and continue cooking for 3–4 minutes or until tender.
2 Add the shredded lettuce to the onions, sprinkle lightly with salt and pepper. Continue to cook until tender and any moisture has evaporated.
3 In a bowl, whisk the eggs and the sour cream until well combined.
4 Evenly distribute the bacon, onion and lettuce mixture over the bottom of the pastry case.
5 Pour the egg and cream mixture into the case, and arrange the tomato rings on top of the mixture.
6 Sprinkle salt, pepper and a little sugar over the tomato rings, and then sprinkle the parmesan cheese over the quiche.
7 Place on an oven tray and bake for 15 minutes or until the filling is set and the top is golden brown.
8 Leave for 5 minutes before cutting.

EVALUATION

1 Why is the butter rubbed into the flour in the first stage of making the pastry?
2 Outline at least two safety procedures that should be observed when making pastry in a food processor.
3 Explain the benefit of chilling and resting the pastry before filling and baking.
4 What are the benefits of blind baking the pastry case for the quiche?
5 Why is white or red onion used in the filling rather than brown onion?
6 Why is it essential to evaporate the moisture from the onion, bacon and lettuce filling before placing it in the pastry case?
7 Why are Roma tomatoes recommended for this recipe?
8 Identify the processes and describe the changes that occur to the physical and sensory properties of the filling during the baking of the quiche.
9 Describe a method of testing to determine if the quiche is cooked.
10 Evaluate the nutritional properties of the summer quiche according to the guidelines of the Australian Guide to Healthy Eating. Give it a health rating and justify your rating.

Summer quiche

Lemon soufflé crêpes

This delicate dessert features the key ingredients of eggs and milk, and demonstrates some of their functional roles in a recipe. During the preparation process, both ingredients are denatured by heat and acid, and beating is the **mechanical action** used to **aerate** the soufflé filling. This recipe also incorporates two dry methods of cooking – frying and baking. Like many other desserts, this recipe contains butter and sugar, which means that it will be quite high in saturated fat and sugar. The eggs and milk provide a source of protein, and the lemon juice is an excellent source of vitamin C as well as some vitamin B6.

CRÊPES

½ cup plain flour

¼ teaspoon salt

2 eggs

½ cup milk

10 grams butter

LEMON SOUFFLÉ

30 grams butter

1 tablespoon plain flour

4 tablespoons milk

2 egg yolks

2 tablespoons caster sugar

2 teaspoons lemon rind

2 tablespoons lemon juice

2 egg whites

METHOD

Making the crêpes

1 Sift the flour and salt.
2 Beat the eggs and pour into the centre of the flour.
3 Gradually beat in the eggs and half the milk.
4 Beat well for 1 minute.
5 Stir in the remainder of the milk. Allow to stand for 30 minutes if possible.
6 'Burn off' the frying pan by melting a teaspoon of the butter and allowing it to come to smoke point. Remove the pan from the heat and wipe out carefully with paper towel.
7 Using a fresh piece of paper towel, wipe a little butter onto the pan and return to the heat. Adjust heat so the butter does not burn.
8 Pour ¼ cup of the batter quickly into the pan and swirl so it forms a thin layer in the pan.
9 Cook until just set. Toss the crêpe and cook the second side.
10 Place on a plate and cover with foil or a clean tea towel to keep warm.
11 Cook the remaining crêpes, remembering to wipe the pan with a little butter between each crêpe.

MAKES 6–8 CRÊPES

Making the soufflé

1 Preheat oven to 200 °C.
2 To make the roux for the base of the soufflé, melt the butter in a small saucepan. Remove from the heat and stir in the flour with a wooden spoon.
3 Stir in the milk and beat vigorously over a low heat until the mixture boils and thickens.
4 Remove from the heat and beat in the egg yolks immediately.
5 Add 1 tablespoon of the caster sugar, the lemon rind and the lemon juice and stir until the ingredients are well blended.
6 In a clean bowl, beat the egg whites until soft peaks form.
7 Gradually beat in the remaining 1 tablespoon of caster sugar until stiff peaks form.
8 Stir a tablespoon of the egg white into the soufflé base using a rubber spatula.
9 Lightly fold in the remainder of the egg white. Do not overmix.

Assembling the lemon soufflé crêpes

1 Carefully separate the crêpes and lay one, speckled side up, in a shallow, ovenproof dish or tray.
2 Place approximately 2–3 tablespoons of the soufflé mixture on one side of the crêpe. Fold the crêpe in half to cover the soufflé mixture.

3 Place a second crêpe in the baking dish and fill with lemon soufflé. Repeat the process until all crêpes are filled.
4 Sprinkle crêpes with a little extra sugar.
5 Bake in the preheated oven at 200 °C for approximately 10 minutes until the soufflé has puffed up and the sugar has melted to a light glaze.
6 Serve immediately with cream or vanilla ice-cream.

SERVES 2–4

Lemon soufflé crêpes

EVALUATION

1 Describe the sensory properties of the lemon soufflé crêpes – appearance, aroma, flavour and texture. Consider both elements of the recipe – the crêpes and the soufflé filling.
2 Why is it important to only add half of the milk with the egg in step 3 when making the crêpe batter?
3 Why is the batter left to stand in step 5 when making the crêpes? In your answer, focus on the changes to physical properties of the starch in the process of gelatinisation.
4 Explain the decision you took in each of the following steps and how it helped you to achieve a successful product:
   - the preparation of the crêpe pan
   - creating even-sized crêpes.
5 Describe the difference between the preparation processes of beating and folding – consider the actions as well as the equipment.
6 Describe how the proteins are denatured when beating the egg whites to create a foam for the soufflé.
7 Explain how the acid from the lemon juice affects the properties of milk and eggs in the soufflé filling recipe.
8 The preparation of the soufflé filling is another important stage in the production of the lemon soufflé crêpes. Explain the decisions you took in each of the following steps in the soufflé filling and how it helped you to achieve a successful product:
   - making the roux base for the soufflé filling
   - beating the egg white.
9 Identify the processes and outline the changes to the properties of the lemon soufflé crêpes during baking.
10 Explain how consumers could adapt this recipe if they wished to use ethically or sustainably produced ingredients.

Powder puffs

These powder puffs are delicate little sponge cakes that demonstrate mechanical and chemical **aeration** of food. Powder puffs – or 'sponge kisses' as they are sometimes known – are ideally filled with cream and lemon butter or raspberry jam several hours before they are served. The filling softens the sponge, ensuring they literally 'melt in the mouth'. Sifting, beating, folding and chemicals create the light texture of the powder puffs. As the powder puffs contain sugar and are filled with jam and cream, they are high in sugar and saturated fat. So, like other sweet treats, they should only be eaten sometimes and in small amounts.

---

2 eggs, separated

½ cup cornflour

2 tablespoons plain flour

1 teaspoon cream of tartar

½ teaspoon bicarbonate of soda

⅓ cup caster sugar

¼ teaspoon vanilla essence

METHOD

1. Preheat oven to 180 °C.
2. Line three oven trays with baking paper.
3. Sift the cornflour, plain flour, cream of tartar and bicarbonate of soda together several times.
4. Beat the egg whites in a clean, dry bowl until stiff peaks form.
5. Gradually add the caster sugar to the beaten egg whites one tablespoon at a time, beating well between each addition. The mixture should form a stiff, glossy meringue.
6. Add the egg yolks one at a time and beat gently. Fold in the vanilla essence.
7. Sift the dry ingredients over the egg mixture. Fold in using a metal spoon or plastic spatula – do not beat. The mixture should be firm.
8. Place heaped teaspoons of mixture onto the lined oven trays, allowing room for the powder puffs to spread.
9. Cook in the preheated oven for 12–15 minutes or until they are evenly coloured and firm to the touch.
10. Allow the powder puffs to rest on the trays for 1 minute, then use a metal spatula to loosen and lift them onto a wire rack to cool. When cool, store in an airtight container.
11. Fill with cream and lemon butter or raspberry jam when cool. Leave for several hours to allow powder puffs to soften. Dust with icing sugar just before serving.

MAKES APPROXIMATELY 15 PAIRS

EVALUATION

1 Describe the sensory properties of the powder puffs.
2 List the different ways in which aeration takes place in the powder puffs.
3 Identify the ingredients in the powder puff recipe that contribute to the aeration of the product.
4 How does the chemical reaction between the ingredients identified in question 3 assist in creating a light airy texture in the powder puffs?
5 Describe how egg whites should be prepared to ensure they reach maximum volume when beaten.
6 Outline the role of sugar in the process of making powder puffs.
7 Describe the process of folding, including the most appropriate equipment.
8 Why are the dry ingredients folded and not beaten into the egg foam in step 8?
9 According to the guidelines in the Australian Guide to Healthy Eating, why should powder puffs be consumed only occasionally and in small quantities?
10 Explain how consumers could adapt this recipe if they wished to use ethically or sustainably produced ingredients.

Powder puffs

Fresh berry mousse

Video

This delicious mousse uses fresh or frozen berries, such as raspberries, blueberries or strawberries, and is set with gelatine. It uses **mechanical** action to aerate the product. The egg-white foam creates the light, airy texture and the gelatine sets and holds the rich berry-flavoured cream custard in its shape. The raspberries in the fresh berry mousse means that this dessert is a good source of vitamin C, and the egg and milk add protein to this dish. However, the recipe also includes sugar and cream, which means that it will be relatively high in sugar and fat. Decorating the fresh berry mousse with caramelised hazelnuts would also increase the sugar content of the dessert.

125 grams frozen or fresh raspberries or other berries
1 egg, separated
2 tablespoons sugar
2 tablespoons milk
1 teaspoon gelatine
1 tablespoon cold water
150 millilitres thickened cream

METHOD

1. Purée the berries in a blender or with a stick mixer. Push the berries through a sieve using a wooden spoon to remove the seeds.
2. Combine the egg yolk, sugar and milk in a small saucepan and stir over a low heat until the mixture thickens slightly, appears pale in colour and has a pouring consistency.
3. Remove from the heat and stir into the berry purée. Cool.
4. Dissolve the gelatine by placing the cold water in a small bowl and sprinkling the gelatine over the water. Put the bowl into a saucepan of hot water and stir until the gelatine is dissolved. Allow to cool, but not to set.
5. Beat the egg white until soft peaks form.
6. Whip the cream in a separate small bowl until soft peaks form.
7. Check that the berry mixture and gelatine are at the same temperature. Stir the gelatine into the berry mixture, and then fold in the cream and egg white.
8. Pour the mixture into a long-stemmed glass or dessert dish and allow to set in the refrigerator. Decorate with shards of caramelised hazelnuts (see page 335).

SERVES 2

Fresh berry mousse

EVALUATION

1 Describe the sensory properties of the fresh berry mousse – appearance, aroma, flavour and texture.
2 Why are the berries puréed before mixing with other ingredients?
3 Identify the process that occurs when the yolk, sugar and milk are cooked in step 2.
4 Outline the problem that may occur if the gelatine is not dissolved before combining with other ingredients.
5 Both the egg whites and cream are beaten in the recipe – explain how beating increases their volume given one is a protein and the other a fat.
6 Describe how to maximise the volume of egg whites when they are beaten.
7 Why should the berry mixture and dissolved gelatine be the same temperature when they are combined?
8 How should the fresh berry mousse be stored to ensure it doesn't cause food poisoning?
9 Discuss how well this dessert would meet the guidelines of the Australian Guide to Healthy Eating.
10 Explain how consumers could adapt this recipe if they wished to use ethically or sustainably produced ingredients.

Middle Eastern chicken

In this recipe for Middle Eastern chicken, the chicken pieces are coated in spices, then briefly pan-fried to develop the flavour of the spices. This process also promotes browning as a result of the **Maillard reactions** when the poultry is exposed to dry heat. **Simmering** tenderises the chicken because the moist heat denatures and coagulates the protein. Using dried fruit such as currants adds a touch of sweetness to balance the citrus flavours of the lemon. This recipe is high in protein but very low in fat. The vegetables also provide a range of vitamins and minerals to the diet. Serving the recipe with couscous balances the meal by providing a valuable source of carbohydrate.

---

2 chicken thigh fillets, skin removed
½ teaspoon salt
½ teaspoon ground cumin
½ teaspoon ground cinnamon
¼ teaspoon ground black pepper
¼ teaspoon ground turmeric
2 tablespoons olive oil
½ brown onion, cut into slices
25 grams fresh ginger, julienned
1 clove garlic, crushed
½ fresh red chilli, finely chopped
½ tomato, diced
¼ teaspoon cumin seeds
2 sprigs thyme
½ lemon, zest and juice
2 teaspoons honey
2 tablespoons currants
½ vegetable stock cube
2 tablespoons fresh coriander to serve
rice or couscous to serve

METHOD

1. Cut each chicken thigh fillet into four portions. Combine the salt and ground spices in a plastic bag, add the chicken and shake to coat with the spice mix.
2. Heat the oil in a frying pan or a heavy-based saucepan and brown the chicken pieces over high heat. Remove the chicken and reduce the heat to medium.
3. Add the onion, ginger, garlic and chilli to the frying pan and cook for 3 minutes until the onion begins to soften. Add the diced tomato, cumin seeds and thyme, and cook for 2 minutes.
4. Return the chicken to the pan and add lemon zest and juice, honey, currants, stock cube and just enough water to cover the chicken.
5. Cover with a lid and simmer over medium heat for 10 minutes. Remove the lid and simmer uncovered for 10 to 15 minutes or until the chicken is tender and cooked through and the sauce is slightly reduced.
6. Garnish with fresh coriander leaves and serve with couscous or rice.

SERVES 2

EVALUATION

1 Describe the sensory properties of the Middle Eastern chicken – appearance, aroma, flavour and texture.

2 Describe the physical and chemical properties of the chicken thigh fillets. Explain why these are the preferred cut of chicken for this recipe rather than chicken breasts.

3 Identify and research the functional role of each spice used to coat the chicken thigh fillets has in the final properties of the dish:
- cumin
- cinnamon
- black pepper
- turmeric.

4 In step 3 of the recipe, the pieces of chicken are fried over medium to high heat. Describe the physical changes to the chicken and identify the two processes that occurred when the chicken was exposed to heat.

5 Explain the process used to julienne the fresh ginger. Use annotated diagrams in a flow chart to demonstrate the stages in the process.

6 What is lemon zest and why would it be used in the recipe?

7 In step 5 of the recipe, the ingredients are simmered for 20–25 minutes. Explain how simmering cooks the chicken, and describe how to test if the chicken is tender and ready to serve.

8 Describe how to prepare the chicken for this recipe safely to ensure there is no possibility of cross-contamination.

9 Outline one safety procedure that should be followed for these cooking methods: frying and simmering.

10 Explain why consumers concerned about ethical or sustainable food production might choose to purchase free-range chicken thigh fillets when making this recipe.

Middle Eastern chicken

Grain and lentil salad with salmon and fennel

This salad is very colourful and has a great crunchy texture. Freekeh is young, green wheat that is toasted to develop a nutty flavour. Both freekeh and Puy lentils are high in dietary fibre, a good source of protein and have a low GI. Boiling and baking enhance the sensory properties of different ingredients in the salad. Serving the salad with salmon adds protein and Omega-3 to a meal. The salmon is quickly pan-fried to ensure it is moist and tender.

Grain and Lentil salad

½ cup freekeh or cracked wheat or quinoa
¼ cup Puy lentils
1 tablespoon salted capers
1 tablespoon pumpkin seeds
1 tablespoon slivered almonds
¼ cup currants
½ pomegranate, de-seeded
¼ red onion, finely diced
¼ bunch flat-leaf parsley, chopped
¼ bunch coriander, chopped
½ lemon, juiced
2 tablespoons extra virgin olive oil
1 tablespoon pomegranate molasses

TOPPING

3 tablespoons Greek yoghurt
1 teaspoon honey

METHOD

1 To cook the freekeh: Fill a medium saucepan with water and bring to the boil. Add the freekeh and simmer, covered, for 40 minutes or until the grains are tender. Drain and cool. *Note:* cracked freekeh and quinoa only take approximately 12 minutes to cook.
2 To cook the lentils: Put the lentils in a small saucepan, cover with cold water and bring to the boil, then strain immediately. Cover the lentils with cold water again, bring back to a simmer and cook for 12–15 minutes or until the lentils are just tender. Drain and cool.
3 Soak the salted capers for 20 minutes. Change the water several times, then drain and chop roughly.
4 Preheat oven to 180 °C and toast the pumpkin seeds and slivered almonds for about 3 minutes until they are pale gold in colour.
5 Finely dice the red onion and chop the parsley and coriander.
6 In a large bowl, combine the freekeh, lentils, chopped capers, toasted pumpkin seeds and almonds, currants, pomegranate seeds, diced onions, chopped parsley and coriander, lemon juice, olive oil and pomegranate molasses.
7 For the topping: Combine the yoghurt and honey.
8 Serve the salad with a spoonful of the honey yoghurt.

SERVES 2

Salmon and fennel

2 x 150 gram portions of salmon with skin on
1 teaspoon fennel seeds
8 black peppercorns
¼ teaspoon ground coriander
¼ teaspoon salt flakes
2 tablespoon olive oil
½ lemon, juiced

METHOD

1 Remove the salmon from the refrigerator 30 minutes before cooking. This allows the portions to cook evenly and prevent them from drying out on the surface.
2 Rinse the salmon portions and pat dry with paper towel.
3 Use a mortar and pestle to coarsely crush the fennel seeds and black peppercorns.
4 Combine the ground fennel seeds, peppercorns, coriander and salt flakes of a plate.
5 Press the flesh side on the salmon into the ground spices.
6 Heat the oil in a frying pan over medium heat. Add the salmon skin side down and cook for about 5 minutes until golden brown. Turn and cook for 3–5 minutes. Place the salmon on a serving plate and drizzle over the lemon juice and pan juices.
7 Serve with the grain and lentil salad and yoghurt topping.

SERVES 2

EVALUATION

1 Describe the sensory properties – appearance, aroma, flavour and texture – of the grain and lentil salad and the salmon with fennel.
2 Discuss why freekeh and Puy lentils are considered valuable ingredients in weight-loss diets.
3 Explain why including foods such as salmon, which are a good source of omega-3, is important in the Australian diet.
4 Leaving the salmon portions covered on the bench top for 30 minutes before cooking is a minimal health threat. Why?
5 Explain how the grain and lentil salad should be stored if prepared before serving time.
6 If freekeh is not available, suggest ingredients with similar properties that could be substituted.
7 Outline two safe work practices you followed when boiling and simmering the freekeh and Puy lentils.
8 If you were preparing this meal, identify tasks within the recipes that primary school children could do to assist.
9 What was most challenging aspect in the preparation of this meal? Discuss changes you would make it you were to repeat these recipes.
10 Plot the ingredients used in the salad and salmon recipes on a diagram of the Australian Guide to Healthy Eating. After classifying the ingredients, comment on how well the meal meets the recommendations of the model.

Lentil soup

Boiling and **simmering** are the two moist methods of cooking used in the lentil soup recipe. The lentils are an excellent source of protein and the wide range of vegetables provides many vitamins, minerals and fibre. The potato is a source of carbohydrate and its starch component helps to thicken the soup. Adding olive oil in the last stage of cooking contributes to the rich mouth feel of the soup and enhances the flavour of the paprika when it is fried. This soup is suitable for those following vegetarian and gluten-free diets.

½ cup green lentils
1 garlic clove, crushed
½ brown onion, diced
1 carrot, diced
1 celery stick, diced
¼ red capsicum, diced
¼ green capsicum, diced
1 bay leaf
1 potato, peeled and cut into quarters
1 vegetable stock cube
4 cups water
2 tablespoons olive oil
¼ teaspoon sweet paprika
½ cup passata
½ teaspoon dried oregano
½ teaspoon dried chilli flakes
salt and pepper
flat-leaf parsley, chopped, to serve

METHOD

1 Place the lentils in a medium saucepan and cover with cold water. Bring to the boil quickly then drain.
2 Return the drained lentils to the saucepan with the crushed garlic, diced vegetables, bay leaf and potato pieces. Add the vegetable stock cube and water.
3 Cover the saucepan and bring the soup to simmer over medium heat. Cook until the potato is soft, about 20 to 30 minutes.
4 When the potato is soft, remove the pieces from the saucepan and mash with a fork. Return the mashed potato to the saucepan.
5 In a small saucepan, heat the olive oil over low heat then add the sweet paprika and passata. Stir to combine the ingredients then heat over low heat for 3 minutes.
6 Add the sweet paprika and passata mixture and the dried herbs to the soup and season to taste with salt and pepper.
7 Simmer the soup for 20 minutes or until the lentils are tender.
8 Serve and top with chopped flat-leaf parsley.

SERVES 2–3

Lentil soup

EVALUATION

1 Describe how you would dice the carrot and capsicum for this recipe.
2 Describe the sensory properties of the lentil soup – appearance, aroma, flavour and texture.
3 Two moist methods of cooking, boiling and simmering are used in the recipe. Explain the difference between boiling and simmering.
4 Describe the changes in properties of the lentils during the cooking process.
5 Describe the changes to the sensory properties of the potato as a result of simmering for 20–30 minutes.
6 Why is the sweet paprika and passata fried in the oil before being added to the soup?
7 Explain why lentils are considered to be an important ingredient in a vegetarian diet.
8 Outline two rules for using the cooktop safely.
9 Explain why lentils are considered to be an important crop in a sustainable agricultural system.
10 Plot the ingredients used in lentil soup on a diagram of the Australian Guide to Healthy Eating. Evaluate the nutritional value of the soup according to the guidelines of this food selection model. What accompaniments could you serve with the soup to ensure it was a healthy lunch meal for children and families?

Dhal

Dhal is a classic Indian dish made from red lentils and spices. Red lentils are a very good source of dietary fibre and a good source of protein, iron and some of the B group vitamins. Red lentils are **simmered** and cook more quickly than green lentils. Serving dhal with basmati rice creates a complete vegetarian meal that can be served for breakfast, lunch or dinner.

---

80 grams red lentils

1 brown onion, sliced thinly

1 clove garlic, crushed

1 long green chilli, sliced thinly

20 grams fresh ginger, finely grated

¼ teaspoon turmeric

½ teaspoon Sri Lankan curry powder

½ cinnamon stick

3 fresh curry leaves

⅔ cup coconut milk

½ cup water

1 tablespoon vegetable oil

½ teaspoon brown mustard seeds

salt

1 tablespoon coconut cream

½ lime, juiced

To serve: sprig fresh coriander, steamed basmati rice and warm roti.

METHOD

1. Rinse and drain the red lentils.
2. Keep the grated ginger, sliced onion, green chilli and garlic separate.
3. Set aside two-thirds of sliced onion, green chilli and crushed garlic.
4. In a medium saucepan, combine the washed lentils, grated ginger, turmeric, curry powder, cinnamon stick, curry leaves, coconut milk, water, and one-third of the sliced onion, chilli and crushed garlic.
5. Bring to boil, then reduce to simmer. Cover the saucepan and cook for approximately 20 minutes until the lentils are breaking down. Stir occasionally.
6. In the meantime, select a small saucepan and add the vegetable oil. Over medium heat, add the mustard seeds and the remaining sliced onion, chilli and crushed garlic. Add a large pinch of salt.
7. Sauté until the onions are tender and golden brown. Remove from heat and stir into the lentils when they are ready.
8. Add the coconut cream and the lime juice. Season with salt if required.
9. Serve with fresh coriander, steamed basmati rice and warm roti.

SERVES 1–2

EVALUATION

1 Describe the sensory properties – appearance, aroma, flavour and texture – of dhal.
2 What is roti and why is it often served with dhal?
3 Boiling and simmering are moist methods of cooking. Describe how heat is transferred in the cooking methods.
4 How is heat transferred when some of the ingredients for dhal are sautéed?
5 Onion, garlic and chilli are cooked using two different methods in dhal. Describe the changes that occur during each cooking method and how that contributes to the final sensory properties of the dhal.

COOKING METHOD	CHANGES THAT OCCUR TO ONION, GARLIC AND CHILLI DURING THE COOKING METHOD	CONTRIBUTION TO THE FINAL SENSORY PROPERTIES OF THE DHAL
Boiling and simmering		
Sautéing		

6 Research recipes for dhal and make a list of the different types of lentils and spices that can be used in this style of recipe.
7 Explain why dhal is sometimes described as a comfort food and is served in many variations for breakfast, lunch and dinner in countries throughout the subcontinent.
8 Dhal can be served as part of an Indian-style meal. List other dishes that could be served with it for the main meal of the day in India.
9 Lentils are grown in Australia and are an important crop in the sustainability of primary production in regions such as the Wimmera and Mallee. Explain why lentils are a valuable crop to farmers in this region.
10 Plot the ingredients of dhal, steamed basmati rice and roti on a diagram of the Australian Guide to Healthy Eating. After classifying the ingredients, comment on how well it meets the recommendations of the model.

Lemon and ricotta steamed puddings

Steam doesn't conduct heat as quickly as water so it is a cooking method suited to delicate ingredients such as ricotta cheese. This mixture will hold at room temperature for several hours so this recipe can be prepared ahead of time and cooked just before serving. The ricotta in this recipe provides a good source of calcium; however, this recipe is also high in fat and sugar and so should only be eaten occasionally as a treat.

3 tablespoons apricot jam or marmalade
65 grams butter, softened
65 grams caster sugar
zest of 1 lemon, finely grated
50 grams ricotta
1 egg
75 grams flour
1 teaspoon baking powder
1 tablespoon lemon juice
2 teaspoons milk
1 tablespoon poppy seeds, optional
extra butter for greasing
cream to serve

METHOD

1. Grease and line the base of 3 dariole moulds or ceramic ramekins, approximately ¾ cup capacity.
2. Place one tablespoon of apricot jam or marmalade in the base of each mould.
3. Beat the butter, sugar, zest and ricotta until smooth, then beat in the egg.
4. Sift the flour and baking powder together and stir into the mixture. Add the lemon juice and milk and mix. Stir through the poppy seeds if using.
5. Divide the pudding mixture between the three moulds – each should be ¾ full.
6. Cover each mould with buttered foil and secure with kitchen string.
7. Bring the water to the boil in the base of a steamer. Place the puddings in a steamer basket and cover the steamer with the lid. Cook for 25 minutes.
8. Invert the puddings onto a plate and serve with pouring cream or ice-cream.

Alternative cooking methods if a steamer is not available:

- Baking – preheat oven to 100 °C and bake for 25 minutes or until the skewer comes out clean.
- Microwaving – use plastic or ceramic moulds or buttered teacups and cover with cling wrap. Microwave for 1 to 2 minutes then leave to sit for 4 minutes before serving.

EVALUATION

1. Describe the sensory properties of the lemon and ricotta steamed puddings.
2. Explain how heat is transferred when using the steaming method.
3. Why is it necessary to line the base of each mould or ramekin used for cooking the puddings?
4. Identify the three processes used to aerate the puddings.
5. Explain how each method of aeration contributes to the light airy texture of the finished product.
6. Explain how eggs contribute to the structure of the cooked puddings.
7. Why do the puddings need to be covered individually before cooking?
8. Describe how to avoid any possibility of a steam burn when steaming.
9. If the puddings were to be baked, a low oven temperature would be recommended. Why?
10. In this recipe, 50 grams of butter has been replaced with 50 grams of ricotta cheese. Explain the health benefits of this substitution.

Lemon and ricotta steamed puddings

Apple and ginger self-saucing pudding

Granny Smith apples are selected because they retain their shape in a high-sugar solution. **Caramelisation** of the sugar develops the golden brown colour, rich flavours and aromatics that are the feature of this pudding. This recipe for apple and ginger self-saucing pudding uses Granny Smith apples, which are a healthy ingredient, especially when eaten raw, because they are a good source of dietary fibre and vitamin C. However, like many other desserts, it contains significant amounts of fat from the butter, and sugar in the caster sugar, brown sugar, crystallised ginger and golden syrup. It is therefore wise to only serve small portions and to consider serving it with a reduced-fat yoghurt rather than cream or ice-cream.

CARAMELISING APPLES

2 Granny Smith apples

25 grams butter

2 tablespoons caster sugar

PUDDING BATTER

⅔ cup self-raising flour

2 tablespoons brown sugar

50 grams butter, melted

¼ cup milk

1 egg

20 grams crystallised ginger, thinly sliced

1 tablespoon golden syrup

TOPPING

2 teaspoons cornflour

2 tablespoons brown sugar

2 tablespoons golden syrup

190 millilitres boiling water

METHOD

Caramelising the apples

1 Preheat oven to 180 °C and grease a 3–4 cup baking dish or 3 individual 350 mL ramekins.
2 Peel and core apples and cut each into eight wedges.
3 Over medium heat, combine the butter, caster sugar and apple wedges in a frying pan and cook for 6–7 minutes. Turn occasionally until the apple has caramelised and the wedges still hold their shape.
4 Spoon the apples and sauce into the baking dish.

Preparing the pudding batter

1 Sift the flour and brown sugar into a mixing bowl.
2 Add the melted butter, milk, egg, sliced ginger and golden syrup and stir until combined.
3 Spoon the pudding batter over the caramelised apples.

Preparing the topping

1 In a small bowl, mix the cornflour and brown sugar together, then sprinkle over the pudding batter.
2 Combine the golden syrup and boiling water in a jug and pour gently over the back of a spoon onto the pudding batter.
3 Bake for 40 minutes for one large pudding or 20 minutes for individual puddings until golden brown and a skewer comes out clean.

EVALUATION

1 Describe the sensory properties of the apple and ginger self-saucing pudding – appearance, aroma, flavour and texture.
2 What causes the caramelisation of sugar?
3 Describe the changes that occur to sugar during caramelisation.
4 Describe the changes in the physical properties of the apples during caramelisation.
5 Explain why the caramelisation of the apples is completed in a frying pan and not a saucepan.
6 Why are brown sugar and golden syrup used in the pudding batter instead of white sugar?
7 List the ingredients and processes used to aerate the pudding.
8 Outline the functional role egg has in the pudding batter.
9 Why is it important to pour the boiling water over the back of a spoon when preparing the topping?
10 Discuss when and how this recipe could be included as part of a meal according to the guidelines of the Australian Guide to Healthy Eating.

Apple and ginger self-saucing pudding

Moussaka

The preparation of this dish uses the cooking techniques of **grilling**, **baking** and **simmering**. Moussaka is the Greek variation of lasagne. Traditionally, it is a rich dish – in this recipe the eggplant is grilled instead of fried, and the sauce for the topping is lighter compared to the traditional cheese sauce made from a roux of butter and flour. Lean lamb is a good source of protein and iron, and eggplant is high in dietary fibre, vitamins and minerals, and contains essential phytonutrients, which are found in the purple skin. Serving the moussaka with a bitter leaf salad provides a wide range of vitamins and minerals, and provides contrast to the sensory properties of the moussaka.

FOR EGGPLANT AND LAMB SAUCE

1 medium to large eggplant

salt

1 tablespoon olive oil

½ brown onion, diced

2 cloves garlic, finely diced

1 teaspoon chilli flakes

½ teaspoon dried oregano

½ teaspoon ground cinnamon

½ teaspoon paprika

300 grams minced lamb

⅓ cup tomato passata

½ cup chicken stock

50 gram feta cheese

FOR TOPPING

1 egg

4 tablespoons double cream

freshly ground nutmeg

50 grams finely grated parmesan cheese

METHOD

For eggplant and lamb sauce

1. Slice the eggplant into round, half-centimetre-thick slices. Sprinkle the slices with a little salt. Cover with a tray and set some weight on top. Leave for 20 minutes, then rinse off the salt and pat the slices of eggplant dry.
2. Preheat grill to medium high.
3. Heat the oil in a medium frying pan over medium heat. Sauté the onion for 3–4 minutes until soft and starting to brown.
4. Add the garlic, chilli flakes, dried oregano, cinnamon and paprika. Cook for about 1 minute.
5. Add the minced lamb and stir over the heat, breaking up the meat, until browned.
6. Stir through the tomato passata and chicken stock. Bring to boil, reduce the heat and simmer for 15 minutes until the mixture is thick. Stir occasionally.
7. Line a baking tray with baking paper. Place the slices of eggplant in single layer and grill for 5 minutes until beginning to brown. Turn the slices and grill for another 5 minutes, or until the eggplant is tender.
8. Preheat the oven to 200 °C.
9. Grease an ovenproof dish of approximately 220 x 200 x 50 millimetres. Line the base with half the eggplant slices, cover with half the lamb sauce, crumble over the feta cheese then spoon over the remaining lamb sauce. Finish with the remaining eggplant slices.

For the topping

10. Lightly beat the egg and cream together and stir in the nutmeg. Pour over the layered eggplant and lamb, and sprinkle with the grated parmesan cheese.
11. Bake for 20 minutes until golden brown. Allow to rest for 5 minutes before serving.
12. Serve with a bitter leaf salad.

SERVES 2

EVALUATION

1 Describe the sensory properties – appearance, aroma, flavour and texture – of the moussaka. Consider all elements of the recipe in your answer.

2 List some examples of bitter, leafy green vegetables that could be included in a salad to be served with the moussaka.

3 Explain how serving a bitter leaf salad with moussaka would improve the sensory and nutritional properties of the meal.

4 Explain why grilling the eggplant is preferable to pan-frying.

5 In step 3, the onions are sautéed until they begin to brown. Explain how the browning process occurs and identify the name of the process.

6 Describe how heat is transferred while the lamb sauce is simmering.

7 During baking, the heat in the oven causes changes to occur in the topping on the moussaka. Identify the process responsible for the change in the ingredients listed and describe the changes in the properties of each ingredient.

INGREDIENT IN TOPPING	PROCESS RESPONSIBLE FOR THE CHANGE IN PROPERTIES	DESCRIPTION OF THE CHANGES IN THE PROPERTIES DURING BAKING
Egg		
Parmesan cheese		

8 Outline any modifications you would make to the recipe if you were cooking it to serve to your family. Justify each of your modifications.

9 Identify four safety and hygiene practices you followed during the production, and explain how they prevented injury or illness.

SAFETY AND/OR HYGIENE PRACTICE DEMONSTRATED DURING PRODUCTION	EXPLANATION OF HOW THE PRACTICE PREVENTED INJURY OR ILLNESS

10 Plot the ingredients of the moussaka on a diagram of the Australian Guide to Healthy Eating. After classifying the ingredients, comment on how well it meets the recommendations of the model.

Coconut chicken bowl

One-bowl meals with several elements are a great way to ensure a meal is designed to meet the proportions of the Australian Guide to Healthy Eating. Layering the elements – rice, chicken and slaw – encourages family members to eat and enjoy a wide range of foods that contrast and complement each other, items that they maybe wouldn't try if making their own selection. The chicken is a good source of protein, the rice is pure carbohydrate, and the slaw is an excellent source of dietary fibre and a range of vitamins and minerals.

CRISPY CHICKEN

2 chicken thigh fillets with skin on

2 teaspoons vegetable oil

salt flakes

COCONUT RICE

½ cup jasmine rice

½ cup cold water

70 millilitres coconut cream

ASIAN SLAW

⅛ white cabbage, finely shredded

½ red chilli, de-seeded and finely slice

¼ carrot, grated

¼ Granny Smith or Pink Lady apple, grated

⅛ fennel, finely sliced

2 spring onions, sliced

1 tablespoon cranberries

1 tablespoon oil

1 tablespoon light soy sauce

1 teaspoon fish sauce

½ lime, juice

¼ teaspoon caster sugar

1 tablespoon roasted peanuts, chopped

1 tablespoon mint leaves, chopped

1 tablespoon coriander leaves, chopped

METHOD

1. Preheat oven to 200 °C.
2. Rub the chicken thigh fillets with oil, place skin side up on a baking tray then sprinkle with salt flakes.
3. Roast for 30 minutes until the skin is golden and crispy. Remove from the oven and allow to rest for 5 minutes.
4. Remove the skin from the thighs, shred the skin and reserve. Shred the meat and set aside.
5. Meanwhile select a small saucepan with a tight-fitting lid. Wash the rice then place it in the saucepan with the water and coconut cream. Cover and bring to the boil, then reduce heat to very low and cook for 10 minutes.
6. Remove from heat and leave, covered, for another 10 minutes. Fluff with a fork before serving.
7. In a large bowl combine the prepared cabbage, chilli, carrot, apple, fennel, spring onions and cranberries.
8. To prepare the dressing, whisk together the oil, soy sauce, fish sauce, lime juice and caster sugar. Pour the dressing over the slaw, add the shredded chicken and toss together. Add mint and coriander leaves and toss again.
9. Serve the rice in a large serving bowl, add the slaw and chicken. Top with some of the shredded crispy chicken skin and chopped peanuts.

SERVES 1

EVALUATION

1 Describe the sensory properties – appearance, aroma, flavour and texture – of the coconut chicken bowl.
2 Explain why roasting the chicken thigh fillets is a healthier way to cook the chicken than frying it.
3 Describe the changes that occur to the physical and sensory properties of the chicken thigh fillets when they are roasted.
4 Identify and describe the changes that occur to chicken due to the application of heat.
5 Identify an alternative ingredient that could be used as a base for the chicken slaw instead of the coconut rice.
6 The absorption method is used to cook the rice. Identify and describe the process that changes the sensory properties of the rice during the cooking process.
7 The dressing on the slaw is a temporary emulsion. Explain what this means.
8 Suggest other ingredients that would add crunch and colour on top of the meal to cater for people with allergies to peanuts.
9 How would you ensure there was no possibility of cross-contamination during the preparation of this recipe?
10 Plot the ingredients of the coconut chicken bowl on a diagram of the Australian Guide to Healthy Eating. After classifying the ingredients, comment on how well the meal meets the recommendations of the model.

Sweet bread plait

The preparation of this delicious sweet bread plait clearly demonstrates the functions of starch and the protein, gluten. This recipe also incorporates both moist and dry cooking methods that illustrate the way functional properties of the ingredients react under different forms of heat. The production of this recipe provides an opportunity to develop skills working with a yeast dough to **aerate** a mixture and making a roux-based sauce for the filling. While, like other breads, this recipe is a good source of carbohydrates, it does contain a small amount of saturated fat found in the butter. The apple and custard filling provides some vitamin C from the apples as well as a small amount of calcium and protein in the milk. The sultanas are a source of sugar, so it would be wise to only consume a sweet bread product such as this occasionally.

YEAST DOUGH

2 cups bread flour

1 teaspoon salt

1 teaspoon bread improver

1 tablespoon sugar

1 tablespoon dried yeast

140 millilitres milk

50 grams butter

1 egg, beaten

APPLE AND CUSTARD FILLING

½ cup (100 grams) pie apples

2 tablespoons sultanas

⅛ teaspoon ground cinnamon

25 grams butter

2 tablespoons flour

125 millilitres milk

1½ tablespoons sugar

1 egg yolk

½ teaspoon vanilla essence

METHOD

Making the yeast dough

1 Preheat oven to 210 °C.
2 Sift dry ingredients into a large bowl.
3 In a small saucepan, heat the milk and butter until the butter has just melted – do not boil.
4 Add the warm milk, melted butter and beaten egg to the dry ingredients. Mix well to make a soft dough.
5 Cover with cling wrap and leave in a warm place to double in size.

Making the apple and custard filling

1 Mix apple, sultanas and cinnamon, and set aside.
2 Melt butter in a small saucepan over low heat then stir in the flour and cook for 30 seconds.
3 Remove from heat and gradually stir in the milk. Return to heat and bring to boil, stirring constantly. Cook for 1 minute.
4 Remove from heat and stir in sugar, egg yolk and vanilla essence. Allow to cool.

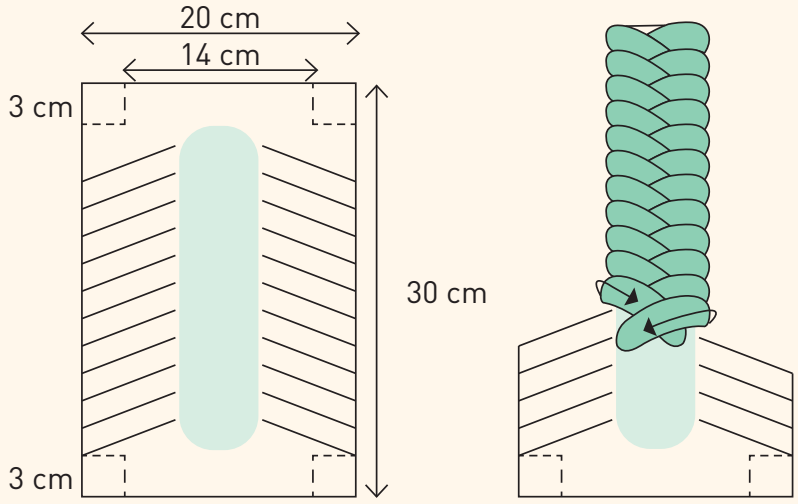
Making the sweet bread plait

1 Turn the yeast dough onto a lightly floured board and knead until smooth.
2 Roll the dough out into a rectangle 30 centimetres × 20 centimetres and approximately 0.5 centimetres thick. Place the dough on an oven tray.
3 Refer to the diagrams before filling and cutting the dough.
4 Spread the apple and custard filling along the length of the dough, leaving a border of approximately 7 centimetres on either side.
5 Make diagonal cuts about 2.5 centimetres apart as shown in the diagram using kitchen scissors. Make sure you have the same number of cuts on each side.
6 Plait the dough by folding alternate strips of dough over the filling.
7 Brush with egg glaze and prove for 10 minutes.
8 Bake at 210 °C for 5 minutes, then reduce to 190 °C for 20 minutes.

SERVES 4–6

EVALUATION

1 Describe the sensory properties of the two elements of the sweet bread plait.
2 Starch is one of the natural components present in the flour. Explain the main functional roles of starch in this recipe:
   - in the dough
   - in the filling.
3 What is gluten and how is it formed?
4 In step 5 of the recipe, the dough is covered and allowed to rest in a warm place to double in size. Explain the main processes that take place within the dough that cause it to double in size.
5 Identify the process that causes the sauce for the filling to thicken. Explain how this process occurs.
6 What is the purpose of using an egg yolk in the filling for the sweet bread plait?
7 If you wanted to use fresh apples for the filling of the sweet bread plait, rather than canned apples, how would you prepare them for use?
8 When you place the bread into a hot oven, 'oven lift' occurs. Explain what causes this reaction in the yeast dough.
9 Identify and explain the two processes that cause the sweet bread plait to brown during baking.
10 Describe one safety strategy you implemented when cooking the sauce for the filling on the cooktop, and one safety strategy you observed when using the oven to bake the sweet bread plait.



How to plait the sweet bread plait

Sweet bread plait

Steamed coriander chicken balls

The recipes for steamed wontons and coriander chicken balls will help develop an understanding of the moist method of cooking foods by **steaming**. These tasty, healthy finger foods can be steamed by the atmospheric steaming method, using either a bamboo steamer or a perforated saucepan placed over boiling water. The minced chicken, egg and nuts in the coriander chicken balls provide a good source of protein. Similarly, the pork used in the preparation of the steamed wontons is high in protein, while the wonton wrappers are a source of carbohydrate. The dipping sauce served with both recipes contains soy sauce high in salt, so it is important to use this sparingly. Steaming the chicken balls and wontons is also a much healthier cooking method than frying them in fat or oil.

CORIANDER CHICKEN BALLS

200 grams minced chicken

2 tablespoons fresh breadcrumbs

½ small egg, beaten

1 tablespoon finely chopped macadamia nuts

4 spring onions, finely sliced

2 tablespoons coriander, finely chopped

1 tablespoon soy sauce

12 large coriander leaves, extra

DIPPING SAUCE

2 tablespoons sweet chilli sauce

1 tablespoon lime juice

1 tablespoon fish sauce

Steamed coriander chicken balls

METHOD

1 Fill half of a saucepan or a wok with water.

2 Combine the chicken mince, breadcrumbs, egg, nuts, spring onions, coriander and soy sauce in a bowl and mix until well combined.

3 Line the top section of a bamboo steamer or perforated saucepan with baking paper. Use a skewer to make holes in the paper to allow the steam to penetrate the food.

4 Using wet hands, take two teaspoons of mixture, roll into a ball and top with an extra coriander leaf. Repeat with remaining mixture.

5 Arrange the chicken balls in a single layer over the lined surface of the perforated saucepan or bamboo steamer and place on the saucepan or wok of simmering water.

6 Cover with a tightly fitting lid and steam for 10 minutes.

MAKES 12 BALLS

Making the dipping sauce

1 To make the dipping sauce, combine the sweet chilli sauce, lime juice and fish sauce and mix well. Place in a small bowl.

2 Serve the chicken balls and won tons with the dipping sauce.

Steamed won tons

125 grams pork mince
½ cup Chinese cabbage, finely sliced
½ small fresh red chilli, finely chopped
1 clove garlic, crushed
2-centimetre piece of fresh ginger, grated
1 tablespoon coriander, chopped
1 tablespoon fish sauce
10 won ton wrappers
1 small egg, lightly beaten

METHOD

1. Place the mince, Chinese cabbage, chilli, garlic, ginger, coriander and fish sauce in a bowl and mix well.
2. Lay the won ton wrappers out on a clean bench and place a teaspoon of the pork mixture in the centre of each.
3. Brush the edges of each won ton with the beaten egg and bring the edges up together to tightly enclose the filling. Press to seal.
4. Half-fill the saucepan base or a wok with water. Bring to the boil then reduce the heat to simmer.
5. Line the top section of a bamboo steamer or perforated saucepan with baking paper. Use a skewer to make holes in the paper to allow the steam to penetrate the food. Arrange the won tons in a single layer over the paper.
6. Cover with a tightly fitting lid and steam for 10 minutes.

MAKES 10

Steamed won tons

EVALUATION

1. Describe the sensory properties of the steamed coriander chicken balls and won tons – appearance, aroma, flavour and texture.
2. Explain how heat is transferred in the moist cooking method of steaming.
3. Why is it important to only fill the base saucepan or wok half-full with water?
4. Explain the purpose of lining the bamboo steamer or perforated saucepan with baking paper.
5. What properties of an egg is used to seal the won ton wrappers during production of the won tons?
6. What role do the breadcrumbs have in the recipe for the coriander chicken balls?
7. Why are wet hands necessary when shaping and rolling the coriander chicken balls?
8. List two safety practices to observe when steaming the finger foods.
9. What are the nutritional benefits of cooking the finger foods by steaming method compared to deep-frying?
10. Evaluate the finger foods according to the Australian Dietary Guidelines. Explain how well they meet the guidelines of this model as a healthy snack food for children and families.

Wholemeal chocolate biscuits

Wholemeal flour and quick-cook oats increase the dietary fibre content of these crunchy biscuits compared to regular biscuits. The dark chocolate is lower in sugar than milk chocolate. Bicarbonate of soda, an **alkali**, combines with the acidic component of golden syrup to produce carbon dioxide, causing the biscuits to spread slightly.

125 grams quick-cook oats

125 grams wholemeal self-raising flour

125 grams brown sugar

pinch of salt

125 grams butter, roughly chopped

1 tablespoon golden syrup

2 teaspoons boiling water

¼ teaspoon bicarbonate of soda

100 grams dark chocolate (60 per-cent cocoa solids)

METHOD

1. Preheat oven to 180 °C. Line two baking trays with baking paper.
2. In a food processor, pulse the quick oats for five pulses then transfer to a large bowl.
3. Add in flour, sugar and salt, and stir to combine.
4. In a small saucepan add the chopped butter and golden syrup. Cook over low heat until the butter is melted. Remove from heat, then stir in the bicarbonate of soda, which has been dissolved in the boiling water.
5. Pour the butter mixture into the dry ingredients and stir until combined. Using your hand, bring the mixture together in the bowl – it will be a little crumbly. Divide the mixture in half.
6. Between 2 sheets of baking paper roll half the mixture to 4 millimetres thick.
7. Use a scone cutter to cut out 6-centimetre diameter circles. Slide a metal spatula under each circle and transfer it to the lined baking tray.
8. Re-roll the scraps and the other half of the mixture and cut out the remainder of the biscuits.
9. Bake for approximately 12 minutes or until the biscuits are golden. Cool on the baking tray for 5 minutes because the biscuits will be soft.
10. Use a metal spatula to transfer the biscuits to a cooling rack.
11. Break the chocolate into pieces and melt over a double boiler. Do not stir the chocolate as it melts because this can cause crystals to form and the mixture to seize. Remove from heat and cool.
12. Use a metal spatula to spread the chocolate thinly over the top surface of each biscuit. Alternatively, the chocolate could be piped on in a pattern.
13. Place the biscuits chocolate side up to set.

MAKES APPROXIMATELY 16 BISCUITS

EVALUATION

1. Describe the sensory properties – appearance, aroma, flavour and texture – of the wholemeal chocolate biscuits.
2. Explain why wholemeal flour is a healthier ingredient to use when baking than white flour.
3. Why are oats classified as a healthy ingredient?
4. Discuss why portion size is an important consideration when making food items that are in the 'eat occasionally' section of the Australian Guide to Healthy Eating.
5. Why would Fairtrade chocolate be a more ethical choice of ingredients compared to a regular chocolate? Explain why consumers might not purchase Fairtrade chocolate.
6. Outline the functional roles of bicarbonate of soda in the wholemeal chocolate biscuits.
7. Explain why brown sugar and golden syrup have been selected to use as the sweetening ingredients.
8. Describe a double boiler and explain why it is used to melt the chocolate.
9. Why are the biscuits left on the baking tray for 5 minutes after removing from the oven?
10. Explain how consumers could adapt this recipe if they wished to use ethically or sustainably produced ingredients.

Plain rice

Two methods for cooking plain rice are by rapid boil or absorption. Both methods produce plain rice, which is ideal to serve as an accompaniment to recipes such as curry, marinaded meats and stir-fries. In both methods it is easy to observe the process of the **gelatinisation** of starch as the rice grains change from being hard and opaque, with a distinct oval shape. During the cooking the starch absorbs water and gelatinises, and the sensory properties of the rice are very different from the raw state. Rice is a high-carbohydrate food and also contains a small amount of incomplete protein. It has a low GI rating.

RAPID BOIL

4 cups boiling water

⅔ cup long-grain rice

METHOD

1. Bring the water to the boil.
2. Stir in the long-grain rice.
3. Boil uncovered and rapidly for 12–15 minutes.
4. Test to see if the rice is tender by tasting a grain.
5. Drain in a strainer and serve.

SERVES 2

ABSORPTION

1⅓ cups water

⅔ cup long-grain rice

METHOD

1. Bring the water to the boil.
2. Add long-grain rice and stir gently with a fork to separate the grains.
3. Place lid on the saucepan, lower the heat and simmer 12–15 minutes. Do not lift the lid during cooking.
4. Remove from heat. Keep covered with the lid and allow to stand for 5 minutes, toss with a fork.

SERVES 2

EVALUATION

1. Why is it necessary to stir the rice a couple of times when you add it to the boiling water?
2. Explain why it is important to leave the lid on the rice when cooking by the absorption method.
3. Why is it necessary to allow the rice to stand for 5 minutes before serving when cooking by the absorption method?
4. Why does the rice increase in size once it has been cooked?
5. Describe how you can tell if rice is cooked when using the rapid boil method of cooking.

Japanese-style curry

Japanese curries are full flavoured but not too spicy. The beef and daikon or potatoes absorb the flavours of the curry base as the curry **simmers** gently and the proteins in the meat denature. The dark chocolate produces a richness to the curry sauce, and the apple a touch of sweetness. The carrots in this recipe provide an excellent source of vitamin A, while the potatoes provide both vitamin C and carbohydrate. Like potatoes, apples provide a good source of vitamin C. All the vegetables add fibre to the diet and the meat provides an excellent source of protein.

CURRY BASE

40 grams butter

20 grams dark chocolate, chopped

3 teaspoons garam masala

2 teaspoons hot curry powder

1 teaspoon salt flakes

1 teaspoon brown sugar

3 tablespoons plain flour

CURRY SAUCE

1 tablespoon olive oil

½ onion, chopped

1 garlic clove, finely diced

1½ carrots, cut into 2-centimetre chunks

½ daikon or 2 potatoes, cut into 2-centimetre cubes

300 grams scotch fillet steak, cut into 4-centimetre cubes

3 centimetres fresh ginger, finely sliced

500 millilitres chicken stock

1 Granny Smith apple, peeled and grated

1 tablespoon mirin

2 spring onions, sliced on angle as garnish

steamed rice to serve

METHOD

Making the curry base

1 Place the butter and chocolate in a small saucepan over low heat until it has just melted.
2 Add the garam masala, curry powder, salt, sugar and flour and cook for 2–3 minutes, stirring constantly until a thick brown paste is formed. Remove from the heat and cool.

Making the curry sauce

1 In a medium saucepan, heat the oil over moderate heat. Add onion, garlic and carrots, and sauté for 2–3 minutes until the onion softens.
2 Add the diced daikon or potatoes and cook for 3 minutes.
3 Add the diced beef and ginger slices, season with salt and pepper, and cook for 5 minutes. Add the curry base and stir through to ensure the meat is coated.
4 Add the stock, grated apple and mirin, then bring to a simmer. Cover and simmer gently for 30 minutes, stirring occasionally.
5 Serve with rice and garnish with sliced spring onion.

EVALUATION

1 Describe the sensory properties of the Japanese-style curry – appearance, aroma, flavour and texture.
2 How does the dark chocolate contribute to the sensory properties of the curry?
3 What type of vegetable is a daikon and why is it included in the curry?
4 Why are the onions, garlic and carrot cooked in oil before other ingredients are added?
5 Describe the process of cooking food by simmering.
6 Scotch fillet is a less tender cut of beef. Explain how cooking this meat by simmering makes it tender to eat.
7 The flour acts as a thickening agent in the curry sauce. Identify the process that takes place to enable the sauce to thicken.
8 Discuss each stage in the process that takes place when flour thickens the curry sauce.
9 Suggest other vegetable dishes that would complement the Japanese-style curry and rice to allow the meal to meet Dietary Guideline 2.
10 Explain how consumers could adapt this recipe if they wished to use ethically or sustainably sourced ingredients.

Japanese-style curry

Free-form pumpkin tart with olive oil pastry

Pastry made with olive oil has health benefits over pastry made with butter in that it doesn't contain saturated fats. This pastry has a crisp, crunchy texture and is best eaten when freshly **baked** and slightly warm. The baked pumpkin provides an excellent source of vitamin A as well as some vitamin C. The eggs and feta cheese are both excellent sources of protein, and the feta cheese has the additional benefit of providing calcium and vitamin B12. The baked pumpkin and feta cheese filling make this free-form tart an excellent choice for a vegetarian lunch.

PASTRY

250 grams flour

¼ teaspoon salt

30 millilitres extra virgin olive oil

125 millilitres cold water

FILLING

750 grams pumpkin, peeled and diced into 2-centimetre cubes

salt and pepper

1 tablespoon olive oil

15 grams butter

1 leek, thinly sliced

2 eggs, lightly beaten

60 grams grated parmesan cheese

100 grams feta

pinch of nutmeg

¼ cup walnuts, roughly chopped

egg glaze

METHOD

Making olive oil pastry

1. Pulse the flour and salt in a food processor to combine.
2. With the motor running, pour in the olive oil followed by the cold water and whizz until a ball forms.
3. Turn onto a lightly floured bench and knead just until a smooth ball has formed.
4. Cover with cling wrap and refrigerate for 30 minutes.

Making the pumpkin filling

1. Preheat oven to 190 °C.
2. Place the cubes of pumpkin, salt and pepper and olive oil in a plastic bag and shake to mix. Place in single layer on an oven tray and cook until the pumpkin is just tender – there should only be a little browning on the edges of the pumpkin. Leave the pumpkin to cool.
3. Melt the butter in a small frying pan and sauté the leek until tender.
4. Place half of the cooked pumpkin in a bowl and lightly mash with a fork. Add the leek, feta and parmesan cheese, nutmeg and beaten eggs. Gently stir in the remaining cooked pumpkin, taking care not to break up the pieces.
5. Roll the pastry into a 34-centimetre circle and place on a lined baking tray.
6. Spoon the pumpkin filling into the centre of the pastry and spread to approximately 14 centimetre in diameter so there will be sufficient pastry to fold up and over the filling. Sprinkle on the chopped walnuts.
7. Pull the edges of the pastry up to form a lid by pleating the pastry and leaving a 4-centimetre hole in the middle.
8. Brush with an egg glaze and bake for 30 minutes.
9. Serve with a bitter leaf salad.

Free-form pumpkin tart with olive oil pastry

EVALUATION

1 Describe the sensory properties of the two elements of the free-form pumpkin tart with olive oil pastry – the pastry and the filling.
2 Describe how the sensory properties of the olive oil pastry are different to pastry made with butter.
3 Explain why the olive oil pastry would be considered healthier than traditional pastry made with butter.
4 The final step in making the pastry is to cover and rest for 30 minutes. Outline the reasons for resting the pastry before rolling it into shape.
5 Identify the two chemical reactions that could have caused the pumpkin to develop some touches of golden brown on the edges of the cubes.
6 Describe how heat cooks the pumpkin in the oven.
7 Identify the ingredient and process responsible for the setting of the filling in the pie.
8 Why is the pie brushed with an egg glaze before baking? Identify the chemical reaction that is responsible for the change.
9 Describe how the heat is transferred when the leek is sautéed.
10 Evaluate the nutritional properties of the free-form pumpkin tart with olive oil pastry and bitter leaf salad by plotting the ingredients on a diagram of the Australian Guide to Healthy Eating. Comment on how well this meal meets the guidelines of this food selection model.

Moroccan lamb hotpot

The Moroccan lamb hotpot recipe demonstrates how heat **denatures** meat protein. Boiling is a wet method of cooking and it enables the connective tissue in the meat to be broken down into collagen, making it very tender. This 'one pot' recipe includes ingredients from every food group and therefore provides a wide variety of nutrients. The lamb is low in fat and an excellent source of protein. The potatoes, carrot, zucchini and onion are all a source of dietary fibre and vitamins and minerals. The dried apricots add a small amount of sugar to the recipe, while the almonds add to the protein content of this recipe.

MOROCCAN SPICE MIX

1 tablespoon cumin seeds
2 teaspoons coriander seeds
2 teaspoons paprika
1 teaspoon fenugreek seeds
¼ teaspoon chilli flakes

MOROCCAN LAMB HOTPOT

250 grams lamb leg steaks
2 potatoes
1 small carrot
1 zucchini
1 onion, finely diced
2 cloves garlic, crushed
1 tablespoon oil
2 tablespoons tomato paste
500 millilitres stock
¼ cup cracked wheat or burghul
¼ cup dried apricots
¼ cup blanched almonds
small handful coriander, chopped
¼ teaspoon salt, approximately

METHOD

Preparing the Moroccan spice mix

1 To prepare the Moroccan spice mix, heat all the spices in a dry frying pan over a low heat until the flavours are aromatic – approximately 30 seconds.
2 Grind the spices together in a mortar with a pestle, or in a spice grinder, until they form a fine powder.

Preparing the lamb hotpot

1 Chop the lamb steaks into 2-centimetre cubes.
2 Place in a bowl and toss with the Moroccan spice mix. Set aside.
3 Peel the potatoes and carrot.
4 Cut the potatoes, carrot and zucchini into even-sized pieces, approximately 2 centimetres in size. Put zucchini aside.
5 Heat the oil in the pan, add the diced lamb and stir over a high heat until browned.
6 Add the finely diced onion and crushed the garlic. Sauté until lightly browned.
7 Add the potatoes and carrot and continue to stir over a medium heat for approximately 1 minute.
8 Add the tomato paste, stock, cracked wheat (or burghul), apricots and almonds.
9 Simmer gently for 30 minutes or until the lamb is tender. Stir occasionally to prevent the mixture from sticking to the bottom of the pan.
10 Add the chopped zucchini and coriander about 5 minutes before serving. Add salt to taste.

SERVES 2

EVALUATION

1 Describe the sensory properties of the Moroccan lamb hotpot – appearance, aroma, flavour and texture – and comment on the overall appeal of the dish.
2 What is the purpose of dry-frying the spices when preparing the spice mix for this recipe?
3 Why is it important to have the vegetables diced into even-sized pieces?
4 Why does the recipe recommend that you should stir the meat over a high heat? What would happen to the meat if you cooked it over a very low heat at this stage?
5 Identify the process that causes the meat to brown.
6 List and explain the main methods of heat transfer used in the preparation of this recipe.
7 Explain the main difference between simmering and boiling.
8 In this recipe the stewing process denatures the meat fibres. Describe the changes that occur to the lamb during the cooking process.
9 Describe two safety practices you followed to prevent cross-contamination when preparing this recipe.
10 Analyse the Moroccan lamb hotpot using the Australian Guide to Healthy Eating and explain how well this recipe meets the guidelines of this food selection model.

Moroccan lamb hotpot

Spinach and pine nut cannelloni

Wheat flour is the main structural component of the cannelloni. The preparation of the cheese sauce and the baking of the cannelloni also demonstrate the **gelatinisation** of starch. When making the cheese sauce, the starch gelatinises, creating a smooth and viscous mixture. During baking of the assembled cannelloni, the pasta gelatinises, using the liquid from the vegetable sauce. The Maillard reaction also becomes evident on the surface, creating a golden brown colour. The production of this recipe provides an opportunity to develop skills in several wet and dry cooking techniques. The recipe for spinach and pine nut cannelloni provides a wide range of important nutrients. The vegetables in both the tomato and mushroom sauce and the spinach and pine nut filling are a source of dietary fibre, vitamins C and B6, and the minerals iron and magnesium. The pine nuts are a source of protein and polyunsaturated fat. The ricotta cheese, tasty cheese and milk are all good sources of calcium, but the cheeses are also high in salt. The pasta provides a good source of carbohydrate.

TOMATO AND MUSHROOM SAUCE

2 ripe tomatoes
1 tablespoon oil
½ onion, finely diced
1 clove garlic, crushed
½ capsicum, diced
60 grams mushrooms, finely sliced
250 grams canned tomatoes
¼ cup tomato paste
½ teaspoon dried basil
¼ teaspoon oregano
½ teaspoon sugar

SPINACH AND PINE NUT FILLING

¼ cup pine nuts
125 grams frozen spinach, defrosted
200 grams ricotta cheese
1 egg
freshly ground black pepper

CHEESE SAUCE

30 grams butter
1½ tablespoons flour
200 millilitres milk
50 grams grated tasty cheese
2 sheets commercial fresh lasagne (from the refrigerator)
2 tablespoons grated parmesan cheese

METHOD

Making the tomato and mushroom sauce

1 Prepare the vegetables.
2 Plunge the tomatoes into boiling water. Leave for 20 seconds then remove and run under cold water. The skin should slip off the tomatoes easily.
3 Dice the peeled tomatoes.
4 Heat the oil in a saucepan and sauté the onion and garlic until translucent. Add the diced capsicum and cook for 3–4 minutes or until just beginning to soften.
5 Add the sliced mushrooms and sauté until tender.
6 Add the diced tomato, canned tomatoes, tomato paste, herbs and sugar.
7 Bring to the boil and simmer gently, uncovered, for 15 minutes or until the sauce thickens slightly. Stir regularly to prevent the sauce from burning.

Making the spinach and pine nut filling

1 In a small saucepan, gently heat the pine nuts until just beginning to brown. Stir occasionally. This will take only 1–2 minutes. No oil is needed because of their high fat content.
2 Squeeze as much moisture as possible from the defrosted spinach.
3 Mix the pine nuts, spinach, ricotta cheese and egg in a small bowl. Add a little black pepper to taste. Set aside until ready to assemble the cannelloni.

Making the cheese sauce

1 Melt the butter over a low heat. Stir in the flour, then remove from heat.
2 Gradually stir in the milk. Cook over low heat, stirring continuously with a wooden spoon until the sauce boils and thickens. Remove from the heat.
3 Add the cheese and stir until melted.

Spinach and pine nut cannelloni

4 If not using immediately, cover the top of the sauce with cling wrap to prevent a skin from forming on the surface.

Assembling the cannelloni

1 Preheat the oven to 200 °C.
2 Cut each lasagne sheet into three – this will make six cannelloni rolls.
3 Spoon half of the tomato and mushroom sauce into the base of an ovenproof dish (15 centimetres × 22 centimetres).
4 Place 2 tablespoons of the spinach and pine nut filling on one of the pasta sheets. Roll up lightly to form cannelloni. Repeat until all of the pasta sheets and spinach and pine nut filling have been used.
5 Place the filled cannelloni on top of the tomato sauce and cover with remaining tomato and mushroom sauce.
6 Cover with the cheese sauce and sprinkle parmesan cheese over the sauce.
7 Bake at 200 °C for 20–30 minutes.

SERVES 2

EVALUATION

1 Describe the sensory properties – appearance, aroma flavour and texture – of each component of the spinach and pine nut cannelloni: pasta, tomato and mushroom sauce, spinach and pine nut filling and cheese sauce.
2 Explain the purpose of sautéing the onion and garlic before adding the capsicum, when making the tomato and mushroom sauce.
3 Identify and describe the two wet methods of cooking used to make the tomato and mushroom sauce.
4 Suggest another method of browning the pine nuts other than heating them in a saucepan.
5 Identify and describe the thickening process used for preparing the cheese sauce.
6 What process is responsible for the browning of the cannelloni during baking? Describe how this process occurs.
7 Identify and describe four safe work practices you followed during production.
8 Plot the ingredients on a diagram of the Australian Guide to Healthy Eating and explain how well it meets the recommendations of this model.
9 What accompaniments could you serve with the spinach and pine nut cannelloni to improve the nutritional properties of this meal? Justify your recommendation.
10 List ingredients in this recipe that are produced using ethical and sustainable farming practices rather than conventional ingredients.

Lemon cake with citrus syrup

A combination of aeration methods – chemical and mechanical actions – are used to create a light texture in this cake. The golden brown colour and delicious aroma of the finished product are a result of the **Maillard reaction** and **dextrinisation** when exposed to dry heat during baking. According to the guidelines of the Australian Guide to Healthy Eating, cakes should only be consumed sometimes and in small amounts. This recommendation is based on the fact that cakes such as this lemon cake with citrus syrup are made with a high proportion of butter and caster sugar, and are therefore high in saturated fat and sugar. This recipe has the benefit of including ground almonds, which would increase the proportion of protein and monounsaturated fat in the cake.

CAKE MIXTURE

120 grams butter, softened

120 grams or ½ cup caster sugar

2 eggs

grated zest of 1 lemon

1 cup self-raising flour

35 grams or 2 tablespoons ground almonds

¼ teaspoon nutmeg

juice of 1 lemon

CITRUS SYRUP

1 lemon

1 orange

water to make up to ¾ cup liquid

½ cup caster sugar

METHOD

Making the cake mix

1 Preheat the oven to 180 °C.
2 Grease and line an 18-centimetre cake tin or use an aluminium foil container.
3 In a large bowl, cream softened butter and caster sugar until it resembles thickly beaten cream.
4 Gradually beat in the eggs until the mixture is light and fluffy. Stir in the lemon zest.
5 Sift the dry ingredients and fold into the mixture. Gently stir through the lemon juice.
6 Spoon the mixture into the prepared tin.
7 Bake for approximately 25–30 minutes until golden brown on top and firm to the touch.

Making the citrus syrup

1 Using a vegetable peeler, peel the lemon and orange thinly. Remove any pith with a vegetable knife.
2 Place the peel on a board and cut into very fine julienne strips.
3 Juice the fruit and place in a measuring jug. Add sufficient water to make ¾ cup of liquid altogether.
4 Place the juice and water and sugar in a small saucepan and stir over a low heat until the sugar is dissolved. Add the strips of rind and cook gently until the rind is tender.
5 Increase the heat and bring the syrup to the boil, uncovered, for 5 minutes or until the syrup has reduced and thickened slightly. If the syrup reduces too much, add a little more water and place a lid on the top of the saucepan.
6 When the rind is tender, remove the citrus syrup from the heat.
7 When the cake has cooked, turn it out onto a plate and prick the surface with a skewer.
8 Pour the hot syrup and rind over the cake and leave to soak for approximately 30 minutes.
9 Serve the cake warm with a dollop of thick cream.

SERVES 4–6

EVALUATION

1 Describe the appearance, aroma, flavour and texture of the lemon cake with citrus syrup and discuss how the following ingredients had an impact on the sensory properties of the cake:
   - butter
   - caster sugar
   - eggs
   - self-raising flour.
2 Discuss the contribution ground almonds make to the properties of the lemon cake with citrus syrup.
3 When making the citrus syrup, explain how you could tell if the sugar had dissolved completely.
4 Describe the method you used to zest the lemon for the cake. What safety precautions did you need to consider in this process?
5 Describe the tests you could have used to determine if the cake made by the creaming method is cooked.
6 Complete the table in relation to the lemon cake with citrus syrup.

FOOD SCIENCE TERMINOLOGY	INGREDIENT INVOLVED IN THE PROCESS	EFFECT OF THE PROCESS ON THE FINAL PROPERTIES OF THE CAKE
Coagulation		
Aeration – mechanical action		
Aeration – chemical		
Maillard reaction		
Dextrinisation		

7 How could you adapt this recipe by using different ingredients to alter the flavour of the cake?
8 Explain why health specialists recommend that we only eat cake occasionally?
9 Outline why some consumers would select to use free-range and/or organic eggs for the cake.
10 Discuss why using flour produced by organic farming methods would be more beneficial to the environment than flour produced from wheat grown traditionally.

Lemon cake with citrus syrup

Traditional flaky pastry

Flaky pastry is made by rolling the shortening between layers of dough. The result is a pastry with a dry texture that easily breaks into fine, flaky pieces after baking. This pastry is often used on the top of sweet and savoury pies. The online recipe for speedy flaky pastry is a quick alternative to making flaky pastry by the traditional method. Like other pastries, flaky pastry is high in fat and should only be eaten occasionally.

---

2 cups flour

pinch of salt

180 grams butter

⅔ cup iced water, approximately

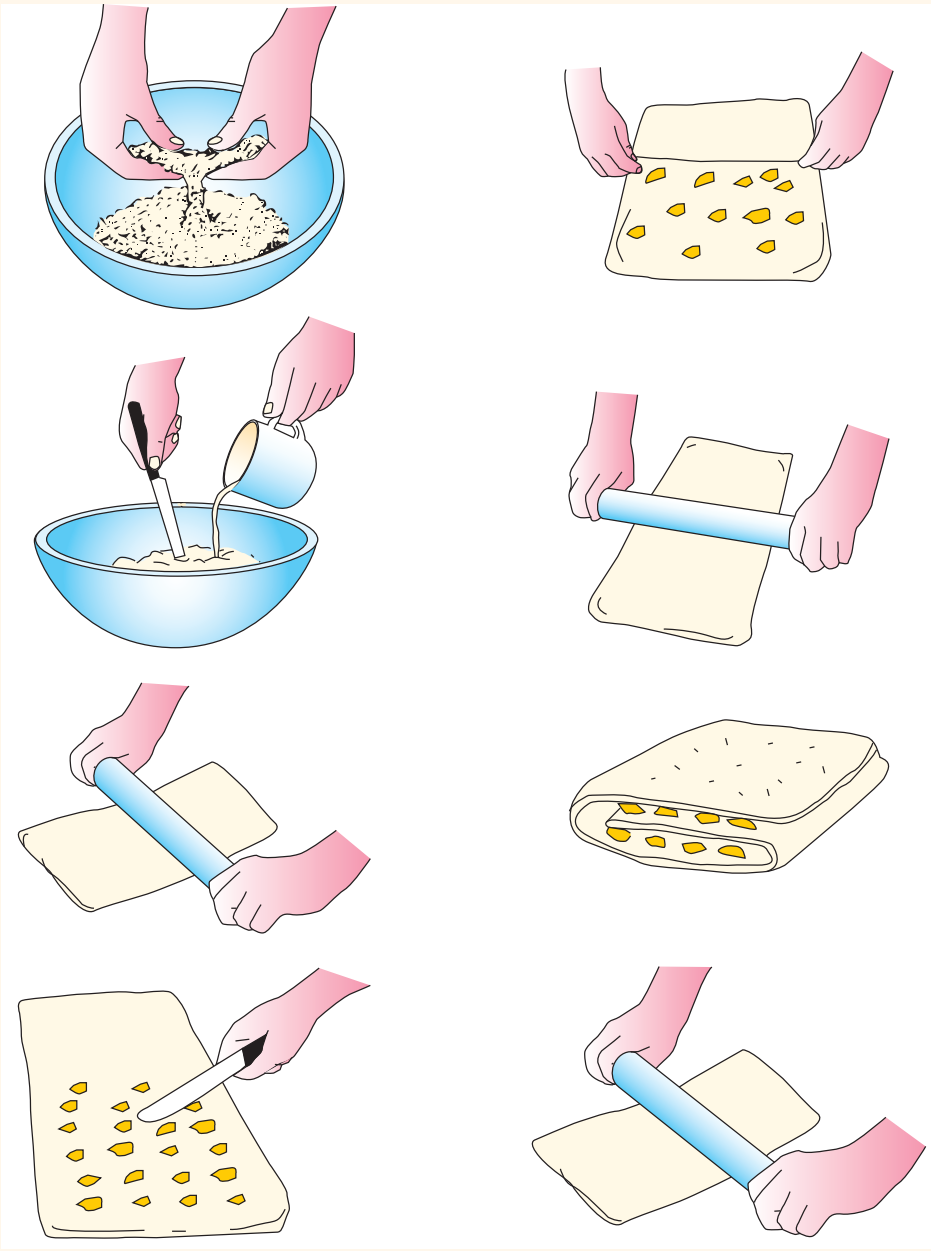
METHOD

1. Sift flour and salt. Add half (90 grams) of the butter and rub in until it resembles coarse breadcrumbs.
2. Add the water – use a metal spatula to mix the dough and finally bring it together with your fingers. Turn onto a lightly floured board and knead lightly until smooth, then shape into a rectangle.
3. Roll the dough into a rectangle, approximately 20 × 30 centimetres.
4. Soften the remaining butter so it is pliable, then divide the remaining butter in half. Cut butter into small pieces. Dot half of the remaining butter (45 grams) on the top two-thirds of the dough.
5. Fold the bottom third of the dough up and the top third down.
6. Seal edges by lightly pressing with the rolling pin.
7. Turn the dough round at right angles so that the top edge flap is to your right as if you were to open a book.
8. Flour board and roll dough into a rectangle 5 millimetres thick.
9. Repeat steps 4 to 7 with the last 45 grams of butter. Wrap dough in plastic and rest in the refrigerator for 30 minutes.
10. Roll out dough and rest again before cutting out and baking.
11. Bake in oven preheated to 230 °C.

This quantity of pastry will make two 18-centimetre rounds or 10–12 small pastries.

iStock.com/ajafoto

Mille-feuille uses flaky pastry.



Stages of making flaky pastry

EVALUATION

1 Identify the shortening ingredient in flaky pastry.
2 Describe the functional role of shortening in pastry.
3 Why is flour with low gluten content recommended for pastry making?
4 Butter is incorporated into flaky pastry in two ways – rubbing-in and dotting and folding. Explain how each method contributes to the aeration of the pastry.
5 Why is the process of folding the pastry repeated three times?
6 Why is the fold of the pastry rotated for each process?
7 In between each folding process the pastry is placed in the refrigerator. Why?
8 Outline why flaky pastry is usually only used on the top of a pie, not the base.
9 Explain why it is essential to make the flaky pastry in a cool work environment.
10 Suggest four products that can be made with flaky pastry.

Vanilla bean ice-cream

Ice-cream is a dessert that uses the process of freezing to create its unique sensory properties. During the freezing process, the mixture is agitated to keep the ice crystals small so the end product has a smooth texture and mouthfeel. When making the egg custard sauce for the base, it is thickened because of **coagulation** of the egg proteins, but care must be taken to prevent it from curdling during cooking. The vanilla bean ice-cream provides a source of protein found in the milk and cream. However, the cream and egg yolk are high in saturated fat, the egg yolk is high in cholesterol, and the recipe includes a significant proportion of sugar. Therefore, ice-cream should be considered a sweet treat and only eaten occasionally and in small amounts.

---

3 egg yolks

1 cup sugar

1 vanilla bean

1½ cups milk

2 cups cream, semi-whipped

METHOD

1 Beat the egg yolks and the sugar together using an electric beater.
2 Split the vanilla bean in half and scrape the seeds into the egg and sugar.
3 Gradually stir in the milk and add the vanilla bean.
4 Transfer the custard mixture to the top of a double boiler or a heatproof basin over a saucepan of simmering water, making sure the base does not touch the water.
5 Stir constantly with a wooden spoon until the mixture is thick enough to coat the back of the spoon and will separate when you run your finger down the back of the spoon.
6 Remove from the heat and allow to cool. Remove the vanilla bean.
7 When the custard mixture is cool, add the cream to the mixture and mix well.

Using an ice-cream maker

1 Refrigerate the mixture in a covered bowl overnight.
2 Churn according to the manufacturer's instructions until the ice-cream is thick.

Using the freezer

1 Pour the mixture into an airtight container, only filling the container two-thirds full, and freeze until almost set.
2 Transfer the mixture to a food processor and process until smooth.
3 Return to the freezer in the sealed airtight container and allow to refreeze overnight.

EVALUATION

1 Explain how a vanilla bean, an important ingredient in the ice-cream – contributes to the final sensory properties of the ice-cream.
2 Why are only egg yolks used in the ice-cream recipe and not the egg whites?
3 Describe the change in the properties of the egg yolk when it is denatured by beating in step 1.
4 Explain how a double boiler cooks food.
5 Why is using a double boiler the most suitable method of cooking an egg custard sauce?
6 Describe the test used to indicate if the egg proteins have coagulated sufficiently to thicken the egg custard sauce.
7 Why is the egg custard sauce overly sweet if taste-tested before freezing?
8 Explain why it is important that the cooked egg custard sauce is cooled before the whipped cream is added.
9 Why must the ice-cream mixture be churned during the freezing process?
10 Explain how consumers could adapt this recipe if they wished to use ethically or sustainably produced ingredients.

RECIPE INDEX

A

almonds
  Chocolate, pear and almond cake 354–5
  Dried apricot and almond conserve 331
apples
  Apple and custard filling 382
  Apple and ginger self-saucing pudding 376–7
  Apple Tart Tatin 338–9
  Caramelising apples 376
Asian slaw 380

B

bacon
  Summer quiche 358–9
  Vegetable frittata 322–3
beef
  Paprika meatballs 350–1
  Spicy meat filling 352
biscuits
  Gingernut biscuits 334
  Wholemeal chocolate biscuits 386–7
blueberries, Ruby red jam 328–9
boysenberries, Ruby red jam 328–9
bread/bread rolls
  Monkey bread 318–9
  Pide with cheese and spinach or spicy meat filling 352–3
  Sweet bread plait 382–3
broccoli, Spring vegetable pasta sauce 346
Broccolini and bean salad 347

C

cabbage
  Asian slaw 380
  Okonomiyaki with mayonnaise 342–3
  Spicy slaw 324
cakes
  Cake batter 332
  Chocolate, pear and almond cake 354–5
  Fresh ginger cake 332–3
  Lemon cake with citrus syrup 396–7
  Powder puffs 362–3
capsicums, 2C jam - capsicum and chilli 330
Caramelised hazelnuts 335
Caramelising apples 376
cheese
  Cheese sauce 394
  Cheese and spinach filling 353
  Lemon and ricotta steamed pudding 374
  Spinach and pine nut cannelloni 394–5
chicken
  Chicken, lemon and pea risotto 356–7
  Coconut chicken bowl 380–1
  Crispy chicken 380
  Middle Eastern chicken 366–7
  Steamed coriander chicken balls 384
  Sticky chicken wings 348
chillies, 2C jam - capsicum and chilli 330–1
Chinese cabbage, Steamed won tons 385
chocolate
  Chocolate, pear and almond cake 354–5
  Japanese-style curry 388–9
  Wholemeal chocolate biscuits 386–8
Choux pastry 340–1
Citrus syrup 396
Coconut chicken bowl 380–1
Coconut rice 380
Coriander chicken balls 384
crêpes, Lemon soufflé crêpes 360–1
curries, Japanese-style curry 388–9

D

Dhal 372–3
Dipping sauce 384
dressings 347, 380, 324, 326
  Mayonnaise 342
Dried apricot and almond conserve 331

E

eggplant, For eggplant and lamb sauce 378–9
Eggs Florentine 320–1

F

For eggplant and lamb sauce 378–9
Free-form pumpkin tart with olive oil pastry 390–1
freekeh, Grain and lentil salad with salmon and fennel 368–9
Fresh berry mousse 364–5
Fresh pasta 344–5

G

Gingernut biscuits 334
Grain and lentil salad with salmon and fennel 368–9
green beans, Broccolini and bean salad 347

H

hazelnuts, Caramelised hazelnuts 335

I

ice-cream, Vanilla bean ice-cream 400

J

jams
  2C jam - capsicum and chilli 330
  Dried apricot and almond conserve 331
  Ruby red jam 328–9
Japanese-style curry 388–9

L

lamb
  For eggplant and lamb sauce 378–9
  Moroccan lamb hotpot 392–3
lemons/lemon juice
  Chicken, lemon and pea risotto 356–7
  Lemon and ricotta steamed puddings 374–5
  Lemon cake with citrus syrup 396–7
  Lemon curd 336
  Lemon icing 332
  Lemon soufflé crêpes 360–1
  Mini lemon tarts 336–7

lentils
Dhal 372–3
Grain and lentil salad with salmon and fennel 368–9
Lentil soup 370–1

M

marinades 324, 348
Mayonnaise 342
meatballs, Paprika meatballs 350–1
meringues, Mini meringues 336
Middle Eastern chicken 366–7
Mini lemon tarts 336–7
Mini meringues 336
Monkey bread 318–9
Moroccan lamb hotpot 392–3
Moussaka 378–9
mousse, Fresh berry mousse 364–5
mushrooms
Mushroom sauce 350
Spring vegetable pasta sauce 346
Tomato and mushroom sauce 394

O

Okonomi sauce 342–3
Okonomiyaki with mayonnaise 342–3

P

pancakes, Okonomiyaki with mayonnaise 342–3
Paprika meatballs 350–1
pasta
Fresh pasta 344–5
Spinach and pine nut cannelloni 394–5
Spring vegetable pasta sauce 346
pastry
Choux pastry 340–1
Olive oil pastry 390
Shortbread pastry 336
Sour cream pastry 358
Traditional flaky pastry 398–9
pears, Chocolate, pear and almond cake 354–5
peas
Chicken, lemon and pea risotto 356–7
Spring vegetable pasta sauce 346
Vegetable frittata 322–3
Pide with cheese and spinach or spicy meat filling 352
Plain rice 387
pork
Paprika meatballs 350–1
Steamed won tons 385
Teriyaki pork cutlets and Spicy slaw 324–5
potatoes
Moroccan lamb hotpot 392–3
Vegetable frittata 322–3
Powder puffs 362–3
puddings
Apple and ginger self-saucing pudding 376–7
Lemon and ricotta steamed puddings 375–6
Pudding batter 375
pumpkin, Free-form pumpkin tart with olive oil pastry 390–1

R

raspberries
Fresh berry mousse 364–5
Ruby red jam 328–9
rice
Chicken, lemon and pea risotto 356–7
Coconut rice 380
Plain rice 387
risotto, Chicken, lemon and pea risotto 356–7
Ruby red jam 328–9

S

salads
Broccolini and bean salad 347
Grain and lentil salad with salmon and fennel 368–9
Salmon and fennel 368
sauces
Cheese sauce 394
Curry sauce 388
Dipping sauce 384
Mushroom sauce 350
Okonomi sauce 342–3
Spring vegetable pasta sauce 346
Tomato and mushroom sauce 394
Shortbread pastry 336
snow peas
Broccolini and bean salad 347
Spring vegetable pasta sauce 346
soups
Lentil soup 370–1
Sour cream pastry 358
Spicy meat filling 352
Spicy slaw 324
Spinach and pine nut cannelloni 394–5
Spring vegetable pasta sauce 346
Steamed coriander chicken balls 384
Steamed won tons 385
Sticky chicken wings 348
Summer quiche 358–9
Sweet bread plait 382–3

T

tarts
free-form pumpkin tart with olive oil pastry 390–1
Mini lemon tarts 336–7
Teriyaki pork cutlets and Spicy slaw 324–5
toffee, Caramelised hazelnuts 335
tomatoes
Spicy meat filling 352
Spring vegetable pasta sauce 346
Summer quiche 358–9
Tomato and mushroom sauce 394
Traditional flaky pastry 398–9
2C jam – capsicum and chilli 330

V

Vanilla bean ice cream 400
Vegetable frittata 322–3

W

Wholemeal chocolate biscuits 386–7
won tons, Steamed won tons 385

Y

Yeast dough 352, 382

Z

zucchini
Moroccan lamb hotpot 392–3
Vegetable frittata 322–3

INDEX

A

absorption
  carbohydrates 14
  fats 16
  nutrients 12–13
  proteins 16
academic articles 283, 284–5
access to food 176
  improving equity in 176–9
accommodation, and food choice 103–4
accuracy of information 284
accurate analysis of data 285
acetic acid 68
acidity
  changes 66
  and temperature of egg white coagulation 74
acids 67–8
  effect on eggs 75–6
  effect on fish 80
  effect on meat 78
  effect on milk 81
  effect on starches 87
  effect on sugar 84
  as raising agents 71
activators 83
  adolescents *see* teenagers
adulthood, dietary needs 32
Advergames 129
advertising 126
advisory statements (food labels) 302, 303, 311
aeration 66, 67, 70–2, 334, 354, 362
  eggs 76–7
  fats role in 90
  sugar effects 84
aerial spraying 211, 212
agricultural chemicals 210–13
agricultural subsidies 175
agriculture 148
  Asian and African small-farm holders 177–8
  biogas systems 183–4
  building the capacity of women 178–9
  challenges in Australia 236
  drone use 181
  environmental sustainability 210, 211–12, 216–23
  genetic modification technology 184
  mobile technology use 180–1
  production *see* primary food production
  solar power use 181–3
  water use 214–18
air pollution 211
Albury/Wodonga community oven 113
alcohol 20, 29
Aldi supermarkets 102–3, 200, 203
alkalis 68–9, 334, 386
  as raising agents 71
all-in-one kitchen machines 105
allergies
  from foods 35–6
  information for consumers with (food labels) 311
amino acids 10, 11, 14, 15, 16, 72–3
ancient grains 98–9
animal welfare, consumer concerns 188–97
antioxidants 69
apartment-style living 104
appearance of food 5
appendix 11
appetite 4
apple industry, threats from exotic diseases 225–6
apps 137–8, 139, 200, 298
aquaculture 198–9, 228
  Ararat, *The Biggest Loser* program 281–2
Arnott's Butternut Snap biscuits 143
aroma 5–6
aseptic packaging 260
Asia
  advancing small-scale farmers 178
  improving food distribution methods 180
Atkins Diet 108
atmospheric steamer 61
augmented reality (AR) 129–30
Australia New Zealand Food Standards Code 302
  compulsory information on food labels 302–4
  health claims 308–9, 310
  nutrition content claims 307–8
Australian diet 22
Australian Dietary Guidelines 20, 22, 23–31, 101, 287
  Dietary Guideline 1 23, 24, 290
  Dietary Guideline 2 23, 24–9, 290, 293
  Dietary Guideline 3 23, 29–30, 296
  Dietary Guideline 4 23, 30–1
  Dietary Guideline 5 23, 31
  practical ways to apply in everyday life 294–8
  research underpinning 282–3
Australian Grains Genebank 231
Australian Guide to Healthy Eating 20, 22, 25–9, 101, 294, 310
  discretionary foods 29–30
Australian Healthy Food Guide 134, 135
Australian International Food Security Centre (AIFSC) 177, 178
Australian Portion Perfection plate 295
author and source of information (articles) 283–4, 286

B

Bacillus cereus 42, 43
bacteria
  causing food poisoning 42, 43, 44, 45–6
  growth conditions 41, 44–6
  probiotics 11–12
  role in digestion 11
  toxins 42, 43
baked custards 75
baked products, fat effect on texture 90
baking 55, 57, 85
  eggs 74–5
  foods suitable for 57
  milk with eggs 81
  safety practices 57–8
  use in recipes 318, 368, 378, 394, 398
banana industry, threats from exotic diseases 224
barbecuing 56
barcodes (food labels) 305
barley stripe rust 226
barn-laid eggs 189
Basal Metabolic Rate (BMR) 31

bases 68
beating 72, 82
beef production 220–2
  and climate change 228–9
  ethical beef products 195
  ethical issues 194–5
  feedlot cattle 194–5
  pasture-fed cattle 195
'best-before' date 303
bicarbonate of soda 68, 69, 71
Bifidobacterium 11
binary fission 45
biodegradable herbicides 210
biodiversity 230, 246
  and GM crops 241
  importance to primary food production 230
  threats to 230–1
biofuel production
  impact on food security 174–5
  reforming mandates 176–7
biogas systems 183–4, 270, 271
biological raising agents 70–1
biomarkers 308
BioPak, case study 263
bioplastic packaging 262–3
biosecurity 224
  on Australian farms 226–7
  and imported pests and diseases 224–6
blanching 57, 60, 345
blogs 141–2
blue-green algae 221
blueberries 98
body image 114–15
  in children 115–16, 120
  impact on health 115
  negative/positive 109, 115
boiling 55, 57, 60
  eggs 75
  foods suitable for 60
  milk 80
  starch 86–7
  use in recipes 346, 348, 350, 368, 370, 373
bottom trawling 198
bread making
  climate change effects 229–30
  GM wheat effects 241–2
bread 'wars' (supermarkets) 203
breakfast, importance of for children 163
breakfast alternatives 99–100
breastfeeding 30–1, 33
bycatch 196

C

Campylobacter 42
cancer 21, 23, 24, 26, 27, 29, 101
canola, GM 237
caramelisation 66, 67, 84
  use in recipes 335, 338, 348, 376
carbohydrates 13, 14, 82
  absorption and utilisation 14
  energy from 13, 14
  types of 13–14, 83
carbon dioxide 71, 267, 268
carbon footprint 254, 258
cardiovascular disease 21, 22, 23, 24, 27, 28, 101
cartoon characters 128–9
cassava, GM crops 184
cattle feedlots 194
cattle production 220–2
  see also beef production
celebrity chefs 135
cereal crops, threat from exotic diseases 225
Chattable 112
cheese 28
chemical digestion 8–9
chemical raising agents 71
chewing food 8, 10
chia 98–9
chicken meat production
  and climate change 229
  consumer concerns 190
  ethical products 191–2
  free-range 189–90, 191–2
  intensive 189
  organic 190
childcare centres, meals in 165
children
  body image 115–16, 120
  comfort eating 120
  dietary needs 32
  dietary supplements for 293–4
  establishing healthy diets in 162–6
  exposure to new foods and flavours 164–5
  food insecurity 171–2
  fruit drinks vs soft drinks 166
  importance of breakfast 163
  involvement in preparing family meals 164
  involvement in shopping 163–4
  marketing to 128–30, 278
  mealtimes 162–3
  modelling healthy eating patterns 162–4
  repetition in developing healthy food habits 165–6
  talking and learning about food 163
Chobani yoghurt 142
chocolate, Fairtrade 202–3
Choice (consumer organisation) 134, 137, 156, 189
choosing this food again 8
citric acid 68, 69
cleanliness of premises 47
climate change 227
  effect on Australian agricultural and livestock production 227–8
  effect on Australian food supplies 228–9
  impact on your loaf of bread 229–30
Clostridium perfringens 42
coagulation 67, 73
  egg protein 74
  meat protein 78
  use in recipes 320, 322, 336, 400
cocoa, Fairtrade 202–3
coeliac disease 36–7, 288
Coles Supermarkets 135, 139, 190, 194, 200, 203, 256, 270
collagen 77, 78
colon 11
colour
  of food 5
  use in marketing 127
comfort eating 119–20
commercial fishing practices 197–8
communities
  cultural events 113–14
  responses to food information 279–82
  sharing and celebrating food 112–14
complete proteins 15
conduction 54, 55
connectedness 110–11
connective tissue, cooking effects 78
consumer organisations and advocacy groups 134
  see also Choice (consumer organisation)
consumers 125, 151
  advantages of accurate food labelling information 309–11
  with allergies, information for 311

concerns about animal welfare 188–97
concerns about GM foods 240
ethical principles 188
and the health halo effect 311–12
convection 54, 55
cooking food, reasons for 54
cooking methods (heat transfer) 52, 54–6
cooking shows 135
cooking techniques 57–62
dry methods 52, 54, 55, 57–9
moist methods 52, 54, 55, 57, 59–62
cooktop, safety practices 61–2
coronary heart disease (CHD) 17
country of origin 99
on food labels 304, 311
coverage of the information (articles) 284
cream of tartar 71
creaming 72
crop rotation 244–5
crops and cropping 148, 210, 211
and climate change 228
spraying impact on environmental sustainability 211–12
sustainable 218–20
cross-contamination, preventing 49
CSIRO Total Wellbeing Diet 288
cultural influences in food choices 100, 106, 151
curdling 75, 76, 83
currency of information (articles) 284
custards 75, 76, 81
cyclones 227, 228, 229

D

daily eating habits of Victorians 152–3
dairy cattle 222, 228
data collection and targeting (by supermarkets) 139
date marking (food labels) 303
declarations (food labels) 302, 303
deep-frying 59
denaturation 67, 73
eggs 74, 76
meat protein 78
use in recipes 322, 324, 326, 348, 360, 366, 392
design of premises 47
dextrinisation 66, 67, 85–6, 89
use in recipes 318, 320, 354, 396
diet-related diseases 21, 22, 23
Dietary Guidelines see Australian Dietary Guidelines
dietary requirements across the life span 31–4
dietary supplements for children 293–4
digestion 8–9, 19
digestive process 9–11
digital marketing 137
data collection and targeting 139
location-based marketing using geolocation techniques 138–9
smartphones and tablets 137–9
directions for use and storage (food labels) 303–4
disaccharides 13, 83, 86
disadvantaged 103, 114
discretionary foods 29–30, 162
diseases
exotic 224–6
lifestyle 22, 23
see also specific types, e.g. cardiovascular disease
disordered eating 116
Domino's Pizza, innovative technologies 138
Dorper sheep 222–3
drones, use in agriculture 181, 212
droughts 227, 228, 231, 240
dry-frying 59
dry heat
for cooking eggs 74–5
for cooking fats and oils 89–90
for cooking sugar 84
effect on starch 85–6
dry-land salinity 216
dry methods of cooking 42, 54, 55, 57–9
Dukan diet 108, 117
duodenum 10

E

early learning centres, meals in 165
easy-to-cook food products 104–5
Eat For Health Program 23
eating patterns in Australia 94
education
about food 276, 277
and food choices 101–2
egg production
barn-laid eggs 189
and climate change 229
consumer campaigns 190–1
consumer concerns 190
ethical products 191–2, 311
free-range eggs 189–90, 191
intensive 188–9
organic 190, 191, 192
egg white foam 76
egg yolks 76
eggs 27–8, 73–7
acid effects 75–6
aeration 76–7
baking 74–5
coagulation 74
denaturing during food preparation 74, 76
dry heat for cooking 74–5
emulsification 76
in food preparation and cooking 73–4
frying 75
moist heat for cooking 75
structure 73
elastin 77
electromagnetic radiation 56
emotional consequences of restrictive diet 118
emotional eating 119–20
emotional roles of food 110
emulsification 67
using eggs 76
using oils 90
emulsions 76, 90, 326, 342
permanent 90
temporary 90, 346
energy, from carbohydrates 13, 14
energy balance, and overweight/obesity 154
energy-dense foods 23
energy requirements 21, 34
energy use, food processing industry 254–5
enjoyment of food 7–8
Entertainers (market segment) 95
environment
impact of food packaging on 259–66
impact of food procession on 254–8
impact of food waste on 269
impact on overconsumption of food on –8
possible impact of GM foods on 240–1
environmental effects of food transportation 267–8

environmental sustainability
agricultural water use 216–18
animals 220–3
crop spraying 211–12
crops 218–20
primary food production 210, 216–23
enzymatic browning 69
enzymatic hydrolysis 9, 10
enzymes 69
effect on meat 79
found in fruit and vegetables 69–70
found in yeast 70
role in digestion 9, 10, 11
essential amino acids 14, 15
ethanol, as biofuel 176, 177
ethical principles for Australian consumers 188
ethical products
beef 195
choices based on country of origin 311
dietary supplements for children 293–4
Fairtrade 202–3
meal-replacement shakes 291
moral satisfaction with 204–5
pork 194
poultry and eggs 191–2, 311
seafood 199–200
weight-loss programs 290
evidence-based information 285
exotic pests and diseases 224–6
eyes 9

F

Facebook 140–1
fad diets 287
fair price for farmers' products 203–4
Fairtrade 202–3
benefits 202
cocoa and chocolate 202–3
products 203
families
responses to food information 276–9
as role models for eating behaviours in children 162–4
family gatherings 110–11
farm biosecurity 226–7
farmers' markets 99
farmers' products
fair price for 203–4
online 204
farming practices and sustainability 210, 218–23
fast-food outlets 103, 111
fast weight-loss diets based on 'low carbs' 288
fats and oils 16, 88–90
absorption and utilisation 16
aeration effects 90
in the diet 29–30
dry heat for cooking 89–90
effect on texture of baked products 90
functional properties 89–90
in meat, cooking effects 78
role in retaining freshness 90
types of 16, 17
fatty acids 11, 16, 88, 89
feedlot cattle 194–5
Ferguson Plarre Bakehouses, sustainability, case study 256–8
fermentation 71
fertilisers 210, 211, 212, 217, 246, 272
run-off impact on Great Barrier Reef 213
fibre 14
fire blight 225–6
fish 25, 27–8, 79–80
acid effects 80
cooking 79–80
ethical products 199–200
structure 79
fish aggregating devices (FADs) 197, 200
fish production
aquaculture 198–9, 228
commercial fishing practices 197–8
sustainable 196, 198–9
Fitzroy soup van 114
five food groups 24–5
basing food selection on 294–5
flavour 6
floods 229
FODMAP intolerance 38
folding 72
food, why we eat it? 4
food acids 68
food additives 311
food allergies 35–6, 311
food availability 176
and climate change 228–9
and overweight/obesity 154–5
food behaviours and habits, improving everyday 296
food choice *see* food purchasing and consumption
food consumption *see* food purchasing and consumption
food contamination
preventing 46–8
through cross-contamination 49
food distribution
in Australia 148, 150
improving distribution methods 179–80
food education 101–2, 276, 277
food fads 287–8
food information
analysing a newspaper article 285–6
assessing a scholarly article 284–5
community responses to 279–82
individual and family responses to 276–9
validity 283–4
food insecurity 171–2
global 172–84
food intolerances 35, 36–8
food labelling
advantages of accurate information for consumers 309–11
in Australia and New Zealand 300–6, 307–9
exceptions to 306
and food safety 309–10
and guidance for healthy food choices 310
and the health halo effect 311–12
misleading, case example 313–14
food labels
compulsory information on 302–4
health claims 308–9, 310
Health Star Rating 102, 305, 310
information that must not appear on 306
nutrition content claims 307–8, 310
optional information on 305
use of words on 312
food market segments 95–6
food marketing *see* marketing
food miles 268
food packaging and the environment 259–66
food poisoning 31, 42, 50
bacteria 42, 43, 44, 45–6
high-risk foods 45–6
microorganisms involved 42
preventing 46–9

toxins 42, 43
viruses 42, 43
food processing industry 148
energy use 254–5
impact on the environment 254–8
minimising food waste 269–72
water use 255–6
food promotion 124
food purchasing and consumption
in Australia 148, 150–1
by market segment 95–6
changing face of breakfast 99–100
country of origin of foods 99, 304, 311
cultural influences 100, 106, 151
preventing food contamination 48
social factors influencing 100–6
trends 95–6, 97–9, 288
food rescue 270
food retailers
energy use 255
see also supermarkets
food safety, and food labelling 309–10
food security 171
biofuel production effects 174–5
by advancing Asian and African small-farm holders 177–8
contribution of technologies to 180–4
four pillars of 176
natural disaster effects 172–3
and poverty 175
solar energy to improve 181–3
through building the capacity of women 178–9
through improved food distribution methods 179–80
war and displacement of populations effects 173
food security risk index 170
food spoilage 42
Food Standards Australia and New Zealand (FSANZ)
Australia New Zealand Food Standards Code 302–4
health claims 308–9, 310
nutrition content claims 307–8
food systems 148
in present-day Australia 148–51
for wheat 149
food transportation 266–7
environmental effects 267–8
food trends 95–6, 97–9, 288
food vans, for disadvantaged 114
food wastage 173–4
food waste 268–9
diverting solid food waste from landfill 272
environmental problem of 269
industry strategies to minimise 269–72
food-borne illness 42, 49–50
foot-and-mouth disease 224–5
four pillars of food security 176
'4 Ps' of marketing 125
free-range eggs 189–90, 191
free-range pork production 193
free-range poultry 189–90, 191–2
fresh fruit, Australia's love of 97–8
freshness, maintaining 90
fructose 13, 83, 84
fruit 24, 25, 26
fruit juice 26
frying 55, 57, 58
eggs 75
fats and oils 89–90
foods suitable for 59
methods 59
safety practices 59
smoke point 58
functional foods 96
functional properties
fats and oils 89–90
food 66
proteins 73–82
starches 85–8
sugars 83–4
future crops 220

G

galactose 13, 83
gall bladder 11
gamification 129
garbage 47
gelatin 70, 77
gelatinisation 67, 86–7
experiment 87–8
use in recipes 340, 344, 387, 394
gender, and dietary needs 34
general level health claims (food labels) 308
genetic diversity
loss of 231
and transgenic crops 241
genetic pollution 240
genetically modified (GM) food production 184, 236
advantages 239–40
challenges 240
characteristics 236–7
GM food crops 237–9
possible impact on the environment 240–1
statement on food labels 302–3
transgenic organisms 237
global food insecurity
causes 172–5
solutions 176–84
glucose 13, 14, 83, 84
gluten 81
kneading a dough 81–2
gluten-free biscuits, comparison with wheat-based chocolate biscuits 37–8
gluten-free debate 288
gluten intolerance 36–7
glycaemic index (GI) 5, 13, 310
glycerol 11, 16, 88
glycogen 14
GM canola 237
GM food crops 239
GM potatoes 238
GM rice 184, 238–9
GM wheat 241–2
goat production and sustainability 223
Golden rice 238–9
Gourmet Chick, case study 141–2
government programs supporting healthy eating 101
graduated steamer 61
grain (cereals) 25, 26–7
grazing 148
Green Light, Eat Right project 280–1
greenhouse gases 220, 221, 222, 254, 257–8, 260, 261, 262, 267, 268
grilling 56, 57, 58, 85, 322, 378
foods suitable for 58
safety practices 58
groundwater contamination 212–13

H

Hakubaku organic noodles 247–8
halo effect 311–12
health claims (food labels) 308–9, 310
health halo effect 311–12
health information news reportage 133
health of Australians 22–3
health-promoting eating behaviours 101
Health Star Rating (food labels) 102, 305, 310

health trends (food purchasing and consumption) 97
health washing 311
healthy eating
  community projects 280–1
  consumer interest in 151
  education about 101–2
  establishing in children 162–6
  magazines and promotions 133–4
  quiz 24
Healthy Eating Pyramid 101
healthy food choices, and food labelling 310
healthy lifestyle campaigns 278–80, 281–2
Healthy Together Communities 279–80
Healthy Together Victoria 279
healthy weight, maintaining a 24
heart disease 26, 29, 30
heat transference to food 52, 54–6
Heinz Gluten Free Pasta 139–40
hepatitis A 43
herbicide resistance 213
herbicides 210, 211, 214, 239, 241, 246
heritage animals 231
high-carbohydrate foods 5
high-density lipoproteins (HDL) 16
high-fat foods 5
high GI foods 13
high level health claims (food labels) 308–9
high-protein foods 5
high-risk foods (food poisoning) 45–6
homelessness 104
House proud category (market segment) 95
hunger 4
hydrolysing 87

I

ileum 10
immigrants 106, 113, 151
income, and food choices 102–3
incomplete proteins 15
Indigenous communities 103
individual identity 110
  and emotional roles of food 110
  and social roles of food 110–12
infancy and early childhood, dietary needs 31–2
infrared radiation 56
ingredients listing (food labels) 303
insoluble fibre 14
Instagram 137, 142–3
insulin 11, 14
integrated marketing 130, 139–40
  case example 130–2
intensive animal farming 188
  beef cattle 194–5
  pigs 192–3
  poultry 188–9
intestinal tract
  microbiology 11
  probiotics and prebiotics role 11–12
intolerances *see* food intolerances
irrigated-land salinity 216
irrigation use, primary food production 214–15, 216, 217

J

jejenum 10

K

kale 98
kidney disease 21
kilojoules 23
Kitchen Garden Program 101
kneading a dough 81–2

L

lactation 33
Lactobacillus 12
lactose 10, 13, 83
lactose intolerance 37
lamb marketing, case example 130–2
large intestine 11
late adulthood, dietary needs 33
lean meats, poultry and fish 25, 27–8
legume protein, beating 82
legumes 24, 25–6
Lemon Detox Diet 18, 117
life span, dietary requirements across the 31–4
lifestyle diseases 22, 23
Listeria monocytogenes 42, 43
listeriosis 43
Lite n'Easy (weight-loss program) 290–1
LiveLighter campaign 278–9
liver 11
Liver Cleansing Diet 108, 117
livestock industry
  and climate change 227, 228–9
  threats from exotic diseases 224–5
location, and food choice 103
location-based marketing using geolocation techniques 138–9
longline fishing 197–8
looking at food before it is eaten 7, 9
lot identification (food labels) 302
low-acid environment, for bacterial growth 46
low cost supermarkets 102–3
low-density lipoproteins (LDL) 16
low GI foods 5, 13
low-impact farming 236, 242–5
low-risk foods (food poisoning) 46

M

macronutrients 3, 12
  absorption and utilisation 12–13
  carbohydrates 13–14
  fats 16
  proteins 14–16
magazines 133–4
Maillard reaction 66, 67, 81, 82, 86, 89
  baking of eggs 74, 75
  baking of sugar 84
  meat cooking 78
  use in recipes 318, 348, 354, 366, 394, 396
main meals
  drivers for choices 95
  planning 94
maltase 70
maltose 10, 13, 83
mandatory warnings (food labels) 302–3, 311
market instability 175
market research 125
marketing 124
  advertising use 126
  influence on food choices 125–6
  integrated 130–2
  process of 124–5
  techniques 127–30
  to children 128–30, 278
marketing mix 125
markets, types of 125
MasterChef 135
mayonnaise 90
meal planning 94, 295, 296
meal-replacement shakes 291–2

meals
  consumption trends 95–6, 97–9, 288
  drivers for main meal choices 95
  eaten at home 94
  preparing for different needs 95
mealtimes, modelling eating behaviours 162–3
meat 25, 27–8, 77–9
  acid effects 78
  cooking 78
  enzyme effects 79
  mechanical action effects 78
  structure 77
  tenderness 77–8
Meat & Livestock Australia, integrated approach to marketing lamb 128–30
meat tenderising 78, 79
mechanical action 66, 72, 354, 360
mechanical digestion 8
mechanical raising agents 72
media
  news reportage 133–4
  popular culture 134–6, 283
  role in shaping food information 124
  social media 136–43
medium GI foods 13
'meet-ups' at fast-food outlets 111
messina 220
methane 220, 221, 222
metropolitan areas, and food choice 103
microbiology of the intestinal tract 11–12
micro-targeting 139
microwave cooking 56, 62
milk 25, 28, 80–1
  acid effects 81
  cooking with 80–1
  effect on other foods 81
milk 'wars' (supermarkets) 203
mindless eating 153, 155
mobile technologies
  use in agriculture 180–1
  use in marketing 137–9
modelling healthy eating patterns for children 162–4
modified atmosphere packaging (MAP) 259–60
moist heat
  for cooking eggs 75
  effect on starch 86–7
moist methods of cooking 52, 54, 55, 57, 59–62
moisture
  absorption by starch 85
  for bacterial growth 45
  retention by sugars 83
monosaccharides 13, 83, 84
monounsaturated fats 16, 29, 30
moral foods 204–5
mouth 10
Murray-Darling Basin 215, 216, 227
muscle fibre, cooking effects 78
myosin 77

N

name and business address of supplier (food labels) 302
National Health and Medical Research Council (NHMRC) 22, 282, 283
National Healthy Canteens Project 101
natural disasters, impact on food security 172–3
negative body image 109, 115
new foods and flavours, exposure of children to 164–5
news reportage 133–4
newspaper articles 134, 283
  analysing 285–6
niche markets 125
no-till farming 242–3
non-essential amino acids 14
nose 9
nutrient supplement companies, analysing claims by 288–9, 292–4
nutrient supplements 292
nutrients 4, 10, 12–13
  see also macronutrients
nutrition content claims (food labels) 307–8, 310
nutrition information (food labels) 303

O

oats 98
obesity 22, 24, 27, 29, 101, 151
  in Australia 158
  causes 153–5
  definition 154
Obesity Policy Coalition 134, 136, 166
objectivity of the information (articles) 284
oesophagus 10
oil-in-water emulsions 90
  oils *see* fats and oils
oily fish 79
Old-fashioned cooks (market segment) 96
olfactory cells 6
Oliver, Jamie 135
online farm products 204
online food ordering systems 105
organic chicken meat and egg production 190, 191, 192
organic food production and products 201–2, 245
  advantages 246
  case study 247–8
  challenges 247
  characteristics 245–6
outdoor bred – indoor raised pork 193
oven, testing your 55–6
overconsumption of food 151–2
  impact of environment on 155–8
overweight, causes of 153–5
oxygen supply, for bacterial growth 46

P

packaging 259
  environmental advantages/disadvantages 261–2
  plastic, making it greener 262–3
  sizes 157
  types of 259–60
packaging waste, minimising 264–6
paddock to plate 266, 267, 268
Paleo Diet 108, 117
pan-frying 55, 59, 346, 366
Panama disease 224
pancreas 11, 14
parents, as role models for eating behaviours in children 162–4
pasta, cooking 87
pasture cropping 243–4
pasture-fed cattle 195
pasture legumes 220
pathways to purchase 143
pear industry, threats from exotic diseases 225
pectin 70, 84
peer groups 111, 276–8
percentage of the characterising ingredients (food labels) 303, 311
permanent emulsions 90
personal hygiene 46–7
pest control 47–8, 247
pesticides 210–11, 212, 214, 239, 246

pests, exotic 224
pet food 272
pH changes 87
pH levels of food 69
pH scale 67–8
physical activity 24
  and dietary needs 34
  lack of 151–2
  and sedentary behaviour 159–61
  see also healthy lifestyle campaigns
physical consequences of restrictive diet 118
place 125
plastic packaging, making it greener 262–3
plastic shopping bags 264
poaching 57, 60, 328
  foods suitable for 60
pole-and-line fishing 199, 200
Polish Festival 113–14
polysaccharides 13–14
polyunsaturated fats 16, 29–30
popular culture 134–6
popular magazines and articles 133–4, 283
popular periodicals 283
pork production 192
  and climate change 229
  ethical products 194
  free-range 193
  intensive 192–3
  outdoor bred – indoor raised 193
portion control plate 295
portion sizes 155–7
positioning of food in supermarkets 157
positive body image 109, 115
potatoes, non-browning 238
poultry 25, 27–8, 79
  cooking 79
  structure 79
  see also chicken meat production
poverty, and food security 175
prebiotics 12
pregnancy, dietary needs 32
premises, design and cleanliness of 47
pre-prepared meals 104, 150
prescribed name of the food (food labels) 302
pressure cooking 57
preventing
  cross-contamination 49
  food poisoning 46–9
price 125
primary food production
  in Australia 148–50
  biodiversity role 230
  chemical use and impacts 210–13
  irrigation use 214–15, 216, 217
  organic products 201–2
  sustainable animal production 220–3
  sustainable crop production 218–20
  water use 214–18
  see also specific foods, e.g. pork production
probiotics 11–12
processes that cause changes during food preparation and cooking 67
product 125
product marketing 124–5
promotion 125–6
properties of food 66
proteins 14, 72–82
  absorption and utilisation 16
  daily requirements 15
  eggs 73–7
  function 14, 15
  functional properties 73–82
  meat 77–9
  milk 80–1
  in plant foods 81–2
  poultry 79
  seafood 79–80
  types of 15
  what are they? 72–3
psychological consequences of restrictive diet 118
purchasing food see food purchasing and consumption
purse-seine nets 197
putting food in your mouth 7

Q

quantity measures (food labels) 304, 310
quinoa 99

R

radiation 54, 56
rainfall, and climate change 227–8
ready-to-cook meals 104, 150
reality television 135
recycling 261, 265, 266, 272
reduce, refuse, reuse, recycle (packaging waste) 264–6
reducing packaging waste 264
refrigeration 48, 255
refugees 106
refusing single-use plastic shopping bags 264
reliability of information (articles) 283
remote rural areas, and food choice 103
renewable energy production 270–1
repetition, importance in developing healthy food habits in children 165–6
research principles to assess validity of food information 283–4
resistant starch 14
restrictive diets/dieting 116–19
reusing packaging 265–6
rice cooking 87
rice growing 214, 217, 219–20
  GM crops 184, 238–9
roasting 55, 57
  safety practices 57–8
  using fats and oils 90
rubbing-in 72

S

safe food 42
safe food supply, preventative practices 46–50
salinity 214, 215–16, 217, 227
saliva 6, 9, 10
Salmonella 42, 43, 44, 49
salt
  added, in the diet 29, 30, 296
  reducing consumption of 297–8
saltbush 220, 223
satiety 2, 4–5
saturated fats 16, 17, 29, 30, 296
  reducing consumption of 296–7
scholarly articles 283
  assessing 284–5
schools
  food and nutrition education in 101
  Kitchen Garden Program 101
  meals at 165
  National Healthy Canteens Project 101
  supporting healthy eating 101
seafood 79–80
  ethical products 199–200
  labelling 200
sealed container (steaming) 61
second-generation biofuels 176–7

sedentary behaviour 159
health implications 159–60
tips for reducing time spent sitting down 160–1
self-raising flour 71
sensory appreciation of food 5–8
sensory properties of food 5
serving plate size 157
serving size (food labels) 305
serving suggestions (food labels) 305
Shabbat meal 111
shallow-frying 69, 383
Shape of Victoria Survey 152–3, 163
sharing meals with family 110–11
sheep production 220, 222–3
shopping
children involvement in 163–4
decisions based on food labels 311
sifting 72
simmering 55, 60
use in recipes 316, 320, 321, 352, 361, 366, 399
small-farm holders, Asia and Africa 177–8
small intestine 10
smartphones and tablets 137–9, 180–1, 298
smell of food 5–6, 9
smoke point 58
snacking and snack foods 97
social disadvantage 103, 114
social factors influencing food choices 100–6
social media 136–43
blogs 141–2
and digital marketing 137
Facebook 140–1
Instagram 142–3
YouTube 139–40
see also smartphones and tablets
social meet-ups for dinner 112
social roles of food 110
and individual identity 110–12
sharing and celebrating with communities 112–14
sharing and celebrating with families and friends 110–12
Social Spoons 112
sodium pyrophosphate 71
soft drinks 30
soil acidification 210, 211, 212, 227
soil erosion 227
soil fertility 210, 211
Solar Electric Light Fund 182–3
solar energy to improve food security 181–3
soluble fibre 14
sources of food information (articles) 283, 284
soy milk 82
sponsorship 128
sporting stars 136
stability of the food supply 176
Staphylococcus aureus 42
starches 14, 84–8
absorbing moisture 85
changing the pH 87
contribution to structure 85
dry heat effects 85–6
functional properties 85
gelatinisation 67, 86–8
moist heat effects 86–7
thickening properties 85
starchy vegetables, cooking 87
steam generation (aeration) 72
steaming 55, 57, 60–1, 331, 340
eggs 75
methods 61
milk with eggs 81
stewing 57, 61
stir-frying 59
stock food 272
stomach 10
Stone, Curtis 135
storage directions (food labels) 303–4
storing food safely 48–9
stroke 29, 30, 31
sub-Saharan Africa
advancing small-scale farmers 177
building the capacity of women 178–9
smartphone use 180
sucrase 70
sucrose 10, 13, 83, 84
sugars 13, 14, 82–7
acid effects 84
added, in the diet 29, 30, 296
baking effects 84
caramelisation 84
effect on aeration 84
functional properties 83
reducing consumption of 297
types of 82, 83
'super' weeds 240
superfoods 98–9
supermarket private labels 102
supermarkets
data collection and targeting 139
energy use 254–5
ethically-produced products 190, 194, 195
in Fairtrade movement 203
for food distribution 150
links to food and cooking shows 135
milk and bread 'wars' 203
positioning of food 157
sustainable seafood 200
use of celebrity chefs 135
see also specific stores, e.g. Coles Supermarkets
sustainable animal production 220–3
sustainable crop production 218–20
sustainable farming practices 210, 246
sustainable fish production 196
aquaculture 198–9
ethical issues 196
sustainable food production 196, 256–8
Sustainable Seafood Guide 200
sustainable water use, by food processors and retailers 256
swallowing food 8, 10
syneresis 75, 87

T

table banks, Kenya 179
tablets and smartphones 137–9, 180–1, 298
Take-it-away category (market segment) 95
talking and learning about food (for children) 163
target market 125
tartaric acid 71
Tassal Tasmanian Atlantic salmon 198–200
taste buds 6
taste sensations 6
taste.com.au 139, 143
tasting food 10
technologies to improve food security 180–4
tedera 220
teenagers
dietary needs 32
overweight or obese 153–4
teeth 10
television news 133
temperature
of egg protein coagulation 74
of food 7

temperature control, to inhibit bacterial growth 45
temporary emulsions 90, 346
tenderisers 78, 79, 83
terminology (scholarly articles) 285
texture 7
thickening agents 85
time for bacterial growth 45
time pressures, and food choices 104–5
tofu 82
tongue 6, 10
toxins, bacterial 42, 43
toys and giveaways 128
trans fats 16, 17, 29
transgenic organisms 237
Trendsetters (market segment) 95
type 2 diabetes 21, 22, 23, 24, 27, 31, 101

U

umami flavour 6
unsaturated fats 16, 29, 30
unstable global food markets 175
usage directions (food labels) 304
'use-by' date 303
utilisation of food 176

V

validity
  of food information 283–4, 286
  of weight-loss claims, assessing 289–90
value of the information (articles) 284
vegetables and legumes 24, 25–6
video brand integrated marketing approach 139–40
villi 12–13, 36
viruses, causing food poisoning 42, 43

W

war and displacement of populations, impact on food security 173
warm noodle salad, taste testing 249–50
warning statements (food labels) 302–3, 311
waste management 269–72
water 25, 29
  in meat, cooking effects 78
water pollution 211, 212–13
water reuse 217–18
water use
  food processing industry 255–6
  monitoring 217
  primary food production 214–18
water-in-oil emulsions 90
weight or measure of contents (food labels) 304, 310, 311
weight-loss claims, assessing the validity of 289–90
weight-loss companies, analysing claims by 288–9
weight-loss programs, assessing claims made by 290–2
Welcome Dinner Project 113
wheat crops, GM 241–2
wheat production 218–19
wheat rust 226
whisking 72
white fish 79
wholegrain cereals 25, 26–7
Wimmera Mallee Pipeline 214–15
women, building the capacity of 178–9
Woolworths Supermarkets 135, 139, 190, 194, 200, 203, 254, 256
  'odd bunch' initiative 272–3
words on food labels 312
world population, feeding an increasing 170–1
Wyndham, Health Together project 280

Y

yeast 66, 70
  as aerating agent 71
  use in recipes 324, 348, 356
yoghurt 28
YouTube 139–40

Z

'Zappit' category (market segment) 95
zymase 70

nelsonnet

Register online at:
www.nelsonnet.com.au
to access digital resources to support improved learning & teaching*

OVERVIEW

- Updated for the new Food Studies VCE Study Design
- New, exciting dishes from around the world to complement existing, much-loved recipes
- Each recipe is accompanied by nutritional information to reflect the increased focus on enabling students to understand and own their food decisions
- Fully updated case studies and activities increase students' understanding and awareness of the issues surrounding food supply and consumption
- Builds a foundation of learning for students to live better and pursue further training and employment in food-related industries.

ISBN: 9780170378482

ISBN: 9780170378611

NELSON CENGAGE Learning
For learning solutions, visit **cengage.com.au**

* Please note that access to NelsonNet and the NelsonNetBook is only available to teachers who purchase the access code. Contact your Education Consultant for information about access codes and conditions.

ISBN: 978-0170378482
9 780170 378482