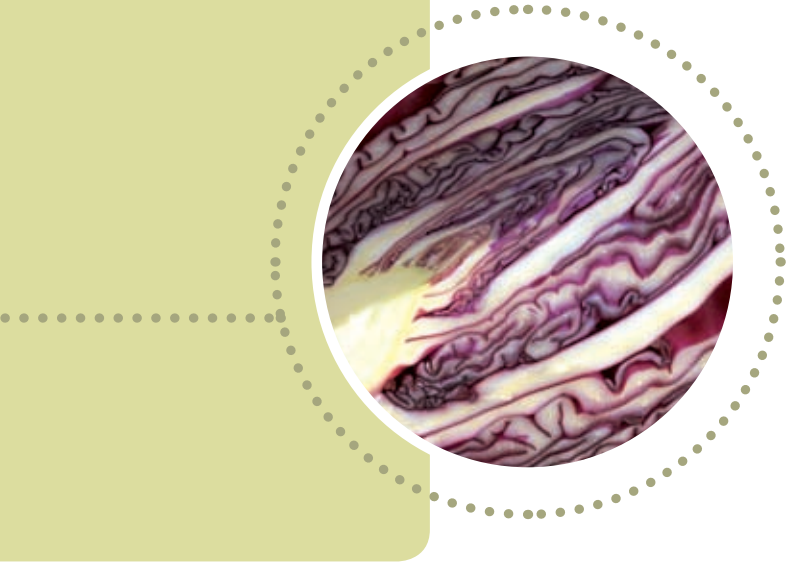
Chapter 7
Diets for optimum nutrition

What's for dinner? A small bowl of chicken and potato purée, a few spoonfuls of mashed banana and a big drink of milk. The baby may be happy, but the rest of the family is left feeling a bit hungry! Yet the same ingredients, used differently, could form the basis of a meal that would meet the needs of everyone in the family. Some members of the family may need more energy or protein, while others need extra fibre, iron or calcium. Selecting the right ingredients is just the beginning — the way in which they are prepared, cooked and combined into meals are all important factors in ensuring optimum nutrition throughout your life.

In this chapter you will learn about:

- nutritional requirements throughout the life cycle
- current food selection guides and nutritional information that assist in planning and evaluating meals and diets
- preparation techniques to produce nutritious food.

How can a family meal meet the nutritional needs of all its members? Nutritional requirements change throughout a person's life, and this means that the diet must change to supply these nutrients.



Chapter 2 outlined the physiological factors affecting our food selection. To summarise, nutritional requirements are affected by an individual's:

- age
- body size
- gender
- body composition (amounts of muscle and fat tissue)
- health status
- physical demands on the body, such as level of activity and whether a woman is pregnant or lactating.

This chapter will look at how these requirements vary throughout the life cycle, and how to plan and assess meals or diets to make sure that these requirements are met.

Adequate **nutrition** is important to supply the energy and nutrients that you need for growth and repair. Rapid growth occurs during infancy, adolescence, pregnancy and lactation, so extra nutrients are needed at these times. Requirements are lower in an adult who is no longer growing, providing only what is needed for routine body maintenance and repair. Although energy requirements decrease with ageing, older people may need other nutrients in larger amounts.

Energy

Your body needs energy to maintain all its essential processes. Chapter 6 looked at the macronutrients (proteins, lipids and carbohydrates), which can be used by your body for energy. We will now look at the factors that affect how much energy you need.

Factors influencing energy requirements

Everyone knows that you need extra energy when you exercise, but what about when you are just lying quietly doing nothing? The minimum amount of energy that your body needs to maintain normal body processes is called the **basal metabolic rate (BMR)**. This is the amount of energy that keeps your body working normally when you are lying awake, but totally relaxed and still, in a comfortably warm room, having not eaten for 10 to 12 hours. The BMR is the lowest energy expenditure that you would have while awake. Your energy expenditure is slightly lower than BMR when you are asleep and higher after you have eaten. When you eat, your body gets to work converting the food to nutrients and making heat. This extra energy expenditure is called the **thermic effect of food (TEF)**. The energy you need every day is the sum of your BMR, TEF and the energy required for activity and exercise.

Even though your total energy expenditure changes from moment to moment, your BMR stays fairly constant, with only moderate changes over your lifetime. The main factor affecting your BMR is the amount of lean muscle and organ tissue, since these are the parts of the body with the most metabolic activity. As these change, the BMR changes. Growth also increases the BMR. Muscle mass and growth explain most of the variation in BMR. Other influences on BMR generally relate to these two factors, and we will look at some of these now.

1. Body composition — People who have more lean muscle tissue have a higher BMR than those with more **adipose tissue**. Body fat has very low metabolic activity and does not contribute significantly to the BMR.
2. Body size — Generally, a larger body has a higher BMR because a larger body usually has more lean tissue. If the extra weight is mostly adipose tissue, it has less effect on the BMR.
3. Gender — The main reason why gender affects BMR is that men usually have more muscle and less fat than women, due to their different hormone patterns.
4. Age — The BMR increases during times of rapid growth, such as childhood and adolescence, when the amount of lean tissue, and the size of organs, is increasing. As an adult gets older, there is a gradual decrease in the energy requirements, mainly because the amount of lean tissue decreases with age.
5. Pregnancy and lactation — Because they are stages of growth, pregnancy and lactation both increase the BMR.
6. Illness and fever — Many illnesses increase the BMR because inflammation and the immune response increase the metabolic activity of the body tissues. Fever causes an increase in heat production and this also increases the BMR.
7. Physical activity — Energy needed during physical activity is not part of the BMR, which measures energy expenditure at rest. However, people who are very active usually have more lean muscle, and this means that their BMR is higher. Also, energy expenditure stays higher for a significant time *after* exercising, so even at rest the BMR is measurably higher for a while after exercise. These two effects mean that BMR may be significantly higher in someone who exercises regularly or works in a physically demanding job.

Despite all of these factors that help to predict BMR, there are big differences between individuals; a group of healthy

These two men are a similar age, and both weigh about 95 kilograms. Do they have the same energy expenditure?

people of the same age and gender, with similar weight and body composition, will not have identical BMRs, even with the same food intake and activity level. The variation within such a group may be as much as 10 per cent.

Energy balance

Your body can be very economical with energy. In times of starvation, your body uses energy far more efficiently, reducing requirements to make fuels last as long as possible.

Energy is measured in kilojoules (kJ) and is obtained from the energy-containing nutrients in the diet.

TABLE 7.1

NUTRIENT	ENERGY SUPPLIED, PER GRAM
Lipids/fats	37 kJ
Alcohol[(a)]	29 kJ
Protein	17 kJ
Carbohydrates	16 kJ

[(a)] Although not technically a nutrient, alcohol supplies energy.

Your blood brings the energy to your body cells in the form of amino acids, glucose or fatty acids. These may have come from the food you have just eaten, or from your body's stores of protein, glycogen or triglycerides. The basic energy balance equation is expressed as:

energy intake (obtained from the diet) = energy expenditure (metabolism + physical activity) + stored energy (adipose tissue and cellular stores)

According to this equation, for weight to remain constant, the energy intake should equal the energy expended. If intake is less than expenditure, some energy is used from the body stores and weight loss will occur. Significantly inadequate intake is recognised by the body as starvation, and several processes start to occur to conserve energy:

- reduction in BMR
- reduction in activity level and loss of interest in exercising
- reduction in body temperature, blood pressure and heart rate
- change in the body's use of different nutrients to conserve body protein.

If energy intake is higher than expenditure, the unused part of the intake is directed to storage, so body weight increases. Unused fat from the diet is easily stored as triglycerides in adipose tissue. Unused carbohydrate is usually stored as glycogen in the liver and muscle tissues. However, there is a limit to the amount of glycogen that can be stored. If there is a very large excess of carbohydrate in the diet, some may be converted to fat. This is an inefficient process, however, and body fat usually comes from fat in the diet rather than carbohydrate. Eating too much of any **macronutrient** will cause this fat to be stored.

How does the body use energy?

Getting energy from food is complicated, involving many stages and many different enzymes and co-factors. Proteins, lipids and carbohydrates each follow a different pathway of chemical reactions. The B-group vitamins are important in these reactions (see page 112 in chapter 6).

The main fuel for your body is glucose. Glucose is transported through the blood, along with oxygen from your lungs, to the cells that need energy. Glucose is oxidised (burned) to release energy, also producing water and carbon dioxide, which is taken back to the lungs so you can breathe it out. The process can be greatly simplified in this equation:

glucose + oxygen ⟶ energy + carbon dioxide + water
($C_6H_{12}O_6$) (O_2) (CO_2) (H_2O)

The energy is used by your body for different purposes including:

- mechanical energy, for movement. Both the voluntary muscles (such as your arm and leg muscles) and the involuntary muscles (such as the muscles that move food through your gut) need energy for movement.
- chemical energy, to make reactions occur in your body. Energy is needed to convert one substance to another, and to build body tissue out of its components.
- electrical energy, to send messages along nerves and muscles
- heat energy, to keep your body warm.

When there is not enough glucose present to meet your cells' energy needs, glycogen stores can be broken down to produce more energy. Alternatively, your body can use fat as a fuel, or it can break down protein. The main purpose of fat in the body is as an energy source, so it is better for your body to use this. In contrast with fat, protein has many important jobs in your body, so it is best if this can be conserved rather than used for fuel.

Recommended energy intakes

We have seen that many different factors affect an individual's energy expenditure. Average energy requirements for different groups have been calculated by the National Health and Medical Research Council to provide general recommendations for Australians (tables 7.2 and 7.3). These

TABLE 7.2 Recommended energy intake for adolescents aged 12–18 years (kilojoules per day)

AGE (YEARS)	MALES		FEMALES	
	VERY SEDENTARY	MODERATELY ACTIVE	VERY SEDENTARY	MODERATELY ACTIVE
12	8 200	10 500	7 400	9 500
13	8 700	11 200	7 800	10 000
14	9 300	11 900	8 100	10 300
15	9 900	12 600	8 200	10 600
16	10 300	13 200	8 400	10 700
17	10 700	13 700	8 400	10 800
18	10 900	14 000	8 500	10 900

Source: Data derived from National Health and Medical Research Council.

TABLE 7.3 Recommended energy intake for adults (kilojoules per day)

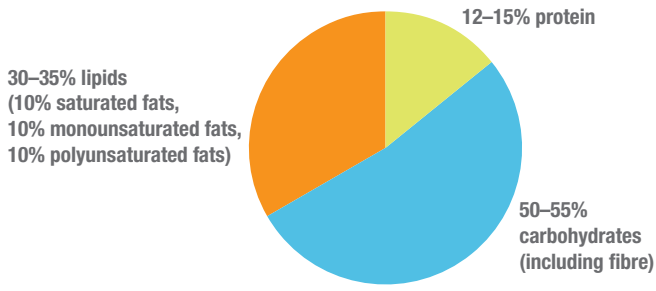
AGE (YEARS)	HEIGHT (CM)	WEIGHT (KG)	MALES		FEMALES	
			VERY SEDENTARY	MODERATELY ACTIVE	VERY SEDENTARY	MODERATELY ACTIVE
19–30	150	50	–	–	7 100	9 200
	170	64	9 700	12 400	8 400	10 800
	190	79	11 100	14 200	9 700	12 500
31–50	150	50	–	–	7 300	9 400
	170	64	9 400	12 100	8 000	10 300
	190	79	10 400	13 400	8 700	11 200
51–70	150	50	–	–	6 900	8 900
	170	64	8 600	11 100	7 600	9 800
	190	79	9 600	12 400	8 400	10 800

Source: Data derived from National Health and Medical Research Council.

are classified according to activity level, ranging from very **sedentary** (inactive), to light activity, moderate activity and heavy or vigorous activity.

It is recommended that energy intake be obtained from protein, carbohydrates and lipids in the ratios as shown in the diagram below.

Ideal proportions of macronutrients in diet



REVIEW QUESTIONS

Remember

1. Define BMR in your own words.
2. List four factors that affect BMR.
3. Draw connecting lines between these three columns to match the following:

Macronutrient	Energy yield (per gram)	Stored as
Carbohydrate	37	Glycogen
Alcohol	29	Muscle
Fat	17	Not stored (toxic)
Protein	16	Adipose tissue

Apply

4. Carol is a 45-year-old woman, with a total daily energy expenditure of 7000 kilojoules, who wants to lose 3 kilograms in weight. She decides to do this by fasting (eating nothing and drinking only water) for a few days. She reads that 1 kilogram of adipose tissue (including the cells and proteins as well as the fat content) is equivalent to 32 200 kilojoules.
   - **a)** Calculate how long it would take Carol to reach a negative energy balance of 32 200 kJ, if her energy expenditure stays the same.
   - **b)** Carol does not lose 1 kilogram in weight when she fasts for this length of time. Why not?
   - **c)** What other processes will occur or not occur in Carol's body during this time?
   - **d)** What are some reasons why this might not be a good way to lose weight?
5. Write down all the foods you ate yesterday, classifying them into protein, lipid and carbohydrate foods. Compare your list with the pie chart above. How did your intake compare with the recommended proportions of macronutrients?

Do an activity

6. Find out how an individual's BMR is measured.
7. Log in to **www.jacplus.com.au** and locate the *Weight loss diets* weblink for this chapter.
   Encouraged by claims made in advertising for weight loss products, people trying to lose weight often forget the energy balance equation. Usually such advertising promotes the idea that there is a 'magic' ingredient or formula that makes the weight loss happen. Look at the diet featured on this web page and answer the following questions.
   - **a)** What is the 'magic' part of this diet?
   - **b)** How much does this programme cost?
   - **c)** What is the real reason that people are likely to lose weight on this diet?
   - **d)** Diets like this usually claim amazing weight loss results. How much weight could be lost in a week, according to this web page?
   - **e)** Is this amount of weight loss likely to be adipose tissue? Explain. (You may need to do a calculation to obtain your answer.)
   - **f)** List some of the disadvantages of this diet.

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Weblink

Nutrient requirements throughout the life cycle

Nutritional requirements change throughout life. People of different ages need different amounts and types of food to meet their individual needs.

Pregnancy and lactation

A pregnant woman needs to eat the right foods to keep herself healthy, as well as providing for the growth and development of the foetus. If she does not have enough of particular nutrients in her diet, her body stores are used to meet the foetus's needs, and her health may suffer. If her stores are inadequate, the baby may have an increased chance of low birth weight and even some birth defects. These extra requirements mean that a pregnant woman needs to increase her intake of a number of nutrients. It is also important to avoid substances that are toxic to the foetus, such as alcohol, nicotine and other drugs. Pregnancy during the teenage years poses a special risk to health, because the mother's body has not completed its own development. Her diet therefore needs to provide for growth and development in both the mother and the foetus, and teenage pregnancy requires close medical supervision.

Nutritional requirements during pregnancy

Protein

Protein is required for growth of the foetus and placenta. The uterus, breasts and blood supply also increase in size and this requires extra protein. The protein must be complete protein for all these processes to occur normally. A woman who follows a **vegetarian** or **vegan** diet may need to take care to combine complementary proteins so that she gets enough complete protein in her diet.

Energy

A pregnant woman experiences an increase in her BMR due to the increased metabolic activity in her own body and because of the growth and development of the foetus. This

CASE STUDY

TWO A DAY SAFE LIMIT ON DRINKS

by JILL STARK

Adults will be advised that more than two drinks a day is a health risk, and teenagers and pregnant women will be warned not to drink at all under sweeping changes to Australia's alcohol guidelines.

Amid estimates that 2 million Australians are risking brain damage through dangerous drinking, the new Federal Government advice will be released today. Anti-alcohol campaigners have heralded the changes as 'the most stringent safe-drinking guidelines in the world'.

Until now, men have been told they could have six drinks a day, and women four, without risking long-term harm.

But the National Health and Medical Research Council's revised guidelines say both men and women should limit themselves to two drinks a day.

Expectant mothers, who were previously advised that up to seven drinks a week was safe, will now be warned there is no safe level of alcohol consumption.

The same advice will be given to women trying to conceive.

And, for the first time, explicit advice will be given for under-15s not to drink at all. The council says 15- to 17-year-olds should only drink under parental supervision. Its advice comes amid growing concern over foetal alcohol syndrome and the effects of drinking on the adolescent brain.

A committee of medical experts has analysed scientific research from around the world over the past year to draft the three new guidelines, which have been reduced from 11 in 2001.

The chairman of the committee, Jon Currie, said the pregnancy advice brought Australia into line with Britain and the US.

'We know alcohol is a toxin and we cannot find a limit at which it is safe during pregnancy, because even at relatively low levels there are still some studies showing developmental changes,' said Professor Currie, director of addiction medicine at St Vincent's Hospital, Melbourne. 'Not drinking provides you with the safest option.'

Source: The Sydney Morning Herald, 13 October 2007.

CASE STUDY QUESTIONS

Carefully consider the article above. Remember that this is not just a comprehension task; use the stimulus material along with your knowledge of *nutritional requirements during pregnancy* to complete the tasks ahead.

1. What is a *safe* quantity of alcohol for a woman to drink leading up to and during her pregnancy?
2. What are the risks of consuming alcohol in pregnancy?
3. What other health problems can occur with excessive alcohol intake?

increase in BMR is often balanced by a decrease in activity during pregnancy, so that it is not usually necessary to increase energy intake significantly.

Vitamins

The increased metabolic activity means that greater amounts of B-group vitamins are needed, as these are all involved in releasing energy from proteins, lipids and carbohydrates. Vitamin C is important for forming strong healthy tissue in the foetus, as well as helping with iron absorption. Folate and B_{12} are both involved in forming normal blood cells.

Minerals

Anaemia is common in pregnancy because requirements for iron are more than doubled due to the need for iron in forming new red blood cells. To compensate for this, the body's ability to absorb iron increases during pregnancy. Despite this, many pregnant women may still need an iron supplement to meet their needs. Calcium requirements also increase during pregnancy for the development of bones and teeth in the foetus.

Nutritional requirements during lactation

Producing breast milk (**lactation**) is nutritionally more demanding than pregnancy, requiring increases in nearly all nutrients. Milk is the infant's energy source, and the mother's body requires energy to produce it. Breast milk is an energy-rich source of nutrition for the infant, so considerable amounts of energy are required by the woman's body to produce it. As in pregnancy, complete protein is important.

TABLE 7.4 Recommended dietary intake of important nutrients for pregnant or lactating women (amounts per day)

NUTRIENT	AMOUNT REQUIRED BY WOMEN DURING:		
	ADULTHOOD	PREGNANCY	LACTATION
Energy	about 7000–10 000 kJ	extra 0–2000 kJ	extra 2000–2100 kJ
Protein	46 g	60 g	67 g
Vitamin C	45 mg	60 mg	85 mg
B-group vitamins: thiamin	1.1 mg	1.4 mg	1.6 mg
niacin	14 mg	18 mg	17 mg
riboflavin	1.1 mg	1.4 mg	1.6 mg
pyridoxine (B_6)	1.3 mg	1.9 mg	2.0 mg
folate	400 µg	600 µg	500 µg
vitamin B_{12}	2.4 µg	2.6 µg	2.8 µg
Iron	18 mg	27 mg	9 mg
Phosphorus	1000 mg	1000 mg	1000 mg
Calcium	1000 mg	1000 mg	1000 mg

Source: Data derived from National Health and Medical Research Council.

REVIEW QUESTIONS

Remember

1. Why is an inadequate diet dangerous for a pregnant woman?
2. List three reasons why protein requirements increase during pregnancy.

Apply

3. Look at table 7.4 and note the vitamins for which the requirement is higher for pregnancy than for lactation. Suggest why the requirement is higher in pregnancy but not lactation. (*Hint:* Look back at chapter 6 to recall what these vitamins do in the body.)
4. A woman may need to eat an extra 14 grams of protein during pregnancy, and an extra 21 grams during lactation. What sorts of foods would provide this much protein? Using tables of food composition, work out how a woman could obtain this extra protein, using some common protein foods.

Do an activity

5. Devise a fact sheet for pregnant women that:
   a) explains how and why their nutritional requirements are different
   b) offers five main-meal ideas that meet their nutritional needs.

Infancy

Infancy is the period between birth and two years of age. This is a period of dramatic growth and development, in which nutritional requirements also change markedly.

Birth to 6 months

An infant doubles its birth weight within the first six months of life, so it needs adequate nutrition for this growth, to form new muscle, bone, blood and body tissues. Normal development cannot occur if the infant does not receive the right nutrients. Breast milk is the ideal way to provide these, although breast milk alternatives (infant formulas) also promote optimal nutrition when used correctly.

Breast milk

Breast milk is the best food for infants because it provides all the required nutrients in the correct proportions for a human baby, in forms that are easily digested and absorbed by an immature digestive system. Unlike formula, breast milk changes its composition to meet the needs of the infant:

- Days 1–3: **Colostrum** is produced. This is a sticky yellow liquid containing large amounts of antibodies to help the infant fight infections while its immune system is still developing. Colostrum is high in protein and low in fat, and acts as a **laxative**, starting the infant's gut working normally.
- Days 3–10: After about three days, transitional milk is produced. Between the third and tenth days, transitional milk thins out as colostrum production decreases and mature milk is produced.
- After day 10: Colostrum production ceases and mature milk is produced. Mature milk allows for the optimal growth of the infant by providing all the nutrients in appropriate amounts and in a readily available form. The main protein in mature breast milk is lactalbumin. Breast milk proteins form a soft curd in the stomach that is easily digested. The lipids in breast milk are a mixture of saturated, monounsaturated and polyunsaturated fats, as well as essential fatty acids. The carbohydrate in breast milk is lactose. Breast milk supplies all the vitamins and minerals, but some, such as vitamin D and iron, are present only in low levels and are affected by the mother's vitamin and mineral intake. However, an infant's absorption of the vitamins and minerals from breast milk is very efficient.

As we have seen, lactating women require increased amounts of many nutrients to produce breast milk. Information and encouragement are also important, since breastfeeding is a skill that has to be learned, and a lack of support (particularly early on) can lead to ceasing breastfeeding unnecessarily.

The composition of breast milk also changes during each feeding session. The milk is more watery to begin with and becomes richer and creamier as the infant continues to feed. This allows the infant's intake to adjust according to its needs, having a shorter feed just to quench thirst or a longer feed to satisfy hunger. In this way, breast milk provides for the complete food and fluid needs of the infant.

Breast milk alternatives

Cow's milk is not suitable for human babies. The composition of cow's milk provides for the needs of a baby cow, which are very different from those of human infants; for example, newborn calves can stand and walk shortly after birth, so their energy and nutrient needs are very different from human babies' needs.

TABLE 7.5 Comparison of breast milk and cow's milk

BREAST MILK	COW'S MILK
• Provides immunoglobulin proteins	• Does not provide immunoglobulin proteins. These are destroyed by pasteurisation.
• Has appropriate amounts of calcium and phosphorus for a human baby	• Has four times more calcium and six times more phosphorus than breast milk
• Has more carbohydrate (as lactose) and less protein than cow's milk	• Has less carbohydrate and more protein than breast milk
• Is sterile and already warm when fed from the breast	• Is not sterile or warm
• Composition of the milk changes over time and during each feed	• Composition does not change
• Flavour of the milk changes according to the mother's diet. This variety may help the infant accept new foods when starting on solids.	• Flavour does not change

Many different infant formulas are available when a mother is unable to, or decides not to, breastfeed. These are based on either cow's milk or soy milk, modified to meet the needs of a human infant. They provide complete nutrition as long as they are prepared correctly. The equipment used in preparation, and the water used to mix the formula, must be sterilised before use. The formula needs to be refrigerated if it is not to be used immediately, and discarded after 24 hours. Formulas should not be reheated.

Weaning

After about six months of age, an infant's needs can no longer be met by breast milk alone, and solid foods are introduced. Ideally, breast milk, rather than other drinks, remains the main fluid in the diet for at least the first year of life. **Weaning** is the process of reducing milk intake as an infant progresses to a varied solid diet.

First foods

Semi-solid foods that are smooth in consistency and bland in flavour are introduced in small quantities when the infant seems ready. Signs of readiness include good control of the head and neck, willingness to take food into the mouth without pushing the tongue forwards, and interest in other family members' food. Baby cereals, puréed fruits and puréed vegetables are usually the first foods introduced. Rice-based, ready-made cereal products are useful because of the low chance of **food allergy** or **intolerance**. These consist of a powder that is mixed with a little water, breast milk or formula to make a smooth wet paste. Other common first foods are puréed apple or pear, mashed banana or avocado, or puréed pumpkin or potato. Then new foods — other vegetables, fruits and cereals, puréed meats, cooked egg yolk, and dairy foods — are introduced one at a time, so that the parents can easily see which ones the infant likes and so that any allergy or intolerance can be identified.

Smooth, bland foods are introduced around six months of age, when the baby shows signs of readiness to start solids.

Foods that are more commonly associated with allergy are not introduced until later in the first year of life (usually at 9–12 months of age). These include nut products, cooked eggwhites, and seafood. The infant gradually manages lumpier textures and larger pieces of food, including finger

TABLE 7.6 Recommended dietary intake of important nutrients for infants (amounts per day)

NUTRIENT	AMOUNT REQUIRED FOR INFANTS AGED:	
	0–6 MONTHS	7–12 MONTHS
Energy	about 1800–2700 kJ	about 2500–3500 kJ
Protein	10 g	14 g
B-group vitamins: thiamin	0.2 mg	0.3 mg
niacin	2 mg	4 mg
riboflavin	0.3 mg	0.4 mg
Iron	0.2 mg	11 mg
Phosphorus	100 mg	275 mg
Calcium	210 mg	270 mg

Source: Data derived from National Health and Medical Research Council.

foods. At 12 months, an infant can generally enjoy the same variety of foods as the rest of the family. Salt, sugar and other flavour enhancers are not recommended for infants.

Table 7.6 shows some of the recommended dietary intake (RDI) values for infants. The RDIs for infants aged 0–6 months are based on the composition of breast milk. For infants aged 7–12 months, values are based on a diet of breast milk plus other foods. Note that the RDI for iron is much lower for infants whose nutrition comes only from breast milk, because iron absorption from breast milk is so efficient, and because the baby's body stores of iron contribute significantly for the first few months. If formula is providing all of the nutrition, or when iron is obtained from other foods, the requirement for iron is much higher because much less of it is absorbed. For this reason, infant formula contains much more iron than breast milk.

Adolescence

Adolescence is a time of rapid growth and major physical change, from child to mature adult. The nutritional demands of the adolescent are greatly increased during this time to provide for the growth of bones, muscles and tissues and an increase in the volume of blood.

Nutritional requirements of adolescents

Adolescents need adequate nutrition to maintain good health and to allow for growth and a high activity level. This means that intakes of all nutrients need to increase, particularly proteins, B-group vitamins, calcium and iron.

Energy

Energy requirements are higher in adolescence, due to an increase in the BMR (due to growth) and often a higher activity

REVIEW QUESTIONS

Remember

1. What are three signs that an infant is ready to start on 'first foods'?
2. Ideally, until what age should an infant receive only breast milk?
3. Why is the RDI for iron so low in breast-fed infants?

Apply

4. Look at the statements below and identify whether they are true about breast milk or formula, or both, or neither.

Expensive	breast milk / formula / neither
Needs to be warmed before use	breast milk / formula / neither
Requires skill and information for successful use	breast milk / formula / neither
May be difficult to obtain	breast milk / formula / neither
Is a wrong way to feed an infant	breast milk / formula / neither
Contains antibodies	breast milk / formula / neither
Contains all the necessary nutrients for growth	breast milk / formula / neither
Is sterile	breast milk / formula / neither

5. List some factors that need to be considered when designing the meal plan of an infant who has started on 'first foods'.

Do an activity

6. Find a commercially available baby food product suitable for an infant aged 9–12 months. Using similar ingredients, prepare a homemade version.
   - **a)** Compare the cost of the commercial baby food with the same weight of the homemade dish.
   - **b)** Using food tables, analyse the nutrient content (protein, thiamine, riboflavin, niacin, iron and calcium) of your homemade dish, and compare this with the commercial product. How do they compare with the RDIs in table 7.6?
   - **c)** Compare the appearance, flavour and texture of both meals.
   - **d)** What are some factors that determine whether parents choose to buy or make foods at home for their infant?

level. Once an individual has stopped growing, a lower energy intake is needed to prevent sudden weight gain.

Protein and B-group vitamins

Protein is required for building new body tissue, such as muscles, during growth. This increases the demand for the B-group vitamins because they are involved in protein synthesis and in releasing energy from proteins, lipids and carbohydrates.

Minerals

Adolescents require higher intakes of some minerals, particularly calcium, phophorus and iron. Calcium and phosphorus are required for bones to grow longer and thicker; inadequate intake at this time may affect future bone strength. Additional iron is needed to supply the increased blood volume and muscle mass. Iron requirements are further increased in girls when they start menstruating.

TABLE 7.7 **Recommended dietary intake of important nutrients for adolescents (amounts per day)**

NUTRIENT	AMOUNT REQUIRED FOR:			
	FEMALES		MALES	
	9–13 YEARS	14–18 YEARS	9–13 YEARS	14–18 YEARS
Protein	35 g	45 g	40 g	65 g
B-group vitamins: thiamin	0.9 mg	1.1 mg	0.9 mg	1.2 mg
niacin	12 mg	14 mg	12 mg	16 mg
riboflavin	0.9 mg	1.1 mg	0.9 mg	1.3 mg
Iron	8 mg	15 mg	8 mg	11 mg
Phosphorus	1250 mg	1250 mg	1250 mg	1250 mg
Calcium	1000–1300 mg	1300 mg	1000–1300 mg	1300 mg

Source: Data derived from National Health and Medical Research Council.

CASE STUDY

POOR DIET PUTS TEENAGERS' HEALTH AT RISK

A quarter of Australian teenagers eat fast food every day and more than a third hardly ever eat fruit, a Deakin University study has found.

Researchers with Deakin's Centre for Physical Activity and Nutrition Research surveyed more than 3800 secondary school students aged 12–15 years to evaluate their food intake patterns. They found that the diets of a significant number of adolescents fell short of the recommendations outlined in the Australian Guide to Healthy Eating.

'Teenagers need to be eating a variety of foods from the five food groups — breads/cereals, lean meat and meat substitutes, vegetables, fruit and dairy — every day,' Professor David Crawford said.

'Our study found that most teenagers are far from having diets that will provide their growing bodies with the nutrients they need to ensure their long term health and wellbeing.'

Extra foods — such as fast foods, energy-dense snacks and sugar-sweetened drinks — were consumed by nearly 90 per cent of the teenagers on a daily basis.

Professor Crawford said that this finding was of particular concern.

'The daily inclusion of fast foods coupled with the omission of a variety of healthy foods is setting many teenagers up for serious health problems such as obesity and the psychosocial and other health-related consequences associated with this condition such as diabetes,' he said.

The study found that only one third of teenagers ate at least one food from each of the five food groups every day and just over half ate from each food group 'most days'.

From the five food groups, bread and cereals were the most commonly consumed food group. These were followed by vegetables, dairy foods, meat/eggs/nuts/legumes with fruit the least consumed.

Teenagers in regional areas tended to eat more vegetables and less fast foods than their metropolitan counterparts. Girls' diets included more fruit and less fast food and sweetened drinks than boys, with boys consuming more meat and meat alternatives. On the positive side, 87 per cent of the adolescents drank water (including low energy-dense drinks) every day.

Professor Crawford said that the results of the study highlight the need for more public health initiatives targeted at adolescents.

'The next phase of the research, which is currently underway, will explore the key influences on teenagers' eating habits, and will be crucial to inform efforts to promote healthy eating in this group,' he said.

The study was funded by the Australian Research Council and the William Buckland Foundation. The results will be published in the *Asia–Pacific Journal of Clinical Nutrition* later this year.

Source: Deakin University, 11 April 2007.

CASE STUDY QUESTIONS

Carefully consider the article above. Remember that this is not just a comprehension task; use the stimulus material along with your knowledge of *nutritional requirements during adolescence* to complete the tasks ahead.

1. Which food groups are most likely to be left out of adolescents' diets? Suggest three reasons why this might be the case.

CASE STUDY QUESTIONS

2. Why is there a gender difference in adolescents' eating habits? Is there a difference in social influences (whether in the peer group or at home) on girls and boys that might explain this?
3. The article implies that 'extra foods' (fast foods, energy-dense snacks and sugar-sweetened drinks) are replacing healthy foods in adolescents' diets. See if you can suggest ways of reversing this process — choose four of the 'extra foods' that you or your friends eat most often. Think about when and where you are most likely to eat these foods, and complete the following table to identify alternative food choices — two examples have been done for you.

'EXTRA FOOD'	WHERE EATEN/WHERE OBTAINED	A HEALTHIER ALTERNATIVE AVAILABLE IN THAT SITUATION	KEY NUTRIENTS THAT THIS PROVIDES
Cola drink	Out with friends, bought from shop	Flavoured milk	Calcium, protein
Chocolate biscuits	Morning tea break, brought from home	Fruit	Fibre, water-soluble vitamins

Nutritional requirements of adults

The nutritional requirements of adult men change very little between the ages of 19 and 70 years. This is also true for women for most nutrients; **menopause** alters women's requirements for some nutrients. When menstruation ceases, iron requirements are decreased, but the risk of osteoporosis increases so calcium requirements are higher. Looking back at table 7.3 on page 127, you can see that energy requirements decrease through middle age, and weight gain can become a problem if intake does not decrease too.

Nutritional requirements of elderly people

Ageing involves some physical changes that can affect nutritional intake. Requirements increase for some nutrients, while requirements for others may decrease. Elderly people experience a further reduction in BMR, and energy intake must decrease to avoid weight gain. Protein requirements increase slightly, and it becomes more important to ensure that the protein is complete, since the elderly may not store amino acids as effectively as younger people.

As in other stages of the life cycle, the calcium and iron intakes of both men and women must be maintained to avoid osteoporosis and anaemia. All other minerals and most vitamins are adequately supplied by a balanced and varied diet, but sometimes folate and vitamin C deficiencies develop in the elderly.

Some problems are common in ageing and these can affect nutrition. Reduced mobility and eyesight may make it more difficult to cook and to shop regularly for fresh food. Reduced taste sensitivity can lead to a loss of interest in

TABLE 7.8 Recommended dietary intake of important nutrients for men and women (amounts per day)

NUTRIENT	AMOUNT REQUIRED FOR:		
	FEMALES		MALES
	19–50 YEARS	AFTER MENOPAUSE	19–70 YEARS
Protein	46 g	46 g	64 g
B-group vitamins: thiamin niacin riboflavin	1.1 mg 14 mg 1.1 mg	1.1 mg 14 mg 1.1 mg	1.2 mg 16 mg 1.3 mg
Iron	18 mg	8 mg	8 mg
Calcium	1000 mg	1300 mg	1000 mg

Source: Data derived from National Health and Medical Research Council.

eating, so ensuring adequate variety and flavour becomes much more important. Eating alone can also reduce motivation to cook and eat a healthy diet. Constipation is more common in the elderly due to changes in the gut, reduced fluid intake (due to changes in the thirst urge) and reduced activity level. It is important to maintain an adequate intake of fluid and fibre to avoid this, but tooth loss and dentures can make it difficult to chew hard or fibrous foods such as raw apples, carrots and salad vegetables. Avoiding these foods may lead to an inadequate fibre intake, increasing the risk of constipation.

Good nutrition can help to optimise the wellbeing of older people. Nutrient-dense foods, with increased variety and flavour, are important. Companionship during shopping and cooking, and at mealtimes, also helps to encourage healthy eating.

TABLE 7.9 Recommended dietary intakes of important nutrients for elderly men and women (amounts per day)

NUTRIENT	AMOUNT REQUIRED FOR:	
	FEMALES > 70 YEARS	MALES > 70 YEARS
Protein	57 g	81 g
B-group vitamins:		
thiamin	1.1 mg	1.2 mg
niacin	14 mg	16 mg
riboflavin	1.3 mg	1.6 mg
Iron	8 mg	8 mg
Calcium	1300 mg	1300 mg

Source: Data derived from National Health and Medical Research Council.

REVIEW QUESTIONS

Remember

1. Why do energy requirements decrease after adolescence, in middle age and again for the elderly?
2. List six reasons why the elderly might have a poor diet.

Apply

3. 'The nutritional needs of adolescents differ from those of children.' Write a paragraph to discuss this statement, mentioning particular nutrients.
4. Decide whether each of the following statements is true or false.
   - **a)** Adolescent boys do not have an increased iron requirement because they do not menstruate.
   - **b)** Older people use protein differently.
   - **c)** Calcium is important for bone strength throughout life.
   - **d)** B-group vitamins are needed in larger amounts when energy intake increases.
   - **e)** Adults have a relatively low protein requirement, needing it only for body maintenance.
   - **f)** Calcium requirements are affected by hormones.

Do an activity

5. Elderly people may require changes to their diets to meet their needs as they age. Prepare and present a two-course meal rich in iron, calcium and fibre. Explain why you chose each food. (You might like to invite several grandparents or elderly neighbours to the school to share the meal.)

Planning and evaluating nutritious meals through the life cycle

It is important that all individuals are provided with the essential nutrients necessary for their particular requirements. Planning diets and meals involves thinking ahead. Here are some factors to consider when planning a meal:

1. Who will be eating the meal? Consider their nutritional needs. For example, older people, or those wishing to lose weight, may need smaller serves of more nutrient-dense foods. Those who are growing, or who have a high level of activity, may need larger amounts of food to meet their energy needs.
2. What resources are available for this meal? Consider how much time is available for shopping and meal preparation. Seasonal availability of particular ingredients is another factor. How much money is available? Are there any limitations on the food preparation facilities? For example, if the kitchen lacks an oven, this will affect what cooking techniques can be used. All of these factors help in choosing the foods and the cooking methods.
3. When will the meal be prepared? When and where will it be eaten? For example, a meal might be cooked in advance, or it might be eaten immediately after it is prepared. Foods might be eaten at home, or while travelling, or for lunch at school or work.

4. What will be eaten? This brings together all of the previous factors. It is also important to take into account the personal likes and dislikes of the individuals who will eat the meal. Foods not eaten have no nutritional value at all!

There are several tools that can be used in ensuring that a meal or diet is nutritionally balanced. These include the official Nutrient Reference Values, and various food selection guides.

Nutrient Reference Values tables

Log in to **www.jacplus.com.au** and locate the *Nutrient Reference Values for Australia and New Zealand* weblink for this chapter.

eBook*plus* Weblink

Tables of Nutrient Reference Values (NRVs) for Australia and New Zealand cover 38 nutrients: energy, protein, fats, carbohydrates, water, 14 vitamins and 14 essential minerals and **trace elements**. The tables are updated by the National Health and Medical Research Council to include the latest research data from around the world and information gathered through large surveys such as the National Nutrition Survey.

The NRVs provide information on:

- The RDI (Recommended Dietary Intake), which is the amount of a nutrient that should be adequate for the majority of people in a particular group.
- The EAR (Estimated Average Requirement) is the amount of a nutrient that is estimated to meet the needs of about half of the healthy individuals in a particular group.
- The AI (Adequate Intake) is an average daily nutrient intake value that is used when it is not possible to determine an RDI. For example, it may be based on observations of the intakes of normal people, which seem to be adequate for maintaining good health.
- The UL (Upper Level) is the highest average intake of a nutrient that is thought to be safe, without any risk of adverse effects on health.
- The SDT (Suggested Dietary Target) is a daily average intake of a nutrient that may help to prevent disease, because of protective effects on the body.

To assess whether an individual's dietary intake is adequate, the food composition tables and the nutritional information on food packages can be compared with the NRVs to indicate whether nutritional needs are being met. Computer software is available to make this easier.

Current food selection guides

Rather than analysing your food intake every day using the NRVs, there are some simpler ways to make sure that your diet is healthy. NHMRC's Dietary Guidelines for Australians are a set of general recommendations about healthy eating, based on scientific evidence about key health issues. Following these recommendations is a simple way to ensure that a diet is nutritious and balanced.

In the 1950s, nutritionists developed the idea of the Five Food Groups to make it easier for people to see whether they were achieving a balanced diet. Each of the groups was defined by particular essential nutrients; for a balanced diet it was necessary to have only some food from each group.

The five groups were:

- meat/poultry/fish/eggs
- dairy foods
- fruits/vegetables
- breads/cereals
- butter/margarine.

Later, these groups were rearranged into a pyramid form, to express the idea that some groups were required in larger amounts than others.

The current official food selection guide for Australia is the Australian Guide to Healthy Eating, which was developed by the Commonwealth Department of Health and Ageing in 1998 to reflect the multicultural nature of our population and food habits. It is shown as a pie chart to indicate how much of each food group to eat. It also incorporates recommendations from the Dietary Guidelines.

TABLE 7.10 **Examples of different NRVs for retinol (vitamin A)**

	ESTIMATED AVERAGE REQUIREMENT	RECOMMENDED DIETARY INTAKE	UPPER LEVEL	SUGGESTED DIETARY TARGET
Women	500 µg	700 µg	3000 µg	1220 µg
Men	625 µg	900 µg	3000 µg	1500 µg
Reasoning	• average amount required to maintain normal retinol levels in healthy people	• increased value to allow for individual variations in requirements	• high intakes may cause liver problems • birth defects occur with high intakes in pregnant women	• may reduce risk of heart disease, cancer and eye conditions • to obtain this effect, increase should be by replacing unhealthy foods with red or yellow vegetables, fruits, reduced-fat dairy foods and small amounts of vegetable oils

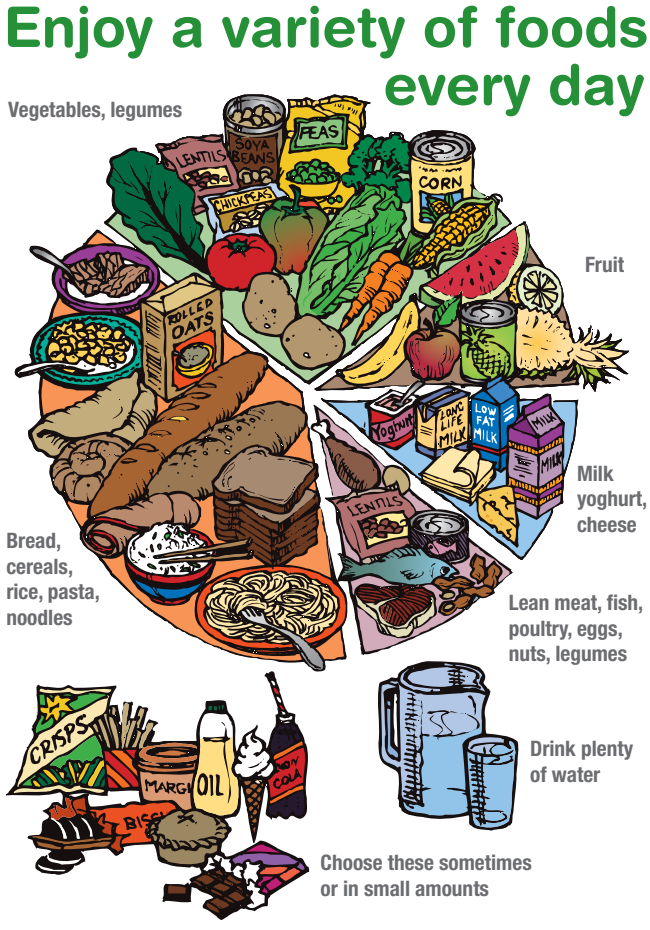
Source: Data derived from National Health and Medical Research Council.
Note: An AI is not included because an RDI value is available.

DIETARY GUIDELINES FOR AUSTRALIAN ADULTS	DIETARY GUIDELINES FOR CHILDREN AND ADOLESCENTS IN AUSTRALIA
Enjoy a wide variety of nutritious foods. • Eat plenty of vegetables, legumes and fruits. • Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain. • Include lean meat, fish, poultry and/or alternatives. • Include milks, yoghurts, cheeses and/or alternatives. Reduced-fat varieties should be chosen, where possible. • Drink plenty of water. • Limit saturated fat and moderate total fat intake. • Choose foods low in salt. • Limit your alcohol intake if you choose to drink. • Consume only moderate amounts of sugars and foods containing added sugars. Prevent weight gain — be physically active and eat according to your energy needs. Care for your food — prepare and store it safely. Encourage and support breastfeeding.	Encourage and support breastfeeding. Children and adolescents need sufficient nutritious foods to grow and develop normally. • Growth should be checked regularly for young children. • Physical activity is important for all children and adolescents. Enjoy a wide variety of nutritious foods. Children and adolescents should be encouraged to: • eat plenty of vegetables, legumes and fruit • eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain. • include lean meat, fish, poultry and/or alternatives. • include milks, yoghurts, cheeses and/or alternatives. – Reduced-fat milks are not suitable for young children under 2 years, because of their high energy needs, but reduced-fat varieties should be encouraged for older children and adolescents. • choose water as a drink. – Alcohol is not recommended for children. • limit saturated fat and moderate total fat intake. – Low-fat diets are not suitable for infants. • choose foods low in salt. • consume only moderate amounts of sugars and foods containing added sugars. Care for your child's food — prepare and store it safely.

Source: Dietary Guidelines for Children and Adolescents in Australia and *Dietary Guidelines for Australian Adults,* National Health And Medical Research Council, 2003 (*Note:* Guidelines are not given in order of importance.)

Healthy Living Pyramid

Source: © The Australian Nutrition Foundation, Inc. (Nutrition Australia).



Australian Guide to Healthy Eating

Source: Australian Guide to Healthy Eating, prepared by the Children's Health Development Foundation, South Australia and Deakin University, Victoria, 1998. © Commonwealth of Australia. Reproduced by permission.

The Australian Guide to Healthy Eating does not suggest a number of serves from each food group. Instead, it shows the different groups as a proportion of an individual's total intake. This prevents confusion about what a serving size is for a particular food (although information on the number and size of serves is provided in other materials that are available to accompany the guide — see tables 7.11 and 7.12).

Other sources of information on healthy eating

Log in to **www.jacplus.com.au** and locate the *Information on healthy eating* weblinks for this chapter.

TABLE 7.11 **Sample serving sizes for foods in each of the five food groups**

BREAD, CEREAL, RICE, PASTA	VEGETABLES AND LEGUMES	FRUIT	MILK, YOGHURT, CHEESE	MEAT, POULTRY, FISH, EGGS, NUTS, LEGUMES
• 2 slices bread • 1 medium bread roll • 1 cup cooked rice, pasta or noodles • 1 cup porridge • 1⅓ cups breakfast cereal flakes • ½ cup muesli	• 75 g fresh or ½ cup cooked vegetables • 75 g uncooked or ½ cup cooked dried beans, peas or lentils • 1 cup salad vegetables • 1 medium potato	• 1 medium piece of fruit (apple, banana, pear etc.) • 2 small pieces of fruit (apricot, kiwifruit, plum etc.) • 1 cup diced canned fruit • ½ cup juice • 1 tablespoon dried fruit (sultanas etc.)	• 250 mL milk (fresh or reconstituted) • ½ cup evaporated milk • 40 g (2 slices) cheese • 200 g (1 tub) yoghurt • 250 mL custard	• 65–100 g cooked meat or chicken • ½ cup cooked mince • 2 small chops • 2 slices roast meat • 75 g uncooked or ½ cup cooked dried beans, peas or lentils • 80–100 g cooked fish fillet • 2 small eggs • ⅓ cup nuts • ¼ cup seeds

TABLE 7.12 **Number of daily servings recommended to achieve a healthy diet**

	ENERGY REQUIREMENT	BREAD, CEREAL, RICE, PASTA, NOODLES	VEGETABLES	FRUIT	MILK, YOGHURT, CHEESE	MEAT, FISH, POULTRY, EGGS, NUTS, LEGUMES	EXTRAS
Children 4–7 years	6400–8300 kJ	3–4	4	2	3	0.5–1	1–2
Children 8–11 years	7700–9800 kJ	4–6	4–5	1–2	3	1–1.5	1–2
Adolescents 12–18 years	8100–13 500 kJ	4–7	5–9	3–4	3–5	1–2	1–3
Women 19–60 years	7200–11 300 kJ	4–6	4–7	2–3	2–3	1–1.5	0–2.5
Pregnant women	8100–10 900 kJ	4–6	5–6	4	2	1.5	0–2.5
Lactating women	9200–12 300 kJ	5–7	7	5	2	2	0–2.5
Women > 60 years	6500–9300 kJ	3–5	4–6	2–3	2–3	1–1.5	0–2
Men 19–60 years	9000–13 700 kJ	5–7	6–8	3–4	2–4	1.5–2	0–3
Men > 60 years	7400–11 000 kJ	4–6	4–7	2–3	2–3	1–1.5	0–2.5

Source: Data derived from the Australian Guide to Healthy Eating.

Information on nutrition is available from a wide variety of sources. Some good places to look include:

- recognised nutrition associations, such as Nutrition Australia and the Dietitians Association of Australia
- groups that are directly linked to food research, such as the National Heart Foundation and the Cancer Council
- publications by well-known Australian dietitians and nutritionists, such as Rosemary Stanton or Catherine Saxelby
- nutrition composition databases available online such as:
  - NUTTAB, the Australian food composition database
  - Food and nutrient calculator, based in the USA. This has a wider range of data than NUTTAB, but watch out for foods that may have a different composition or serving size.

Information from sources like these is usually accurate and well-researched. However, it is important to take care when you obtain information from other sources, such as the media (newspapers, magazines, television and internet) as it may be incomplete or incorrect. Food labelling contains nutrition information that is regulated by law, but is sometimes difficult to interpret correctly. Many people without appropriate qualifications provide nutritional advice, and nutrition is an area where a lot of false claims are made in order to make money.

Preparation techniques to produce nutritious food

Your ability to produce nutritious food depends on several factors:

- your understanding of basic nutrition concepts, such as the variety of foods needed for a healthy diet
- selection and correct storage of fresh, good-quality produce to maximise the nutritional value of your ingredients (see pages 48–52 in chapter 3)
- your knowledge of preparation and cooking techniques to prevent the ingredients losing their nutritional value.

Variety of foods

We saw in chapter 6 that foods contain six types of nutrient: protein, carbohydrates, lipids, vitamins, minerals and water. No single food contains all of the nutrients in the right amounts, so a healthy diet has to provide a variety of different foods. The amounts of the different foods need to be balanced to provide enough of each nutrient.

Retaining the nutritional value of food: preparation techniques

Preparation of ingredients can make a big difference to the nutritional value of the resulting meal. Some simple but effective strategies include:

- making sure that fruit and vegetables are fresh and appropriately stored, particularly those to be eaten raw
- peeling fruit and vegetables only thinly, if at all, because the skin and surface layers contain valuable vitamins, minerals and fibre
- using larger pieces of fruit and vegetables if boiling them, because nutrients leach into cooking water in greater amounts when pieces are small
- avoiding overcooking, especially with vegetables
- removing excess fat from meats, or selecting lean cuts
- removing skin and fat from chicken.

Overcooking can cause changes in colour, texture and taste, which may also reflect a significant loss of nutrients.

Retaining the nutritional value of food: cooking methods

Many foods can be eaten raw, but cooking can:

- provide more variety in the diet, with different cooking methods or combinations of ingredients
- increase the palatability of foods
- improve the availability of some nutrients (they may be easier to digest or absorb if cooked)
- improve the safety of the food by killing bacteria that can cause illness
- lengthen the shelf-life of food by killing bacteria and enzymes that can spoil the food.

Cooking means applying heat to food to achieve a particular result. The different methods of cooking can be classified according to how that heat is applied. These methods — moist-heat cooking, dry-heat cooking and microwaving — have already been mentioned on page 61 in chapter 3, but here we discuss their impact on the nutritional value of the food.

TABLE 7.13 Nutritional aspects of moist-heat cooking methods

METHOD OF COOKING	HOW IT IS DONE	THINGS TO REMEMBER	NUTRIENTS AFFECTED
Boiling	A liquid, generally water, is heated to boiling point before the foodstuff is immersed. The liquid is then returned to a simmer.	• Do not add salt because it is unnecessary in the diet. • Do not add bicarbonate of soda because it speeds up vitamin C destruction and mineral leaching. • Keep cooking time to a minimum. • Use a small amount of water. • Use the cooking medium for stock.	• When fruits and vegetables are boiled, the water-soluble B-group vitamins and vitamin C will dissolve in the cooking water. Up to 25 per cent of the vitamin C will be lost. • Some minerals will also be leached into the cooking medium.
Parboiling	The food is partly cooked in boiling water for a short period (to soften the product). It can then be drained and cooked or frozen (for example, oven fries).	• Minimal cooking time for frozen vegetables is required because they have already been parboiled. • Excessive cooking will lead to continued loss of nutrients.	This process is relatively quick, so the loss of nutrients brought about by prolonged heating is reduced.
Steaming	Food is placed in a perforated container which is suspended above boiling water. The heat generated by the steam is responsible for cooking the foods.	Keep cooking time to a minimum to reduce the loss of heat-sensitive vitamin C.	Nutrient loss is reduced because the food is not in contact with the cooking medium.
Stewing	Food is cooked in a small amount of liquid — a long, slow process which occurs in a covered saucepan or casserole dish. Stewing can occur on the stove top or in the oven.	• Retain the cooking liquid as a sauce to retain leached minerals. • Stewing will make the protein of tougher, cheaper cuts of meat more tender and palatable. No loss of protein will occur.	• The presence of acids such as those found in tomatoes and citrus fruits can reduce vitamin C loss. • B-group vitamins will dissolve into the cooking medium. • The leaching of minerals will also occur.
Braising	This involves a combination of stewing and roasting. The foods are usually browned first, being fried in a little oil, then cooked slowly in a small amount of liquid. Meats and some starchy vegetables are cooked in this way.	• Use low heat, making sure the product is not overcooked. • Do not use excessive fat in the browning process.	• Nutrient losses due to the leaching of minerals and the dissolving of water-soluble vitamins will occur, but this is not a concern because the cooking liquid is usually served as an accompanying sauce.
Poaching	Food is slowly simmered in an open, shallow pan with a little water or milk.	Loss of water-soluble nutrients is minimised if the cooking medium is used to make a sauce.	Water-soluble nutrients are lost into the cooking medium.

TABLE 7.14 Nutritional aspects of dry-heat cooking methods

METHOD OF COOKING	HOW IT IS DONE	THINGS TO REMEMBER	NUTRIENTS AFFECTED
Baking	Food is cooked in dry heat in an oven — a prolonged and even method of cooking whereby the food is left in one position and does not need attending during the cooking process.	Unnecessary fat can be added to the diet if excessive fat is used in the baking process.	• Heat-sensitive vitamins such as vitamin C can be destroyed. • Protein will be denatured and coagulate, but will not be lost.
Roasting	True roasting involves cooking foods either over or under a fire, such as on a spit. However, roasting is now seen as cooking meats, fish or vegetables in hot fat in an oven.	• The addition of fat in the cooking process can significantly add to the fat content of the diet. • Keep the cooking time short.	• B-group vitamins and vitamin C can be destroyed as a result of the pronged time required for roasting. • Fat-soluble vitamins (A, D, E and K) can be lost when the fat content of the food dissolves and drips away.

METHOD OF COOKING	HOW IT IS DONE	THINGS TO REMEMBER	NUTRIENTS AFFECTED
Grilling	The food is placed under or over a source of radiant heat, cooking quickly.	Fat will be added to the diet if the food product is basted with oil during the cooking process.	Fat-soluble vitamins can be lost through the melting of invisible fat which drips away.
Frying	Frying is considered to be a form of dry cooking because high temperatures are involved. Frying can involve shallow-frying, stir-frying or deep-frying.	• Excessive fat can be added to the diet if the food product is fried in a large quantity of fat or oil. Cooking oils and fats can be either saturated or unsaturated. Avoiding animal fats containing saturated fats as a cooking medium is recommended. • Stir-frying is the most nutritious method of frying.	Fat-soluble vitamins (A, D, E and K) can be lost. The B-group vitamins and vitamin C are safe because they do not come in contact with water in the frying process.

TABLE 7.15 Nutritional aspects of microwave cooking methods

METHOD OF COOKING	HOW IT IS DONE	NUTRIENTS AFFECTED
Microwaving	This is a unique method of cooking because the microwave oven produces no heat. Instead, the oven emits microwave energy that can penetrate up to 5 centimetres into the food. These microwaves cause the water molecules in the food to become agitated and move at more than 2000 million times per second. This process generates the heat which then cooks the food.	• Vitamin C loss is limited because long exposure to heat is reduced. • Water-soluble vitamins (B-group vitamins and vitamin C) can be lost. • Mineral leaching can occur if excessive liquid is lost during the cooking process.

Moist-heat cooking

Moist-heat cooking methods use liquid to apply the heat. This liquid might be water, milk, stock or steam. Examples of this method of cooking include boiling, poaching, parboiling, steaming, stewing and braising. Each of these methods has an effect on the nutritional values of the foods being cooked.

Dry-heat cooking

Dry-heat cooking involves applying heat directly to the food. Examples include baking, roasting, grilling and frying.

Microwave cooking

Microwave cooking uses lower energy waves to cook food. If the food is cooked in a liquid, nutrient losses are similar to those of moist-heat cooking. If no liquid is used, nutrient losses are much less.

When planning nutritious meals and diets, important factors to consider are:

- ingredients selected
- cooking methods used
- frequency and amount of the food consumed.

Look back at the Australian Dietary Guidelines discussed on page 137.

You can apply these recommendations when planning nutritious meals. Here are some ideas:

- Try different ingredients and new recipes to increase variety.
- Regularly choose wholegrain bread and pasta, and brown rice.
- Add some fruit or vegetables to each meal, and choose them as snacks, to increase fruit and vegetable intake.
- If vegetables are cooked using moist-heat methods, water-soluble vitamins may be lost into the cooking liquid. Use the cooking liquid in a sauce or soup so that the vitamins are not lost.
- Avoid deep-frying and basting with fats, and use cooking methods that do not add excess fat to the food. For many dishes, small amounts of oil can be used with a non-stick pan instead. Fat-soluble vitamins are retained better this way as they may otherwise dissolve in the frying fat.
- Use vegetable-based sauces (such as tomato) as a low-fat alternative to creamy sauces.
- Use reduced-fat substitutes for cream and sour cream; yoghurt or skim evaporated milk can work well in some recipes.
- Low-fat cheese can be used instead of full-fat cheese in many recipes.
- Use herbs, spices, garlic or lemon juice instead of salt to liven up the flavour of a dish.

REVIEW QUESTIONS

Remember

1. List four advantages of cooking foods rather than eating them raw.
2. Describe, in your own words, the meaning of EAR, RDI, UL and SDT.
3. How does the Healthy Living Pyramid differ from the current Australian Guide to Healthy Eating? List four differences and suggest a reason why each change was made.

Apply

4. Suggest two different ways of preparing each of the following foods. Choose one method that follows the recommendations of the Australian Dietary Guidelines (such as increasing fibre intake) and one that does not (such as increasing fat or salt intake). The first two are completed for you.

FOOD	RECOMMENDED	NOT RECOMMENDED
Potato	• Baked in its jacket and topped with grated low-fat cheese	• Thickly peeled, cut into thin strips, deep-fried and served with plenty of salt
Apple pie	• Made with sheets of filo pastry thinly brushed with oil • Filled with lightly cooked, thinly peeled, lightly sweetened apple • Served with low-fat yoghurt	• Made with rich, shortcrust pastry • Filling cooked to a purée, thickened with cornstarch, and sweetened with plenty of sugar • Served with double cream
Chicken		
Spaghetti		
Omelette		
Lamb cutlets		
Pumpkin soup		
Pavlova		

5. The grid below has eight words hidden in it: four are components of the diet that the Australian Dietary Guidelines suggest should be reduced; four are components that should be increased. The letters left over spell a message for you.

S	A	U	S	T	R	A
E	L	I	A	N	D	I
L	E	T	A	R	Y	G
B	U	I	D	E	L	T
A	L	C	O	H	O	L
T	I	U	R	F	I	A
E	N	R	A	G	U	S
G	E	F	I	B	R	E
E	S	A	R	O	C	K
V	I	T	A	M	I	N

Do an activity

6. Write down all the foods that you have eaten so far today. Using food composition tables, work out how much iron you have eaten. Take care to compare the amounts you ate with the standard serving sizes in the food composition tables, and make sure that you have not left any foods out. How does this compare with the RDI of iron for your age and gender?

CASE STUDY

FOOD TYPE	CHOICES FOR SATURDAY	CHOICES FOR SUNDAY
Breakfast		
Cereals and grains (choose one)	• Bowl of corn flakes (1½ cups), sugar • Two slices of white toast, margarine, honey • Two halves of an English fruit muffin, margarine	• Bowl of rice bubbles (1½ cups), sugar • Two slices of white toast, margarine, jam • Two crumpets, margarine, honey
Dairy food (choose one)	• Milk (150 mL) for cereal or to drink • Fruit yoghurt (100 g tub)	• Milk (150 mL) for cereal or to drink • Fruit yoghurt (100 g tub)
Fruit (choose one)	• Canned pear halves (100 g) • Apple (medium) • Orange juice (100 mL)	• Canned peach halves (100 g) • Banana (medium) • Pineapple juice (100 mL)
Hot item (choose one)	• One-egg omelette with ham and mushroom pieces • Baked beans (50 g)	• Poached egg with small piece of bacon and grilled tomato half • Baked beans (50 g)

FOOD TYPE	CHOICES FOR SATURDAY	CHOICES FOR SUNDAY
Lunch		
Sandwiches on two slices of white bread (choose one)	• Egg and lettuce • Ham and tomato	• Salmon and lettuce • Cheese and tomato
Fruit (choose one)	• Banana (medium) • Pineapple juice (100 mL)	• Pear (medium) • Apple juice (100 mL)
Dinner		
Hot item (choose one)	• Grilled lamb chop (small) • Baked fish fillet (80 g)	• Roast chicken (50 g) • Bolognese sauce (with 50 g minced beef)
Starchy food (choose one)	• Baked potato wedges (50 g) • Boiled white rice (½ cup)	• Mashed potato (50 g) • Penne pasta (½ cup)
Vegetables (choose one)	• Peas and corn (100 g) • Green salad (100 g)	• Beans and carrots (100 g) • Green salad (100 g)
Fruit (choose one)	• Apricot crumble (100 g canned apricots with thin sprinkling of crumble mix) • Canned two fruits (100 g)	• Baked apple (100 g apple stuffed with sultanas and small amount of breadcrumbs with butter) • Canned pear halves (100 g)
Dairy foods (choose one)	• Custard (100 mL) • Milk (150 mL) to drink	• Ice-cream (100 mL) • Milk (150 mL) to drink

OUTCOME TASK **RESEARCH ASSIGNMENT**

Students learn to:

- investigate the recommended dietary intake of energy, protein, vitamins and minerals for particular individuals and groups using appropriate data such as NRV tables in print or electronic format
- select foods to provide a balanced intake of nutrients for particular individuals and groups to meet a variety of nutritional needs
- use suitable preparation methods to optimise the nutritional value of foods.

Contributes to the following outcomes:

- presents ideas in written, graphic and oral form using computer software where appropriate
- selects foods, plans and prepares meals and diets to achieve optimum nutrition for individuals and groups
- generates ideas and develops solutions to a range of food situations.

Carefully consider the menu above, planned for a Year 7 weekend camp. Remember that this is not just a comprehension task; use the stimulus material along with your knowledge of *recommended dietary intakes for adolescents* to complete the tasks ahead.

1. Look at the Year 7 camp menu. Use food tables or food composition software to estimate the energy, protein and calcium intake of a 12-year-old student who chooses and consumes one item from each group in the Saturday menu. You might like to ask a 12 year old to circle the item they would choose from each group. Compare this with the energy, protein and calcium requirements of 12 year olds.
2. Use a food guide (such as the Healthy Living Pyramid or the Australian Guide to Healthy Eating) to evaluate the menu and identify areas that could be improved for a healthier diet.
3. Morning and afternoon tea will be eaten during the camp activities and may be carried for long periods in hot weather. Suggest some between-meal snacks that help the menu to meet healthy eating recommendations (and provide any extra energy, protein or calcium needed to reach daily targets for 12 year olds).
4. Prepare a written report for the camp organisers, suggesting changes to the menu, listing your between-meal snack ideas, and justifying each of your suggestions.

CHAPTER 7 SUMMARY

- Nutritional requirements vary substantially throughout life.
- Energy is required for all body processes, in the form of mechanical, chemical or electrical energy, or heat.
- Total energy requirements consist of the basal metabolic rate, the thermic effect of food and the energy needed for physical activity.
- Energy requirements are mainly determined by body size, lean muscle and organ tissue, activity and physical condition (including growth and illness).
- The body can obtain energy from carbohydrate, fat, protein and alcohol, and maintains a balance between intake, expenditure and storage.
- Increased amounts of protein and micronutrients are required in pregnancy for normal growth and development of the foetus without depleting the mother's nutrient stores.
- Increased energy, protein and micronutrients are required during lactation to produce breast milk without depleting the mother's nutrient stores.
- Breast milk provides all the nutritional needs of an infant aged up to six months, although formula is an appropriate substitute if breastfeeding is not possible.
- Solid foods are introduced gradually from about six months of age. Food groups are introduced in a particular order, to reach a full variety of foods at around one year of age.
- Requirements for all nutrients are increased during adolescence due to a high rate of growth and development and increased physical activity.
- Elderly people have special nutritional needs as their energy requirements decrease with ageing. Requirements of some nutrients (such as protein and calcium) increase and they may experience difficulties with eating or preparing an adequate diet.
- Nutrient reference values provide guidance on the requirements of different nutrients at various stages in life.
- Food selection guides are a simple way of assessing a diet for nutritional adequacy.
- Food preparation and cooking techniques can have a powerful effect on the nutritional value of the resulting meal.
- Planning nutritious meals requires a knowledge of nutritional needs, as well as information on the available time, resources and skills.

KEY TERMS

adipose tissue
anaemia
basal metabolic rate (BMR)
colostrum
dry-heat cooking
food allergy
food intolerance
lactation
laxative
macronutrient
menopause
moist-heat cooking
nutrition
protein
sedentary
thermic effect of food (TEF)
trace elements
vegan
vegetarian
weaning