

# FOOD AND HEALTH: WORKING WITH NUTRITION

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### **CHAPTER OBJECTIVES**

This chapter will enable the reader to:

- broadly define the relationship between food consumption and health
- recognise the ways in which nutrition knowledge can be applied throughout the life stages
- appreciate the influences of the broader social environment on nutrition and health.

### **KEY TERMS**

Biochemistry Dietary guidelines Food Life stages Nutrients Physiology Social environment

## **KEY POINTS**

- Nutrition is about understanding how food and nutrient consumption influences health.
- Nutrition concepts can be applied to support human health throughout the lifecycle.
- Working with nutrition involves an appreciation of the broader social environment, including the roles of a wide range of stakeholders.

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## INTRODUCTION

It is common knowledge that **food** is essential for health. Everyone eats food and most people have an opinion on which foods are better for them. So why do we need nutritionists? What's more, why does advice on nutrition always seem to change? The chapters in this book will address these questions from several perspectives.

One short answer to the quandary is that nutrition is both a science and a practice. The World Health Organization (WHO) defines nutrition as 'the intake of food, considered in relation to the body's dietary needs' [1]. As a science, nutrition builds a very broad knowledge base from a range of disciplines that practitioners are then able to apply in practice. A great deal of nutrition knowledge comes from the basic sciences such as chemistry, **biochemistry**, biology and **physiology**. Other knowledge comes from health disciplines such as epidemiology, dietetics and medicine, and then from humanities disciplines such as sociology and anthropology, and the study of economics.

The unifying factor is the need to better understand the relationship between food and health. Because this is a complex relationship, it needs to be considered from a number of different angles, but they can all come together to represent the science of nutrition.

It is difficult to locate the exact origins of modern nutrition science, but it can be seen in a number of settings: from the chemistry laboratories of Wilbur Atwater [2], determining the energy value of foods, to the observations of scurvy prevention with citrus fruits consumption by long-haul mariners [3]. The subsequent isolation and description of the nutrient, vitamin C, through the science of chemistry heralded the discovery

of vitamins in foods and the recognition that **Nutrient Reference Values** (**NRVs**) [4] were required to protect the health of populations. Today the exploration of food composition continues to expand rapidly, particularly with an interest in phytochemicals found in plants that have very intriguing properties [5]. This research has also triggered food innovation, driving the development of foods with improved nutritional qualities that may be linked to better health outcomes.

From the perspective of Western populations, nutrition science also developed strongly during the world wars when food rationing became

a major issue [6]. Methods for measuring population eating patterns and observing their relationships with health outcomes were developed and led to observations of the relationship between diet and the development of cardiovascular disease. This has now expanded to diet and chronic disease generally, and the identification of food components and food patterns that may prove deleterious to health when consumed in excess. Food and nutrient-based trials have tested a number of hypotheses related to food consumption and health. This research has led to a reconsideration of the emphasis on nutrients and other food components rather than whole foods and whole diets [7].

The emerging concept of **food synergy** suggests that the sum of the parts may be more effective than the component parts themselves, driving researchers to first consider food and dietary patterns in addressing the effects of food on health [8]. This has implications for how research may be evaluated, for example, in developing dietary guidelines [9].

#### Food

substance consumed as part of a meal or snack to provide energy and nutrients for sustaining health; originating from plants or animals and consumed as whole or components thereof with or without processing and blending with other ingredients.

#### **Biochemistry**

study of the chemistry of living organisms.

#### Physiology

study of the vital biological functions of plants and animals.

See Chapter 4 on phytochemicals.



#### Nutrient Reference Values (NRVs)

a set of standards based on scientific evidence of nutrient requirements, used for assessing nutritional quality of dietary intakes.

#### Food synergy

a concept that acknowledges the sum of the parts is greater than the components of foods.

### >> RESEARCH AT WORK

#### THE FRAMINGHAM HEART STUDY

The Framingham Heart Study is an observational study that began in Framingham, Massachusetts. Starting in 1948, it is the longest-running cohort study in the United States aimed at understanding obesity and related disorders such as type 2 diabetes [10]. Originally, 5209 men and women were enrolled in the study and since then have returned for detailed medical examinations every two years. In 1971 a second cohort of 5124 children and spouses of the original cohort were enrolled. In 2002 the third generation (i.e. grandchildren of the original participants) were signed up to join the study. This study has led to the identification of risk factors and other related medical and psychosocial issues associated with cardiovascular disease. The study continues today, with research expanding into other areas such as the role genetics has in the development of cardiovascular disease. From 1950 to 2016 over 3300 articles have been published using data collected from the Framingham Heart Study.

In addition to these developments, the discovery of the human genome in the 1950s has produced significant implications for nutrition. Nutritional genomics and nutritional genetics are just some of the emerging scientific disciplines that contribute to our understanding of food and health (Figure 1.1). Research in this area shows how the components of foods can act as agents of the environment when we study the effect of environment on genetic expression. This understanding has implications for how much of a nutrient a person may need and how diet may influence when a person develops a disease state [11].



#### FIGURE 1.1 NUTRIGENETICS AND NUTRIGENOMICS

Source: P. J. Stover & M. A. Caudill (2008). Genetic and epigenetic contributions to human nutrition and health: managing genome-diet interactions. *Journal of the Academy of Nutrition and Dietetics*, 108(9), 1480–7. doi:10.1016/j.jada.2008.06.430



# FIGURE 1.2RELATIONSHIP BETWEEN BASIC BIOLOGICAL CONCEPTS IN NUTRITION,<br/>APPLICATIONS OF THIS KNOWLEDGE TO HUMAN HEALTH, AND PRACTICE DOMAINS

A useful framework for studying nutrition is to consider the building blocks of knowledge in a sequential manner (Figure 1.2). First we may consider the nature of food as a source of nutrients and other biological substances that serve particular functions within the body. This extends to the concept of food synergy, where the sum of the parts is greater than the individual components. We can then consider the largely observational evidence that dietary patterns are associated with the emergence of lifestyle-related disease. The knowledge derived from research in human nutrition can then be applied to examine the specific needs for nutrients and foods throughout the human lifecycle. We can also study the characteristics of dietary patterns that appear to protect against the development of lifestyle-related disease. Integrating this knowledge helps to develop guidelines and policies for practice.

Nutrition practice occurs in various contexts, from an individual making their personal food choices through to the activities of communities, healthcare systems, industry and governments. Thus there are different levels of practice and different pathways for practice. At the most basic level, nutrition practice equates to an individual looking after their health, applying nutrition knowledge to personal food choices. Practices that have an impact on the broader community require specific levels of expertise depending on the context (e.g. in healthcare, industry, research and development or public policy) and require higher levels of learning.

Regardless of the context, nutrition practice will always be dependent on quality research. This research occurs at many levels, from the basic biological underpinnings of nutrition through to clinical trials on foods, and social and environmental research on food systems. By its nature, research will introduce new knowledge.

Frameworks for evaluating research will also be applied, but in the end there may be shifts in recommendations and applications. Students of nutrition need to have this 'big picture' view of their discipline. As well as having a good grasp of basic concepts, they will also need to appreciate the need to keep up with the scientific literature and maintain strong critical evaluation skills.

#### **STOP AND THINK**

- How has knowledge about nutrition evolved within modern science?
- How has this knowledge been applied, and how might this relate to practice?
- What might the study of nutrition look like in the future?

# HOW DOES FOOD CONSUMPTION AFFECT HEALTH?

The old adage 'you are what you eat' provides one of the simplest summaries of the relationship between food and health. When food is eaten, it is broken down in the digestive system and most is absorbed as small molecules into the bloodstream. From here it is transported to various parts of the body to serve functions that enable the organism to survive. To fully appreciate this effect (and the sciences that underpin this knowledge), there is a need to understand the structures and functions of the various components of the body (physiology), how these are affected in disease states (pathophysiology), the chemical structure of food molecules (chemistry) and how these play a role in pathways that underlie

See Chapter 3 on digestion, absorption and metabolism. body function (biochemistry). Part of this may include understanding how the molecules in food influence genetic expression. This is just the start of a biological perspective on nutrition.

### >> RESEARCH AT WORK

#### NUTRITIONAL ECOLOGY

Before we eat food, it is worthwhile taking a moment to think about food itself. Food can be described as a variety of substances consumed to build and maintain the body's structure and function, but food also has its own biological origins as plants and animals. The composition of food reflects its genetic potential [8], nutritional environment and the way in which the food is modified for human consumption. There are parallels to understanding human health and understanding decisions behind the production of food (plants and animals) for human consumption. In reality, food is not only 'produced'; it also grows across the planet in its own right, but there is a strong human influence on the overall supply of food.

#### Nutritional ecology

interactions of the animal with its environment from a nutritional perspective. Nutritional ecologists have looked closely at the dynamic interface between humans and their food environment to develop new theoretical positions on how obesity and cardiovascular disease may have emerged with our current food environment. Raubenheimer and Simpson [12], for example, have developed an approach known as 'nutritional geometry' to present a 'protein leverage hypothesis'. Through analytical means, they argue that the current state of overconsumption of food may be due to varying access to

protein in a food environment that has vast amounts of food with a very wide range of nutritional quality. Raubenheimer and Simpson integrate knowledge of environment and evolution with analyses of data on food and nutrient consumption patterns to add a useful dimension to the study of nutrition science. This has implications for future developments in obesity management and the development of the food supply.

### **>> CASE 1.1**

# SHOULD WE RELY ON FOOD OR VITAMIN SUPPLEMENTS FOR ADEQUATE NUTRITION?

The debate between the relative value of foods versus vitamin supplements can be seen in many forms of media. For example, the headline 'Vitamins can harm cancer patients: scientist' appeared in the *Sydney Morning Herald* on 10 January 2013 [13]. This article reported Professor James Watson—co-discoverer of deoxyribonucleic acid (DNA)—debating in the Royal Society's journal *Open Biology* whether antioxidant use was much more likely to cause than prevent cancer. Supplementing with vitamins A, C and E was discussed. On the other hand, foods such as blueberries tend to be considered for their taste, even though they deliver vitamins. So how do we know what is better for consuming vitamins: food or supplements?

In a review of the food versus nutrient debate, Jacobs and colleagues [8] observed that vitamin supplemental trials often drew their logic from observational studies of relationships between food consumption patterns and health. Identifying the vitamins in those foods, and considering the known mechanisms of action of the vitamins, may have led to the hypothesis that vitamin supplementation may produce desired health benefits. When put to the test, however, some studies that used vitamin supplements produced unexpected negative health effects.

More recently, a group of European researchers conducted a systematic review and meta-analysis of trials involving dietary supplements and the prevention of heart disease and cancer. They examined data from 49 trials and 287,304 participants to conclude there was insufficient evidence to support the use of dietary supplementation in primary prevention. They found some small beneficial effects with some, no effects with others and a link between vitamin A supplementation and increased cancer risk [14].

- What does the research discussed above suggest about the nature of food versus vitamin supplements?
- What does it mean for the promotion of health?
- When might it be necessary to take vitamin supplements?

Given its fundamental role in human health, the nutritional value of food has a direct impact on the health of the population. The relationship between food and health goes beyond simple digestion and absorption of food at the individual level, but it is a good starting point for studying nutrition.

In the last 100 years or so, scientists have identified the chemical composition of critical food components that have proved essential for life. These are referred to as **nutrients**: macronutrients (protein, fat and carbohydrate) and micronutrients (vitamins and minerals). While it is now possible to consume nutrients in isolated and supplemental form, it is important to remember that their origins lie in food. Indeed, scientists are continuing to expand their knowledge of nutrients themselves, as well as identifying other components in food that are also proving to be significant. Breaking down food into its component parts is informative, but in the end we need to put it all back together again to understand the effect of food on health.



#### Nutrients

substances required for the nourishment of the organism, generally provided as components of foods.

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#### **Nutritional balance**

meeting the required amounts of all nutrients while at the same time meeting requirements for energy intakes. The knowledge of nutrients and other components in food does enable us to categorise foods in terms of their common composition. Thus, for example, we associate fruit with vitamin C and milk with protein and calcium. However, in classifying foods we should not be limited by our knowledge of single nutrients. By 'thinking foods first' [7], we are able to integrate new knowledge on food components as it emerges and build an understanding of why (and how) a particular food contributes to health. Of course, we do not eat one food alone, so effects are exposed in the context of a total diet.

In other words, there is interdependence between foods in promoting health (Figure 1.3). Specific foods may be associated with a total diet (e.g. extra virgin olive oil in a Mediterranean diet), but health outcomes result from all the foods consumed in the diet. Foods can be categorised in terms of their relative position in healthy diets and are likely to have that position because of their nutrient composition relative to the energy value they also contribute. Overall nutrient content is one attribute of a healthy diet, but achieving balance in total energy content and other dietary factors such as sodium and saturated fat also appears important in managing the diet–health relationship. At the same time, these dietary attributes will reflect the types of food chosen for consumption.

The concept of balance is critical in nutrition. This relates to the delivery of multiple nutrients as well as the construction of whole diets from different foods. It is consistent with the medical concept of homeostasis—the

physiological process by which the internal systems of the body are maintained at equilibrium, despite variations in external conditions [15]. The ensuing chapters in this book expand on the issue of food and nutritional balance from science and practice perspectives.

FIGURE 1.3 RELATIONSHIP BETWEEN FOOD, NUTRIENTS AND WHOLE DIETS



### **>> CASE 1.2**

#### NUTRITION INFORMATION ON FOOD LABELS

#### Food labels

Food Standards Australia New Zealand (FSANZ) provides useful information for consumers on details contained on food labels. Components include:

- 1 nutrition information panel (including nutrients per serve)
- 2 percentage labelling concerning the amount of ingredients
- 3 name and description of the food, which must be accurate
- 4 food recall information (including Australian or New Zealand name and business address of manufacturer or importer)
- 5 information for allergy sufferers
- 6 date marking (best before if shelf life less than two years, or 'use by' date for safety requirements)
- 7 ingredient list.

For more information, see www.foodstandards.gov.au/consumer/labelling/Pages/interactive-labelling-poster.aspx.

#### Health Star Rating System

A Health Star Rating can be seen on many manufactured food products in Australia. The Health Star Rating System was developed by Australian state and territory governments in partnership with industry and public health and consumer groups. The ratings are based on the overall nutrient composition of the food, with reference to overall energy value alongside 'positive nutrients' (e.g. fibre, protein, vitamins and minerals) and 'risk nutrients' (e.g. saturated fat, sodium and sugar). Not all foods will have ratings.

For more information, see http://healthstarrating.gov.au/internet/healthstarrating/publishing.nsf/ content/home.

- How do food labels and Health Star Ratings on food packages expose the consumer to the relationship between foods and nutrients?
- What are the challenges for consumers in using these features to make food choices?

From a biological perspective, food consumption affects health in the first instance by delivering key nutrients to support and maintain vital systems in the body. Scientific knowledge has provided a great deal of information for understanding why this is so, but there is always more to know, which means that some of our assumptions may change with time. We do not know everything that is in food and there is more to understand about the functions of the human body, but with ongoing research the picture is becoming clearer, providing stronger evidence for practice.

#### **TRY IT YOURSELF**

Consider the foods in your shopping trolley at your next supermarket visit. How many of them are fresh and how many are in packages? Of those in packages, what do the labels tell you about their nutritional quality? How would you use the information on nutrient content and/or Health Star Rating to judge the contribution of this food to the quality of your overall diet?



#### **Mechanistic research**

research that explains natural processes in physical or deterministic terms.

#### **Observational research**

research that examines relationships between environmental exposures and health outcomes.

# Randomised controlled trial (RCT)

an experimental study design that tests effects of treatments on health outcomes.

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There are many ways to establish a position on how food consumption affects health. From the perspective of modern Western science, there is a strong commitment to the scientific method, and this is applied by a range of scientific disciplines. Evidence frameworks [16] apply a system by which information is appropriately assessed to produce a position that is scientifically defensible.

Identifying the different chemical compounds in food has been one of the most significant steps in understanding how food affects health. The next step has been to characterise their mode of action in the biological context [17]. This can involve highly controlled experiments that use cell cultures or animal models where a great deal is already known and the pathways under study can be isolated and observed. This form of research can explain how the isolated compounds in food might act on physiological and biochemical

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processes, and is often referred to as **mechanistic research**. Given the nature of this research, it is not taken as direct evidence of effects but rather helps to explain observations that suggest this may be happening. Studying the basic sciences of chemistry, biochemistry and physiology helps the nutritionist to understand what underpins mechanistic research and to apply this knowledge appropriately in practice.

**Observational research** looks for relationships between dietary factors and health. Observational studies emerge from the science of epidemiology and help to build knowledge for practice. Population health research can provide important observations of relationships between dietary practices and health outcomes. Findings from observational studies still provide indirect evidence, but these studies are stronger than mechanistic

research because they are more directly related to the consumption of food and measurements of human health. The study context is less controlled than in a laboratory setting, but the discipline of epidemiology exerts its own controls on how the population is sampled, what is measured and the forms of statistical analyses that are conducted. Understanding these processes enables the nutritionist to evaluate the quality of the research in applying it to practice.

> **Randomised controlled trials (RCTs)** are considered to provide the best evidence where people consume foods and health outcomes are measured. Such studies provide direct evidence of effects of food consumption on health. The research is conducted in a more controlled human context, although this creates limitations as people normally eat food in a more flexible environment, and so the results may not be very generalisable. Nevertheless, evidence-based methodologies tend to accept that the results from RCTs

provide the highest level of evidence for effects of food on health. The practising nutritionist needs to keep up to date with food-related RCTs, bearing in mind that in most cases there will be studies showing positive effects and others that will not.

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### >> RESEARCH AT WORK

#### PREDIMED STUDY OF THE MEDITERRANEAN DIET

The most robust method of determining a cause-and-effect relationship between an intervention (such as a diet) and outcome (such as heart disease) is the RCT. An RCT is defined by:

- randomly allocating participants into different intervention groups
- including a 'control' or 'comparison' group in order to judge the effects of the intervention.

Participants in an RCT should be unaware of the group into which they have been placed and, ideally, staff working on the trial should also be blinded to the intervention (although this is not always possible) [18].

In the PREDIMED trial, around 7500 adults aged 55–80 years with either type 2 diabetes or three risk factors for cardiovascular disease were randomly allocated to receive control (low fat) dietary advice

in one of two groups advised on the Mediterranean diet, one supplemented with nuts and the other with extra virgin olive oil. The researchers found around a 30% reduced incidence of cardiovascular events (heart attack, stroke) in the Mediterranean diet groups [19].

See Chapters 1, 2, 5 and 7 on the PREDIMED trial and Mediterranean diet.

There are problems in conducting RCTs with food but, in reality, positions on the relationship between food and health are based on a body of evidence that is produced from many studies, often of different forms. The end result of all this science may appear to be that nutritionists are constantly changing their minds. This, however, is a simplistic response to a complex, evolving field.

As the science of nutrition evolves, it is expected that new knowledge will emerge and this may result in a changed recommendation. With the development of a broad framework for understanding nutrition in its own right, however, this is



less likely to be problematic. Quality review systems for evidence-based practice in nutrition are now widespread (Table 1.1) and are used in the development of dietary guidelines (Figure 1.4)—for example, in Australia (www.eatforhealth.gov.au), the United States (http://health.gov/dietaryguidelines) and other areas of food and nutrition policy around the globe (e.g. American Institute for Cancer Research at www.aicr.org). These systems provide methods for searching the scientific literature through to analysing the content of studies, evaluating their quality and arriving at a conclusion on the body of evidence as provided. The practice of evidence-based review is another form of science that is now being taken up and developed substantively in the nutrition domain.

Level	Intervention	Diagnostic accuracy	Prognosis	Aetiology	Screening intervention
_	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies
=	A randomised controlled trial	A study of test accuracy with an independent, blinded comparison with a valid reference standard, among consecutive persons with a defined clinical presentation	A prospective cohort study	A prospective cohort study	A randomised controlled trial
-	A pseudorandomised controlled trial (i.e. alternate allocation or some other method)	A study of test accuracy with an independent, blinded comparison with a valid reference standard, among non-consecutive persons with a defined clinical presentation	All or none	All or none	A pseudorandomised controlled trial (i.e. alternate allocation or some other method)
	<ul> <li>A comparative study with concurrent controls:</li> <li>Non-randomised, experimental trial</li> <li>Cohort study</li> <li>Case-control study</li> <li>Interrupted time series with a control group</li> </ul>	A comparison with reference standard that does not meet the criteria required for Level II and III-1 evidence	Analysis of prognostic factors among persons in a single arm of a randomised controlled trial	A retrospective cohort study	<ul> <li>A comparative study with concurrent controls:</li> <li>Non-randomised, experimental trial</li> <li>Cohort study</li> <li>Case-control study</li> </ul>
	<ul> <li>A comparative study without concurrent controls:</li> <li>Historical control study</li> <li>Two or more single arm study</li> <li>Interrupted time series without a parallel control group</li> </ul>	Diagnostic case-control study	A retrospective cohort study	A case-control study	A comparative study without concurrent controls: • Historical control study • Two or more single arm study
2	Case series with either post- test or pre-test/post-test outcomes	Study of diagnostic yield (no reference standard)	Case series, or cohort study of persons at different stages of disease	A cross-sectional study or case series	Case series

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LEVELS OF EVIDENCE IN HEALTH TABLE 1.1

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#### FIGURE 1.4 WORLD MAP OF FOOD GUIDES

#### **STOP AND THINK**

- How do we know that food consumption affects health?
- What is the relationship between nutrients, foods and diets?
- How can we achieve nutritional balance?

# HOW IS KNOWLEDGE OF NUTRITION APPLIED THROUGHOUT THE LIFECYCLE?

Translating nutrition knowledge to practice involves identifying the problem and working out how it can be changed. In the first instance, it is important to know what people are eating, the nutritional value of their diet, how it measures up to standards of nutritional requirements [4] and how it fits with **dietary guidelines**. Dietary guidelines provide recommendations for achieving a healthy diet; food standards regulate the composition of food and the statements that can be made about food products.

A consideration of **life stages** provides a useful platform for organising the application of nutrition knowledge to the healthcare of individuals and communities. Eating food is part of survival (recall that 'you are what you eat'), so understanding the needs of the body throughout the stages of life provides some insight into determining which foods might be best to consume. Not surprisingly, the resource needs of the first stages of life

#### **Dietary guidelines**

statements on strategies for choosing a healthy diet based on scientific evidence on the effects of food intake and dietary patterns on health.

#### Life stages

defined periods throughout the lifespan, such as infancy, childhood, adulthood and old age.

are critical, with subsequent growth and development affected by how the nutritional stage is set. For example, pregnancy and lactation are changed physiological conditions with specific requirements for nutrition resources. With maturation of the adult person and possible declines in physical activity, body composition may change, as will body chemistry and function, altering the need for energy and nutrients. The onset of chronic disease and the loss of functionality demand particular consideration in terms of changes to eating habits.

#### CASE 1.3

#### **OBESITY AND DIETARY HABITS OF AUSTRALIANS**

The Australian Institute of Health and Welfare (AIHW) produces regular reports on Australia's food and nutrition. In *Australia's Health 2016* [20], it was noted in data from the Australian Bureau of Statistics (ABS) that:

- in 2014–15 around 11.2 million Australian adults were overweight or obese
- the rate of obesity is increasing, with an average weight gain of 4.4 kg between 1995 and 2014–15
- overweight and obesity is more common among Indigenous adults
- in 2014–15 most adults (93%) did not eat the recommended five serves of vegetables
- in the same period, 50% did not eat the recommended two serves of fruit
- about 35% of energy intake was consumed as discretionary foods.

See more at www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129556760.

- How do the obesity statistics above reflect food and nutrition problems in the Australian community?
- How are discretionary foods defined from a nutrient and food perspective?

Most people are healthy when they are born, so the focus is on meeting nutritional requirements and maintaining energy balance. In the absence of chronic disease, applying nutrition principles from the perspective of managing physiological changes and functionality is the primary concern. For example, matching physiological changes and meeting specific nutrient requirements are key focal points for pregnancy and lactation. Meeting requirements is also important for infants and children, but there are particular considerations such as the development of healthy eating patterns and the prevention of childhood obesity. The main focus in adulthood is the prevention of chronic lifestyle diseases, such as obesity, hypertension, diabetes and cardiovascular disease, with a special emphasis on dietary patterns that are proving to be protective. Nutritional requirements for older ages are different again, particularly when older people are institutionalised and may suffer from malnutrition. In each case, however, being able to assess nutrition and dietary aspects are entry points to practice, as is the reference to standards and guidelines from which to judge the extent of potential problems (Figure 1.5).



#### FIGURE 1.5 NUTRITION REQUIREMENTS THROUGHOUT THE LIFECYCLE

### >> RESEARCH AT WORK

#### **IDENTIFYING NUTRITION TARGETS IN OLDER AGE**

Nutrition scientists are aware that the global population aged over 60 years is predicted to double by 2050. A review of nutritional considerations for healthy ageing noted that where older adults are unable to meet their nutritional requirements, 'nutritional frailty' can become a major concern. Chronic conditions likely to affect this are:

- cognitive decline
- dementia
- sarcopaenia (loss of muscle mass)
- reduced immunity to infectious disease.

There is evidence that all of these conditions may benefit from careful attention to a healthy diet, as has been shown, for example, with the Mediterranean diet in the PREDIMED study. Arguments have been made for research that examines biomarkers of these conditions, tests effects of nutritional interventions and re-evaluates current body mass index (BMI) standards for older adults. Health services may also consider how older adults can undergo a 'nutrition physical' as part of their routine healthcare [21].

In order to apply nutrition principles to individuals and populations we need valid dietary assessment methods, databases of food composition, population NRVs, and food and dietary policies and guidelines. **Dietary assessment methods** are necessary to be able to gauge the extent of nutritional problems. There are many forms of dietary assessment, ranging from surveys (questionnaires) to food records and observations of

# Dietary assessment methods

surveys, interviews and records that provide an account of a person's usual eating habits.

eating behaviour. The best method for assessing intake will very much depend on the purposes of the practice, the information required and the resources available to undertake the assessment. Decisions on methods of choice also need a well-informed nutrition base.

Food composition databases are required to convert information on food to information about nutrients. It is this process that tells us, for example, that a diet with many takeaway foods has a certain level of fat. From this information judgments can be made and appropriate advice given or action taken. The development of food composition databases is another significant area of nutrition science, and it also carries considerations for limitations of use and application.

Population NRVs provide the values for nutrient intakes that would best support the health of most people in the population. As such, they enable practitioners to compare values with those reported in their dietary assessment. Because there is a great deal of science behind the derivation of these values, it

is important to be able to apply this knowledge appropriately.

#### **Nutrition practice**

the application of nutrition knowledge to address an identified problem.

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**Nutrition practice** broadly relies on the identification of problems. Nutrition problems can be identified at the individual, community or institutional level. In Western societies, the prevalence of chronic disease associated with poor nutritional habits (e.g. overweight and obesity, type 2 diabetes, cardiovascular disease) underlines the problem

[22]. At the individual level, nutritional health can be managed by the person themselves through their own food choices, or they can seek individual help. The concept of 'self-care' recognises the autonomy of individuals in conducting the personal aspects of their lives, bearing in mind the responsibilities that go with them [23]. A starting point is the person's ability to assess dietary intake using valid methods and to make judgments on the quality of their diet with reference to dietary guidelines and food standards. At the individual level, people choose different foods because they have come to know they are better than others for health. They may use information on food labels in making those choices. They may look for advice, such as national dietary guidelines formulated by government health authorities [24].

Primary healthcare services provide medical, nursing and allied health support for individuals in the community and associated groups. The nutrition knowledge applied will also depend on individual circumstances, but in the first instance will reference the dietary guidelines as they relate to specific groups. For specific problems, such as the need to address the risk of cardiovascular disease, resources from related authoritative groups such as the Heart Foundation may provide more specific information. It all comes down to the level of translation required, which draws on the degree of specialised training in nutrition undertaken by the healthcare professional. If an individual becomes ill and this has implications for the food they eat, they may need to consult a health practitioner, and for specific nutrition expertise may consult a dietitian.

When disease takes hold and food intake can influence outcomes, the degree of knowledge integration, translation and application is much more demanding. It requires an understanding of where and how the condition deviates from the normal (pathophysiology) and how the components of food may influence this process. Combining this with an understanding of a person's usual eating habits and a knowledge of food composition then enables a specific dietary prescription to be drawn up that would help support the condition. The information provided in each case is usually different and therefore the application of generalised tools such as the dietary guidelines is inappropriate. The extent of nutrition knowledge required for this category of care is quite substantial, drawing on the basic sciences through to the evidence frameworks for the effects of diet on health. Medicare payments for dietetic services and employment of dietitians in hospitals reflect this required level of expertise.

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At a broader community level, there is a need to protect against the development of nutritionrelated illnesses in the population and ensure the food supply is supportive. Governments will also be involved at this level, developing public health-related policies, guidelines and standards aimed at protecting the health of the population (www.foodstandards.gov.au; www.nhmrc.gov.au; www. eatforhealth.gov.au). The food and agricultural industries are also important because of the role they play in the food supply to the population at large (www.agriculture.gov.au; www.agriculture.gov.au/ abares). In addition, there are various forms of nutrition promotion. Groups and societies can form to disseminate nutrition information and undertake activities that support nutrition in their communities. For example, schools provide basic nutrition education (based on the dietary guidelines) to children and can engage in activities to promote healthy food choices such as through school canteen policies and fresh food gardens (www.kitchengardenfoundation.org.au). Healthcare workers within community and public health programs can provide these community groups with resources and further guidance in developing nutrition promotion activities. These services may work across all age groups, including maternal, child, home and aged care facilities. The goal of nutrition in supporting health is the same throughout, but the particular knowledge and applications will depend on the needs and circumstances of the specific group.

### **>> CASE 1.4**

#### THE OTTAWA CHARTER FOR HEALTH PROMOTION

Translating knowledge of nutrition into practice requires a comprehensive approach to health and health promotion. Growing expectations regarding health promotion in developed nations around the world led to the development of a charter for health promotion. On 21 November 1986, an International Conference on Health Promotion was held in Canada to respond to the view that public health systems were too medically and disease-focused, too oriented to the individual, and not in keeping with the environmental, social and economic challenges facing health systems into the future.

The Ottawa Charter for Health Promotion [25] continues to represent consensus agreement on health promotion today. Essentially, the Charter vowed to build healthy public policy, create supportive environments, strengthen community action, develop personal skills and reorient health services.

- How might the Ottawa Charter for Health Promotion be applied in the Australian context?
- What are the implications of the Charter for the delivery of health services in nutrition?

At the community and institutional level, food service systems play a major role in decisions about food choice. These include services such as Meals on Wheels [26] and food-service systems in childcare centres, nursing homes, hospitals and worksite canteens. The nutrition knowledge applied in food-service systems includes and goes beyond the dietary guidelines. It references a range of standards and policies that have been developed through the fundamentals of nutrition science to ensure that the food delivered to recipients meets nutritional requirements, is safe to eat and is likely to be consumed. This includes policy relating to recommended dietary intakes of nutrients for different age groups, food safety standards and knowledge of culinary preferences and needs of the recipients. Most, if not all, people working in this

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area would benefit from an understanding of the fundamental principles of nutrition and food safety. At higher levels of responsibility, as in the case of a food-service dietitian [27], they would also need to apply standards for determining and monitoring food and nutrition quality, while translating and integrating a number of areas of nutrition knowledge.

### **>> CASE 1.5**

#### MEALS ON WHEELS: MORE THAN JUST A MEAL

The concept of Meals on Wheels—delivering meals to frail elderly people who wish to remain in their own homes and maintain a degree of independence, but who require a little extra help—began in Britain during the Second World War. The service came to Australia in 1952; it was started in Melbourne by an individual, taken over by the Red Cross and then spread to other states. Millions of meals are delivered each year to many older Australians by around 70,000 volunteers. The work carried out by the service also includes food safety and labelling for Meals on Wheels, research and resource development, advocacy in regard to national policy issues, and membership support [26; 28]. See also: http://mealsonwheels. org.au.

• What are some of the critical nutritional issues that Meals on Wheels services may have to deal with in meeting the nutritional needs of older Australians?



Research contributes to the generation of new knowledge, which helps to drive the practice, and practice creates new questions for research to address. Research agencies play an important role in expanding the understanding of all aspects of nutrition, from the details of how food supports health, to how better to implement strategies that have an effect on health (www.arc. gov.au; www.nhmrc.gov.au). There is a large number of locations for practice in nutrition with different pathways and requirements for applications of knowledge.

#### **STOP AND THINK**

- Why do nutritional needs vary across the lifecycle?
- How are nutritional problems identified at the individual and community level?
- What are some of the locations of nutrition practice where nutritional problems may be addressed?

# HOW DOES THE BROADER SOCIAL ENVIRONMENT INFLUENCE NUTRITION AND HEALTH?

Applications of nutrition science to human health occur in a broader social and environmental context. One way to consider this is to view the systems that influence See Chapter 2 on dietary guidelines.

the supply of food and the way it is regulated. Key stakeholders include governments and agencies, the food industry, the health and agricultural sectors, and other groups with interests in food (Figure 1.6).



#### FIGURE 1.6 KEY SECTORS IN THE COMMUNITY RELATED TO FOOD AND NUTRITION

**Food and nutrition policy** concerns plans for actions to be taken to deal with nutrition problems. Knowledge of nutrition is fundamental to ensure these policies are grounded in sound science and strong evidence. Nutrition research is an important underpinning factor in the development of policies and their related actions. Nutrition policy and related activities involve a principled approach.

This approach concerns many sectors of government and the community at large, and requires agencies for implementation and standards that inform implementation. For example, food standards are set to protect public health. They govern the types of ingredients that can go into foods and the information that can be provided on labels. FSANZ [29] develops the standards and they are enforced at state government level. These standards also relate to health claims that can be made on foods, based on scientific evidence.

# Food and nutrition policy

principles of action relating to the way in which food is dealt with by organisations and individuals.



### **>> CASE 1.6**

#### MARKETING OF FOODS AND BEVERAGES

The marketing of individual foods and beverages to targeted groups within the community is standard practice for the food industry and is integral to managing a business. However, controversies often arise in food and beverage marketing. These might relate to the way in which health-related messages are constructed, or when a risk to the community is perceived from the type of products being marketed to specific groups.

There are many issues surrounding the marketing of healthy food. These include the definition of a food or defining characteristics (e.g. wholegrain versus 'brown' versus wholemeal), the ingredients used in a food, and fresh single food versus foods processed with multiple ingredients. There are also many issues concerning the marketing of beverages, particularly where there may be health risks [30].

- What are the health risks of energy drinks mixed with alcohol?
- How much do we know about the effects of caffeine and alcohol mixed together?
- What are the particular risks to the target market of young adults?

#### Stakeholders

people or groups with a vested interest in an area under consideration.

#### Food value chain

the added value that occurs in relation to events that begin with agriculture or primary food production through to food processing, manufacturing, distribution, retail and food service to consumers. The way in which policy is developed generally involves drawing together a high level of expertise and some degree of consultation. The simple listing of stakeholder groups in food and nutrition policy demonstrates the very broad and complex social and cultural contexts in which it occurs. It also reflects the extent to which nutrition practice operates, and the levels at which this may relate to policy development.

Food is dealt with by society in a number of ways, so there are **stakeholders** at many points. Some stakeholders have a major influence on food choice behaviour. Others are important to the food value or supply chain. The **food value chain** is a concept that deals with the way food makes its way from where it is grown to where it is eaten (sometimes referred to as 'paddock to plate'). Because there are so many dimensions to food in society, linking food policy with nutrition requires a working relationship across a number of sectors. This has implications for nutrition practice, because it means the knowledge of nutrition has to be effectively applied in several settings.

#### **TRY IT YOURSELF**

Look at a food product you have recently purchased from a supermarket. Using the information on the packet, identify as many groups as possible that may be related to the production of this food and the reasons behind your purchasing it.

*Health services* are clearly a major stakeholder group in nutrition practice. This is because nutrition is important in the prevention of chronic disease (such as obesity, type 2 diabetes and cardiovascular disease), dietary change is required in managing disease once it is established (such as for weight loss, supporting cholesterol-lowering and hypertension management), and dietary intervention is required for certain disease conditions (e.g. malnutrition is a particular condition that has emerged in the elderly hospitalised population). As outlined previously, health services provide a key location for various forms of nutrition practice.

*Government departments and agencies* have many roles that have implications for food and nutrition. They need to protect public health, build an educated community, foster the creation of employment, encourage innovation and manage the economy. Food is associated with all of these components. The development of a national food and nutrition policy can be seen as one step towards integrating the functions of government to improve the nutritional health of the population.



### **>> CASE 1.7**

#### THE HEALTHY FOOD PARTNERSHIP

Making healthy food choices is dependent on being able to discriminate between foods, understanding how much food is appropriate (serve size), and the availability and accessibility of foods.

Under the auspices of the Australian Government's Department of Health, the Healthy Food Partnership aims to 'improve the dietary habits of Australians by making healthier food choices easier and more accessible and by raising awareness of better food choices and portion sizes' [31]. Aims include to:

- support industry to reformulate foods supported by the Health Star Rating System
- support consumers to eat more core foods—for example, fruits and vegetables
- educate consumers on portion and serve sizes
- improving consumers' knowledge and awareness of healthy food choices.

More detail can be found at: www.health.gov.au/internet/main/publishing.nsf/content/healthy-food-partnership.

- How would knowledge of food and nutrition be applied in the work of the Healthy Food Partnership?
- What do consumers need to know about food and nutrition to be able to make healthy food choices?

#### >> RESEARCH AT WORK

#### FOOD SECURITY IN A CHANGING WORLD

Climate change has significant implications for food production, with subsequent implications for nutrition. In 2010, the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) formed an Expert Working Group to develop a report titled *Australia and Food Security in a Changing World* [32]. The working group members included scientists with backgrounds in plant functional genomics, agribusiness, animal studies, environmental and rural sciences, climate adaptation, rural affairs and nutrition, who produced a set of recommendations on many aspects of food production, human health and environmental management. The awareness of the importance of nutrition was a key element, as was the need to reference nutrition standards and guidelines in broader overall activities. This example shows how nutrition science can contribute to multidisciplinary teams addressing important global health and economic problems.



Non-government organisations and many community organisations also have an interest in nutrition. Examples in Australia include the Heart Foundation (www.heartfoundation.org.au) and the Cancer Council (www.cancercouncil.com.au). Groups such as these take a particular interest in how nutrition relates to their specific concerns, such as the links between nutrition and the prevalence of heart disease and cancer, and how community education may assist in prevention. More general consumer advocacy groups (e.g. www.choice.com.au) may address concerns supporting consumer decisions that affect food and nutrition for the population.

Professional societies and organisations link individuals in a particular area of nutrition practice. They provide a form of peer support and tend to do so by setting standards (recognised through membership), providing continuing education and interacting with governments and the general community. Examples of professional nutritionrelated societies in Australia include the Dietitians Association of Australia (www.daa.asn.au), Nutrition Society of Australia (www. nsa.asn.au), Australian Institute of Food Science and Technology (www.aifst.asn.au) and Public Health Association of Australia (www.phaa.net.au).

*Schools* provide a basic education for life and this includes knowledge of human nutrition, often covered in health areas of the curriculum. The activities of schools can also influence nutritional

behaviours, such as through policies regarding the types of foods sold in school canteens (see, for example, www.health.gov.au). *Universities and higher education institutions* provide a deeper level of knowledge and enquiry, giving students pathways to many areas of practice, including nutrition communications and policy such as in public health, media and the food industry, education in schools and elsewhere, healthcare practice such as in dietetics, and ongoing formal research, to name just a few.

*Researchers* from a range of disciplines contribute to working with nutrition via many paths. Researchers in basic science bring cutting-edge knowledge of mechanisms by which components in food may be affecting the function of the human body. Food scientists build knowledge on food composition and how this is affected by food production and manufacturing processes. Epidemiologists and public health practitioners expose the links between dietary patterns and health, and the surrounding circumstances influencing these relationships. Dietitians and other health practitioners evaluate the consequences for individual and population health of any action or advice given in relation to food and

# Research and development

activities that address key questions and use valid methods to collect and analyse data or information that is evaluated and acted upon in developing new products or processes. nutrition. Food and agriculture groups advise on the opportunities, risks and feasibility of food supply positions. Consumer groups provide another critical set of perspectives.

**Research and development** agencies are integral to building nutrition knowledge. Research produces new knowledge that is taken up into the various forms of nutrition practice. In Australia, the research sector includes funding agencies such as the Australian Research Council (www.arc.gov.au) and the National Health and Medical Research Council (NHMRC), which serve as primary sources of research funds for universities (www.nhmrc.gov.au) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (www.csiro.au). The research and development (R&D) sector also considers the links between research and commercialisation.

Agricultural and livestock industries provide primary products to the food value chain in many countries (www.agriculture.gov. au). Australia produces most of its own fruit and vegetables, grains, meat and dairy products. Each of these sectors has associated research and development arms aimed at sustaining and enhancing their productivity with food innovation. Primary food products are significant contributors to the nutritional quality of diets, and primary food production therefore is an important stakeholder group for nutrition practice.

*Food companies* (food manufacturing industries and firms) are an important part of the food value chain. Much of the food sold in large



urbanised societies is manufactured to some extent. Food companies are able to compete on the market with their products through brands that are known for particular qualities. Some of this information is given on food labels and in marketing strategies. Innovation in food manufacturing includes the development of new products and this draws on R&D. This may relate to improving nutritional quality or establishing evidence of likely nutritional effects from consumption of those products. Nutrition research and marketing are important forms of nutrition practice with this stakeholder group.

*Retail outlets such as supermarkets* provide the main interface between consumers and food in large urbanised societies. They provide all forms of food, and represent a significant component of the food value chain from the paddock to the plate. Other food outlets such as restaurants, cafés, fast-food chains, institutional food-service/catering systems and vending machines are also significant contributors to the food supply. These constitute key elements of exposure to the food environment in which individuals make food choices that ultimately influence their health.

From this introductory chapter it becomes apparent that we need to know more to better understand and apply nutrition knowledge more effectively. Knowledge of food and nutrition expands into a network that takes us to different areas and poses more and more questions as we go. You will soon realise why nutrition is constantly debated and why you need to keep abreast of new knowledge to get the most out of your study of nutrition. Enjoy the journey!

#### **STOP AND THINK**

- Who are the main stakeholder groups in food and nutrition in Australia?
- What is the relevance of the food value chain to the nutritional health of the population?
- How do policies and guidelines protect the nutritional health of the population?

### SUMMARY

- Food delivers essential components that support the structure and function of the human body, but the concept of food synergy recognises that the effects of food may be greater than the sum of its parts.
- The stages of life provide a useful framework for applying scientific knowledge of nutrition to health-related practice.
- The applications of nutrition science in practice can occur at a number of levels, from individualised self-care through to managing individuals in healthcare institutions.

### **PATHWAYS TO PRACTICE**

- There are many areas of practice that relate to working with nutrition. This occurs at the individual level with consumer food choice and healthcare dietary advice, and at the population level through guidelines, standards and community programs.
- Healthcare delivery and the development and governance of policy are high-order activities, but involvement in nutrition occurs at all levels of society.
- The important issue is that contributions are appropriately located, and recognition is given for the area of expertise that is required.

### **DISCUSSION QUESTIONS**

- 1 How is food defined and how is it different from vitamin supplements?
- 2 How does nutrition science provide evidence for the effects of food consumption on health?
- **3** What are some of the problems associated with communications in nutrition and the health benefits of foods and nutrients?
- 4 How does the concept of life stages provide a useful framework for defining nutritional needs?
- 5 How do we know if there are nutrition problems in the community?
- 6 What is a food value chain and where do stakeholders fit into this concept?

### **USEFUL WEBLINKS**

American Institute of Cancer Research: www.aicr.org

Australian Bureau of Agricultural and Resource Economics and Sciences: www.agriculture.gov.au/abares

Australian Dietary Guidelines: www.eatforhealth.gov.au

Australian Government, Department of Health Healthy Food Partnership: www.health.gov.au/internet/main/publishing.nsf/content/healthy-food-partnership

Australian Government, Department of Health. Health Star Rating System: http://healthstarrating.gov.au/internet/healthstarrating/publishing.nsf/content/home

Australian Health Survey 2011–13: www.abs.gov.au/australianhealthsurvey

Australian Institute of Food Science and Technology: www.aifst.asn.au

Australian Institute of Health and Welfare—*Australia's Health 2016*: www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129556760

Australian Meals on Wheels Association: http://mealsonwheels.org.au

Australian Research Council: www.arc.gov.au
Cancer Council:
www.cancercouncil.com.au
Choice:
www.choice.com.au
Commonwealth Scientific and Industrial Research Organisation: www.csiro.au
Department of Agriculture and Water Resources: www.agriculture.gov.au
Dietary Guidelines for Americans: http://health.gov/dietaryguidelines
Dietitians Association of Australia: https://daa.asn.au
Food Standards Australia New Zealand: www.foodstandards.gov.au
Heart Foundation: https://heartfoundation.org.au
National Health and Medical Research Council: www.nhmrc.gov.au
Nutrition Society of Australia: http://nsa.asn.au
Public Health Association of Australia: www.phaa.net.au
Stephanie Alexander Kitchen Garden Foundation: www.kitchengardenfoundation.org.au

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