

4 Food and nutrition: 1901 onwards

From 1901 onwards, improvements in food quality, food safety and nutrition contributed to the health and increased longevity enjoyed by most Australians at the start of the 21st century, as evidenced by:

- declines in death rates generally, through improved nutrition and correspondingly better health, and
- declines in death rates specifically, through
 - decreases in foodborne infectious diseases, as the result of a range of food safety measures;
 - an 85% reduction in stomach cancer over the period 1925-2000, largely credited to the introduction of refrigeration and changes in meat-curing practices (Box 4.1); and
 - reductions in some chronic diseases, such as coronary heart disease, partially attributed to dietary changes from the 1970s.

From early in the 20th century, public health practitioners marketed the advantages of particular foods in order to improve the nutritional status of the population. Later in the century, nutritional campaigns and public concerns about food tended to be more critical, even as food availability, affordability and quality increased.³⁰⁸

Over the century, it was recognised that food had the capacity to both cause and protect against disease.³⁰⁹ For example, the rapid rise and subsequent decline in the rate of sudden deaths from coronary heart disease was mirrored by the dietary intake of saturated fats and later, of polyunsaturated margarine from the 1970s.^{310,311} By the end of the century, there were concerns about over-nutrition, 'empty nutrition' (high caloric foods which lacked nutrients), and energy-dense foods and drinks; the role of poverty in nutritionally poor diets that led to overweight and obesity; the claims made about the health benefits of some foods; and the community's need to interpret conflicting advice and 'science' about food and healthy food behaviours.^{312,313,314,315}

Health, growth and nutrition are interrelated, and average population height has been used to reflect the nutritional status, health and life expectancy of a population.²³⁹ As nutrition improves with general improvements in socioeconomic conditions over the century, average population height also increases. Long-term changes in height slowed over the last two decades of the century, although body weight increases began occurring, raising concerns about population levels of overweight and obesity.

***Survey respondent:** 'Life expectancy was impacted by lack of nutrition knowledge and poor food security. Whilst not all segments of society are equally advantaged, under-nutrition is less widespread than was the case prior to the baby boom era (from the late 1940s when food rationing no longer occurred).'*

Food production also underwent significant transformation during the 20th century, in areas such as animal husbandry, agricultural production, and food harvesting, processing and storage technologies. Standard setting and the regulation of standards for food production ensured that Australia's food supply was one of the safest in the world.³¹⁶ Changes in food regulation (such as the adoption of a whole-of-food-chain approach) were designed to adapt and respond, in order to protect consumers from unpredictable risks in the food supply chain.

At the end of the 20th century, the cheaper manufacturing and growth in sales of energy dense foods and the affordability of fresh foods emerged as important issues, with fresh foods affected by increases in the price and availability of land, water and transport, and subject to drought, crop disease and sudden disaster (e.g., the effect of Cyclone Larry in decimating Australian banana production in 2006).³¹⁷

Public health practices

Public health approaches were exemplified by a focus on prevention, promotion and early intervention in partnership with the community and other agencies, to influence population nutrition and improve food quality. The supply of safe, affordable and nutritious food was an important public health goal, and principles were applied:

- to guarantee the safety of food and the food supply;
- to set standards for safe food production and supply, and enforce and monitor them;
- to inform and educate the community about food, nutrition and healthy food practices;
- to operate a response system to contain, treat those affected by, and prevent the further spread of, outbreaks of foodborne disease; and
- to reduce preventable nutrient-related deficiency diseases and conditions.

By the end of 2002, food was required to be labelled with information related to seven nutrients (including sodium and saturated fats), so that consumers had access to information to assist healthy food selection.

From its relatively early days, Australia was a supplier of food to other countries, and a keen user of innovative technologies, many of which improved and extended the ability to supply fresh food to distant markets (e.g., the use of refrigeration on ships to export fresh meat), and reduced various hazards in preserving food (e.g., lead-free food canning). The technology of food fortification was used from the 1960s when salt was first fortified with iodine. Subsequently, flour for bread was fortified with thiamine (from 1991), and various foods were voluntarily fortified with folic acid (from 1996). These public health measures were aimed at reducing a number of preventable deficiency diseases and certain congenital malformations.

The early establishment of dietary standards, including those for breastfeeding and later of nutrition policies, provided guidelines, educational material for health workers and other instruments to support the national effort to improve public nutrition. Health promotion practitioners worked to educate the Australian community in 'food literacy', healthy food behaviours, and hygienic food handling practices, from school onwards. Apparent increases in the consumption of fresh fruit and vegetables were attributed to public health's educational efforts; however, more remained to be done to tackle the unintended effects of cheaper, energy dense and processed foods on the population.

Table 4.1: Historic highlights of better food and nutrition

1901	Federation - under Section 51 of the Australian Constitution, food controlled by state and territory legislation.
1905	The Victorian <i>Pure Food Act</i> enacted - the first overall food act in Australia.
1907	Federal Council of Chambers of Manufacturers lobbied commonwealth and state governments for a uniform system of food laws.
1908	Commonwealth <i>Quarantine Act 1908</i> passed, covering imported foods. Uniform food standards promised by the Prime Minister Deakin.
1912	The first refrigerators for domestic use appeared.
1914	Australia likely the first country in the world to enact pure food laws and standards.
1922	Victorian <i>Milk Supply Act</i> passed after concerns about the quality of Melbourne's milk supply. Australian Dairy Council established - enforced the pasteurisation of milk and undertook research, advertising and marketing.
1926	Free School Milk program began in Australian primary schools.
1936	A Commonwealth Inquiry into Nutrition concluded that Australians were generally well-fed, but there was much ignorance about diet. National Health and Medical Research Council (NHMRC) set up.
1939-45	World War II food rationing, and exportation of food to England to serve the war effort. Public health information on feeding a family was couched in patriotic terms.
1940s	Major improvements in many food technologies, standards and regulation following World War II.
1961	The international Food and Agriculture Organisation established the Codex Alimentarius Commission, to further both consumer health and fair trade practices. Australia was a member from the outset.
1968-72	Fast food chains established.
1970s	Crisis of heart disease, stroke, hypertension & diabetes. Public discussion of the role of diet.
1973	Food packaging scare (relating to polyvinyl chloride (PVC) food and beverage containers) led to public health measures to establish standards for plastics that come into contact with food.
1974	Free School Milk Program ended after evidence suggested that children's protein and calcium levels were adequate. Decline in calcium intake followed.
1975	Conference of Commonwealth and State Health Ministers agreed to a joint working party to draft a Model Food Act to achieve national uniform food legislation.
1981-89	States and territories implemented uniform food legislation based on the 'Model Food Act' developed in 1980.
1982	First <i>Dietary Guidelines for Australians</i> published.
1986	The Better Health Commission recommended a strategic focus on nutrition. ³¹⁸
1991	The <i>National Food Authority Act</i> passed, the first federal legislation enacted to unify food standards in Australia, and the National Food Authority (NFA) created.
1992	Imported food regulated specifically by the Commonwealth <i>Imported Food Control Act 1992</i> .
1994	NFA proposed national food safety programs using Hazard Analysis and Critical Control Points (HACCP) methods.
1995	First National Nutrition Survey conducted by the ABS (in association with the National Health Survey). Death of a child from Haemolytic Uraemic Syndrome and hospitalisation of 23 others in SA after eating contaminated mettwurst led to strengthened national food regulation for fermented meat products.
1996	Trans-Tasman Mutual Recognition Arrangement signed, permitting goods, including foodstuffs, to be freely traded between Australia and NZ.
1998	Food regulation review (Blair report) <i>Food: a growth industry</i> released. National Office of Food Safety created. <i>Australian guide to healthy eating</i> released.
1999	National Aboriginal and Torres Strait Islander Nutrition Working Party established. <i>Dietary guidelines for older Australians</i> published (NHMRC).
2000	Draft Model Food Bill released. New joint <i>Australia New Zealand Food Standards Code</i> adopted after a six-year review of existing food standards - the first joint food code between Australia and NZ. National Biotechnology Strategy launched.
2001	Food Standards Australia New Zealand (FSANZ) created (replaced ANZFA, which was established in 1996).
2003	<i>Dietary guidelines for children and adolescents in Australia</i> published (NHMRC). National Biotechnology Strategy extended to 2008, after 2003 evaluation.
2004	Government ministers asked to consider compulsory iodine and folic acid fortification of certain food following the re-emergence of iodine deficiency in Australia and NZ.
2006	Review of food and agricultural policy, <i>Creating our future: agriculture and food policy for the next generation</i> . New <i>Nutrient Reference Values for Australia and NZ</i> including <i>Recommended Dietary Intakes</i> prepared by the NHMRC released.

4.1 Food technology development

1901 onwards

Modern food technologies date back to the introduction of heat processing in the 1780s.³¹⁹ In the 19th century, there were many essential developments in the storage and transport of food. An over-production of lean meat in Australia in the 1840s stimulated the development of a meat export industry to Britain. From 1840 to 1940, food technology became firmly established, and Australia was, and remained, a significant net exporter of food.³²⁰

Technological changes included meat canning and refrigeration. The refrigeration and pasteurisation of milk conferred protection against bovine tuberculosis (TB) and other milkborne diseases. The introduction of refrigeration reduced the need for harmful food preservatives, leading to substantial reductions in stomach cancer, increased dietary protein intake, and directly contributed to the modern rise in adult height.³²¹

Meat canning expanded in the 1870s, and accelerated in the last twenty years of the 19th century. During that time, substantial advances in the milling, dairy, brewing and sugar industries and in refrigeration were introduced.³¹⁹

'Science began to be applied to food; new methods and efficiency lent new authority to analytical chemistry, which quite rapidly led to the control of food technology through food regulations, and science was also applied in the brewing and sugar industries and to cereals.' – Australian Academy of Technological Sciences and Engineering, 2000.³¹⁹

Up to the beginning of World War II, modern can-making and canning techniques replaced older hand fabrication and sealing methods. A variety of food companies was established, the processing of fruit and vegetables (by canning, freezing and dehydration) was refined, research and development emerged in government and industry laboratories, and ancillary or service companies arose.

World War II provided a major impetus to the development of food technology in Australia. New products, methods, packaging materials and techniques were introduced. Better regulation of foods led to important changes in the control of food additives and contaminants, and in packaging (e.g., the introduction of lead-free, welded cans replaced those with lead solder-sealed side seams). The period after World War II was a time of technological expansion, with the application of food science. Public health practices expanded in concert with these technologies.

Plastic food packaging suffered a setback in 1973 when a number of cases of a rare angiosarcoma (a malignant vascular tumour, which can arise from prolonged exposure to vinyl chloride monomers) were found in workers involved in the manufacture of polyvinyl chloride (PVC), and traces of vinyl chloride monomer were detected in some foods and beverages packaged in PVC containers. Immediate action was taken to establish standards for plastics that were in contact with food, and food containers were made according to stringent regulations and standards.

By the end of the century, there were further advances in food science and technology leading to potential changes to foods. These included developments in modern biotechnology (e.g., recombinant DNA technology, molecular and cellular biology, biochemistry and immunology) to produce genetically modified crops, animals and foods. Managing change in existing and future food technologies and the associated risks to public health was challenging.

Other changes in food regulation - adopting a whole-of-chain approach to food safety and restructuring the regulatory system around the identification, assessment and management of risk - had a flow-on effect, improving management technologies for primary producers (e.g., in information systems for traceability). Australia became an exporter of food standards and regulatory systems, as well as an exporter of food.³²²

Factors critical to success

The almost universal application of food technologies across the population was critical to the successful public health actions taken in this area. Refrigeration, for example, was a remarkable invention both domestically and commercially; and refrigerated containers allowed fresh food to be supplied to distant markets. Improvements and innovation in food packaging and storage technologies were introduced industry-wide, contributing further to Australia's reputation as a country with a safe food supply, and, therefore, a supplier of safe food.

Many new food technologies were introduced relatively quickly after their benefits had been identified (e.g., pasteurisation of milk against TB), thus substantially improved public health and safety, efficiently and at low cost. Good science and improving cost-benefit risk assessments also guided food technology developments, such as the introduction of Hazard Analysis and Critical Control Point (HACCP) methods.

Future challenges

Challenges included finding better ways to manage the introduction and risks associated with changes in food technologies, represented by advancements in biotechnology such as genetically modified crops, animals and food.

'Biotechnology holds the promise of improved health and welfare for all Australians through better understanding of disease, improved diagnosis, and treatment with more specific biopharmaceutical products. Biotechnology, including the genetic modification of agricultural and food products also has the potential to deliver productivity, competitiveness and sustainability benefits to Australia. The technology offers improved resistance to insects and disease, and new uses for agricultural products, improved food qualities, reduced environmental impact and bioremediation are all possible.' – Ministerial foreword, Australian biotechnology: a national strategy, 2000.³²³

The Australian government's National Biotechnology Strategy (NBS) identified the importance of capturing the benefits of biotechnology, while safeguarding community and environmental health.³²³ Genetically modified (GM) foods were likely to become more common globally, as food producers used biotechnology to control 'input traits' (such as herbicides, drought and salt tolerance), insect and virus resistance, and 'output traits' (such as improved food characteristics e.g., rice containing Vitamin A, oilseeds with increased levels of omega-3 fatty acids).³²⁴ The possible long-term health effects of these modifications were undetermined, and difficult to anticipate.³²⁵

In response, Australian governments established a strong regulatory framework for gene technology. For example, FSANZ's food safety assurance program assessed whether food contained any additional allergens or toxins resulting from the GM process; the Gene Technology Regulator assessed GM plants for potential environmental impacts; and GM plants were subject to regulatory safeguards before being licensed for release.³²⁶

'Safety issues surrounding foods derived from GM [genetically modified] plants are central to their acceptance into the food chain. Consumers seek reassurance about the safety of the food they eat, in terms of both its immediate and long-term health effects. Rigorous scientific assessment of GM food safety is therefore essential to provide a sound scientific basis for future regulation.'

Huppatz & Fitzgerald, *Medical Journal of Australia*, 2000, p. 170.³²⁶

Other public health safety approaches to GM food interventions involved:

- developing monitoring systems for adverse events in those eating GM foods and for ecological impact when effects might not become apparent for years, or possibly decades (e.g., if the latency period between the impact of the food and related illness is long, as with Mad Cow disease);
- governments, industry and researchers working together to achieve nationally consistent traceability and tolerance protocols; and

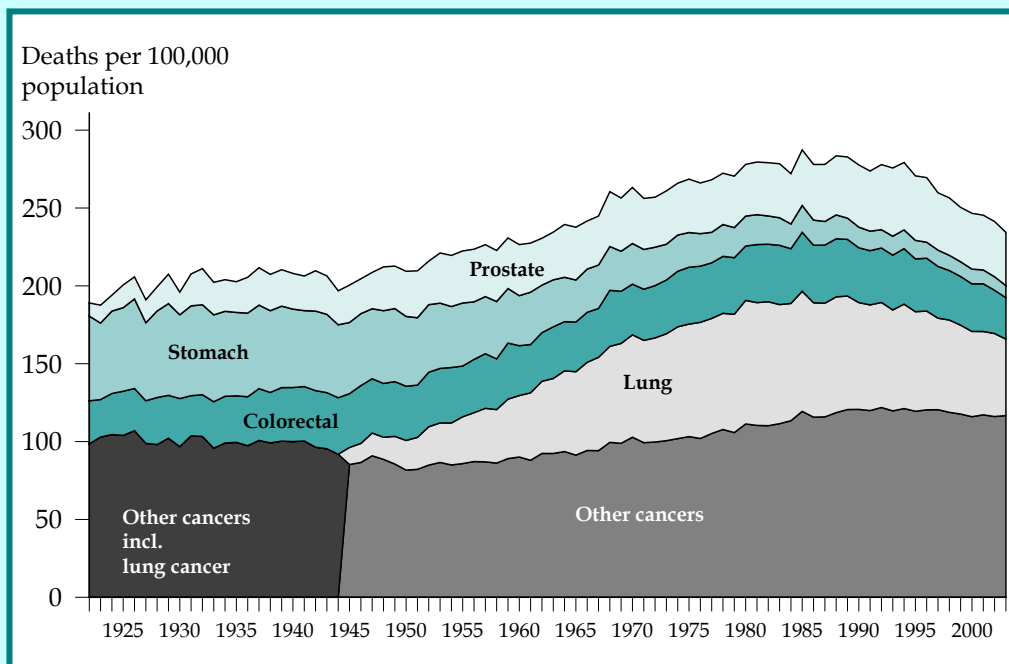
- regulatory systems to build community trust and confidence that the operational checks and balances would ensure that food derived from new technologies was safe and beneficial.^{324,325,326}

Box 4.1 The health impact of refrigeration, and reductions in cases of stomach cancer, 1900-

In 1897, refrigeration was first used in ships to transport fresh meat, thereby reducing wastage and improving nutrition in the 'old world' (the UK). The decline in the prevalence of stomach cancer was associated with the increased consumption of fresh fruit and vegetables, and the advent of widespread refrigeration after World War II.³²⁷

Refrigeration replaced the need for harmful food preservatives (e.g., nitrates) that caused stomach cancer. The fall in the death rate of 85% (1925 to 2000) for stomach cancers was applauded as one of the 'notable success stories relating to trends in mortality'.²⁵ Stomach cancer rates fell from 54 deaths per 100,000 males and 32 deaths per 100,000 females in 1925, to ten and four deaths per 100,000 males and females, respectively, in 2000 (Figure 4.1).

Figure 4.1: Decline in stomach cancer rate, males, 1922-2003



Source: AIHW, *Mortality over the twentieth century in Australia*, AIHW, Canberra, 2006, p. 28.

Refrigeration was strongly linked to improved nutrition - it was estimated that the adoption of refrigeration increased dairy consumption by 1.7% and overall protein intake by 1.25% annually after the 1890s; and directly contributed at least 5.1% of the increase in adult stature of post-refrigeration cohorts (see Section 4.3).³²⁸

Refrigeration enabled the storage and transport not only of fresh food, but also of medicines and vaccines. The related technology of air conditioning was expected to play an increasing part in preventing heat stress deaths in the hotter areas of Australia, as the climate warmed.

The need to improve mechanisms for public information and consultation about significant technology issues in the community and politically was supported by public views of biotechnology developments.³²⁹ Strategies identified in the *National Biotechnology Strategy* (NBS) to increase community awareness and informed debate included action:

- to engage the community in discussion of regulatory processes, including testing and labelling of GM foods, and assessing and managing risks to human health and the environment;
- to build community confidence in biotechnology, its regulation, the industry, and the way risks are assessed and managed;
- to inform consumer discussions and listen to community concerns; and
- to encourage public contribution to policy decisions.³²³

The 2003 evaluation of the NBS affirmed a continuing need for ‘generic information on risks and assessment methodology to underpin future risk assessment’ and suggested that more information on the role of each of the various regulatory agencies could increase public confidence in the safeguards already in place.⁷²⁷

4.2 Food regulation

1905 onwards

Historically in Australia, food regulation intersected the areas of public health and safety, consumer protection, and business regulation.³⁰ Food regulation was defined as:

‘Actions by government which affect the safety or quality of, or the information available in relation to food; encompassing all types of government regulation-making, industry self-regulation, compliance and enforcement activities; and covering relevant activities of all businesses in the supply chain’ – Food Regulation Review Committee [‘the Blair Review’], 1998.³³⁰

Food regulation involved the development and enforcement of food standards that took into account possible regulatory impacts, yet ensured the highest possible level of consumer protection.

Food and drug legislation expanded in Australia in the early 20th century, as standards for foodstuffs were developed, and it became an offence to sell food that did not comply with the detailed specifications applying to it. The *Victorian Pure Food Act 1905* was the first over-arching food act developed in Australia. In 1908, the *NSW Pure Food Act* was passed, with other states following soon after. Despite the fact that a conference of state premiers in 1908 decided that uniform legislation to standardise manufactured food was desirable, it was not until 1975 that federal and state Health Ministers agreed to draft a Model Food Act.³⁵ Its purpose was to meet the need for complementary national regulations for food standards, hygiene, labelling and packaging.³³¹

The Model Food Act developed in 1980 as a blueprint for the development of jurisdictional legislation was described (in 1995) as ‘the most important recent development in food law in Australia’.³⁰ The *Queensland Food Act 1981* was the first state legislation to implement the model legislation. Other states and territories legislated soon after, with Victoria, SA, NT, NSW and ACT creating *Food Acts* in 1984, 1985, 1986, 1989 and 1992 respectively; and Tasmania and WA amending their *Public Health Acts* in 1984 and 1985.³³¹

The *National Food Authority Act*, passed in 1991, was the first federal legislation to unify food standards across Australia. The legislation implemented a number of commonwealth/state/territory agreements, including that of the Australian Health Ministers in 1990 to a national method of setting food standards. It established a National Food Authority to develop food standards and, in cooperation with the states, to educate the community. In 1996, the Commonwealth passed amending legislation to transform the National Food Authority into the Australia New Zealand Food Authority (ANZFA) and establish a joint food standards-setting system for Australia and New Zealand.³³²

Imported food was regulated by the Commonwealth under the *Imported Food Control Act 1992*, so such foods had to conform to domestic Australian laws.

A review of food industry regulation conducted by Dr Bill Blair sought ways to reduce the regulatory burden of Australia's food regulation regime, while maintaining public health and safety.

The Blair Review reported in 1998 that the food regulatory system in Australia was 'complex, fragmented, inconsistent and wasteful', and recommended that governments:

- aim for an integrated, streamlined and cost-effective co-regulatory system to protect public health and safety effectively across the whole food supply chain;
- develop effective working relations and partnerships between food regulation agencies, the agrifood industry, statutory authorities and consumers;
- centralise responsibility for developing domestic food regulations and standards in a national agency that operated as a partnership between the Commonwealth, states and territories, and recommended resulting regulations and standards to Ministers for national agreement and uniform adoption, enforced and administered by state/territory regulatory agencies;
- ensure a single Commonwealth/state/territory and New Zealand Food Regulation Ministerial Council responsible for developing all food regulations in Australia; and
- streamline standard-setting processes.^{333,330}

The main proposal was for a co-regulatory approach to food regulation based upon government, industry and consumers working together.³³⁴ Under the Food Regulation Agreement (FRA) signed in 2000, the Commonwealth, states and territories agreed to implement a cooperative national system of food regulation. A draft Model Food Bill was released, with Annex A to be uniformly applied when states and territories passed Model Food Bill legislation, and Annex B varying between jurisdictions. The *Australia New Zealand Food Standards Code* was adopted after a six-year review of existing food standards – the first joint food code for Australia and New Zealand.

A new statutory authority, Food Standards Australia New Zealand (FSANZ), replaced ANZFA in 2001.³³³ FSANZ reported to the Australia New Zealand Food Regulation Ministerial Council, which was composed of Australian and New Zealand government representatives from both health and agricultural portfolios.³²⁴ The Ministerial Council endorsed principles and protocols for the development of food regulation policy guidelines in 2005 (Box 4.2).

FSANZ' role was to develop and regulate food standards in Australia and NZ. It did so with advice from other government agencies (e.g., the Therapeutic Goods Administration), input from consumer and industry groups, and consideration of food regulation policies endorsed by the Ministerial Council. In the process, FSANZ was required to consider the many public health issues that fall within the spectrum of food regulation. These included labelling, mandatory fortification of foodstuffs, health claims, additives and nutritional supplements.^{335,313}

Food standards then covered the entire food supply chain - from primary production to

'Never before in the history of food consumption have people been so conscious of the safety of their food – and so dependent on others for protection, both within and outside the food supply chain.'

G Peachey, *National standards for food safety*, 2005.³¹⁶

Box 4.2 Principles for development of food regulation policy guidelines

The Australia and New Zealand Food Regulation Ministerial Council (2005) endorsed principles and protocols for the development of food regulation policy guidelines. The guidelines should:

- be consistent with the *FSANZ Act*;
- reflect the application of the *Australia New Zealand Food Standards Code* to the whole food supply chain (Australia only);
- take into consideration existing legislation;
- prioritise policy principles, where appropriate;
- be clear, concise and unambiguous;
- be evidence based wherever possible;
- be developed in a level of detail commensurate with the complexity and sensitivity of the policy issue;
- take into consideration any relevant social or cultural impacts; and
- take into consideration the potential regulatory impact of the policy.

Source: Australia and New Zealand Food Regulation Ministerial Council, *Principles and protocols for the development of food regulation policy guidelines*, 2005, p. 9.

manufactured food and retail outlets - and all food sold in Australia (i.e., both domestically produced and imported food), had to comply with the relevant standards.³³⁵ Implementation, monitoring, and enforcement of food standards was, however, carried out by state and territory, and in some cases, local governments - introducing the potential for inconsistent and burdensome regulation for food suppliers who operated across several jurisdictions.

A review of food and agricultural policy in 2006 concluded that 'despite Australia's high food safety standards, there [was] considerable room for improvement in their governance and implementation'.³²⁴ The review noted that regulation-imposed business costs were ultimately paid by consumers, and that, while reforms were to have reduced the compliance burden on the food sector, they had not achieved their aims. Other problems included inconsistent implementation of food regulation, regulatory processes, and a lack of alignment of domestic food standards with international standards under Codex. The review concluded that food regulation governance arrangements needed to be revised urgently to meet national policy objectives.³²⁴

Public health practices

The supply of safe, affordable and nutritious food was an important public health goal. As such, food regulation in Australia was strongly focused on the protection of public health and safety through the development and enforcement of nationally uniform food standards.

Food regulation had three objectives:

- protection of public health and safety;
- provision of adequate information relating to food to enable consumers to make informed choices; and
- prevention of misleading and deceptive conduct.

Responsibility for the regulation of food in Australia was shared between the Commonwealth and state and territory (and in some cases, local) governments, and relied upon the effective cooperation between the parties to the Food Regulation Agreement.

By the end of the 20th century, food hygiene practices provided protection from foodborne diseases in the growing, processing, preparation and handling of food. Good agricultural practice (GAP) and good manufacturing practice (GMP), helped to avoid, for example, the introduction of viruses onto raw foodstuffs and into the food manufacturing environment. HACCP controlled viruses that might be present during the manufacturing process.³³⁶ Food premises in Australia were regulated and routinely inspected. These public health practices in agriculture, manufacturing, processing, and food service, together with the protection afforded consumers by the Commonwealth *Trade Practices Act*, the *Food Acts* of states and territories and non-mandatory codes of practice for specific foods and food processing industries, all contributed to a food supply that was reported to be one of the cleanest and safest in the world.³¹⁶

At a national level, several additional government agencies were involved in the regulation and supply of safe food. The Australian Quarantine and Inspection Service (AQIS), for example, performed a vital role in monitoring imported foodstuffs and minimising the risk of diseases such as 'mad cow disease' and aflatoxins (fungal toxins) entering the local food supply.³³¹ Likewise, the Department of Agriculture, Forestry and Fisheries monitored new agricultural methods, such as genetic modification of crops, processing techniques and chemical or microbiological contamination risks.³³⁷

As manufacturing processes became more sophisticated and consumer demand expanded accordingly, products such as 'nutriceuticals' (functional foods), medicinal foods, and performance-enhancing foods (sports foods) necessitated increased scrutiny by regulators. The development of new or strengthened food standards followed, along with further food packaging and labelling standards. Improved nutritional and ingredient-derived labelling was, in part, a reflection of the desire of consumers to achieve dietary goals through the ability to make informed choices.

Factors critical to success

The modern ability of Australian governments to regulate food standards and processes across the food supply chain was critical to the development and continuation of a safe food supply. Domestic food regulation and standards were operationalised in a complex partnership between the Commonwealth, state and territory, and local governments. Effective cooperation was enhanced through the agreement between these parties to a national method of setting food standards, and the enactment of legislation to implement unified food standards. Strengths were getting these and other partners across the federal system to act in a nationally consistent way, while weaknesses related to the inevitable inconsistencies and the somewhat cumbersome processes that were developed.³²⁴

FSANZ, the independent statutory agency with responsibility for standard-setting, worked with industry, consumers and state and territory jurisdictions, and considered that 'consultation [had been] replaced with engagement', believing that 'engagement leads to convergence'.³¹⁶ The time taken to achieve a standard was critical to remove ambiguities and align all partners to a common approach.

The 'whole-of-supply-chain' approach to regulating the food supply, adopted by Australia and NZ in 2002, was another successful factor in transforming food regulation. It identified potential hazards and applied risk management control at key points along the chain.³¹⁶

Cost-effectiveness

Overall, improvements in food safety regulation over the century resulted in benefits to society – in terms of reduced health risk (e.g., less illness, death, and loss of productive capacity due to failures in food safety) over and above the costs of introducing and maintaining improvements. It was, however, a complex area and difficult to 'prove' this likely outcome over the whole of the century with the knowledge and analytic tools available to date.

The Blair Review (1998) reported that most agrifood businesses employed practices and equipment that matched or exceeded the standards required by law.³³⁴ Indicative costs of food-related regulatory compliance per firm represented around 0.3% of average annual turnover. ANZFA assessed the proposed improvements to food safety standards as a tangible way to achieve 'highly significant savings' of benefit to the entire Australian community. An immediate reduction in the incidence of foodborne illness was not expected; however, as food industry compliance with new standards was achieved, a potential 20% reduction in the incidence of foodborne illness could realise an annual saving of over \$500 million.⁵⁰ The cost of foodborne disease to the community was estimated at more than \$2.6 billion each year. The cost to government of implementing food safety reforms was expected to be an increase of \$22.9 million on the (then) current annual cost of \$47.7 million. For small retail businesses, compliance costs were estimated at \$1,071 each year, partly replacing existing annual food regulation compliance costs of \$1,640.

Analyses of rates of salmonellosis, before (1993/1994) and after (2000/2001) changes in food standards and the regulation of meat and poultry hygiene in Australia, concluded that improvements in the microbiological quality of red meat and poultry were evident over the same timeframe as the regulatory changes.³³⁸ The fact that improvements did not appear to reduce case-rates for salmonellosis was attributed to lack of control over other sectors (e.g., the food service and domestic sectors), and the difficulties inherent in quantifying the public health outcomes of changes to food hygiene regulation (e.g., impossible to estimate what the case rates might have been without the changes).

Food markets were becoming global, and trade in food products was increasing, especially for minimally processed foods (e.g., seafood).³³⁹ About 10% of food consumed by Australians originated overseas, and was regulated by the *Imported Food Control Act 1992*. A review of its operation, including barrier inspection and end-point testing by the AQIS Imported Food Inspection Program (IFIP), concluded that the benefits were substantial. The scheme was estimated to have potentially saved Australians at least \$21 million in medical expenses and lost production in 1997, based on only three bacterial contaminants in imported food detected by IFIP in that year.³⁴⁰ The costs (largely borne by

food importers and consumers) were estimated at around \$9 million per year, or about 0.25% of the value of imported food.

Finally, a review of the economics of HACCP, undertaken shortly after it was introduced in the food legislative system in New Zealand, concluded that HACCP brought benefits to society by reducing costs associated with food safety risks, but that it also imposed additional costs on the food industry.³⁴¹ A full cost-benefit analysis of the food legislation system was required, which would include not only benefits (reductions in health risks) and costs, but also issues such as effects on productive efficiency, export values and market share, and producers (e.g., on firm sizes and market structure).

Future challenges

Future challenges in food regulation included ongoing public engagement in regulatory and standard-setting processes, which recognised the unequal resources of the food industry compared with the general public. The regulatory system needed to be accessible to all stakeholders, have clear objectives, and be open and transparent in its operation, in order to gain and retain the confidence of the community.³⁴² There needed to be a greater commitment overall – by government and industry – to consumer engagement in food standards and policy development.

In light of recent events in biosecurity and biothreats, potential gaps and vulnerabilities in agriculture and food chain safety and security had to be identified and addressed, to ensure the integrity of food and minimise the potential for destructive interference.^{343,344,345} Finally, regulators had to ensure that there were appropriate regulatory approaches to manage new foods and food technologies.

4.3 Improved nutrition

1901 onwards

Improvements in nutrition impact positively on long-term trends in health, life expectancy, labour productivity, and the economic growth of nations.^{239,346} Historical bio-demographic analyses showed that poor nutrition increased vulnerability to diseases, both infectious and chronic diseases.²³⁹

The average height of a population reflected its nutritional status, health (including the prevalence of chronic diseases) and life expectancy.^{239,347} Over the 20th century in Australia, nutrition – the right food in adequate quantities – improved with better socioeconomic conditions, and was reflected in an increase in average population height. The rate varied between 0.4 and 2.1 cm/decade in males and between 0.01 and 1.6 cm/decade in females.³⁴⁸ The increase slowed during the last two decades of the century.

The strongest increase in stature coincided with major improvements in the socioeconomic conditions of the population, with a corresponding shift towards earlier maturation. Australian men were estimated to be around 5 cm taller in 2003 than those of 80 years before, while women's height increases were somewhat smaller, at around 1.5 cm from the 1920s.³⁴⁹ The improved availability of nutritious food was the likely reason for these height increases, although quantity rather than quality may have been a key factor.

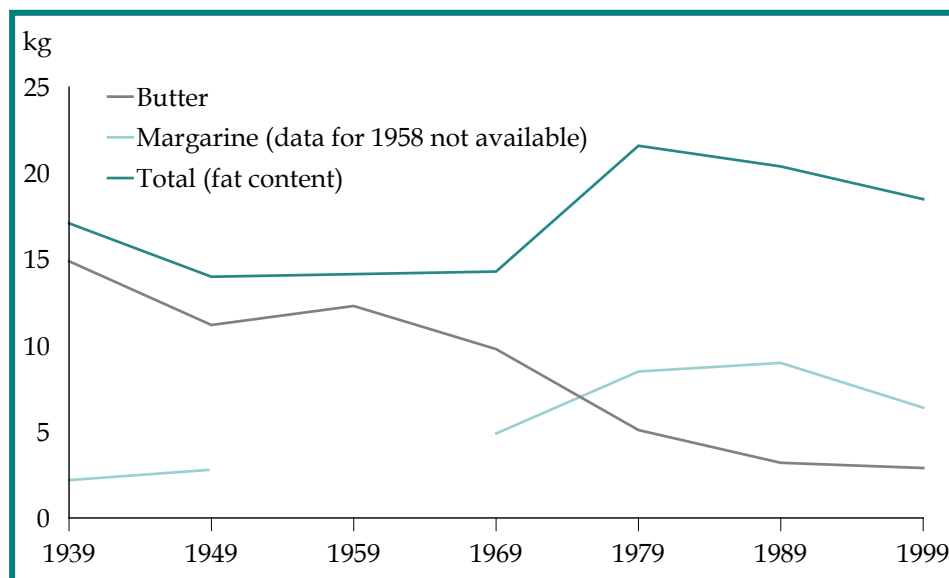
After World War I, nutrition emerged as a public health issue, when a larger than expected proportion of the young male population who enlisted were found to be unfit. The School Milk Program, which subsidised the provision of milk to school children, started in 1926 in response to observed protein and calcium deficiencies in their diets. The program continued until 1974, and the success of this policy was evident when calcium deficiencies were again observed in children after it ceased.³⁰⁸ In 1936, a Commonwealth Inquiry into Nutrition concluded that 'Australians were generally well-fed, but there was much ignorance about diet' – for example, inspection of schoolboys' lunches at the time revealed that the most popular sandwich spread was tomato sauce.³¹⁸

The traditional public health approach to nutrition also focused on educating the population, by providing advice and information to encourage healthy eating – one such example was the second edition of *Diet and nutrition for the Australian people* (which originated from the 1936 Advisory Council on Nutrition). Published in 1943, it was partly rewritten to take account of the changes that war had brought in the variety, quantity, and cost of available foodstuffs. *Dietary guidelines for Australians* (first published in 1982) were extensively used for nutrition education by groups with interests in the public's health, including NGOs such as the National Heart Foundation.³⁵ These were later revised and updated by the NHMRC.

The important place of nutrition in influencing the incidence and prevalence of many chronic diseases, through a causative or a protective role, was evident.³⁵⁰ The later 'nutrition transition' in Australia was the shift to greater dietary intakes of animal and partially hydrogenated fats and lower intakes of fibre.^{351, 352} This was reflected in higher rates of chronic conditions (such as obesity, Type 2 diabetes, cardiovascular disease and high blood pressure), which were previously associated with middle age, and of risk factors, such as sedentary lifestyle, poor diet and lack of exercise.³⁵³

The transition was driven by urbanisation and technological change, and the increasing supply of ready-to-eat, highly processed and energy-dense foods. The first self-service supermarkets opened in Australia in 1950, and, by 1994, four major chains held 95% of the retail market in packaged foods.³⁵ There was also expansion in the sectors where food was prepared or eaten away from the home. Dietary changes, such as that from butter to margarine and oils (from saturated to unsaturated fats) in the 1960s and 1970s (Figure 4.2), less use of salt in cooking and in food preparation, and increases in the consumption of fresh fruits and vegetables, had a positive impact on the prevalence of some chronic diseases (Section 6.2).³¹⁰

Figure 4.2: Selected oils and fats consumption (per capita, based on proxy data), 1939-1999



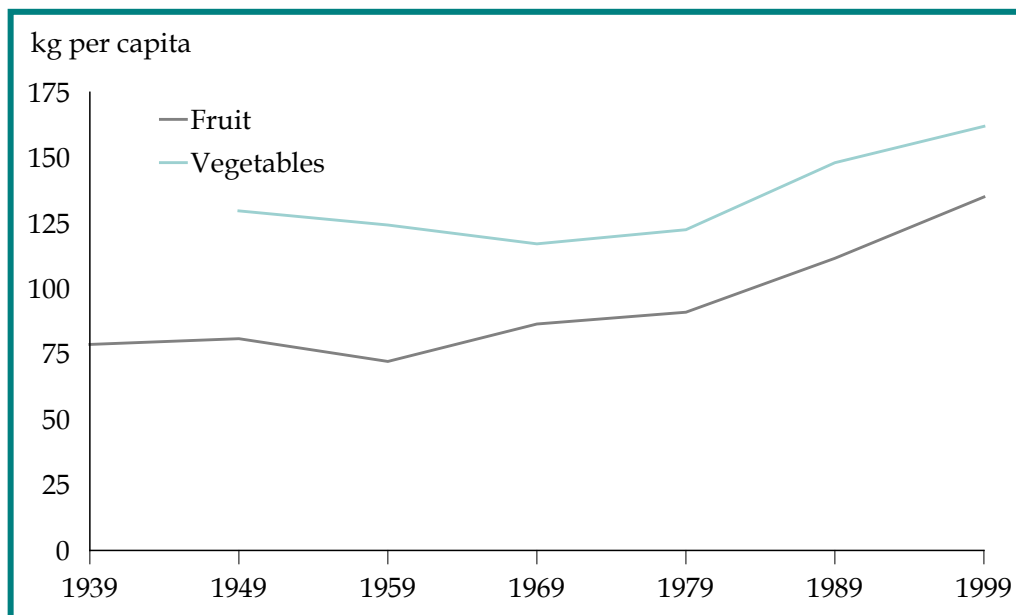
Source: ABS, *Apparent consumption of foodstuffs, Australia, 1997-98 and 1998-99*, ABS, Canberra, 2000.

In 1986, the Australian Better Health Commission inquired 'into the current health status of the Australian population and [recommended] national health goals, priorities and programs to achieve significant improvements in illness prevention and health awareness'.³¹⁸ It proposed a strategic focus on nutrition as one of three priority areas for prevention activity.³¹⁸

Analyses of household expenditure on food between 1988-89 and 2003-04 showed that consumption increased most significantly for poultry, seafood and fresh fruit and vegetables, and decreased for meat, eggs, grains and sugar. Longer term trends suggested that, from 1948-49 onwards, the population as a whole had consumed larger proportions of high-value foodstuffs, such as seafood, and less meat, eggs, grains, and sugar.³⁵⁴

Increases in the apparent consumption of fruit and vegetables for the period from 1939 to 1999 are shown in Figure 4.3. Although the highest proportions of people usually eating the daily recommended number of serves of fruit and vegetables were reported by the 55–64 year and older age groups, other evidence indicated that young people had also increased their consumption of fresh fruit and vegetables.^{355,356}

Figure 4.3: Apparent fruit and vegetable consumption (per capita, based on proxy data), 1939-1999



Source: ABS, *Australian social trends*, 2002, 2002, p. 84; data: ABS, *Apparent consumption of foodstuffs, Australia, 1997-98 and 1998-99*, ABS, Canberra, 2000.

Nevertheless, a lack of fruit and vegetable intake was identified (with other risk factors such as smoking, physical inactivity, and obesity) as having a quantifiable role in the population's burden of disease.³⁵⁷ The national nutrition plan for 2000-10, *Eat Well Australia*, and the related *National Aboriginal and Torres Strait Islander Nutrition Strategy*, identified the following priorities: increasing vegetable and fruit consumption; overweight and obesity as major health issues; and the nutrition of vulnerable groups, especially Indigenous peoples.^{358,346}

The *National Chronic Disease Strategy* (2006) regarded poor diet and nutrition as one of a cluster of preventable risk factors for chronic diseases that could be addressed by interventions that took a whole-of-life approach, and started early in life.³⁵⁹ The Strategy also called for the evidence base for prevention to be improved - through monitoring and surveillance of population trends, particularly in the chronic disease-related risk factors of diet and nutrition, and physical activity.



Mixed fruit

Source: Australian Government Department of Agriculture, Fisheries and Forestry, 2006.

In the latter part of the 20th century, there was rising concern about over-consumption of food and the rapid increase in overweight and obesity among the population. It was estimated that the proportion of overweight or obese adult females (aged 18 years and over) increased from 32% in 1995 to 40% in 2005, while the proportion of overweight or obese adult males rose from 49% in 1995 to 58% in 2005.³⁶⁰

Similar increases were observed for children. The *NSW Schools Physical Activity and Nutrition Survey* (SPANS), which weighed and measured 5,500 children aged five to 16 years across a range of schools, found that the prevalence of overweight and obesity had increased markedly in school-aged children over the 20 years from 1985.³⁶¹ The proportion of boys who were overweight or obese increased from 11% in 1985 to 25% in 2004 (across all school years), and the proportion of girls rose from 12% in 1985 to 23% in 2004. Overall, around a quarter off NSW school students were estimated to be overweight or obese in 2004, many more than in previous comparable surveys (in 1985 and 1997). It also appeared

that, for boys, the rate of increase in those overweight was escalating, while for girls, it was steady or slowing. Many consumed foods and drinks that were high in calories and low in nutritional value.³⁶¹

While inadequate nutrition was a substantial problem at the start of the 20th century, this had been replaced by overweight and over-nutrition at the start of the 21st century.

Other public health nutrition issues included:

- improving access to fresh foods including fruit and vegetables in less populated rural and remote areas;
- the role of 'empty nutrition' in health – the concern that some overweight children could also be malnourished, with 'empty calories' from energy dense nutrient-poor foods and high sugar content drinks;
- poverty, food insecurity, and unhealthy eating practices also leading to obesity and other chronic diseases; and
- under-nutrition (e.g., among remote Indigenous children and youth, elderly people at home and in nursing homes, and people living in poverty).^{315,362,363}

'Inequitable food pricing is an issue for all remote communities.'

Webb & Leeder, *Medical Journal of Australia*, 2007, p. 7 ³⁶⁴

Public health practices

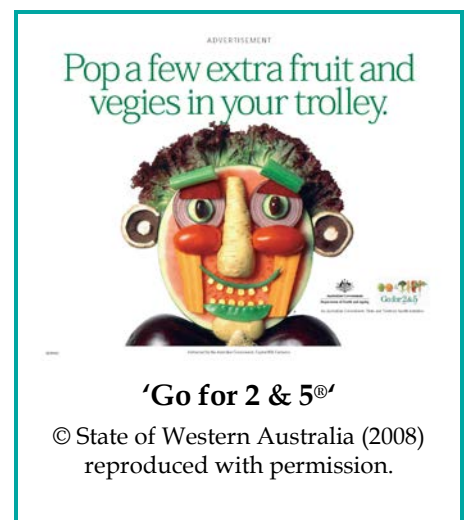
Over the century, there were many public health programs initiated by governments, schools, health-related NGOs and others to improve the diet and nutrition of specific populations. Examples included:

- the School Milk Program (1926-1974);
- school nutrition education programs, including the Health-Promoting Schools Programs (from 1994); and
- public education campaigns, such as the Victorian '2 Fruit 'n' 5 Veg every day', based on a campaign strategy developed by the Health Department of WA in 1990 (the first of its kind in Australia); and the national 'Go for 2 & 5[@]' campaign under the *Building a Healthy and Active Australia Initiative*, also based on effective Health Department of WA nutrition campaigns (2002-2005). The national 'Go for 2 & 5[@]' campaign encouraged Australian children and families to increase their daily intake of fruit and vegetables to the levels recommended in the Australian dietary guidelines: for adults two pieces of fruit and five servings of vegetables, and for children of the following ages:
 - 4-7 years - 1 serve of fruit and 2 serves of vegetables;
 - 8-11 years - 1 serve of fruit and 3 serves of vegetables;
 - 12-18 years - 3 serves of fruit and 4 serves of vegetables;

while recognising the reality that the amount a child ate at any one time depended on age, appetite, activity levels, and cultural and family factors.^{308,365,366,367,368,369}

Within all levels of government, together with NGOs such as the Heart Foundation, schools and community groups, there were many programs aimed at improving public health nutrition by encouraging the community to have healthier food behaviours, only some of which are detailed here.

Developments over the century such as water fluoridation and improvements in food standards, standard setting, food legislation and regulation were public health measures that aimed for universal



application across the population, as the most cost-effective way to deliver maximum benefit. For example, both food fortification and water fluoridation were applied universally (providing protection against disease for almost an entire population) at minimal cost, using existing distribution systems.

Nationally recommended daily dietary requirements set standards that allowed population dietary behaviours to be assessed against an ideal.³⁷⁰ The role of fruit and vegetables in the prevention of chronic diseases was quantified and codified in dietary guidelines, and their consumption monitored by population health surveys at the national and jurisdictional levels. Population nutritional status was extensively recorded in the *National Nutrition Survey* in 1995, but a further national nutrition survey had not been repeated by 2006. In 2001, state and territory population health surveys agreed to use a set of standard questions to gather data on the consumption of fruit, vegetables and type of milk.³⁷¹

FSANZ' ultimate goal was 'a safe food supply and well-informed consumers'.³⁷² It conducted surveillance and monitoring of the food supply by regular sampling of a basket of foods - the 21st *Australian Total Diet Study* was published in 2005 - and modelling the impact of cumulative and 'all-diet' (i.e., including nutritional supplements, vitamins and minerals) exposure to certain variables in foods (e.g., micronutrients, additives, and pesticides), amongst its other activities.³⁷³

The National Nutrition Action Plan for 2000 to 2010, *Eat Well Australia* and the related *National Aboriginal and Torres Strait Islander nutrition strategy* focused on a partnership model to address areas where the greatest impact could be achieved, with priorities being:

- a major health focus: overweight and obesity;
- a critical food group: vegetables and fruit;
- strategic population/target groups: women, infants and children (including school canteen policies);
- the nutrition of vulnerable groups, especially Indigenous peoples; and
- capacity building to strengthen the infrastructure required for effective action, including strategic management, funding and resources, research and development, workforce development, communication, monitoring and evaluation.^{346,358}

Despite these strategies, however, it remained very difficult to change the population's eating habits, especially while powerful commercial interests maintained activities that militated against good nutritional practice and healthy food affordability. Some researchers called for governments to tax processed foods containing high sugar and saturated fat, and reinvest the monies collected to fund effective measures to increase the intake of fruit, vegetables, and other low fat foods.³⁷⁴ Thus, 'success' in changing the population's food consumption behaviours continued to be difficult to achieve.

Factors critical to success

Better economic circumstances and developments in agriculture and in food treatment, processing, packaging and storage technologies contributed to improvements in the population's nutritional status over the 20th century. Uniform food legislation created a national focus for public health issues to do with food, although the competing interests of the food industry and consumers had to be balanced. Regulatory regimes, based on risk assessment and improved compliance with food standards and regulations, had the effect, over time, of significantly raising food safety and quality.

Strategies to provide standardised information to consumers, and public health education on good eating habits and the nutritional value of foods successfully increased health literacy in relation to food for some, though not all, members of the community, as health literacy continues to be largely determined by socioeconomic status. However, the Australian community expected government to play an active role in improving population nutrition. For example, a community survey about the so-called 'obesity epidemic' revealed that 83% of respondents believed government 'should go beyond regulating food advertising to kids and also require manufacturers to make children's food healthier'.³⁷⁵

Cost-effectiveness

The *National Chronic Disease Strategy* reported that increasing fruit and vegetable consumption by just one serve a day would save the Australian health care system \$157 million annually, by preventing heart disease, and lessening the prevalence of osteoporosis.³⁵⁹ Public policies to promote healthy eating and dietary change were among the most cost-effective methods to prevent cardiovascular disease at a population level.³⁷⁶ Published studies of the primary and secondary prevention of cardiovascular disease were reviewed to determine the cost-effectiveness of dietary change strategies compared to other measures. Although evidence was limited, strategies promoting healthy eating appeared more likely to be cost-effective than those relying on modern cholesterol-lowering drugs, or primary care screening and dietary advice; and comparable to, or less costly per year of life saved, than anti-smoking strategies.³⁷⁶ The beneficial impact of consuming a 'Mediterranean diet' after suffering a heart attack was also assessed as a cost-effective strategy at the population level.³⁷⁷

Future challenges

Differential improvements in population nutrition, and access to fresh and affordable food remained substantial challenges for Australia. Lack of access to food was one of the factors that contributed to the higher death rates of Australians from socioeconomically disadvantaged and remote areas.^{378,379} Studies in Queensland, WA, SA, Tasmania and the NT found the costs of food were higher in rural and remote areas than in capital cities and large rural centres, and that the quality of fruit and vegetables was poorer, and they were more expensive and less varied.³⁸⁰ In SA, the cost of a basket of healthy food was highest in population centres of fewer than 400 people (cost ranged from \$274 in the capital to \$389 in towns of less than 400 people); and in remote and socioeconomically disadvantaged towns, where it ranged up to 175% of the cost in the capital.³⁸⁰

Comparison of a basket of healthy food items in Queensland over the period 1998-2004 found the cost of healthy foods rose more than that of less nutritious foods, making healthy foods (especially fresh fruit) relatively less affordable.³⁷⁹ The provision of fresh nutritious food, including fruit and vegetables, at affordable prices to all Australian communities - especially for Indigenous communities and others in remote areas - continued to be a major challenge.³⁸¹

Other challenges included:

- changing food behaviours and achieving better compliance with recommended dietary intakes (e.g., of fresh fruit and vegetables) at a population level;
- continuing and increasing levels of overweight and obesity, especially at younger ages;
- increasing access to fluoridated drinking water across the whole population;
- the advertising, pricing (relative to fresh food), nutritional value and energy density of processed foods;
- the need to ensure the reliability and consistency of public health nutritional messages - with some food producers, for instance, advertising their products as 'low fat' but neglecting to mention accompanying high sugar or salt levels; and
- the wider issues related to control over the food supply, the food chain, and influences on the food choices of individuals and communities.^{317,382,383}

In relation to food fortification, folic acid fortification was identified as an evidence-practice gap by the National Institute of Clinical Studies (2005), which recommended encouraging periconceptional use of folic acid supplements and consideration of the mandatory fortification of a commonly eaten food (Box 4.3).¹²⁶ FSANZ was also considering the mandatory replacement of non-iodised salt with iodised salt in breads, breakfast cereals and biscuits, to reduce the rising prevalence of iodine deficiency in some population groups.^{384,385}

Box 4.3 Food fortification, 1960s-

Food fortification for public health reasons was undertaken from the 1960s with the fortification of salt with iodine, bread-making flour with thiamine (1991), and various foods with folic acid (voluntarily, from 1996). The goal of food fortification was to reduce nutritional deficiencies, related diseases and congenital malformations. For example, after the detection of iodine deficiency in Tasmania in the 1960s, subsequent iodine fortification had a large impact on reducing the incidence of goitre.³⁸⁶

Iodine fortification, 1960s-

Without adequate iodine, infants can suffer from mild intellectual disability to cretinism. Iodine deficiency is 'the single most important cause of preventable intellectual deficit in the world.'³⁸⁷ In adults, iodine deficiency leads to hypothyroidism, poor mental performance and goitre, a condition where the thyroid gland expands massively in response to low iodine levels.

Iodine fortification of salt led to reductions in a range of iodine deficiency disorders.³⁸⁸ The re-emergence of iodine deficiency in some population groups is a repetition of a previous public health problem, as Australian soils were iodine-deficient, especially in the mountainous areas of northern and eastern Tasmania, the Atherton Tablelands (north Qld), the Great Dividing Range (NSW), the plains surrounding Canberra, the eastern region of Victoria and the Adelaide Hills.^{385,389} FSANZ considered mandatory replacement of non-iodised salt with iodised salt in bread to reduce the prevalence of iodine deficiency, along with folic acid fortification.³⁸⁴ Tasmania had a voluntary iodine fortification program using iodised salt in bread from 2001.³⁹⁰

Thiamine fortification, 1991-

Fortification of flour with thiamine led to reductions in Wernicke-Korsakoff Syndrome (WKS).³⁹¹ WKS is a neurological disorder – potentially fatal – caused by thiamine (vitamin B₁) deficiency. It is easily treated by thiamine supplementation, and most people so treated show good clinical improvement.³⁹² Although the occurrence of WKS was reduced by the fortification of bread-making flour with thiamine, it was not eliminated. As most cases were found in heavy alcohol drinkers with a preference for beer, it was suggested that beer would be a more appropriate medium for thiamine fortification, and more cost-effective than the fortification of bread-making flour.³⁹³

Voluntary folic acid fortification, 1996-

Voluntary folic acid supplementation of foods led to a reduction in babies born with congenital neural tube defects (NTDs); however, the National Institute of Clinical Studies recommended increased periconceptional use of folic acid supplements, and consideration of the mandatory fortification of a food staple.^{126, 394} The NHMRC *Recommended Dietary Intakes (RDIs)* were reviewed, and recommended consumption of an additional 400µg/day of folic acid through a supplement or fortified foods, for women planning to become pregnant, for at least one month before and three months after conception (in addition to consuming dietary folate) to reduce the likelihood of NTDs in the baby.^{370,395,396} After extensive consultation, FSANZ determined that mandatory fortification of wheat flour for bread-making purposes in Australia with folic acid was the preferred approach.³⁹⁷

Food fortification policy

Food fortification for preventable deficiency diseases provides a 'generic solution which does not require daily decisions by every individual'.³⁹⁸ Food fortification policy must, however, 'be driven by a demonstrated health need rather than by competition within the food industry'; fortified foods should be limited to those consumed by the target population and be consistent with nutritional rationale; and fortification should not exceed safe upper limits.³⁹⁹ Mandatory fortification of foods with iodine, for example, is considered to fulfil the public health criteria (derived from interventions to increase nutrient intakes) of 'effectiveness, equity, efficiency, certainty, feasibility and sustainability'.³⁸⁴

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