Primary Prevention of Chronic Diseases: The Role of Nutrition

Public Health Nutrition Background Paper

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Chronic diseases, such as diabetes, cardiovascular disease and cancers, are largely preventable non-communicable conditions associated with risk factors such as poor nutrition, physical inactivity, tobacco use, and inappropriate intake of alcohol, as well as the social determinants of ill health. The burden of chronic diseases is increasing rapidly worldwide, and **the public health approach of primary prevention is considered to be the most cost-effective, affordable and sustainable course of action to cope with this epidemic**. [1] Collaborative efforts and political will are needed to make major societal changes towards health-promoting environments that support the protective factors of healthy eating and adequate physical activity. **Reducing population-wide intakes of energy-dense, nutrient-poor foods and drinks will make a big impact throughout society**. [1]

The contribution of nutrition to the burden of disease

The Australian Institute of Health and Welfare (AIHW) estimated the proportionate contribution of major factors to the overall Australian burden of disease and injury in 1996. These included tobacco (9.7%), physical inactivity (6.7%), obesity (4.3%), inadequate consumption of fruit and vegetables (2.7%), high serum cholesterol (2.6%) and the net impact of harm and benefit of alcohol (2.1%). [2] However this important study did not attempt to determine some other risk factors including socioeconomic issues and the impact of total nutrition on the burden of disease. It is likely that nutrition contributes at least as significantly as cigarette smoking to the burden of disease and premature death throughout Australia.

More recently the World Health Organisation (WHO) has estimated global burden of disease.[3] AIHW estimates and WHO estimates for developed countries are shown in Table 1.

Table 1 : Estimated risk factor % contribution to Burden of Disease

Risk factor	AIHW (Australia) 1996	WHO (developed countries) 2003
Tobacco	9.7	12.2
Blood pressure	5.4	10.9
Alcohol	2.1 (net of harm & benefit)	9.2 (harm)
Cholesterol	2.6	7.6
Overweight	4.3	7.4
Low veg & fruit intake	2.7	3.9
Physical inactivity	6.7	3.3
Illicit drugs	1.7	1.8
Unsafe sex	0.9	0.8
Iron deficiency		0.7

Source: Mathers & Vos 1999, WHO 2002

The major causes of preventable premature death, illness and disability associated with nutrition are: [4]

- coronary heart disease
- stroke
- hypertension
- atherosclerosis
- some forms of cancer
- type 2 diabetes
- osteoporosis
- dental caries
- gall bladder disease
- non-cancer disorders of the large bowel and
- nutritional anaemias

The treatment of these diseases requires extremely costly medical interventions. Future health spending on the management of chronic diseases will account for an increasing proportion of the Queensland budget due to the ageing of the population and the effects of the current epidemic of overweight and obesity.

Overweight and obesity

The prevalence of overweight and obesity has increased rapidly in Australia and globally and now constitutes a major epidemic. Because overweight increases the risk of several chronic diseases, there is significant overlap between the prevention of obesity and the prevention of a range of chronic diseases, especially type 2 diabetes.

The direct costs of obesity in the United States (US) were estimated at around 7% of total health care costs in 1995. [1] For Australia, costs of obesity were estimated at 2% of total health care costs in 1989-90, [5] but since obesity levels in Australia are approaching that of the US, it is now likely that costs are similar to the US estimates.

Obesity and overweight are risk factors for: [6]

- type 2 diabetes
- hypertension
- cardiovascular disease
- strokes
- some types of cancer
- psychosocial disorders
- arthritis
- gall bladder disease
- sleep apnoea and
- asthma

Obesity severely reduces health-related quality of life, particularly in terms of pain, functional capacity and vitality, as well as effects on social functioning and mental health. [7] Weight gain adversely affects quality of life, while weight loss improves it.

There is a linear increase in the mortality risk associated with body mass index (BMI), with the gradient being evident from a BMI of less than 20. [8] In a large US study over half (53%) of all deaths in obese women could be directly attributed to their obesity. A large prospective study in Norwegian adolescents found that after 32 years of followup, adolescent obesity (BMI › 95th centile) was associated with a doubling of mortality in middle age. [9]

In the short term, a modest weight loss of 5-10% of initial weight in overweight and obese people is associated with substantial health benefits, including improvements in blood pressure, lipids and glucose tolerance. [10] In the longer term, a large prospective study found that intentional weight loss is associated with a reduction in mortality, independently of the amount of weight lost. [11]

Several studies have demonstrated the psychological dysfunction and social isolation of overweight or obese children. Overweight and obese children are also more likely to experience co-morbidities, such as asthma. [12, 13]

Table 2: Relative risk of health problems associated with obesity

Greatly increased Relative risk ››3	**Moderately increased Relative risk 2-3**	**Slightly increased Relative risk 1-2**
• Type 2 diabetes • Gall bladder disease • Hypertension • Dyslipidaemia • Insulin resistance • Breathlessness • Sleep apnoea	• Coronary heart disease • Osteoarthritis (knees) • Gout and hyperuricaemia	• Cancer (postmenopausal breast cancer, endometrial cancer, colon cancer) • Reproductive hormone abnormalities • Polycystic ovary syndrome • Impaired fertility • Low back pain • Increased anaesthetic risk • Foetal defects arising from maternal obesity

Source: International Obesity Taskforce 2003

Prevalence

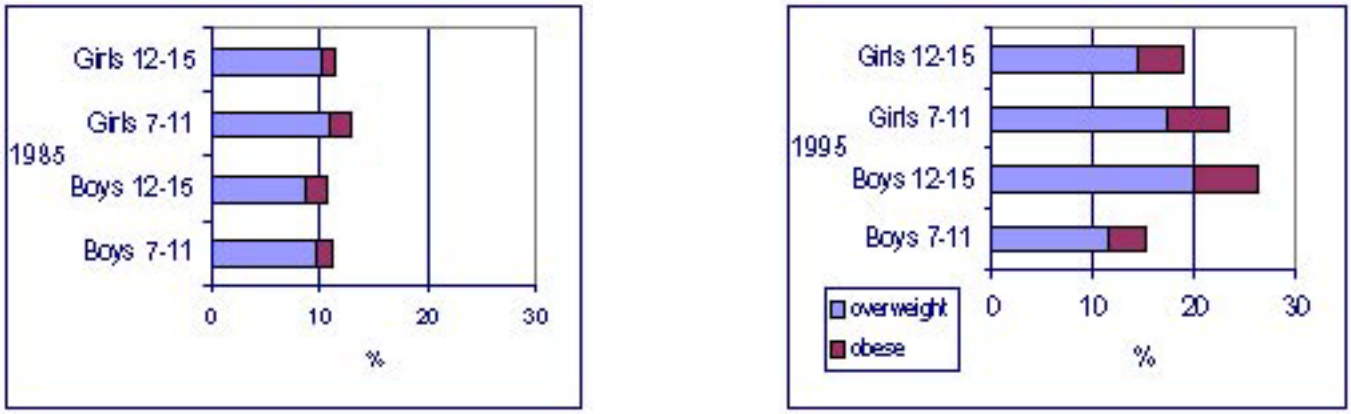
National data indicates that the prevalence of overweight and obesity is increasing rapidly in Australia. From 1983 to 1995 the proportion of the adult population classified as obese doubled to nearly one in five. [14] The AusDiab study conducted in 2000 found the prevalence of overweight and obesity had increased to 67% of men and 52% of women aged 25 and over. [15]

From 1983 to 1995, the mean Body Mass Index (BMI) of Australian adults aged 25–64 increased from 25.5 to 27.2 for men, and from 24.3 to 26.8 for women. [16] The WHO recommends that for optimum health, the median BMI of the population should be in the range 21 to 23, while the range for individuals should be 18.5-24.9. [1]

In the decade between 1985 and 1995, the rate of overweight in Australian children had doubled and the rate of obesity in children had trebled, as shown in figure 1. [17]

Figure 1: Prevalence of overweight and obesity in Australian children in 1985-1995

Data source: Magarey, Daniels & Boulton 2001. Based on analysis of the 1985 National Dietary Survey of School Children and the 1995 National Nutrition Survey against new standard international definitions.



Recent evidence from South Australia has found that in four-year-old children, rates of overweight have risen from 12.9% (girls) and 10.6% (boys) in 1995 to 21.5% (girls) and 18.4% (boys) in 2002. [18] This is the first time such high prevalence has been described in pre-school-aged children in Australia.

Determinants of obesity

Overweight and obesity are caused by an imbalance between energy intake and energy expenditure. Only a small, persistent energy imbalance (eg 1-2%) is required to cause a weight gain of 1-2 kg per year in adults, which over time progressively increases BMI. Both decreased physical activity and increased food consumption have contributed to the epidemic of overweight and obesity.

There is evidence that total energy intake in Australia has increased in recent decades, mainly due to increased consumption of categories of foods that are heavily advertised. Comparison of national nutrition surveys in 1983-85 and 1995 found that energy intake of adults increased by around 4%, and of adolescents by a massive 11-15%. [16]

Table 3: Comparison of nutrient intake in Australia, 1980s and 1995

Nutrient	Adults (aged 25–64 years) Extent of change	Adolescents (aged 10–15 years) Extent of change
Energy	M +3% F +4%	B +15% G +11%
Protein	unchanged	B +14% G +13%
Carbohydrate	M +17% F +16%	B +22% G +18%
Fat	M -6% F -4%	unchanged
Total Sugars	M +12% F +6%	B +22% G +19%

Source: Cook, Rutishauser & Seelig 2002. Based on analysis of comparable samples from the 1983 National Dietary Survey of Adults, the 1985 National Dietary Survey of School Children and the 1995 National Nutrition Survey

Cross sectional data indicate that obese individuals tend to have lower levels of physical activity than normal-weight individuals. However it is not clear whether this is cause or effect of obesity. There is evidence from national surveys in 1997, 1999 and 2000 that the proportion of the population that met the criterion for sufficient physical activity for health (150 minutes per week of moderate physical activity) declined from 62% in 1997 to 57% in 2000. [19] However, there is no evidence that population energy expenditure has decreased.

While there are genetic differences in individual susceptibility to obesity, the dramatic increases in prevalence over the last few decades without any change in the gene pool clearly illustrates that environmental factors are responsible for the epidemic. Profound changes in society over the last 3 decades, including urban design, our reliance on cars, social marketing, globalisation and consumer changes, have created an environment that promotes inactivity and overconsumption of energy-dense foods. The World Health Organisation has described the effect of these changes as creating an obesity-promoting or "obesogenic" environment. [6]

What is already known about the specific factors in society, which promote or protect from obesity is summarised in Table 4. Although more research is needed, we already know enough to take action.

Table 4: Evidence for factors promoting or protecting against obesity

Evidence	Decreases risk	Increases risk
Convincing	• Regular physical activity • High fibre intake (vegetables, legumes, fruit, wholegrains)	• Sedentary lifestyles • High intake of energy-dense, nutrient-poor foods
Probable	• Home and school environments that support healthy choices for children • Breastfeeding	• Heavy marketing of energy-dense foods and fast-food outlets • Sugar-sweetened soft drinks and fruit juice • Adverse social and environmental conditions
Possible	• Low glycaemic index foods	• Large portion sizes • High proportion of food prepared outside the home • Rigid restraint/periodic disinhibition eating patterns
Insufficient	• Increased eating frequency	• Alcohol

Source: WHO, 2003

Strategies for obesity prevention

The prevention and management of overweight and obesity requires a spectrum of four key strategies, [6] with the focus on prevention, including (in order of priority):

1. prevention of weight gain
2. promotion of weight maintenance
3. management of co-morbidities
4. promotion of weight loss.

The prevention and management of obesity is not just the responsibility of individuals, their families or health professionals, but requires a commitment from all sectors of society. **In general, all interventions that promote and provide supportive environments for increased physical activity and healthy eating contribute to obesity prevention.**

Guidelines for healthy eating are described in the Dietary Guidelines for Australians series published by the National Health and Medical Council (NHMRC) [20-23] and the Australian Guide to Healthy Eating published by the Department of Health and Ageing. [24]

Guidelines for physical activity published by the Department of Health and Ageing recommend at least 30 minutes of moderate-intensity exercise, such as walking, on most days of the week for health benefits. [25] However, a total of one hour of moderate intensity activity is probably needed to maintain a healthy weight, particularly for people with sedentary occupations. [1]

Some interventions recommended for prevention include:

- Schools - comprehensive programs to reduce TV viewing at home, increase physical activity and increase proportion of core foods consumed at schools
- Restrict availability of soft drinks in schools
- Early childhood care and education- provide environments which promote healthy choices
- Neighbourhoods- encourage active transport to school & other physical activity initiatives
- Breastfeeding- increase proportion of infants fully breastfed at 6 months
- Fast food outlets- reduce fat/saturated fat content of deep-fried foods, limit supersizing, increase healthy choices, limit density of outlets
- Food supply- increase access to fruit and vegetables- (eg pilot free fruit in primary schools)
- Reduce TV advertising to children
- Primary care- increase families access to information on managing children's weight-related behaviour
- Transport and building infrastructure designed to promote active transport (walking, cycling, using stairs)

Dietary Guidelines for Australian Adults - NHMRC 2003

Enjoy a wide variety of nutritious foods

- Eat plenty of vegetables, legumes and fruits
- Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain
- Include lean meat, fish, poultry and/or alternatives
- Include milks, yogurts, cheeses and/or alternatives. Reduced fat varieties should be chosen, where possible
- Drink plenty of water

And take care to

- Limit saturated fat and moderate total fat intake
- Choose foods low in salt
- Limit your alcohol intake if you choose to drink
- Consume only moderate amounts of sugars and foods containing added sugars

Prevent weight gain: be physically active and eat according to your energy needs

Care for your food: prepare and store it safely

Encourage and support breastfeeding

Coronary heart disease (CHD) and stroke

Prevalence

In 1996 cardiovascular disease was the leading cause of burden of disease and injury in Australia and was second only to cancer as a cause of premature death. [2] Of the cardiovascular diseases, coronary heart disease (CHD) accounts for nearly 60% of mortality and a large proportion of morbidity. [26] Although the age-standardised death rates from cardiovascular disease in Australia fell between 1985 and 1996 by about 3.6% per year, the absolute number of people with this disease is expected to increase over the next few decades, as the number of older people increases, and technological interventions and life-sustaining treatments improve.

Throughout the 1990s, Queensland's death rates for CHD were the highest of all the States. [27] **Age-standardised mortality from CHD among Indigenous people is more than double that for the rest of the Queensland population**. [27] Remote areas in Queensland have significantly higher CHD mortality, compared to other areas, by about 25%. Much of this excess mortality is due to the higher proportion of Indigenous people who live in remote areas. Mortality rates are about 15% higher in areas of socioeconomic disadvantage in Queensland. [27]

Around 40,000 Australians have a stroke each year, with 70% of these being first-ever strokes. Stroke is the leading cause of long-term disability in adults and Australia's second greatest single cause of death after coronary heart disease, claiming 11,982 lives in 1998 (9% of all deaths). [28]

Hypertension (high blood pressure) is the most common chronic disease in Australia. About one in four Australian males and one in six females aged 25–64 are hypertensive [29] but the prevalence rises steeply with age. Nearly half of those aged 55–64, two-thirds of those aged 65–74 and three-quarters of those aged over 75 are hypertensive. [30]

The risk of stroke and coronary heart disease increases continuously with increases in blood pressure. [31] Reduction of blood pressure with medication can reduce the risk of these complications, but may be accompanied by poorly tolerated adverse effects, and represents a considerable cost burden to the community. [32]

Determinants

Several biochemical risk factors for cardiovascular disease, such as elevated serum cholesterol, are associated with dietary factors. The intake of saturated fatty acids is the key determinant of serum total and LDL cholesterol. [33] Preliminary data from a recent Queensland study indicate over 51% of adult men and over 48% of adult women had elevated serum cholesterol levels. [30] It has been estimated that the number of coronary events in Australia could be reduced by 12.6% if the mean serum level of cholesterol in the Australian population was reduced by 0.5 mmol/L. [34]

The intake of omega-3 fatty acids is inversely related to risk of arrhythmia, sudden cardiac death, and thrombosis. [35] The major sources of omega-3 fatty acids are fish, and alpha-linolenic acid from canola oil and margarine, linseeds, soybean oil and green leaves.

The intake of trans-fatty acids is strongly associated with CHD. [35] The main sources of trans-fats in the Australian food supply are hydrogenated fats in some deep-fried and baked foods. Unlike the situation in the US, Australian margarines contain low or minimal levels of trans-fats.

Population levels of intake of folate and vitamins B12 and B6 are the key population determinants for serum homocysteine, which is a strong predictor of both cardiovascular and non-cardiovascular mortality. [36, 37] A recent large prospective study in men free of prior CHD found a strong inverse association between folate intake and the risk of acute coronary events. [38] Consumption patterns consistent with dietary guidelines have been shown to substantially lower fasting levels of serum homocysteine, compared to a control diet similar to a typical American diet. [39]

There is substantial evidence that a high salt (sodium) intake is associated with the widespread prevalence of age-related hypertension. [32] The recommended dietary intake for sodium is 40–100 mmol/day (2.5–6 g salt) [21] but average sodium intake in Australia ranges from 130–200 mmol/day (8-12 g salt/day). [32] About 75% of the sodium in Western diets comes from salt and other sodium compounds added to food during processing. [40]

A public health approach to lowering the average salt intake of the population would involve reducing the amount of salt entering the food supply in processed foods. If dietary salt were decreased by an average of 3 g (50 mmol sodium) per day, the average systolic blood pressure of those aged over 50 would be expected to fall by about 5 mmHg. Age-specific stroke mortality would decrease by about 22% and ischaemic heart disease mortality would decrease by about 16%. [41, 42]

In addition to the effects of sodium, consumption of a diet rich in vegetables and fruit and containing low fat dairy foods and low levels of saturated fat has been shown to significantly lower blood pressure [43] as have weight loss and reduction of alcohol intake. [32]

Table 5: Evidence on risk of developing cardiovascular disease

Evidence	Decreased risk	No relationship	Increased risk
Convincing	• Regular physical activity • Linoleic acid (polyunsaturated fat) • Fish and fish oils (omega-3 fats) • Vegetables and fruit • Potassium • Low to moderate alcohol intake (CHD)	• Vitamin E supplementation	• Myristic and palmitic acids (saturated fats) • High sodium intake • Overweight • High alcohol intake (stroke)
Probable	• alpha-linolenic acid (omega-3 fat) • oleic acid (mono-unsaturated fat) • dietary fibre • wholegrains • nuts (unsalted) • plant sterols/stanols • folate	• Stearic acid (type of saturated fat)	• Dietary cholesterol • Unfiltered boiled coffee
Possible	• Flavonoids • Soy products		• Fats rich in Lauric acid • Impaired foetal nutrition • Beta-carotene supplements
insufficient	• Calcium • Magnesium • Vitamin C		• Carbohydrates • Iron

Source: WHO, 2003

Strategies for prevention

Strategies for the prevention of heart disease include all interventions which aim to improve compliance with dietary and physical activity guidelines.

Specific recommendations for the prevention of heart disease [1]

- Fats:
  - Trans-fat intake should be as low as possible (<1% total energy).
  - Polyunsaturated fatty acids (PUFA): 6-10% of energy intake made up of
    - omega-6 PUFA 5-8% of energy
    - omega-3 PUFA 1-2% of energy
  - Monounsaturated fat: balance of fat intake (i.e., 7-20% energy)
  - Total fat intake: 15-30% of energy (up to 35% for populations with high physical activity and diets rich in vegetables, legumes, fruits and wholegrains)

- Fruits and vegetables: at least 7 serves/day [24] (or 400-500g excluding potato)
- Salt (sodium) less than 5g salt or 70-100 mM sodium per day
- Potassium: at least equivalent to sodium intake to maintain the Na:K at close to 1.0, achieved by adequate consumption of fruit, vegetables and wholegrains and limiting consumption of salt
- Dietary fibre: more than 20g, achieved by adequate consumption of fruit, vegetables and wholegrains
- Fish: regular consumption (1-2 serves per week) providing 200-500mg of omega-3 fatty acids or an adequate intake of alpha-linolenic acid
- Physical activity: At least 30 minutes of moderate-intensity activity on most days of the week

These guidelines apply to the whole population, not only those identified as high risk.

Diabetes

Prevalence

More than 85% of adults with diabetes suffer from type 2 diabetes, formerly known as adult onset or non-insulin dependent diabetes. Type 1 diabetes (previously known as insulin-dependent diabetes) occurs much less frequently and is associated with an absolute deficiency of insulin, usually due to autoimmune destruction of insulin-producing cells.
Complications of both types of diabetes include blindness, kidney failure, circulatory problems which may lead to foot ulceration and gangrene, and increased risk of infections, coronary heart disease and stroke.

The overall prevalence of type 2 diabetes in Queenslanders aged over 25 was 7% in 2000. [44] However, prevalence is strongly age-related, ranging from around 2% in 35-44 year-olds to around 28% in over 75s. In addition, 17% of adults suffer from some form of impaired glucose metabolism, which is highly predictive of later development of type 2 diabetes and is also an important risk factor for cardiovascular disease. Diabetes prevalence in Australia has more than doubled since 1981.

Estimates of the prevalence of type 2 diabetes in the Australian Indigenous population are much higher than in the general population. Amongst Torres Strait Islanders, the age-standardised prevalence of diabetes is six times higher than that of the Australian population. [45] The age of onset is also lower amongst Indigenous people. Australian South Sea Islanders and people born in Southern Europe, the Pacific Islands, South-East Asia, China and the Middle East are also at high risk.

The total cost of diabetes to the Queensland health system was estimated at $163.8M per year in 1999/2000. [44]

Determinants

Type 2 diabetes is strongly associated with overweight and obesity, particularly abdominal obesity. Based on the Queensland AusDiab study, overweight adults are twice as likely to have diabetes, and obese adults four times as likely. [44] A prospective study with 8 years of follow-up found that weight gain after age 18 was a major risk factor, with a gain of 35kg associated with 17 fold increased risk. [46] Other recognised risk factors include age over 40, family history of adult-onset diabetes, high blood pressure, physical inactivity, dietary factors, regular smoking and high alcohol intake.

Evidence from large prospective studies suggests that a 'Western dietary pattern' (characterised by a high consumption of red meat, processed meat, refined grains, fried potato chips, high fat dairy products, sweets and desserts and high sugar drinks) is associated with a substantially increased risk for type 2 diabetes, independently of physical activity and obesity. [47]

Table 6: Evidence on lifestyle factors and risk of developing type 2 diabetes

Evidence	Decreased risk	Increased risk
Convincing	• Voluntary weight loss in overweight and obese people • Physical activity	• Overweight and obesity • Physical inactivity
Probable	• Dietary fibre	• Saturated fats • Intrauterine growth retardation
Possible	• Omega-3 fatty acids • Low glycaemic index foods • Exclusive breastfeeding	• Total fat intake • Trans fatty acids
Insufficient	• Vitamin E • Chromium • Magnesium • Moderate alcohol	• Excess alcohol

Source: WHO 2003

Strategies for prevention

Measures aimed at reducing overweight and obesity and cardiovascular disease may also be expected to reduce the risk of developing type 2 diabetes. These include:

- Prevention and management of overweight/obesity, particularly in high-risk groups
- Maintaining an optimum BMI (at the lower end of the normal range)
- For adults, maintaining a BMI in the range 20-23 and avoiding weight gain of >5kg during adult life
- Intentional weight loss in overweight or obese individuals
- Physical activity at moderate or greater level of intensity (e.g., brisk walking) for an hour or more on most days of the week.
- Limiting saturated fat intake to less than 10% of energy (<7% for high-risk groups)
- Consuming a minimum of 20g fibre daily through adequate consumption of vegetables, fruit, legumes and wholegrains.

Cancer

Prevalence

Cancer is the second most common cause of death in Queensland after cardiovascular disease. Cancer is estimated to contribute 30% of premature mortality and 7% of disability in Queensland. [48] Health system costs in Australia attributable to selected dietary factors for colorectal, breast, lung and prostate cancers account for $96.8 million per year. [49]

Determinants

Cancer is caused by a variety of factors with the most important determinants being tobacco, diet, physical inactivity, alcohol, overweight and obesity, infections, hormonal factors and radiation. [1]

It has been estimated that around 30% of all cancers are preventable by dietary means [50] making diet second only to tobacco as a preventable cause of cancer. Good nutrition acts as a protective factor against the initiation and promotion of cancers due to exposure to environmental carcinogens.

In Australia in 1996, around 11% of the burden of disease due to cancer was attributable to inadequate fruit and vegetable consumption. [2] Substantial savings in costs for cancer alone could be achieved by increasing average vegetable consumption by just one serving per day, increasing average fruit consumption by one serving per day, and decreasing consumption of red and processed meats to less than two serves per day. [49]

For specific cancers, estimates of the burden attributable to dietary factors range from 20% to 75% as shown in Table 7.

Cancer site	% attributable to diet
Colorectal	66–75%;
Stomach	66–75%
Oesophageal	50–75%;
Breast	33–50%;
Lung	20–33%

Source: World Cancer Research Fund 1997

There is evidence that inadequate intake of vegetables and fruit is associated with cancer of the mouth/pharynx, oesophagus, lung, stomach and larynx, pancreas, breast and bladder, and that inadequate intake of vegetables is associated specifically with colorectal cancer.[51]

Obesity increases breast cancer risk in post-menopausal women by about 50%. Endometrial cancer is about three times higher in obese women than lean women. Obesity is likely to account for about 30% of cases of cancer of the kidney. [1] Obesity also increases the risk of adenocarcinoma of the oesophagus. This cancer was previously rare, but its incidence is increasing in developed countries.

Inadequate physical activity contributes to colon cancer, whilst rapid growth, early menarche and greater adult height are associated with breast cancer. Alcohol is associated with cancer of the mouth, pharynx, larynx, oesophagus and liver, and colon, rectum and breast. There is some evidence that red meat intake, particularly processed meat, may be associated with colorectal cancer. [1]

Epidemiological studies suggest that diminished folate status is associated with cancer of the cervix, lung, oesophagus, brain, pancreas and breast, with the most compelling evidence for colorectal cancer. [52] One report suggests that folate supplementation during pregnancy may protect against acute lymphoblastic leukaemia in childhood. [53]

Evidence	Decreased risk	Increased risk
Convincing	• Physical activity (colon)	• Overweight/obesity (oesophagus, colon, breast, endometrium, kidney) • Alcohol (oral cavity, pharynx, larynx, oesophagus, liver, breast) • Aflatoxin (liver) • Chinese-style salted fish (nasopharynx)
Probable	• Fruit and vegetables (oral cavity, oesophagus, stomach, colorectum) • Physical activity (breast)	• Preserved meat (eg, sausages, salami, bacon, ham etc) • Salt-preserved foods & salt (stomach)
Possible/ insufficient	• Fibre, soy bean, fish, n-3 fatty acids, carotenoids, vitamins B2, B6, B12, folate, C, D, E, calcium, zinc, selenium, other phytochemicals	• Animal fats, heterocyclic amines, nitrosamines, polycyclic hydrocarbons

Source: WHO 2003

Strategies for Prevention

Strategies to promote physical activity and improved nutrition and healthy weight will all contribute to the prevention of cancer.

A nationally coordinated Commonwealth, State and Territory campaign to increase the consumption of vegetables and fruit has been identified as a priority action to prevent cancer by the National Cancer Strategies Group. [54] A marginal analysis of health benefits and costs estimated that such a campaign would result in substantial cost savings in cancer treatment alone. [55]

Disease-specific recommendations [1]

- Maintain adult weight in the BMI range 18.5-24.9 and avoid weight gain of >5kg during adult life.
- Maintain regular physical activity of 30-60 minutes moderate activity on most days.
- Alcohol is not recommended but if consumed, should be limited to 2 standard drinks per day.
- Limit consumption of salt and salt-preserved foods.
- Minimise exposure to aflatoxin in foods
- Include at least 2 serves of fruit and 5 serves of vegetables daily
- Limit consumption of preserved meats (eg, sausages, salami, bacon, ham etc)
- Do not consume food or drinks at very hot temperatures

Dental diseases

Prevalence

Dental diseases include dental caries, dental erosion and periodontal disease. Although there is no significant mortality associated with dental diseases, they affect quality of life and impact on self-esteem, eating ability, nutrition and health. Australia has a low rate of dental disease by world standards. Nevertheless, dental caries was ranked the most costly diet-related disease in Australia in 1989–90, for both health care costs and total costs. [56]

Determinants

Dietary factors associated with protection from caries include adequate fluoride intake [57] and breastfeeding for up to 12 months. [58] Dietary factors associated with dental caries include frequency of consumption of foods and drinks containing added sugars, and inappropriate infant feeding practices. [22]

Table 9: Evidence linking diet to dental caries

Evidence	Decreased caries	No relationship	Increased caries
Convincing	• Fluoride exposure (local and systemic)	• Starch intake (eg, rice, potatoes and bread without added sugars)	• Amount of free sugars • Frequency of free sugars
Probable	• Hard cheese • Sugar-free chewing gum	• Whole fresh fruit	
Possible	• Xylitol • Milk • Dietary fibre		• undernutrition
Insufficient	• Whole fresh fruit		• Dried fruits

Source: WHO 2003

Strategies for prevention

The World Health Organisation recommends a population goal of 6-10% of energy derived from free sugars, in order to prevent both dental caries and unhealthy weight. This equates to an intake of around 10 teaspoons of added sugars for an adult. Free sugars includes all sugars added to foods by manufacturer, cook or consumer, plus sugars naturally present in honey, syrup and fruit juice. 10 teaspoons (50g) is the amount of sugar found in one can of softdrink.

Renal disease

The significance of addressing kidney disease relates not so much to its contribution to the burden of disease, as to its important and increasing contribution to health care costs. The cost of dialysis for a single patient for a year is equivalent to the annual salary of an Indigenous health worker. [59]

Prevalence

End-stage renal failure (ESRF) occurs when about 95% of kidney function has been lost. This may occur after many years of gradual and silent decline in kidney function, or acutely after an infection. There are no figures available for the prevalence of renal disease, but the incidence of ESRF is recorded by the Australia and New Zealand Dialysis and Transplant Registry.

In 2001 there were 12,278 Australians (633 per million) receiving renal replacement treatment (haemodialysis, peritoneal dialysis or renal transplantation). The annual incidence of new patients has been increasing steadily over recent decades and was 97 per million population in 2001. Over half of these were Indigenous Australians, who make up around 2% of the Australian population. In 1993-96, the incidence of end-stage renal failure was 73 per million amongst all Australians, and 270 per million in Indigenous Australians. [59] Standardised end stage renal disease (ESRD) incidence among Indigenous Australians is highest in remote regions, where it is up to 30 times the national incidence for all Australians. Amongst Indigenous Queenslanders, the incidence ranged from 17.7 times the national incidence in the Mt Isa region to 2.5 times in Brisbane. [60]

The increasing incidence of new patient treatment partly reflects the global trend towards the provision of dialysis for groups of patients that would earlier have been regarded as high risk, including older patients. The mean age of the dialysis population has increased and in 2001, the mean age of commencement of renal replacement treatment was 58.5 years. [61]

Indications for renal replacement therapy in 1996 are shown in Table 10. Glomerulonephritis has been the most common cause but diabetes is likely to become the most common cause in the near future, following similar trends in the US and Europe. In 2001 27% of cases were due to glomerulonephritis, 25% due to diabetic nephropathy and 15% to hypertension. [61]

Table 10: Indications for end-stage renal disease, Australia 1996 62

Indications	Males (n = 296)	Females (n = 207)
Diabetic nephropathy	23	26
IgA glomerulonephritis	19	11
Other glomerulonephritis	26	32
Polycystic kidney disease	9	10
Reflux	5	9
Hypertension (represents an aggregated group of vascular conditions)	7	1
Other	9	7
Unknown	2	4

Source: Disney 1998

The increasing incidence of ESRD in the Indigenous population also reflects the increased availability of dialysis in remote areas, as well as the increasing prevalence of diabetes in the Indigenous population. Amongst Indigenous patients in the Northern Territory, Western Australia and Queensland from 1993 to 1997, the primary causes leading to renal replacement therapy were diabetes (46%), glomerulonephritis (29%) and hypertension (5%). [63] Other factors which contribute to the high prevalence of renal disease in indigenous people include glomerulonephritis secondary to streptococcal infection, and early life factors including low birthweight. [64]

In a study in an Aboriginal population with high prevalence of renal disease, low birth weight contributed an estimated 27% of the population prevalence of albuminuria, an early marker of renal disease. [65] This association was not mediated through higher rates of hypertension or diabetes. It may be mediated, in part, through impairment of nephrogenesis resulting from intrauterine malnutrition.

Strategies for prevention

The increasing prevalence of renal disease is strongly related to the epidemic of obesity, mediated through diabetes, hypertension and metabolic syndrome.[1] The role of nutrition in the prevention of renal disease is similar to that for the prevention of obesity, cardiovascular disease and diabetes. This includes programs to increase access to a nutritious food supply in remote areas, and to improve maternal nutrition and reduce smoking amongst the Indigenous population.

Conclusion

There is convincing evidence that nutrition is a major underlying determinant of a range of chronic diseases, and the associated premature death and disability. Programs that promote healthy eating and physical activity, and address the underlying environmental determinants of eating patterns and physical activity behaviour will contribute substantially to improved population health.

Currently, our social, economic and physical environment promotes the consumption of recreational and non-basic foods that are profitable, energy-dense and nutrient-depleted, and discourages active transport and other forms of physical activity. Changing this environment requires recognition, substantial intersectoral collaborative effort and political will. This will requires multi-strategy interventions across a range of sectors including food producers, manufacturers, wholesalers, retailers, restaurateurs, caterers, transporters, advertisers, the media, education, policy makers at all levels of Government, in addition to the health sector. In communities and countries where there has been widespread implementation of multi-strategy, integrated nutrition interventions, risk factors have been dramatically reduced. [1].

The Queensland public health food and nutrition strategy Eat Well Queensland: Smart Eating for a Healthier State, developed by the Queensland Public Health Forum, identifies nutrition priorities for population health improvement in Queensland, outlines strategies to address priority issues and provides a framework for inter-sectoral collaborative effort. [66]

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[1] The metabolic syndrome is also known as Syndrome X. It is a cluster of conditions that tend to occur together and appear to be linked by Insulin resistance. Features include abdominal obesity, hypertension, impaired glucose metabolism, elevated triglycerides and low HDL cholesterol, with increased risk of cardiovascular disease.

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