Nutrition is the term given to the study of the food we eat, and how the body utilises the nutrients in food [1]. These nutrients, including proteins, lipids, carbohydrates, vitamins, minerals and water play an essential role in the body processes of digestion, breathing, growth and repair of body tissue, heart function and prevention of disease [2]. The nutritional requirements of an individual depend on such measurable characteristics such as age, sex, height, weight, degree of activity and rate of growth [3]. Good nutrition requires a satisfactory diet that is capable of supporting the individual consuming it in a state of good health by providing the desired nutrients in required amounts. If the total amount of nutrients provided in the diet is insufficient – in total or by nutrient group – a state of under-nutrition will develop.

Why is optimal nutrition important?

The importance of sound nutrition is widely recognised by the Australian Commonwealth and State/Territory governments which have identified monitoring and assessing nutrition as a high priority [4]. Proper and adequate nutrition is closely related to optimal growth, good education outcomes and health throughout life, and contributes to the economic and social wellbeing of communities [5]. It is also fundamental to the prevention of disease and disability.

Optimal nutrition is not just beneficial to physical health, but is also important for good social and emotional health [6]. The eating patterns of individuals and families are constantly being shaped and changed by wider social, cultural, geographical and economic factors [7]. For example, a family’s nutritional intake can be effected by the kinds of food that are available at the local shop (or supermarket in cities and large towns), the cultural and family

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More detailed information about nutrition in Indigenous people can be found at:
http://www.healthinfonet.ecu.edu.au/nutrition_review
background, the amount of time available to collect, prepare and cook food, facilities for storing food, values attitudes and beliefs about food and eating, knowledge about food and nutrition, advertising campaigns and food promotions, and, the amount of money that can be spent on the food budget [8]. It has become clear that there are socio-economic, geographical, environmental and social factors that may influence the availability and cost of food, and therefore affect the nutritional status of certain groups of the population.

It must also be noted that aspects about dietary advice change due to ongoing and advancing technology and research. It is true that there are some basic concepts that are universally accepted by nutrition experts, but many fields of diet and nutrition are still evolving.

What is poor nutrition?

Poor nutrition concerns both under-nutrition and over-nutrition. Under-nutrition involves inadequate levels of energy and/or nutrients in the diet. Over-nutrition is where the energy intake from diet exceeds energy expenditure, often leading to overweight or obesity. Both under-nutrition and over-nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity [8].

Diets globally are going through a remarkable transition: staple foods are becoming more refined, fat and meat intake is increasing, processed dairy products and other processed foods are consumed more than before, and an increasing proportion of meals is eaten outside home, making households more reliant on the food industry, food vendors and markets [9]. This transition of dietary habits is associated with increasing incidence of chronic disease. Strong evidence shows that an unhealthy diet and insufficient physical activity are among the major factors contributing to the development of coronary heart disease, strokes, several forms of cancer, type 2 diabetes, hypertension, obesity, osteoporosis, renal disease, dental caries, some forms of cancer and other conditions [9].

Diseases/illnesses that are related (sometimes controversially) to poor nutrition include:
- Cardiovascular disease;
- Obesity, overweight;
- Diabetes;
- Renal disease;
- Dental problems;
- Cancer;
- Osteoporosis;
- Diarrhoea;
- Pneumonia;
- Anaemia;
- Neural tube defects;
- Respiratory infection; and
- Asthma, eczema [9].

Under-nutrition

There is increasing evidence that nutrition pre-natally and in the first months and years of life may play an important role in the development of later disease, as well as leading to slower mental and physical growth [10]. Various studies have linked under-nutrition during foetal growth and over-nutrition during childhood with obesity, diabetes, renal disease and cardiovascular disease in adults [6].

Many people in the developing world, particularly women and children, continue to suffer from under-nutrition. The poor, especially, often suffer from a basic lack of protein and energy, the adverse health effects of which are frequently compounded by deficiencies in micro nutrients [6].

Under-nutrition is mainly a consequence of inadequate diet and frequent infection, leading to deficiencies in calories, protein, vitamins and minerals [11]. Underweight children are at increased risk of mortality from infectious illnesses such as diarrhoea and pneumonia. The effects of under-nutrition on the immune system are wide-ranging, and infectious illnesses also tend to be more frequent and severe in underweight children. A child’s risk of dying from under-nutrition is not limited to those children with the most severe under-nutrition [6]. There is a continuum of risk such that even mild under-nutrition places a child at increased risk. Mild and moderate under-nutrition are more prevalent than severe under-nutrition and so much of the burden of deaths resulting from under-nutrition is associated with less severe under-nutrition [6].

The World Health Report 2002 concluded that 50–70% of the burden of diarrhoeal diseases, measles, malaria and lower respiratory infections in childhood is attributable to under-nutrition [11]. Chronic under-nutrition in the first two to three years of life can also lead to long-term developmental deficits [12]. Among adolescents and adults, under-nutrition is also associated with adverse pregnancy outcomes and reduced work capacity. Underweight was estimated to cause 1 in 15 deaths globally in 2000 [11]. Since almost all deaths from under-nutrition occur among young children, the loss of healthy life years is even more substantial.

Over-nutrition

Poor nutrition not only involves under-nutrition or inadequate
levels of energy or nutrients in the diet, but it also involves
over-nutrition, where energy intake from diet exceeds energy
expenditure, which can lead to overweight or obesity. This
imbalance has been linked to lifestyle factors, such as increased
consumption of foods with high levels of sugar and saturated fats,
as well as a reduction in physical activity [7]. Being overweight (that
is, having a BMI of 25 or more) is a modifiable risk behaviour for
a number of long-term health conditions, including a number of
National Health Priority Area (NHPA) conditions (such as diabetes,
arthritis and some cancers) [6]. (See Box for information about
BMI.) It is also associated with a range of other NHPA risk factors,
such as high blood pressure and high blood cholesterol [6].

Assessing weight

The most commonly used measure of the appropriateness of
adult weight is the body mass index (BMI), which is calculated
by dividing a person’s weight (in kilograms) by their height (in
metres) squared. For example, a woman who is 1.70 metres tall
and weighs 65 kilograms would have a BMI of 22.5. As the table
below shows, this lies within the normal range.

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI</th>
<th>Risk of co-morbidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.50</td>
<td>Low</td>
</tr>
<tr>
<td>Normal</td>
<td>18.50–24.99</td>
<td>Average</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.00–29.99</td>
<td>Increased</td>
</tr>
<tr>
<td>Obese</td>
<td>30.00+</td>
<td>Further increased</td>
</tr>
</tbody>
</table>


The classification scheme used here differs slightly from the one used
previously in Australia, in which 20 was the lower limit of normal
weight. Also, waist and hip measurements have traditionally been
used to determine the degree of abdominal fat deposition, but waist
measurement alone may be a sufficient test of health risk.

Modest weight reduction reduces blood pressure and abnormal
blood cholesterol and substantially lowers the risk of type 2
diabetes [11]. Raised BMI also increases the risks of cancer of the
The mechanisms that trigger increased cancer risks are not fully
understood, but they may relate to obesity-induced hormonal
changes. Chronic overweight and obesity contribute significantly
to osteoarthritis, a major cause of disability in adults. In the analyses
carried out for the World Health report 2002, approximately 58%
of diabetes mellitus globally, 21% of ischaemic heart disease and
8-42% of certain cancers were attributable to overweight or obese
conditions [11].

Food choices have increased over time, but it is not clear whether
this has improved diet overall. One area of particular concern is
the increase in energy intake that has been accompanied by a
decrease in many areas of physical activity [9]. The combination
of the two factors has led to a rise in the proportion of children
who are overweight or obese. Type 2 diabetes mellitus, which was
confined to older adults for most of the 20th century, now affects
obese children even before puberty [14].

It has been estimated that obesity and its associated illnesses
cost Australia a total of $21 billion in 2005 [7]. Over-consumption
is contributing to Australia’s increase in obesity which is itself a
significant risk factor for diseases such as cardiovascular disease
and type 2 diabetes [6]. Over-consumption of foods, particularly
those high in energy and low in nutrients, is therefore, a serious
problem for the Australian population.

Nutritional health issues

Food basics

Food groups

Different foods contain different nutrients and other substances
beneficial to good health. Most industrialised countries now group
foods according to their broad nutritional properties [3] [15] [16].

No single food can supply all the nutrients in the amounts that a
person needs, so nutrition experts recommend a number of daily
servings from each of the five major food groups.

The Australian dietary guidelines recommend consumption from
each of the five food groups:

- vegetables & legumes
- fruit
- breads, cereals and grain
- milk, yoghurt, cheese
- meats, fish, poultry, eggs, nuts, legumes [3] [12].

Carbohydrates

Carbohydrates provide the body with the fuel it needs for physical
activity and for proper organ function [17]. Carbohydrates are
generally classified as simple or complex.

Simple carbohydrates include sugars (such as glucose and fructose)
found naturally in foods, including fruits, vegetables, milk, and milk
products [17]. Simple carbohydrates also include sugars added
during food processing and refining. In general, foods with added
sugars have fewer nutrients than foods with naturally-occurring
sugars [17].

Starch and dietary fibre are the two main types of complex
carbohydrates [18]. Starch must be broken down through digestion
before the body can use it as a source of glucose [18]. Foods which
contain starch and dietary fibre include breads, cereals, and vegetables [17].

Complex carbohydrates were believed to be the healthiest to eat, but it is now thought not to be as simple as this view does not account for what happens to the different kinds of carbohydrates inside the body [18]. A new system, called the glycemic index, aims to classify carbohydrates based on how quickly and how high they boost blood sugar compared with pure glucose. Foods with a high glycemic index (such as white bread) cause rapid spikes in blood sugar [19]. Foods with a low glycemic index (such as whole oats) are digested more slowly, causing a lower and less rapid change in blood sugar [19].

Diets rich in high-glycemic-index foods, which cause quick and large increases in blood sugar levels, have been linked to an increased risk for diabetes, heart disease, and overweight [18]. There is also preliminary work linking high-glycemic diets to age-related macular degeneration, ovulatory infertility, and colorectal cancer. Foods with a low glycemic index have been shown to help control type 2 diabetes and improve weight loss.

Protein

Proteins are part of every cell, tissue, and organ in the body, which are constantly being broken down and replaced [20]. The ‘building blocks’ of proteins are essential and non-essential amino acids [21]. Some of these amino acids cannot be made by the human body, and are known as essential amino acids. It is essential that a healthy diet provide these.

Proteins are found in meats, poultry, and fish legumes (dry beans and peas) tofu, eggs, nuts and seeds, milk and milk products, grains, some vegetables, and some fruits [20]. Protein sources are classified according to how many of the essential amino acids they provide. A complete protein source is one that provides all of the essential amino acids. For example, animal-based foods (such as meat, poultry, fish, milk, eggs, and cheese) are considered complete protein sources. An incomplete protein source is one that is low in one or more of the essential amino acids. Complementary proteins are two or more incomplete protein sources that together provide adequate amounts of all the essential amino acids: these include rice and beans or peanut butter and jelly.

People who eat too much protein may be at risk for high cholesterol or gout, a joint disorder [22]. High-protein diets have also been implicated in kidney problems because of the extra effort the body must expend to process large amounts of protein. High-protein diets may also be high in fat, which also contributes to heart disease.

A lack of protein can cause growth failure, loss of muscle mass, decreased immunity, weakening of the heart and respiratory system, and death [20]. Some proteins contribute to allergies, which are overreactions of the immune system [21]. Beyond that, relatively little evidence has been gathered regarding the effect of protein on the development of chronic diseases.

Dietary fat

Dietary fat plays an important role in good health, but not necessarily a good one [23]. Fats are essential for normal body function, some fats are better than others. Fats are divided into three groups: saturated, polyunsaturated and monounsaturated. Most fat should come from unsaturated sources that are prominent in nuts, vegetable oils, and fish.

Trans fats, saturated fats and cholesterol are less healthy than polyunsaturated and monounsaturated fats [23]. Animal fats (such as high-fat cuts of meat, high-fat cheeses, whole-fat milk and cream, butter, and ice cream products) are the primary sources of saturated fat. Too much saturated fat and cholesterol may increase blood cholesterol, as well as the risk of heart disease, certain types of cancer and weight gain and obesity [22] [24].

The reason for over-consumption of bad fats is fairly clear. They make food taste good, but contain nine calories per gram (proteins and carbohydrates contain only four calories per gram [24]. It has been recommended that fats should contribute less than 35% of total caloric intake, comprising less than 10% from saturated fat, less than 10% from polyunsaturated fat, and 10-15% from monounsaturated fat [23].

Water

Water is essential for good health because it is in every cell, tissue, and organ in the body [25]. Therefore, water is known as an essential nutrient – one that must be supplied from an outside source because they cannot be made by the body in sufficient amounts. Water deprivation kills faster than the lack of any other nutrient [26].

Water is not only essential for good health, but is a vital ink to life for a number of reasons. Water regulates body temperature, lubricates and cushions the joints, protects the spinal cord and other sensitive tissues, and helps get rid of wastes through urination, perspiration, and bowel movements [26]. Water is essential in prevention of dehydration as it is needed to replace what the body loses through normal everyday functions (such as sweating and even exhaling) [26].

Getting enough water every day is therefore important for optimum nutrition. The majority of a person’s water needs is gained through the intake of water and beverages, but foods also...
include water [25]. For example, soups and other foods (foods such as celery, tomatoes, oranges, and melons are 85% to 95% water). Under normal circumstances adults may need up to six to eight cups of fluid each day [25]. However, unlike many of the essential nutrients, there is not a specific daily recommendation for water intake [26]. This is partly due to the variability in climate in which people live, physical activity, age, state of health and body size [26].

Vitamins and minerals

Vitamins and minerals are essential for healthy growth and development [27]. Vitamins are organic substances (made by plants or animals), and minerals are inorganic elements (that come from the earth and are absorbed by plants). Vitamins and minerals are essential for maintaining good health, and each requires adequate intakes. There are many different types of vitamins, each having its own specific function. The best way to meet vitamin requirements is to eat a balanced diet with a variety of foods.

Vitamin A

Vitamin A is a group of compounds that play an important role in vision, bone growth, reproduction, cell division, and cell differentiation (in which a cell becomes part of the brain, muscle, lungs, blood, or other specialised tissue) [28]. It promotes healthy surface linings of the eyes and the respiratory, urinary, and intestinal tracts [29]. When those linings break down, it becomes easier for bacteria to enter the body and cause infection. Vitamin A also helps the skin and mucous membranes function as a barrier to bacteria and viruses [28].

Various breakfast cereals, juices, dairy products, and other foods are fortified with retinol (also known as preformed vitamin A) [30]. Many foods, including fruits and vegetables, whole grains, beans, breakfast cereals, and fortified grains and grain products, are excellent sources of folate [32]. Folic acid is the synthetic form of folate that is found in supplements and added to fortified foods [30].

Folate levels have been highlighted recently as having a major affect on nutritional status and prevention of disease [7]. This could be related to a lack of breastfeeding, which is another factor known to be fundamental for healthy infant and childhood growth and to the achievement and maintenance of optimum nutrition throughout life.

Symptoms of folate deficiency include low red cell folate, possibly resulting in megaloblastic anaemia, forgetfulness, insomnia and irritability [31].

Insufficient folate in the diet of females of child-bearing age increases the risk of having a foetus affected with a neural tube defect (NTD), a developmental defect resulting from failure of the neural tube to close properly during the first four to six weeks of pregnancy [33]. Babies born with NTDs can have severe mental and physical disorders. Women capable of, or planning, pregnancies should consume additional folic acid as a supplement for at least one month before and three months after conception, in addition to consuming food folate from a varied diet [30].

Folate deficiency has also been linked to other health conditions, including cancer and cardiovascular disease [31]. Folate

Hypervitaminosis A refers to high storage levels of vitamin A in the body that can be toxic [28]. The four major adverse effects of hypervitaminosis A are: birth defects; liver abnormalities; reduced bone mineral density (that may result in osteoporosis); and central nervous system disorders [28].

B Group vitamins: Folate, Vitamin B6, and Vitamin B12

The B-group vitamins, a collection of eight water-soluble vitamins, are present in many foods, but are delicate and easily destroyed, particularly by alcohol and cooking. Food processing also removes the B vitamins, making white flours, breads and rice less nutritious than their wholemeal counterparts.

The body cannot store most of the B-group vitamins (except B12 and folate, which are stored in the liver), and they need to be consumed every day.

Folate

Folate, a water-soluble B vitamin that occurs naturally in food, helps produce and maintain new cells and is especially important during periods of rapid cell division and growth (such as infancy and pregnancy) [31]. Many foods, including fruits and vegetables, whole grains, beans, breakfast cereals, and fortified grains and grain products, are excellent sources of folate [32]. Folic acid is the synthetic form of folate that is found in supplements and added to fortified foods [30].
contributes to DNA synthesis and repair, so it may also reduce the risk of cancer by preventing its occurrence and reducing its progression [34]. Several studies have associated diets low in folate with increased risk of breast, pancreatic, and colon cancer [31]. The impact of folate deficiency on cardiovascular disease is less clear, however, but may be related to its effect on blood homocysteine. It should be recognised that associations between diet and disease do not indicate a direct cause, and more research is required to ascertain whether enhanced folate intake from foods or folic acid supplements could reduce the risk for cancer and cardiovascular disease [32].

Vitamin B6

Vitamin B6, which exists in three major chemical forms (pyridoxine, pyridoxal, and pyridoxamine), is found in a wide variety of foods, including fortified cereals, beans, meat, poultry, fish, and some fruits and vegetables [35]. Vitamin B acts as an important coenzyme in a number of metabolic processes, including that of amino acids and glycogen. [30].

Some vitamin B6 is stored in muscle tissue and the liver, but this capacity is limited and so it is important to ensure a regular dietary intake [30].

Clinical deficiency of Vitamin B6 is rare, but can occur in individuals with poor quality diets that are deficient in many nutrients [30] [35].

Vitamin B12

Vitamin B12 is another important vitamin with a variety of functions, including synthesis of red blood cells, maintenance of the nervous system, growth and development in children, and generation of genetic material in all cells [36]. The actual amount required by the body is very small (measured in milligrams of a gram), as it can be stored in the human body for up to six years [30].

Vitamin B12 is found primarily in meat, eggs and dairy products [30]. Fermented soy products, seaweeds, and algae (such as spirulina) have been suggested as containing significant B12, but the present consensus is that any B12 present in plant foods is not likely to be available to humans, so these foods should not be relied upon as safe sources [37].

Most children and adults consume recommended amounts of vitamin B12 [36]. A deficiency may still occur as a result of an inability to absorb vitamin B12 from food and in strict vegetarians who do not consume foods that come from animals [37]. The first signs of deficiency include a loss of appetite, mental confusion, hair loss, poor growth and fatigue [36]. Gross depletion will produce anaemia and severe neuro-psychotic disorders [36].

Vitamin C

Vitamin C is a very important essential nutrient. It is readily absorbed in the human body, but continued intake through food or supplement is necessary for optimum nutrition [30]. It is found only in the fruit and vegetable foods and is highest in fresh, uncooked foods [38]. Food sources high in vitamin C include citrus fruits and juices, berries, green and red peppers, tomatoes, broccoli, and spinach [30]. Many breakfast cereals are also fortified with vitamin C [38]. Vitamin C is one of the least stable vitamins, however, and the level can be affected by season, transport, shelf life, storage time, cooking practices and chlorination of water [30].

An important function of vitamin C is in the formation and maintenance of collagen (the basis of connective tissue), which is found in skin, ligaments, cartilage, vertebral discs, joint linings, capillary walls, and the bones and teeth [30]. Collagen, and thus vitamin C, is needed to give support and shape to the body, to help wounds heal, and to maintain healthy blood vessels [30]. Vitamin C also aids effective brain functioning, stimulates adrenal function, assists hormone production, and aids in cholesterol metabolism, increasing its elimination and thereby assisting in lowering blood cholesterol [38].

Vitamin C stimulates the immune system and may help in the prevention and treatment of infections and other diseases [38]. Vitamin C is used up more rapidly under stressful conditions and with alcohol use, and blood levels are reportedly much lower among smokers than among non-smokers given the same intakes [30].

Vitamin D

Vitamin D helps ensure that the body absorbs and retains calcium and phosphorus, both critical for building bone [39]. It is a fat-soluble vitamin that is naturally present in very few foods [40]. The flesh of fish, such as salmon, tuna, and mackerel, and fish liver oils are among the best sources [30]. Small amounts of vitamin D are found in beef liver, cheese, and egg yolks [39]. Vitamin D is also produced endogenously when ultraviolet rays from sunlight strike the skin and trigger vitamin D synthesis [40].

Together with calcium, vitamin D also protects older adults from osteoporosis, as lack of sufficient vitamin D causes bones to become thin and brittle [40]. People at high risk of vitamin D deficiency include older people (particularly those in residential care), people with skin conditions where avoidance of sunlight is advised, those with dark skin, and those with malabsorption [30].

Vitamin D is now also believed to protect against some cancers and diabetes, to be an essential element for a hormone that protects muscle, and to inhibit autoimmune disorders from multiple sclerosis and lupus to inflammatory bowel disease [39].
Vitamin E

Vitamin E is a fat-soluble vitamin that exists in eight different forms [41]. Good sources of vitamin E include sunflower and safflower oils, oil-based salad dressings, almonds, sunflower seeds, peanut butter, and dark leafy greens [42].

Vitamin E is an antioxidant that protects body cells against the effects of free radicals, which are potentially damaging by-products of energy metabolism [42]. Free radicals can damage cells and may contribute to the development of cardiovascular disease and cancer. Studies are underway to determine whether vitamin E, through its ability to limit production of free radicals, might help prevent or delay the development of those chronic diseases [41]. Vitamin E has also been shown to play a role in immune function, DNA repair, and other metabolic processes.

Intestinal disorders, such as Crohn’s disease and cystic fibrosis, often result in malabsorption of vitamin E and may require vitamin E supplementation [41]. Very low birth weight infants may also be deficient in vitamin E.

Vitamin K

Vitamin K is essential for synthesising the liver protein that controls blood clotting [43]. It is also involved in bone formation and repair, and assists in the intestines in converting glucose to glycogen, so that it can be stored in the liver. The major dietary sources of vitamin K are green leafy vegetables (such as spinach, salad greens, cabbage, broccoli and brussel sprouts) and certain plant oils (such as soybean and canola oils, and, to a lesser extent, cottonseed and olive oils) and margarines and salad dressings made from them [30].

Cases of dietary-induced deficiency are rare, but newborn babies are vulnerable to vitamin K deficiency so it is recommended that they receive an injection or oral supplement shortly after birth [30] [44].

Calcium

Calcium is the most abundant mineral in the body and is needed for numerous functions, including building and maintaining bones and teeth, blood clotting, the transmission of nerve impulses, and the regulation of the heart’s rhythm [45]. Ninety-nine percent of the calcium in the human body is stored in the bones and teeth [46]. The remainder is found in the blood and other tissues [46].

The body gets calcium it needs in two ways – by eating foods containing calcium (or by taking calcium supplements) or by re-absorbing it from bones [45]. Calcium must be consumed as the body cannot produce it. Examples of good sources of calcium include dairy products (which have the highest concentration per serving of highly absorbable calcium) and dark leafy greens or dried beans (which have varying amounts of absorbable calcium) [45].

The calcium in human bones is in a constant state of turnover and, when diet does not provide enough, the body can draw on the calcium stored in bone to maintain adequate blood levels [46]. Over a sustained period, this can contribute to osteoporosis (a disorder characterised by porous, weak bones). In older adults, particularly among postmenopausal women, bone breakdown exceeds its formation. This can result in bone loss, increasing the risk for osteoporosis.

Osteoporosis is common in industrialised countries and can result in bone fracture [30]. It is one of the major causes of morbidity among older Australians, particularly postmenopausal women. Lifelong dietary calcium intake is necessary to reduce the risk of osteoporosis, and vitamin D intake and regular, weight-bearing exercise are also important to maintain maximum bone density and strength [45].

Iron

Iron is essential for good nutritional health as it plays a role in a number of important functions in the body [47]. It is an essential component of haemoglobin and is required for normal blood formation and oxygen transport around the body [48]. It is also required for the normal functioning of the immune system and for neurological development in the embryo [47].

Iron in food comes in two general forms - as haem or non-haem iron [30]. Haem iron is found in animal foods that originally contained haemoglobin (such as red meats, fish, and poultry) [48]. Iron in plant foods (such as lentils and beans) is arranged in a chemical structure called non-haem iron. Haem iron is absorbed better than non-haem iron, but most dietary iron is non-haem iron [30]. In addition to a healthful diet that includes good sources of iron, it is also necessary to eat foods that help the body absorb iron better. Foods rich in vitamin C (such as many fruit and vegetables) help the body absorb the non-haem iron foods [49].

The World Health Organization considers iron deficiency the most important nutritional disorder in the world [50]. Iron deficiency ranges from depleted iron stores without functional or health impairment to iron deficiency with anaemia, which affects the functioning of several organ systems [49].

As many as 80% of the world’s population may be iron deficient, and 30% may have iron-deficiency anaemia [50]. A deficiency of iron limits oxygen delivery to cells, resulting in fatigue, poor work performance, and decreased immunity [47]. Iron-deficiency
anaemia can be associated with low dietary intake of iron, inadequate absorption of iron, or excessive blood loss [48].

Women of childbearing age, pregnant women, preterm and low birth weight infants, older infants and toddlers, and teenage girls are at greatest risk of developing iron-deficiency anaemia because they have the greatest need for iron [50]. Women with heavy menstrual losses can lose a significant amount of iron and are at considerable risk for iron deficiency [48]. People in these high risk groups need to eat a healthy diet that includes good sources of iron and vitamin C and an iron supplement may also be necessary [49]. Breastfeeding is encouraged to prevent iron deficiency in infants [50].

**Magnesium**

Magnesium is an essential mineral which is found in the muscles, soft tissues and body fluids [30]. It works in conjunction with calcium, and is necessary for healthy bone growth and helps to relax muscles [51].

Magnesium is widely distributed in the food supply in both plant and animal foods. Most green vegetables, legumes, peas, beans and nuts are rich in magnesium, as are some shellfish and spices [30]. Most unrefined cereals are reasonable sources, but highly refined flours, tubers, fruits, oils and fats contain very little as the magnesium-rich germ and bran are removed [30]. Tap water can be a source of magnesium, but the amount varies according to the water supply [51]. Water that naturally contains more minerals is described as ‘hard’ and contains more magnesium than ‘soft’ water [51]. Eating a wide variety of legumes, nuts, whole grains, and vegetables is generally necessary to meet daily dietary magnesium needs.

Magnesium deficiency is relatively rare, but dietary intake for many people may not be enough to promote an optimal magnesium status, needed to protect fully against cardiovascular disease and immune dysfunction [51]. Early signs of magnesium deficiency include loss of appetite, nausea, vomiting, fatigue, and weakness. As magnesium deficiency worsens, numbness, tingling, muscle contractions and cramps, seizures, personality changes, abnormal heart rhythms, and coronary spasms can occur. Severe magnesium deficiency can result in low levels of calcium in the blood (hypocalcemia) [30]. Magnesium deficiency is also associated with low levels of potassium in the blood (hypokalemia).

**Potassium**

Potassium is a mineral that helps the kidneys function effectively and also plays a key role in cardiac, skeletal, and smooth muscle contraction [30]. This makes it an important nutrient for normal heart, digestive, and muscular function. A diet high in potassium from fruits, vegetables, and legumes is generally recommended for optimum heart health.

Leafy green vegetables, vine fruit (such as tomatoes, cucumbers, zucchini, eggplant and pumpkin), and root vegetables are particularly good sources of potassium [30]. It is also moderately abundant in beans and peas, tree fruits (such as apples, oranges and bananas), milks, yoghurts and meats.

Proper balance of potassium in the body depends on sodium, and excessive intake of sodium may deplete the body’s stores of potassium [30]. Other conditions that can cause potassium deficiency include diarrhoea, vomiting, excessive sweating, malnutrition, and use of diuretics. Evidence suggests that the intake of dietary potassium may play a role in decreasing a range of diseases such as stroke, osteoporosis and kidney stones.

**Zinc**

Zinc is an essential mineral that is found in almost every cell in the human body. It stimulates the activity of enzymes, substances that promote biochemical reactions in the body. Zinc supports a healthy immune system, is needed for wound healing, helps maintain a sense of taste and smell, and is needed for DNA synthesis [30]. Zinc also supports normal growth and development during pregnancy, childhood, and adolescence.

Rich sources of zinc are red meat, nuts and seeds (such as sunflower kernels), whole grains, and shellfish such as oysters. Other good food sources include beans, nuts, certain seafood, whole grains, fortified breakfast cereals, and dairy products.

Other dietary components, such as protein, can influence the absorption of zinc [30]. Zinc absorption is greater in a diet high in animal protein than one high in plant protein. Phytates (found in whole grain breads, cereals, legumes and other products), can decrease zinc absorption. Situations of stress, acute trauma and infection can also lead to lower levels of zinc absorption [30].

Zinc deficiency occurs most often when zinc intake is inadequate or the mineral is poorly absorbed, when there are increased losses of zinc from the body, or when the body’s requirement for zinc increases. Signs of zinc deficiency include growth retardation, hair loss, diarrhoea, delayed sexual maturation and impotence, eye and skin lesions, and loss of appetite.

**Selected dietary aspects**

**Fruit and vegetable consumption**

The benefits of fruit and vegetable intake for a healthy diet are widely recognised [3], [5]. Fruits and vegetables provide essential vitamins and minerals, fibre and other substances that are...
important for good health. They are also naturally low in fat and calories and are filling.

The World Health Organization’s World Health Report 2002 estimated that 4% of the overall disease burden in developed countries is caused by low fruit and vegetable consumption [11]. Diets rich in plant foods are associated with a lower incidence of cardiovascular disease, type 2 diabetes, some cancers, and cataract and macular degeneration of the eyes [5]. A number of substances that are found in plants (such as antioxidant nutrients, non-nutrient novel substances (including bioflavonoids, phytoestrogens and indole carbinols for example) and some minerals) are thought to protect against these diseases. Low intake of fruit and vegetables is estimated to cause about 19% of gastrointestinal cancer, about 31% of ischaemic heart disease, and 11% of stroke worldwide [11].

Australian dietary guidelines recommend that adults consume two to four serves of fruit and four to eight serves of vegetables per day [3].

Large sections of the Australian population are not consuming adequate amounts of fruit and vegetables [7]. The 2004-2005 National Health Survey found that 86% of people aged 18 years or older did not usually consume five serves of vegetables per day, and 46% did not consume two serves of fruit. There are socio-economic disparities relating to the consumption of fruit and vegetable intake, with fresh fruit and vegetable intake is greater in higher income than in lower income households. Inadequate consumption of fruit and vegetables is often related to a range of social, cultural, economic and geographical issues.

Breastfeeding

Internationally and in Australia, breastfeeding has received increased attention as a focus for improving public health [14]. Breastfeeding is one of the most important health behaviours to promote the survival, growth, development and overall nutritional health for both mother and child. Breast milk also contains immune components, cellular elements and other host-defence factors that provide various antibacterial, antiviral and antiparasitic protection. Breast-milk components stimulate the appropriate development of an infant’s own immune system [11]. Breastfeeding may also have protective role in several chronic diseases and infections (such as diarrhoea, respiratory infection, middle ear infections, SIDS, diabetes, and inflammatory bowel disease) and in allergic diseases (such as asthma and eczema), and be associated with higher IQ scores [7]. Breastfeeding has also been seen to play an important role in preventing obesity in children [6].

Positive implications for women’s health have also been recognised. Breastfeeding helps a mother’s body recover to its pre-pregnant state more quickly, and lactation (the production of breast milk) protects against premenopausal breast cancer and osteoporosis [4]. Psychological benefits between a mother and an infant when breastfeeding – encouraging close bonds – have also been recognised [14].

Some population groups are more likely to continue with breastfeeding than others, and older, more educated mothers were more likely than younger, less educated mothers in 2001 to still be breastfeeding their children (either exclusively or in combination with breast milk substitutes and/or solid food) at 6 and 12 months of age [7]. For mothers aged 30 years or older, 54% were still breastfeeding their baby at 6 months of age, compared with 38% for mothers aged 18–29 years. Mothers aged 30 years or older were also twice as likely to be breastfeeding their babies at 12 months of age (28%) than were mothers aged 18–29 years (14%). Almost two-thirds (64%) of mothers with a post-school qualification at the level of associate diploma or above were breastfeeding their babies at 6 months of age, compared with 41% of those with no post-school qualification. By the time their babies were 12 months old, nearly twice as many mothers with an associate diploma or above (35%) were still breastfeeding their child compared with women with no post-school qualification (17%) [7].

The mounting evidence of the nutritional benefits of breastfeeding for both mother and child are supported by the Australian Government and the World Health Organization, and it is recommended that babies are fed only breast milk until 6 months of age [9]. Current Australian and World Health Organization guidelines outline optimal breastfeeding practices in terms of initiation (when breastfeeding begins), intensity (the extent breastfeeding is a dominant source of nutrition), and, total duration (the length of time a mother breastfeeds her infant) [7].

Nutrition-related diseases

High blood pressure and high cholesterol

High blood pressure and high cholesterol are related to behavioural risk factors, such as poor diet, and/or hereditary risk factors [7]. The effect of nutrition on the risk of cardiovascular disease cannot be attributed to any one dietary component alone, but results from the combined effects of individual dietary factors and total energy intake if it leads to overweight and obesity [6].

High blood pressure

A person’s diet, and more specifically their salt intake, can have major affects on their blood pressure and, therefore, their risk of disease. The main modifiable causes of high blood pressure are diet, especially high salt intake, low levels of exercise, obesity, and
excessive alcohol intake [11]. As a result of the cumulative effects of these factors, blood pressure usually rises steadily with age, except in societies in which these factors are largely absent. Many Australian adults have blood pressure levels that are suboptimal for health [7]. It has been estimated that high blood pressure is responsible for more than 5% of the total disease burden among Australians [7]. High blood pressure is recognised as being a major risk factor for a number of conditions, particularly coronary heart disease, stroke and heart failure, with the risk of disease increasing as high blood pressure increases [6].

The Australian Bureau of Statistics [4] reported that people with high blood pressure were more likely to have certain long-term conditions compared to adults without high blood pressure. For example, adults with high blood pressure had a much higher prevalence of high cholesterol than those without high blood pressure (20% compared with 6%) [4]. In addition, they were more than twice as likely to have diabetes (7% compared with 3%) and over five times more likely to report oedema (7% compared with 1%) [4]. Obesity, and physical inactivity, and consumption of alcohol are often higher among those with high blood pressure [6].

To reduce high blood pressure, people are advised to lower their weight (if necessary), undertake sufficient exercise, limit alcohol intake and reduce the amount of salt in their diets [6].

High blood pressure levels vary among adults with different socio-demographic characteristics [4]. For example, 16% of adults from the most disadvantaged socioeconomic areas had high blood pressure compared with 12% of adults from the least disadvantaged socioeconomic areas. With regard to household composition, adults living in one-person households with children were most likely to report high blood pressure (17%) and those adults living in a couple household with or without children were least likely (13%).

**High cholesterol**

A diet high in saturated fat content, heredity, and various metabolic conditions (such as diabetes mellitus) influence a person’s level of cholesterol [6]. Cholesterol levels usually rise steadily with age, more steeply in women, and stabilise after middle age [6]. Mean cholesterol levels vary moderately between regions, but generally not more than 2.0 mmol/l in any age group. Cholesterol is a key component in the development of atherosclerosis, the accumulation of fatty deposits on the inner lining of arteries [11]. Mainly as a result of this, cholesterol increases the risks of ischaemic heart disease, ischaemic stroke and other vascular diseases. As with blood pressure, the risks of cholesterol are continuous and extend across almost all levels seen in different populations [11]. Adults with high cholesterol are more likely to have particular long-term conditions, such as ischaemic heart disease and diabetes [4].

Differences in cholesterol levels between certain population groups are less consistent than some other health indicators [4]. For example, 5% of employed adults aged 18-64 years reported having high cholesterol compared with 6% of unemployed adults. Among females, those in the lowest income quintile were more likely than those in the highest income unit quintile to report having high cholesterol (9% compared with 5%) [4]. However, among males, the proportions with high cholesterol were more similar for the lowest and highest income quintiles (9% and 11% respectively).


39. National Health and Medical Research Council (2006) Joint statement and recommendations on vitamin K administration to newborn infants to prevent vitamin K deficiency bleeding in infancy. Canberra: National Health and Medical Research Council


The Australian Indigenous HealthInfoNet is an innovative Internet resource that contributes to ‘closing the gap’ in health between Indigenous and other Australians by informing practice and policy in Indigenous health.

Two concepts underpin the HealthInfoNet’s work. The first is evidence-informed decision-making, whereby practitioners and policy-makers have access to the best available research and other information. This concept is linked with that of translational research (TR), which involves making research and other information available in a form that has immediate, practical utility. Implementation of these two concepts involves synthesis, exchange and ethical application of knowledge through ongoing interaction with key stakeholders.

The HealthInfoNet’s work in TR at a population-health level, in which it is at the forefront internationally, addresses the knowledge needs of a wide range of potential users, including policy-makers, health service providers, program managers, clinicians, Indigenous health workers, and other health professionals. The HealthInfoNet also provides easy-to-read and summarised material for students and the general community.

The HealthInfoNet encourages and supports information-sharing among practitioners, policy-makers and others working to improve Indigenous health – its free online yarning places enable people across the country to share information, knowledge and experience. The HealthInfoNet is funded mainly by the Australian Department of Health and Ageing. Its award-winning website resource (www.healthinfonet.ecu.edu.au) is free and available to everyone.

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