Challenges in meeting nutritional requirements

A brief history

Did you know that the early development of dietary standards and recommendations was largely a result of wars and economic depression? In order to determine how much food a person needed to prevent starvation, the first dietary standards for energy and protein were proposed in 1862 by Dr Edward Smith in the UK—2800 kcal and 80 g protein for a working man. It was not until the beginning of the twentieth century that it was generally accepted that foods contained other, as yet unidentified, essential nutrients.

In response to the Great Depression of the 1930s, the League of Nations (now known as the United Nations) committee on nutrition recommended people to include ‘protective foods’ in their diets, with an emphasis on milk, leafy vegetables, eggs, fish and organ meats. As more information about nutrient requirements was accumulated, dietary standards for energy, protein, fat and a few vitamins and minerals were proposed. Canada and the USA were the first countries to publish dietary standards and allowances to evaluate diets, and now, many countries and health authorities have their own sets of recommended nutrient intakes.

Nutrient Reference Values

In Australia, the nutritional requirements are provided in the form of Nutrient Reference Values (NRVs). These include requirements for individuals (recommended dietary intakes) and for groups (estimated average intakes or EARs) based on the traditional concept of adequate physiological or metabolic function and/or avoidance of deficiency states. Chronic disease prevention is dealt with separately, using acceptable macronutrient distribution ranges and suggested dietary targets. These NRVs are set by the National Health and Medical Research Council and the New Zealand Ministry of Health and are based on the latest available scientific knowledge. NRVs apply to a healthy population and vary according to age, gender and life stage. They are set on the basis of long-term (i.e. usual) nutrient requirements.

The Eat for Health website has a number of calculators that can be used to estimate dietary energy and nutrient requirements based on age, gender, weight and physical activity level, as well as to determine the recommended number of servings of core (and discretionary) foods to be consumed each day. These estimates are developed for people of all ages and backgrounds in the general healthy population, including those with common diet-related risk factors such as being overweight.

Australian Health Survey (2011–2013)

The nutrient intakes of the Australian population were evaluated as part of the Australian Health Survey of 2011–2013 conducted by the Australian Bureau of Statistics (ABS). Detailed information was collected on dietary intake from over 12,000 participants aged two years and above using a structured 24-hour recall method. By collecting two days of recall data, the researchers were able to apply a statistical model, the National Cancer Institute (NCI) method, to estimate the ‘usual intake’ of nutrient distributions for each age and gender group. This method is superior to using only one day or the mean of two days in the estimation of population distributions. This ‘usual intake’ can then be used to assess the nutritional adequacy of the population’s dietary intake. The prevalence of nutrient inadequacy can be evaluated from the proportion of people who do not meet their nutritional requirements or the ‘EAR cut-point method’.

The ABS report on Usual Nutrient Intakes of 2011–2012 provides a summary of the population’s usual intake of selected nutrients and estimates the proportion with inadequate or excessive intakes. Any vitamins or minerals obtained from supplements were not included. This report showed that almost all Australians met their nutritional needs for protein, niacin, vitamin C, vitamin B12, phosphorus and selenium. In addition, most men met their requirements for folate, iodine and iron.

Folate and iodine intakes were adequate for most of the population, with the exception of women aged 19–50 years. In this age group, 10% did not meet their folate or iodine requirements, both important nutrients for babies’ development. Since the introduction of mandatory fortification of bread with folate, thiamin and iodine in 2009, the prevalence of inadequate intakes has greatly improved. Biochemical tests undertaken as part of the Australian Health Survey showed that the vast majority of women of child-bearing age had sufficient red blood cell (RBC) folate levels to prevent neural tube defects. More alarming were the iodine levels, with two thirds of women of child-bearing age considered as being below the recommended levels. Iodine deficiency was particularly high in Tasmania and lowest in West Australia. The report suggests that mandatory fortification may not be enough to meet the additional iodine requirements of these women. Iodine is an essential nutrient required for growth and deficiency and can result in impaired mental and physical development.

Other nutrients of particular concern were calcium, vitamin D, sodium, iron and zinc. Over half of the Australian population surveyed had inadequate intakes of calcium. This reached 90% for adolescent girls and women aged 50 years and above. Low calcium intake can result in
lower peak bone mass attainment and increase the risk of osteoporosis, a condition affecting one in four women over the age of 50. In addition, vitamin D deficiency was common in the Australian population. Although not strictly a dietary deficiency, as sunlight exposure is the major source of vitamin D, the Australian Health Survey found that 23% of the population had insufficient levels (<50 nmol/L). Severe vitamin D deficiency can lead to rickets in children and osteoporosis in older people.

In contrast, sodium intakes were excessively high, with more than half of the population exceeding the upper level of intake (UL). As this did not include sodium added at the table or during cooking, these numbers are likely an underestimate. High sodium intakes have been linked to high blood pressure and a range of other health conditions, such as heart failure, kidney problems, stomach cancer and osteoporosis.

Iron intakes were inadequate among adolescent girls and pre-menopausal women, with 40% not meeting their requirements through diet alone. Iron deficiency is common in this age group and can lead to fatigue, reduced performance and cognitive functioning. Zinc intakes, on the contrary, were particularly low among adolescent boys and adult men. Requirements for zinc are higher in men than women, and the greatest prevalence of inadequacy was among men aged 71 years and above (66%). Although overt zinc deficiency is relatively uncommon in Australia, the symptoms of mild deficiency may include growth impairment and reduced immune function.

Perhaps surprisingly, large sections of the population did not meet the required intakes for magnesium and vitamin B6 and, to a lesser extent, vitamin A and thiamin as these nutrients are not usually considered to be at risk. Magnesium and vitamin B6 intakes were inadequate for one in three people. Severe deficiencies of magnesium and vitamin B6 deficiencies are rare, and signs and symptoms are usually not present in mild deficiency. Vitamin A intakes were low for approximately 20% of adolescents and adults and thiamin for 20% of adult women. Vitamin A deficiency is rare in Australia, and the incidence of thiamin deficiency Wernicke-Korsakoff syndrome, which was the stimulant for introducing mandatory thiamine fortification to wheat flour for bread making in 1991, has now reduced significantly.

Based on these shortcomings in meeting nutritional requirements, it is evident that many people are not following the dietary guidelines and consuming the recommended number of core foods. Fruit, vegetable, dairy products and meat and alternatives were all consumed in insufficient amounts. Less than 5% of the population met the recommended vegetable intake, and only 10% met the guidelines for dairy products. Compliance was the highest for meeting servings of fruit and grains, although refined cereals made up the bulk of grain servings. Excessive amounts of discretionary foods and beverages—high in saturated fat, sugar, salt or alcohol—were consumed and made up 35% of the total energy intake. Alcohol intakes were particularly high in middle-aged Australian adults.

A few limitations of this survey need to be mentioned. The underestimation or underreporting of food and beverage intake was highly likely and appeared to have increased since the previous national nutrition survey in 1995, particularly for males. Energy underreporting was estimated to be approximately 21% for women and 17% for men. Underreporting is unlikely to affect all foods and nutrients equally and must be considered when interpreting results from this survey. In order to translate food into nutrients, an up-to-date food composition and measures database is essential, and the AUSNUT (2011–2013) database was created specifically for this survey by Food Standards Australia New Zealand (FSANZ). This is a comprehensive database containing over 5500 foods and beverages, with a complete nutrient profile of 53 nutrients. Nutrient data were derived from a variety of methods, such as laboratory analysis, imputed from similar foods, calculated using a recipe approach or borrowed from other databases. Although many foods were directly analysed, the nutrient content is an average of a particular sample of foods and ingredients and should be considered an approximation only.

Even though Australia is one of the wealthiest countries in the world, with a plentiful and safe food supply able to meet the population’s nutritional requirements, most people are not choosing their foods wisely. Too often, healthy food choices are compromised because of a lack of time or skills to prepare balanced meals and the abundant availability of cheap energy-dense convenience foods. Australians are eating out more and spending less time preparing foods at home. Discretionary foods, such as biscuits and chocolate, are becoming everyday foods, and many Australians believe that their diets are healthy.

Nutrition requirements in other population groups

So if the healthy population has trouble meeting their nutrient recommendations, it is likely to be even more challenging for those with medical conditions requiring specialised dietary advice or for those at risk of malnutrition. Vulnerable groups include the hospitalised, elderly, the disadvantaged and people with chronic illness. The NRVs have limited application in the clinical setting, where a more individualised approach is necessary. Requirements can be influenced by many factors such as current nutritional status, illness, metabolic stress, malabsorption and genetic abnormalities.

Current journal issue

This edition of the journal captures a number of studies that raise challenges in the meeting of nutritional requirements, in both healthy populations during pregnancy and for those at higher risk of inadequate intakes, such as patients in an acute care setting, and for those with chronic disease.
The article by Lovell et al. explores the association between maternal vitamin D intake and sunlight exposure and breast-fed infant vitamin D status in New Zealand. The authors recommend vitamin D supplementation to exclusively breast-fed infants throughout the winter months to reduce deficiency.

Host et al. used focus groups to explore factors that influence food shopping, cooking and eating behaviours among independently living people aged 60 years and above. Participants showed a high level of interest in health and nutrition and demonstrated a high degree of resourcefulness to overcome any barriers. The study by Xiong et al. showed that an adequate iron intake was associated with lower risk of osteoporosis among 1870 Chinese people. Iron intakes that were inadequate or excessive were found not to be protective. Mullaney et al. examined energy and macronutrient intakes in pregnant women and their association with BMI and fasting blood glucose levels. Farrer et al. investigated oral intake of patients requiring texture modified diets. Patients were provided with a smooth pureed meal in a moulded or non-moulded form. Intake was found to be higher for the moulded meals, suggesting that the presentation of meals in this way may help with improving nutritional status. Shalit et al., in a group of stable chronic obstructive pulmonary disease (COPD) patients, found inadequate consumption of dairy products, fruit and vegetables. The main factors influencing food choices were breathlessness and fatigue affecting appetite, swallowing problems, limited social and financial supports, reduced motivation and limited knowledge about the impact of nutrition on COPD.

Four articles in this issue examined factors that can influence food choice and consumption, such as food literacy and labelling, portion size estimation and, at a higher level, the food regulation setting. The paper by Wilson et al. aimed to identify how food regulators can facilitate their response to food incidents to ensure that consumer trust is maintained and that food and nutrient intakes are not adversely affected. Ringland et al. evaluated an electronic tool designed to assess nutrition literacy and found that food label reading was a challenging skill for many people. Yang et al. compared three different nutrition front-of-pack labelling systems and found the Healthy Star Rating system to be the most useful for beverages but suggested several further refinements to improve consumer awareness of the overall healthiness of the product. Nguyen et al. aimed to compare the estimated portion sizes of common foods to their actual intake in order to reach satiation. They found good overall agreement but a tendency for people to over-portion energy-dense foods. The authors suggest that this could have implications for body weight maintenance as over-portioning can lead to over-consumption.

The remaining studies examined diet quality and nutrient patterns. De Franca et al. examined associations between diet quality, muscle mass and low phase angle (a measure of cellular health and integrity) in Brazilian adults. They found that both diet quality and muscle mass were associated with phase angle measured using whole body bioelectrical impedance analysis. The study by Kang et al. used pattern analysis to explore associations between nutrient patterns and geographical areas in Korea. Their ability to identify differences in nutrient patterns between regions could lead to more targeted health promotion campaigns.

Conclusion

Despite Australia’s abundant food supply, population intakes are far from optimal. The low consumption of core foods such as vegetables, fruit, whole grains and dairy products have led to inadequate intakes of calcium, iron, zinc, magnesium and vitamin B6. Although the national survey only provided a snapshot in time, prolonged deficient intakes could lead to serious consequences such as osteoporosis, iron deficiency in women, impaired immunity and intellectual disability or mental retardation in babies. This highlights the importance for dietitians to ensure that nutrient deficiencies are not overlooked in the current obesogenic food environment.

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References

15 Lovell AL, Wall GR, Grant CC. Do maternal dietary vitamin D intake and sunlight exposure affect the vitamin D status of exclusively breastfed infants? Nutr Diet 2016; 73: 420–6.
16 Host A, Mcmahon AT, Walton K, Charlton K. ‘While we can, we will’. Exploring food choice and dietary behaviour amongst independent older Australians. Nutr Diet 2016; 73: 463–73.