

Review of nutrition and growth among Indigenous people



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This review draws heavily on two previous articles prepared by HealthInfoNet-related staff: Burns J, Irvine J (2003) Nutrition and growth. In: Thomson N (ed.) *The health of Indigenous Australians*, South Melbourne, Vic.: Oxford University Press (pp75-92); and Burns J, Thomson N. Overweight and obesity - a major problem for Indigenous Australians. *Australian Indigenous HealthBulletin*, 2006, 6(4): (Online journal: www.healthbulletin.org.au).

Being drawn heavily from two previous reports means that this review lacks some balance in terms of the amount of attention directed to the early life nutrition and growth sections and nutrition information related to adults. This imbalance is also partly due to the substantial gaps in information about food intake and nutritional status, and in incidence and prevalence data about diet-related health conditions.

Introduction

Good nutrition is necessary for growth and physical and mental health [1]. Proteins, fats, and carbohydrates are required for normal metabolic functioning and for recovery from illness and injury. Vitamins and micronutrients have specific functions, and a deficiency can result in a clinical disorder. Poor nutrition can increase the risk of a number of diseases, including cardiovascular disease, diabetes, some cancers, obesity, gall bladder disease, iron-deficiency anaemia, dental caries, and renal disease. The dietary risk factors for cardiovascular disease, for example, include saturated fat from meat and processed foods, lack of fresh fruit and vegetables, high salt intake, excess energy intake, and alcohol consumption. It is difficult to

determine, however, the precise extent to which diet contributes to disease, because disease is also caused and influenced by behavioural, biological, genetic, and environmental factors [2].

In the Indigenous population, the major causes of diet-related mortality and morbidity are cardiovascular disease, diabetes, and renal disease [1]. Poor nutrition (both under- and over-nutrition) across the life cycle can be even more detrimental to health when it occurs in combination with other risk factors, such as smoking and physical inactivity [3].

In the past, Indigenous people's hunter-gatherer methods of obtaining food involved physical activity and social interaction. Transition to a European diet and changes in lifestyle have been problematic for many Indigenous people [1]. The causes of current inadequacies in nutritional intake among Indigenous people are complex; socioeconomic, environmental and geographic factors have influenced the availability of healthy and affordable food. The current inadequacies in Indigenous nutrition are another example of the substantial disadvantages experienced by many Indigenous people, to which more concerted efforts are now being made in Australia to 'close the gap' [4] [5] [6].

Historical overview of Indigenous nutrition

Hunter-gatherer methods of living were the usual way of life of humans until about 12,000 years ago, when human groups started to experiment with plant production [7]. Indigenous groups in Australia lived in a diverse range of climatic conditions and terrains, varying from tropical to temperate climates, and from coastal regions to the interior. Indigenous hunter-gatherers depended on naturally occurring plants, animals and fish, with males primarily the hunters of large game and women the collectors of plants and small game. Where food and water were plentiful, large groups of Indigenous people might camp for weeks or months before moving to another locality [8]. Semi-nomadism, often associated with this lifestyle, was less evident among coastal groups.

The limited information on the nutrition of Indigenous people prior to the European colonisation of Australia suggests that they were healthy, fit, and strong [7] [9] [10]. The traditional diet, according to the available information, was high in protein, low in sugars, high in complex carbohydrates (of low glycaemic index) and high in micronutrients—hence it was generally low in energy density and high in nutrient density [1]. Season and location greatly influenced the composition and diversity of the food supply [11].

The diet of Torres Strait Islander people contained more seafood than that of Aboriginal people, a direct reflection of their location [12]. Torres Strait Islanders, along with Aboriginal people living in coastal areas, had extensive knowledge of the marine environment—of feeding patterns of marine animals and tidal movements, for example [13]. The food supply in the Torres Strait varied between islands, and Islanders depended on subsistence agriculture and trading more than Aboriginal people did. Fishing, hunting, and foraging were supplementary to horticultural activities.

Indigenous nutrition after 1788

The hunter-gatherer lifestyle of Indigenous people changed after the arrival of European people in Australia in 1788 [7]. Many Indigenous people were forced to become dependent on Europeans for food, as well as for many other resources. Indigenous population numbers decreased after initial contact with Europeans—due to violence, introduced diseases, and malnutrition. The loss of land to farmers and graziers and the relocation of Indigenous people to settlements led to marked reductions in the hunting and gathering of food [14].

Many Indigenous groups became established on cattle stations, government settlements, or missions, where their diets consisted mainly of introduced foods. Some of these foods were highly processed—as they had to endure long periods of transportation and storage—and were generally high in sugar, salt, and fat. When the food supply was inadequate, Indigenous people resorted to bush foods [1]. Communal feeding for Indigenous people, with food available at little or no cost, sometimes was the only option. This was especially so in the years prior to 1969, when Indigenous people did not receive all their wages in cash. Communal feeding lessened mothers' responsibility for the economic management of food and the feeding of their children [14].

Overall dependence generally led to conversion to a 'Western' diet, role changes and a reduction in physical activity [8]. Women lost much of their food-gathering and food-processing role, and spent more time sitting around camps or settlements. Men were often employed in the workforce, but in the 1970s a combination of a reduction in rural employment opportunities, the availability of social welfare benefits, and freely available alcohol led to a decline in the physical activity of men in Indigenous settlements. This was accompanied by an increased energy intake and continued dietary imbalances.

A rapid change in the diet of many Indigenous people from a fibre-rich, high-protein, low-saturated-fat traditional diet to one high in refined carbohydrates and saturated fats increased the risk of diet-related disease [2]. Vulnerability to obesity and non-insulin-dependent diabetes mellitus has been common among other groups that have been subjected to similar rapid lifestyle changes—for example, Pima Indians and Native Americans [15].

Contemporary nutrition and growth

Intra-uterine growth

The effects of diet and nutrition in pregnancy and a child's early life may have lifelong consequences [16]. Healthy nutrition in pregnancy is crucial for the mother, as it influences both her health and that of her baby. Low dietary-energy intake, malnutrition, inadequate weight gain during pregnancy, and low pre-pregnancy weight can lead to intra-uterine growth retardation, which in turn can reduce birthweight.

Of particular concern are birthweights below 2,500 grams - defined as 'low birthweight' - which increases the risk of death in infancy and other health problems [2]. The factors influencing birthweight are complex, and reflect not only the nutritional health of the mother, but also the duration of pregnancy, number of babies previously born, high maternal age and low socioeconomic status, as well as risk factors such as substance use in pregnancy (particularly cigarette smoking and alcohol consumption).

Birthweights

The average birthweight of babies born to Indigenous mothers in 2005 was 3,158 grams - more than 200 grams less than the average for babies born to non-Indigenous mothers, 3,375 grams (Table 1) [17]. Babies born to Indigenous women in 2005 were more than twice as likely to be of low birthweight (LBW) (13.2%) than were those born to non-Indigenous women (6.1%). The low-birthweight proportions for babies born to Indigenous women were highest for SA (17.7%), WA (15.5%) and the NT (14.5%).

Table 1: Mean birthweights and percentage of low birthweight for babies born to Indigenous and non-Indigenous mothers, selected jurisdictions, Australia, 2005

NSW Vic Qld WA SA NT Australia

Source: Derived from Laws, Abeywardana, Walker, Sullivan, 2007 [17]

Notes:

1. Low birthweight is defined as less than 2,500 grams
2. Mean birthweights and low birthweight proportions for babies born to non-Indigenous mothers have been estimated from published figures for Indigenous and all mothers

Indigenous mothers	Mean birthweight	3,214	3,179	3,184	3,080	3,059	3,157	3,158
	% low birthweight	12.0	13.6	11.8	15.5	17.7	14.5	13.2
Non-Indigenous mothers	Mean birthweight	3,382	3,369	3,385	3,359	3,361	3,338	3,375
	% low birthweight	5.7	6.3	6.3	6.0	6.7	6.7	6.1

The impact of maternal nutrition on birthweight was demonstrated in a study of 503 infants born to Aboriginal mothers in the Darwin region between 1987 and 1990 [18]. The study found that mothers with a body mass index (BMI) of less than 18.5 had five times the risk of having a low-birthweight baby and over two-and-a-half times the risk of their baby suffering intra-uterine growth retardation. (See Box for an explanation of BMI.) Overall, the study found that 28% of cases of low birthweight and 15% of cases of growth retardation could be attributed to maternal malnutrition.

Tobacco use also has a major impact on birthweight. The mean birthweight of live babies born in 2001-2004 to Indigenous women who smoked was 3,037 grams,

more than 250 grams lighter than those born to Indigenous women who did not smoke (3,290 grams) [\[19\]](#). The comparable figures for live babies born to non-Indigenous women were 3,210 and 3,416 grams respectively. The impact of tobacco smoking during pregnancy was seen also in the proportions of low birthweight liveborn babies - 16% and 10% respectively for Indigenous and non-Indigenous women who smoked during pregnancy, and 10% and 5% for those who didn't.

Box Assessing growth and weight

Child growth

Growth of child is one marker of their overall health and development.

Measuring growth can be useful for tracking the progress of individual children when serial measurements are compared with the expected growth/reference charts, or to record how a population is growing. Charts of children's heights and weights, such as those produced by the World Health Organization [\[20\]](#) [\[21\]](#) and the US Centers for Disease Prevention and Control [\[22\]](#) - the latter endorsed by the NHMRC - can give a comparative indication of growth at any given age. Various points can be used to define 'underweight', 'stunting', and 'wasting' at a population level. More than one measurement is necessary for tracking growth of individual children. The exact place of a measurement on the graph is not that important for growth monitoring—the critical factor is whether the line of the child's growth has a similar slope to the lines on the chart, and weight is relatively proportionate to length/height.

Assessment of the growth of populations involves analysis of average measures for height and weight at various ages. Differences of these average measures from the chosen standards are usually expressed in standard deviations (z-scores) or centiles. These values are recorded on sex-specific charts.

The NT Department of Health and Community Services is currently consulting broadly, and is recommending adoption of the WHO growth standards for all health services. It is understood that Queensland Health has also developed a position paper on the WHO standards.

Child growth has not normally been assessed using the body mass index (BMI), but the WHO has recently developed BMI growth references for school-aged children and adolescents [\[23\]](#). (See below for details of BMI.)

Adult weight

The most commonly used measure of the appropriateness of adult weight is 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.

Classification of BMI and risk of co-morbidity

Classification

BMI

Risk of co-morbidity

Sources: WHO Consultation on Obesity, 2000 [\[24\]](#) and NHMRC, 2000 [\[3\]](#)

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.

Underweight	< 18.50	Low
Normal	18.50-24.99	Average
Overweight	25.00-29.99	Increased
Obese	30.00+	Further increased

Growth in infancy and early childhood

Introduction

Healthy growth, after birth as well as in the intra-uterine environment, depends on a favourable combination of genetic and environmental influences [\[1\]](#). Genetic indicators may include the physical size and growth patterns of particular racial and/or ethnic groups, and specific familial factors. Environmental determinants of normal growth include good maternal health during pregnancy and healthy weaning and feeding practices. Growth can be hampered by, among other things, under-nutrition, malnutrition, specific nutritional deficiencies, anaemia, infections and parasitic infestations.

The role of breastfeeding in the early months of life is the focus of following section, which leads into an analysis of the patterns of growth among Indigenous infants and young children.

Breastfeeding

Introduction

Breastfeeding is one of the simplest ways of improving the health of Indigenous children, and there are benefits for mothers and communities as well as babies [\[1\]](#) [\[25\]](#). For infants, breast milk is the optimum food; it is nutritionally superior to any alternative, and is accessible at a suitable temperature. It also contains a number of anti-infective agents and immune factors; consequently, breastfed infants have a lower incidence of gastroenteritis, infections, and respiratory problems than formula-fed infants. For Indigenous people living in remote communities, where water quality may be poor and access to electricity and gas limited, breastfeeding is ideal. For mothers, breastfeeding is convenient, requires no special equipment, and is significantly cheaper than bottle-feeding. Breastfeeding is particularly important for 'high risk children', such as low-birthweight babies and babies of mothers with diabetes [\[26\]](#) [\[27\]](#).

The most important advantage of breastfeeding for communities is its positive impact on infant and child health [\[25\]](#) [\[28\]](#). Since health in infancy is a major contributor to

health status in later life, it is logical and potentially more effective to address issues of health and nutrition as early as possible, beginning with the encouragement of breastfeeding.

The National Health and Medical Research Council's 2003 dietary guidelines for children and adolescents placed 'encourage and support breastfeeding' at the top of its list of guidelines, stressing the unequivocal importance of exclusive breastfeeding in the first 6 months of life, followed by the introduction of solids with continued breastfeeding until 12 months and beyond, as mutually desired [25].

Breastfeeding among Indigenous people

Before the arrival of Europeans, breastfeeding of Indigenous infants was universal [29]. Babies would be carried and fed while their mothers gathered food. If the need arose, other lactating mothers would substitute for a mother. Traditional practice was to breastfeed for up to four years, occasionally longer, gradually introducing nutritious bush foods [26].

According to survey information, Indigenous people now have a lower breastfeeding rate than non-Indigenous people, except for those living in remote parts of the country [30]. According to the 2004-2005 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS), 92% of Indigenous women aged 18-64 years living in remote areas who had had children reported having breastfed their babies, compared with 81% of those living in non-remote areas.

These figures include women whose breastfeeding occurred many years ago, and information about recent breastfeeding is restricted to women living in non-remote areas who had a child aged less than 4 years at the time of the 2004-2005 survey. Based on the results from the 2004-05 NATSIHS, 79% of Indigenous children aged less than 4 years living in non-remote areas had been breastfed for at least some period [30]. In comparison, 88% of non-Indigenous children aged less than 4 years living in non-remote areas had been breastfed for at least some period. The level of breastfeeding by Indigenous women living in non-remote areas appears to have improved slightly between 2001 and 2004-2005 with the overall proportion of breastfed babies increasing from 77% to 79%, and the proportion breastfed for more than 6 months increasing from 24% to 30%.

Reasons for early cessation of breastfeeding are varied, and there are anecdotal reports of young Indigenous women choosing not to breastfeed. A number of interconnected social, cultural, and psychological factors may be associated with early weaning of infants, factors such as: lack of support from partners, family, and friends; return to paid employment; a mother's belief that she produces insufficient milk; difficulties getting the infant to attach or suck; sore nipples; and lack of public acceptance [29] [31] [32].

A study in Victoria found that the most common explanations urban Indigenous mothers gave for stopping breastfeeding were cracked or sore nipples, poor milk supply, and tiredness [33]. Similar reasons were given by and/or for Indigenous mothers in rural Northern Territory for cessation of breastfeeding of babies under 3 months [34]. Other factors mentioned for some mothers were: very low birthweight or

pre-term baby; supplementary feeding given in hospital for a sick baby; adoption or fostering of the infant by a relative; unwanted baby; and substance use by the mother.

Indigenous infants become more directly exposed to the substandard environment in many Indigenous communities during the transition stage when breast milk becomes insufficient [1]. They become vulnerable to a wide range of infections related to unhygienic living conditions and high levels of environmental contamination, and also more susceptible to malnutrition. Early cessation of breastfeeding and introduction of solids and other fluids can result in myriad nutritional problems. Decreased availability of nutrients from replacement foods can lead to deficiencies, particularly in iron and fat. In circumstances where bottle-feeding is necessary, attention to hygiene and appropriate infant formulae is crucial. Dried full-cream cow's milk, which some Indigenous women have fed their babies, is not an appropriate choice as it is not an infant formula [1] [33].

The Australian Government's Office for Aboriginal and Torres Strait Islander Health (OATSIH) and Healthy Public Policy Unit commissioned two reports in 1997 as part of a strategy to encourage longer breastfeeding and appropriate introduction of foods for Indigenous infants [26] [35]. The reports addressed training in breastfeeding support and infant nutrition, and interventions and best practice. The reports found that improvements could be made in training for all the education sectors considered in the audit [35]. Areas highlighted as needing attention were antenatal and postnatal care and advice; counselling and clinical problem-solving skills; advice on feeding choices and the benefits of breastfeeding; and appropriate cultural and community-support structures. Training strategies should take into account the NHMRC's dietary guidelines for children and adolescents. The issues raised by respondents informed the report's recommendations, which aimed to develop and sustain a supportive environment for Indigenous mothers to breastfeed and provide appropriate food for their babies. The recommendations addressed areas pertaining to policy and information, staff expertise, service management, research and evaluation, and community and family support [26].

More recently, the Australian Parliament's inquiry into breastfeeding directed specific attention to breastfeeding by Indigenous mothers [36]. As well as including Indigenous mothers in general initiatives (such as national monitoring of breastfeeding indicators, and the 'baby friendly hospital initiative' program), specific recommendations included:

- the Department of Health and Ageing provide leadership in the area of monitoring, surveillance and evaluation of breastfeeding rates and practices in Indigenous populations in both remote and other areas; and
- the Commonwealth Government promote breastfeeding within Indigenous Australian communities as a major preventative health measure [36].

Growth of Indigenous infants and young children

In the 1960s, it was recognised that many Indigenous infants and young children demonstrated patterns of growth that were different to those of most other Australian children [37] [38] [39] [40]. Many Indigenous babies, characteristically lighter and

smaller than non-Indigenous babies (see 'Birthweights' above), were found to have at least 'normal' growth over the first 4 to 6 months, followed by a fall-off in growth lasting until about 3 years of age. A similar overall pattern was also found for head growth [41]. This pattern of growth—according to which significant numbers of Indigenous children were growth retarded by non-Indigenous standards—had been postulated as a genetic characteristic, but this suggestion was refuted by studies that demonstrated 'normal' growth in Indigenous children exposed to reasonable living conditions [42].

A number of studies in the 1970s and 1980s reported that this general pattern of infant and childhood growth was common in rural and remote areas of Western Australia and the Northern Territory [43] [44] [45] [46], and possibly also in other parts of Australia [47] [48].

The general pattern of faltering growth starting at around 6 months of age appears to have persisted, at least in rural and remote areas of the Kimberley region and the Top End, but there have been some improvements since the 1960s [49] [50] [51] [52].

Growth data collected by health workers in the Kimberley region demonstrate two phases of improvement: during the 1970s, the growth of town-living Indigenous children improved relative to that of children living in remote areas; and from the mid 1980s on, the growth of children living in remote areas improved to the extent that there were no differences between the two groups by the early 1990s. Even after these improvements, however, Kimberley Indigenous children at 12 months of age were still around one standard deviation below the norm for weight for that age [53].

Results from the Aboriginal Birth Cohort in the Top End documented a similar pattern for Indigenous babies born between January 1987 and March 1989 to that described in the 1960s: good growth until around 3-4 months and then a faltering, so that by 12 months of age the median weight of Indigenous infants was around two standard deviations below the norm for that age [54]. The faltering in growth occurred for infants both less than and greater than the tenth percentile of birthweight for gestational age.

Another analysis of findings from the Aboriginal Birth Cohort reported that overall growth at 11 years of age was appropriate for urban Indigenous children, but not for Indigenous children living in remote areas, who were around one standard deviation below international standards for weight and on the 24th percentile for height [55].

The relatively poor growth of Indigenous children living in remote areas of the Northern Territory resulted in the establishment in the late 1990s of the Growth Assessment and Action (GAA) program [56]. The GAA, which involves implementation of early action if growth falters, reviews regularly the growth status of Indigenous children up to 5 years of age living in around 80 remote communities across the NT [57].

The review undertaken in April 2007 assessed the growth of around 3,000 out of the 4,064 children aged less than 5 years living in rural and remote communities [58]. Overall, 11% of these children were assessed as 'stunted' (more than two standard

deviations below the median height for age of the reference population), 14% as 'underweight' (more than two standard deviations below the median weight for age), and 10% as 'wasted' (more than two standard deviations below the median weight for height) (Table 2) [57] [58]. The current levels continue the very gradual improvements in growth that have occurred since the late 1990s [56] [58].

According to UNICEF, wasting rates of 10% or more indicate a serious problem urgently requiring a response [59]. Countries with similar rates of wasting to those described for Indigenous children living in rural and remote areas of the Northern Territory include Niger, and the Central African Republic.

Table 2: Proportions (%) of Indigenous children aged less than 5 years with growth impairment, by growth measure and region, rural and remote Northern Territory, 2007

Region	Growth measure		
	Stunted	Underweight	Wasted

Source: [58]

Notes:

1. Proportions are based on growth assessments of 3,003 out of 4,064 Indigenous children aged less than 5 years of age resident on around 80 rural and remote communities in April 2007
2. 'Stunted' is defined as more than two standard deviations below the median height for age of the reference population, 'underweight' as more than two standard deviations below the median weight for age), and 'wasted' as more than two standard deviations below the median weight for height

Alice Springs remote	10	8	6
Barkly	8	8	6
Darwin rural	14	21	12
East Arnhem	10	17	14
Katherine	11	12	8
All regions	11	14	10

The factors contributing to the persisting growth deficiencies of many Indigenous children are complex, but the most important are likely to be 'persistently negative' environmental factors—'living in overcrowded, unhygienic conditions, with repeated infections and poor nutrition' [1]. Also, as summarised below (see 'Factors influencing nutrition—social/cultural, economic, and environmental'), food supplies are often less than adequate in many parts of central and northern Australia.

Normal growth in infancy and childhood is vitally important for good health in adulthood, and much more needs to be done to achieve satisfactory growth for many Indigenous children. As noted by the NHMRC, 'approaches to eradicating malnutrition and its consequences need to be multi-faceted and include improved physical infrastructure, better food supplies, health and nutrition education and access to clinical care' [1].

Overweight and obesity

Obesity is a surplus of body weight due to an excess accumulation of body fat [24]. (See Box for information about the classification of weight.) Obesity is related to cardiovascular risk factors such as high insulin, cholesterol, lipid, and blood pressure levels. For many Indigenous people, obesity has become a significant health problem; often it results from a high intake of highly refined carbohydrates and alcohol and a low level of physical activity [1]. Obesity is associated with several of the main causes of Indigenous morbidity and mortality, including cardiovascular diseases, diabetes, renal diseases, respiratory disorders, gastrointestinal diseases, and pregnancy complications.

Recent evidence of the extent of overweight and obesity in the Indigenous population comes mainly from population surveys. The 2004-2005 NATSIHS found that obesity is an increasing problem in the Indigenous population [30]. Self-reported height and weight measurements were collected for people aged 15 years and over (an option to have height and weight measured was provided in some remote areas). Height and weight information could not be obtained for 17% of Indigenous people and 8% of non-Indigenous people.

Almost two-fifths of Indigenous people aged 15 years or older were in the normal or healthy weight range, but 28% were overweight and 29% obese (Table 3) [Derived from 30]. The overall proportion of Indigenous people who were overweight or obese (57%) was slightly higher than the proportion of non-Indigenous people (52%), but the proportion of obese Indigenous people (29%) was considerably higher than that of obese non-Indigenous people (17%). The difference in levels of obesity between Indigenous and non-Indigenous people was greater for females than for males.

Overweight and obesity were more common among Torres Strait Islanders aged 15 years or older (61%) than among Indigenous people in that age range (56%) (the difference is not statistically significant [Derived from 30]). The level of overweight and obesity was particularly high among Torres Strait Islanders living in the Torres Strait area, with 86% having a BMI of 25.0 or greater.

The proportions of Indigenous people who were overweight or obese in 2004-2005 NATSIHS were similar for those living in remote and non-remote areas, and had not changed significantly since the previous survey in 2001 [30]. Similar information about body weight is not available for Indigenous people living in remote areas for earlier years, but level of overweight and obesity among Indigenous people living in non-remote areas increased from 48% in 1995 to 58% in 2004-2005.

The 2004-2005 NATSIHS did not collect information about obesity in childhood, but a recent Northern Territory report found that substantial levels of overweight and obesity among Indigenous and non-Indigenous children aged 4-6 years [60]. Around 12% of both Indigenous and non-Indigenous children aged 4-6 years living in 'urban' areas were obese, and 6.5% and 3.6% respectively were obese. Four percent of Indigenous children aged 4-6 years living in 'remote' areas were overweight and none obese.

Table 3: Body weight: proportions for BMI categories for males, by Indigenous status and age group, Australia, 2004-2005

Age Group	Under-weight	Indigenous			Non-Indigenous		
		Normal	Over-weight	Obese	Under-weight	Normal	Over-weight

Source: Derived from [\[30\]](#)

Notes:

1. Derivation of proportions excludes people for whom BMI was not known
2. Any discrepancy in the sums of proportions results from rounding for presentation

Males	15-24	8	52	25	15	6	64	25	6
	25-34	3	37	37	24	1	40	42	17
	35-44	1	32	31	36	1	30	47	22
	45-54	3	27	38	32	0	29	46	25
	55 and older	2	24	39	36	1	35	45	19
	All ages	4	38	32	26	2	39	42	18
Females	15-24	13	53	19	15	13	64	16	7
	25-34	5	38	22	35	5	57	25	14
	35-44	7	30	25	38	4	54	26	16
	45-54	4	29	26	41	2	48	30	20
	55 and older	3	24	30	43	3	43	33	21
	All ages	7	38	23	32	5	52	27	16
Persons	15-24	11	53	22	15	9	64	21	6
	25-34	4	38	29	29	3	48	34	16
	35-44	4	31	28	37	2	42	37	19
	45-54	3	28	32	37	1	38	38	22
	55 and older	2	24	34	39	2	39	39	20
	All ages	6	38	28	29	3	45	35	17

Factors influencing nutrition and growth

Introduction

The diets of many Indigenous people are energy-rich and contain high amounts of fat, refined carbohydrates, and salt, and are also poor in fibre and certain nutrients (including folate, retinol, vitamin E, and other vitamins) [\[61\]](#). The factors contributing to the restricted availability of healthy food to Indigenous people include low socioeconomic status, various environmental and social factors, and geographic

remoteness [\[1\]](#). The quality and variety of foods consumed are affected by their need to be stored suitably, protected from contamination, and possibly refrigerated. In remote areas, foods such as vegetables and fruit (which are high in nutrients) are often expensive and of poor quality, and in some cases are not available at all.

Socioeconomic factors

The extreme social disadvantages of Indigenous people across Australia - seen in measures of education, employment and income - are important contributors to their poor nutritional status [\[62\]](#).

According to the 2006 Census, 22% of Indigenous people aged 15 years or older reported having completed year 12 or equivalent (compared with 47% of non-Indigenous people), and just over 4% of Indigenous people reported having completed a university or higher degree (compared with almost 18% of the non-Indigenous population) [\[63\]](#). Among those who had left school, almost 47% of the non-Indigenous population had some form of post-secondary school qualification (including degrees, diplomas, and trade or basic qualifications), compared with 25% of Indigenous people.

From information collected by the 2006 Census (which uses different procedures to those used in the compilation of the standard employment indicators), 16% of Indigenous males aged 15 years or over were unemployed, as were just over 15% of Indigenous females - the levels for non-Indigenous people were 5% for males and 5.1% for females [\[63\]](#). Just under a quarter (24.2%) of employed Indigenous Australians worked as 'labourers and related workers' (Australian Standard Classification of Occupations (ASCO)), as did around 10% of employed non-Indigenous people. Around 17% of employed Indigenous Australians were classified as managers or professionals (ASCO 'managers and administrators' and 'professionals'), as were 34% of employed non-Indigenous people.

Also according to the 2006 Census, the median family income for Indigenous people was \$460 per week compared with \$740 per week for non-Indigenous people. Between 2001 and 2006, mean equivalised gross household income for Indigenous people rose 9% (after adjustment for inflation using the Consumer Price Index) which is the same level of growth for non-Indigenous people over the same period. [\[63\]](#)

Community Development Employment Projects (CDEP) aim to create local employment opportunities in remote Indigenous communities, with a particular focus on community development. Of the Indigenous people participating in CDEP 76% were in very remote areas and 14% in remote areas [\[63\]](#).

Environmental aspects

The physical environment in which many Indigenous people live also has significant implications for their nutritional status [\[1\]](#) [\[62\]](#). Adequate housing, services, and cooking facilities are imperative, as are access to water for drinking and washing, and safe sewage and garbage disposal.

The living conditions of many Indigenous people, particularly those living in remote areas, are characterised by overcrowding, inadequate water and washing facilities, poor sanitation and sewage disposal, limited food storage and sub-optimal food preparation facilities [64] [65] [66].

According to the 2006 Census, Indigenous households are more likely to be larger than other Australian households [67]. The average size of an Indigenous household was 3.4 persons per bedroom compared with 2.6 persons for non-Indigenous households [67]. At least one additional bedroom was required by 14% of Indigenous households (by 9% of households in major cities and by 40% of those in very remote areas) and around 3% of other households. [63]

Using the Canadian National Occupancy Standard for housing appropriateness, 14% of Indigenous households were overcrowded with 27% of Indigenous people living in overcrowded conditions. Overcrowding rates varied according to tenure, with the highest rates occurring in households renting Indigenous/mainstream community housing accommodation (40% of households) compared with 7% of homes that were privately owned. [67]

Indigenous households were more than twice as likely as other households to be living in rental accommodation. About half as many Indigenous households owned their own homes (either with or without a mortgage) compared with other households (36% compared with 71%). [63]

For Indigenous people living in discrete Indigenous communities, bore water was the main source of drinking water for 58% of the 1,187 communities included in the 2006 CHINS [66]. (A 'discrete Indigenous community' is an area bounded by physical or cadastral (legal) boundaries and inhabited or intended to be inhabited predominantly by Aboriginal or Torres Strait Islander people.) The total reported usual population of these communities was 92,960. Generators were the main source of organised electricity for 50,317 people living in 377 discrete Indigenous communities. Almost 68,000 people experienced some interruption to their electricity supply within the previous 12 months, with more than 13,000 people experiencing 20 or more interruptions. Of the 366 communities for which information about organised rubbish collection was obtained, 29 (8%) had not organised collection. Across all 1,187 communities in the 2006 CHINS, rubbish was disposed of in an unfenced community tip in 571 (48%) communities.

The 2006 CHINS did not collect information about cooking arrangements, cool storage and vermin-safe food storage for perishables, but these aspects are known to be 'inadequate, and sometimes dangerous' for a considerable number of Indigenous people living in remote areas [1].

Geographic factors

Considerable numbers of Indigenous people live in rural or remote areas where fresh, nutritious food is not always readily available and where communities often rely on the stock of the community store [1]. In many cases, the store is supplied with foods once a week, or, as in some areas of the Torres Strait, much less frequently. After long journeys in trucks, which are often ill-equipped to deal with trips in the heat

and dust, the food arrives in a less than satisfactory state and some is wasted. Transport is expensive, so food is often highly priced. The availability of convenience foods and their ease-of-use (no preparation) means that they are often favoured over poor-quality fruits and vegetables, which usually require cooking or other preparation.

The 2006 Healthy Food Access Basket Survey in Queensland confirmed that basic food costs were considerably higher in rural and remote communities than in metropolitan and regional centres [68]. For stores in very remote areas greater than 2,000 kilometres from Brisbane, the overall basket cost was \$146 (33%) higher than in major cities. The cost of fruit, vegetables and legumes was \$59 (30%) higher. Stores in remote locations were less likely to have some basic food items and to have healthy food options (such as reduced-fat milk, wholemeal bread, lean meat, and a variety of fresh fruits and vegetables).

A similar survey in the Northern Territory found that the average cost of a standard food basket in remote stores was 29% more expensive than a Darwin supermarket and 19% more expensive than a Darwin corner store [69]. Remote stores in the Barkly region were most expensive - 56% higher than a Darwin supermarket and 44% than a Darwin corner store. The cost differences between remote and Darwin stores were particularly high for fruit (39% and 25% respectively) and vegetables (37% and 12% respectively).

Community stores can favourably influence the diets of community members, as has been demonstrated by those stores that have supported nutritional programs [1] [70]. By stocking a wider variety of healthy foods and using supportive strategies within their stores, they have also often benefited from increased sales of such products; this happened in a central Australian community where the food-purchasing behaviour of children and young Indigenous people was monitored following the implementation of a nutritional program [71].

Store managers are important influences on the food supply in remote Indigenous communities, and can be significant allies in efforts to improve nutrition [70]. A project implemented at Minjilang (Croker Island, Northern Territory), highlighted the fact that community power and community capacity are essential for sustaining improvements [72]. A study of four communities in western New South Wales found that factors such as the extent and type of advertising, food prices, and the availability of takeaway food influenced the dietary habits of residents [73]. Tax changes, such as the introduction of the goods and services tax, and national food-safety legislation can also have implications for remote community stores and takeaway-food outlets (as they do in urban areas) [74].

National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan (NATSINSAP)

National approaches to improving the nutritional health of Indigenous people are guided by the National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan 2000-2010 [74], which was developed as part of an overall national nutrition strategy, Eat Well Australia: a national framework for action in public health

nutrition, 2000-2010, [75]. Both strategies were endorsed by the Australian Health Ministers' Conference in August 2001.

The NATSINSAP, which was developed recognising that poor diet is central to the poor health and disproportionate burden of chronic disease experienced by Indigenous Australians, provides a framework for action across all levels of government, in conjunction with partners from industry and the non-government sector [74].

The NATSINSAP identified the following seven priority areas to build on efforts to improve access to nutritious and affordable food across urban, rural and remote communities:

- food supply in remote and rural communities;
- food security and socioeconomic status;
- family-focused nutrition promotion;
- nutrition issues in urban areas;
- the environment and household infrastructure;
- Aboriginal and Torres Strait Islander nutrition workforce; and
- national food and nutrition information systems [74].

To help progress key areas, a NATSINSAP Project Officer, working under the guidance of a national Steering Group and Reference Group, has been funded by OATSIH until October 2008.

Summary

Throughout their lives, many Indigenous people suffer major disorders of nutrition and growth.

At birth, Indigenous babies are substantially lighter than non-Indigenous babies. Most significantly, the proportion of Indigenous babies of low birthweight is more than twice that of non-Indigenous babies.

From birth, the growth of most Indigenous infants tends to be satisfactory until breast milk becomes insufficient by itself, at which time they need complementary food and become more directly exposed to the substandard environment in which many Indigenous people live. At this time, they become vulnerable to a wide range of infections, in many cases entering the vicious synergistic cycle of infection-malnutrition. Many Indigenous people carry this legacy of impaired growth into early adulthood, where it has a significant impact on the health of mothers, and of the next generation.

From the early adult years, and increasingly even earlier, many Indigenous people start to gain weight excessively, eventually becoming overweight or obese. Associated with the high levels of overweight and obesity in adulthood, there are now alarming levels of chronic disease, particularly cardiovascular disease and diabetes mellitus.

The underlying factor common to these growth and nutritional problems is the extreme social disadvantage experienced by many Indigenous people, seen in low levels of education, high levels of unemployment, low incomes, and a sub-standard physical environment.

In view of the central role that nutrition and diet-related diseases will play in addressing at least two of the targets set for 'closing the gap' between Indigenous and other Australians - to halve the 17-year gap in life expectancy within a generation, and to halve the gap in infant and childhood mortality within a decade - it is clear that commitments to redressing the underlying social disadvantages experienced by many Indigenous people will need to be accompanied by expansion of key initiatives in the area of public health nutrition. In this regard, the NATSINSAP remains as relevant and critical today as it was in 2001.

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