

Nutrition in remote Aboriginal communities: lessons from Mai Wiru and the Anangu Pitjantjatjara Yankunytjatjara Lands

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Aboriginal and Torres Strait Islanders continue to suffer a much greater burden of ill-health than other Australians.¹ The gap in Indigenous life expectancy at birth remains unacceptably high at 10.6 years for men and 9.5 years for women.² More than three-quarters of Indigenous deaths are from potentially avoidable causes, which include preventable non-communicable chronic diseases (NCDs) such as type 2 diabetes.¹ Excess body weight is a major contributor, with about 70% of Aboriginal and Torres Strait Islander adults now overweight or obese, compared with 63% of non-Indigenous Australians.² Around 38% of Aboriginal and Torres Strait Islander children are an unhealthy weight, including 8% who are underweight.³

Poor diet accounts for more than 10% of the burden of disease in Australia and is now the leading single preventable risk factor, followed by obesity.⁴ This is likely to be higher in Indigenous Australians, particularly the 26% living in remote areas who experience 40% of the health gap of Indigenous Australians overall.⁵

Prior to European settlement in Australia, Aboriginal and Torres Strait Islander peoples were healthy and enjoyed a varied traditional diet low in energy density and rich in nutrients. Now, poor diet and food insecurity in Aboriginal and Torres

Abstract

Objective: To examine the impact of efforts to improve nutrition on the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands from 1986, especially in Mai Wiru (good food) stores.

Methods: Multiple methods were employed. Literature was searched systematically. In 2012, the store-turnover method quantified dietary intake of the five APY communities that have a Mai Wiru store. The price of a standard market basket of basic foods, implementation of store nutrition policy requirements and healthy food checklists were also assessed in all seven APY community stores at intervals from 2012. Results were compared with available data from 1986.

Results: Despite concerted efforts and marked achievements, including decreased intake of sugar, increased availability and affordability of healthy foods (particularly fruit and vegetables) and consequent improvement in some nutrient intakes, the overall effect has been a decrease in total diet quality since 1986. This is characterised by increased supply and intake of discretionary foods high in saturated fat, added sugar and salt, particularly sugar sweetened beverages, convenience meals and take-away foods.

Conclusions: The documented improvements confirm that residing in these communities can help Aboriginal residents exert control over key aspects of their food supply. However, the overall findings reflect broader changes to the general Australian food supply, and reinforce the notion that, in the absence of supportive regulation and market intervention, adequate and sustained resources are required to improve nutrition and prevent diet-related chronic disease on the APY Lands.

Implications: This study also provides insights into food supply/security issues affecting other remote communities and wider Australia.

Key words: Aboriginal health, nutrition, food supply, Indigenous, preventive health

Strait Islander groups is exacerbated by socioeconomic disadvantage, including lower incomes and educational attainment, higher rates of unemployment, disruption to family structures and poorer access to health infrastructure, such as adequate housing, compared to the broader Australian community.⁶

Among recent nutrition initiatives, collaborative implementation of the National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan 2000-2010⁷ improved workforce capacity and practice, for example, through development of the Remote Indigenous Stores and Takeaways (RIST) resources and training.^{8,9}

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Co-ordinated implementation, however, has now ceased. An objective study of the income management component of the Northern Territory National Emergency Response Act 2007 (the NT Intervention) found no beneficial effect on tobacco, cigarette, soft drink or fruit and vegetable sales.¹⁰ In 2006, the Commonwealth Government, with Indigenous Business Australia, set up the Outback Stores enterprise.¹¹ Although positive local stories have featured in the media,¹² nutrition impacts in the 33 stores have not been reported formally.¹³ In 2008, the House of Representatives Standing Committee on Aboriginal and Torres Strait Islander Affairs made more than 30 recommendations to improve remote community stores.¹⁴ Response was limited, and, although the Statement of Intent included ensuring supplies of fresh healthy foods were available by 2018, improving nutrition was not included as a key intervention area in the Council of Australian Government (COAG) Close the Gap initiative.¹⁴⁻¹⁶ In 2009, COAG developed the National Strategy for Food Security in Remote Indigenous Communities (the Strategy).^{13,14,17} This was adapted for implementation in some areas, including the South Australian Government's Anangu Pitjantjatjara Yankunytjatjara (APY) Lands Food Security Strategic Plan 2011-2016 (SAFSSP).^{13,18} However, recent audit of the Strategy implementation¹³ found that resourcing has been poor, activities focused mainly in the Northern Territory, and few outcomes have been achieved.¹³ A recent review has confirmed that efforts to improve Indigenous nutrition remain fragmented and largely ineffective in Australia.¹⁶ However, successful programs – demonstrating marked improvements in diet and objective health indicators – have been conducted previously by Aboriginal communities and store groups, for example at Minjilang,¹⁹ and adapted and applied elsewhere.¹⁵ This paper describes similar efforts on the APY Lands.

Aim

This descriptive study aimed to examine the impact of approaches to improve nutrition on the APY Lands over the past three decades in terms of: i) food prices; ii) compliance with store nutrition policies; and iii) apparent community dietary intake.

Methods

Multiple methods were applied. To identify available dietary, food price and store data

and the approaches to improve nutrition, peer reviewed and grey literature from 1986 to 2104 was searched systematically for nutrition studies, interventions and evaluations using the search terms 'Austral*', 'Aborig*', 'diet*', 'nutrition*', 'nutr*', 'communit*', 'store*' 'intervention', 'promot*', 'prevent*'. Databases included The Cochrane Library, MEDLINE, EMBASE, CINAHL, Web of Science: Science Citation Index and Conference Proceedings Citation Index. Websites searched included: COAG, Australian Government jurisdictions' health, education and community services departments, Australian Indigenous HealthInfoNet, Nganampa Health Council (NHC), Mai Wiru Regional Stores Council (Mai Wiru), Outback Stores and Ngaanyatjarra Pitjantjatjara Yankunytjatjara Women's Council (NPYWC). A physical search of documents held by NHC and Mai Wiru in their Alice Springs administrative offices was also conducted. In addition to references cited above, several papers and unpublished reports were identified.²⁰⁻³⁵

Historic apparent dietary intake and food price and availability data for communities on the APY Lands and food price data from a small and a large supermarket in Alice Springs were accessed from this literature and transcribed. Previous Market Basket prices were identified for January 2008, October 2008, November 2009, June 2010, January 2011 and June 2011. Apparent community dietary intake data from October 1986 were identified for three APY stores. Foods were reclassified as belonging to either the: a) 'core' five food groups; b) healthy spreads and oils allowance; or c) discretionary food group, according to the recently revised Australian Dietary Guidelines⁹ as per the methods detailed in the Educators' Guide.³⁶ Nutrition interventions were summarised. Community names were coded to retain anonymity.

i) *Food prices* were assessed using the same standardised tools as previous studies^{24,37} in the APY community stores and both a small and large supermarket in Alice Springs by costing the price of a standard Market Basket of 'healthy' and other basic foods³⁷ in December 2012, September 2013 and April 2014 as part of ongoing NHC service delivery. Results were compared with available previous data. Permission to collect food prices in two small privately run 'convenience stores' on the APY Lands and the road house at Marla was provided in September 2013 only.

ii) *Compliance* with Mai Wiru nutrition policy guidelines²⁰ in Mai Wiru stores and level

of implementation of the RIST national healthy food stocking checklists⁹ in all APY community stores were assessed using the same tools as previous studies^{9,20} during site visits in April 2014, and compared with available previous data.

iii) *Apparent dietary intake of the communities* was estimated by the updated store-turnover method,²¹ validated previously for use in remote Aboriginal communities against biomedical indicators of dietary intake.¹⁹ Sales data from bar code scans of all foods and beverages purchased in the five Mai Wiru community stores (including the three stores with data available from 1986) were collected electronically for the month of October 2012 from the stores' Grocery Manager Program. Product descriptions, the size (weight) and number of units sold were downloaded, transferred to Excel spreadsheets (Microsoft Office 2007), tallied, then entered manually into the Foodworks 7 (Xyris) software program for nutrient analysis using the AUSNUT07 database. The 'usual' Indigenous population of each community was estimated from census records held by NHC clinics in October 2014, as this method had been used to estimate usual community population for store-turnover purposes in 1986.²⁹ Apparent per capita daily consumption of food and nutrients was calculated by dividing the mean daily store turnover by this 'usual' population. Food data from store-turnover studies at three of these APY communities in 1986²⁹ were transcribed into Excel spreadsheets (Microsoft Office 2007), reclassified as described above and compared with 2012 data. Differences in the store-turnover methods applied are discussed under Limitations.

Due to the small number of data points, statistical analysis was not conducted.

Results were presented to NHC and *Mai Wiru* Store Councils verbally and in written and pictorial reports. This project conforms to the 10 principles for health research among Indigenous Australian populations.³⁸ The QUT University Human Research Ethics Committee assessed this research as meeting the conditions for exemption from HREC review and approval in accordance with section 5.1.22 of the National Statement on Ethical Conduct in Human Research (2007).

Results

Setting and context

The *Pitjantjatjara Land Rights Act 1981* provides inalienable freehold title to the APY

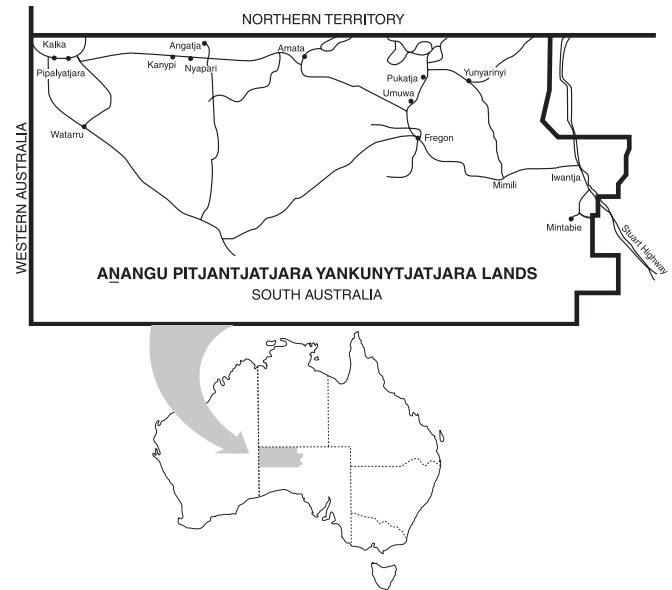
Lands that cover about 105,000 km² (Figure 1). About 3,000 Anangu (Aboriginal people) live in seven communities and more than 40 homelands in the area. Anangu practise a largely traditional culture, and Pitjantjatjara/Yankunytjatjara is the first language.

Identified nutrition interventions on the APY Lands included both efforts to increase demand for healthy foods (including nutrition education and 'behavioural' approaches) and to improve food supply and food security (environmental approaches centred on the community stores). No data for behavioural interventions in individuals or families were identified in the literature search. The communities are 'dry' and alcohol is prohibited. There are currently seven main retail stores on the APY Lands. Five are managed by Mai Wiru²² (MW1-MW5), one by Outback Stores and one independently by the local community council (C1-C2). There are also two smaller privately operated 'convenience' stores.

Health services are provided by NHC, an Aboriginal-owned and controlled health service organisation.²³ Improving nutrition is a key focus of NHC's clinics, especially in maternal and infant health and management of chronic diseases. The wider food security work sits under the Uwankara Palyanyku Kanyintjaku (UPK)²⁴ program that works in partnership with Mai Wiru to improve food supply. Family-focused support for children with growth faltering, and broader community nutrition education initiatives, are provided by the Child Nutrition Program of the NPYWC.²⁵

The need for an APY Lands regional stores policy was first identified in the 1987 UPK environmental and public health review.²⁴ In 1998, this was reinforced by a cost of living study that found that some Anangu families survived on sugary tea and damper for up to three days a week because they could not afford to buy other food.²⁶ Anangu had expressed concern about the availability, accessibility and affordability of healthy food and their lack of control over stores.²⁰ The Mai Wiru Regional Stores Policy was developed 1998–2001 by NHC and the NPYWC, in conjunction with all Community Councils on the APY Lands.²⁰ The accompanying implementation plan was finalised in 2005.²⁷ The nutrition component of these documents is consistent with the recommendations of the Australian Dietary Guidelines.⁶ One key initiative was the development of a subsidy scheme to provide healthy food and other

Figure 1: APY Lands location.



essential items in parity with Adelaide prices.²⁸ Inadequate external funding was provided for the original scheme, so Mai Wiru internally cross-subsidises the cost of healthy foods with less healthy items. In 2012, a voluntary income management scheme was also introduced on the APY Lands.¹⁸ Mai Wiru Regional Stores Council Aboriginal Corporation was set up in 2010 under the Office of the Registrar of Indigenous Corporations with a board of 12 Anangu directors. Corporatisation of Mai Wiru stores provided the structure for monitoring and reporting on trading practices, food security and nutrition issues to inform decision making by local Community Store Councils on selection, recruitment and retention of store managers, preferred supplier and transport arrangements, store pricing and stocking practices.²⁷ The efforts of Mai Wiru were recognised by receipt of a Heart Foundation Local Government Award in 2007. The main SAFSSP activities include: establishing a Stephanie Alexander school garden project at Iwantiya school; providing television screens for use in health promotion in community stores; and producing a recipe calendar.^{13,18}

Cost of healthy foods

In April 2014, the price of a standard Market Basket of basic 'healthy' foods on the APY Lands was \$738 (\pm \$38), which is around 35% and 14% more, respectively, than the large and small supermarket in Alice Springs. The price of the Market Basket was similar in Mai Wiru stores (MW1-MW5) and other stores (C1, C2) on the APY Lands, although variability over time was very high (Figure 2). However,

when assessed in September 2013, the price of the Market Basket was over 15% higher at the two privately-run convenience stores (\$877 and \$774) and at the road-house at Marla (\$769), than at the community stores on the APY Lands.

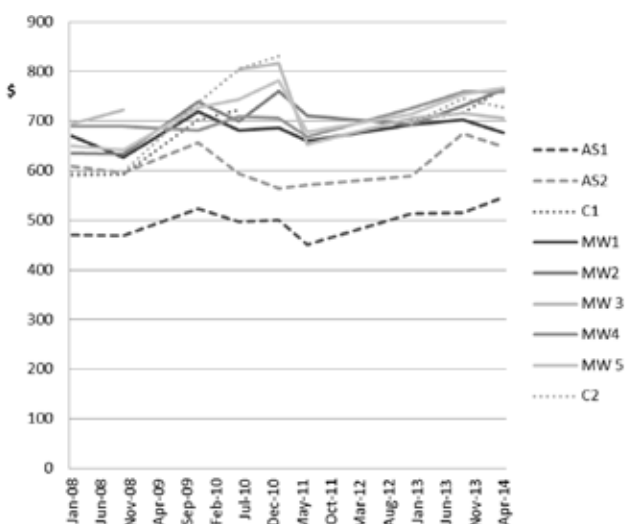
Since January 2008, the price differential between the cost of the Market Basket in Mai Wiru and Alice Springs stores has decreased by 9% (Figure 2). Much of this improvement is due to the price differential of fruit and vegetables decreasing from 40% to <15%. During this period the price of the discretionary items in the basket, such as sugar, increased by just 2%; hence, despite cross-subsidisation in Mai Wiru stores, these unhealthy choices are relatively cheaper than healthy foods, and cost only 3% more on the APY Lands than in Alice Springs.

Healthy store checklists

All Mai Wiru stores are clean and well laid out, with good lighting, air-conditioning, refrigeration display facilities and adequate storage areas. Road trains have delivered supplies weekly instead of fortnightly since 2005. The stores comply with tobacco control and pricing legislation, dogs are prohibited from the premises and nothing is sold to children during school hours. Healthy foods are stocked and promoted close to cash registers, and displays of healthy foods suitable for diabetics and infants are prominent and usually accurate.

In 1986, almost 20% of recommended healthy food items were not available consistently in the community stores and fresh fruit and vegetables lasted for only a few days after delivery.²⁴ Now more than 98% of healthy

Figure 2: Cost of market basket in APY community stores and Alice Springs, January 2008–April 2014.



foods including fruit, vegetables, lean meats, poultry, eggs and milk are available consistently, with all Mai Wiru stores stocking a good range of quality fruit and vegetables even on the day before truck delivery.

There is no longer a clear inverse relationship between the range, quality and quantity of produce stocked and distance from the transport service centre. However, the free water chillers installed outside the stores as a component of the Mai Wiru nutrition policy are not always functional.

The average number of different types of food and beverage items stocked in Mai Wiru stores has increased from less than 300 in 1986 to more than 930, with additional flavours, varieties and sizes of many products available. The shelf space for food display has also increased from 1986 to 2014; in the smallest store from less than 10 metres to more than 50 metres and in the largest store from 60 metres to more than 120 metres. Extensive refrigerated display cabinets are now available in all Mai Wiru stores.

All stores on the APY Lands achieved at least 65% implementation of the 40 items included on the RIST 'how healthy is your store?' checklist (Supplementary data file 1); the highest level of implementation (75%) was observed equally in one of the Mai Wiru stores (MW1) and another community store (C1). The proportion of diet drinks/water to sugar-sweetened beverages (SSBs) ranged from 40% to 78%.

Of the requirements outlined in the Mai Wiru nutrition policy reinforced by recommendations in previous nutrition reports,²⁴ Mai Wiru stores had high levels of implementation of: removing stocks of high trans-fat (>5%) margarine and large sizes of

energy drinks and sports drinks; stocking an increased range of cooking items, foods suitable for infants and wholemeal bread; and ensuring that >50% of the SSBs stocked are ≤ 375 mL. Lower levels of implementation were observed for: removing fruit juice drinks and large sizes of fruit juice; providing healthy take-away food; increasing the range of healthy breakfast cereals and ensuring that >50% of large (≥ 2 litres) SSBs are diet varieties. The implementation of recommendations in the five Mai Wiru stores varied, ranging from 44% to 63% (see Supplementary data file 1, available online).

Over the years, an increasing number/range of items inconsistent with the Australian Dietary Guidelines^{6,36} have been observed in most stores on the APY Lands. These include: sweetened iced teas; sweetened mineral waters and juices (including flavoured and novel carbonated varieties); novel high-sugar items targeted to children (such as fruit straps); cheap high-trans-fat (>5%) margarines (not clearly labelled); high salt and saturated fat 'convenience' meals (such as frozen pizzas); and relatively expensive 'gluten-free' items. Sometimes expensive 'specialty' items have completely displaced cheaper conventional choices in some stores. For example, in one store only 'low glycaemic index' basmati rice was available; this was priced at \$17 per kilogram compared with \$4/kg for regular varieties of rice.

Apparent dietary intake: store turnover

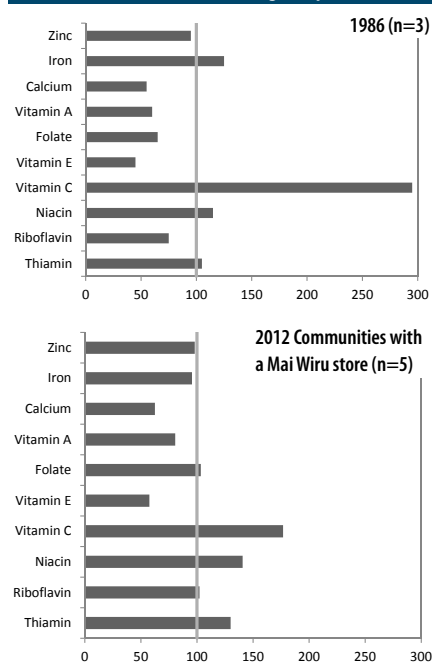
The apparent energy intake per person per day increased 11% from $13,250 \pm 779$ kJ in 1986²⁹ to $14,720 \pm 820$ kJ in 2012 (Supplementary data files 2 and 3). From 1986 to 2012, mean energy intake from

sugar decreased 25% (from 30% to 22%), but from total carbohydrate remained the same (48%). Energy intake from protein increased 30% (from 12% to 16%). Energy intake from total fat decreased 8% (from 40% to 36%), but energy from saturated fat increased 20% (from 15% to 18%). From 1986 to 2012, mean energy intake from healthy foods – not including unsaturated fats and oils^{6,36} – decreased 3% (58% to 53%) and mean energy intake from discretionary foods^{6,36} increased 5% (39% to 41%). In 2012, intake of discretionary choices was highest (46% energy) in the community with the largest take-away outlet (MW5), but was next highest (42%) in a store (MW2) without a kitchen, where microwaved pizzas and pies are popular.

Micronutrient intake improved generally from 1986 to 2012 (Figure 3). Bread was the major source of increased folate and the major source of increased thiamine and niacin was fortified breakfast cereals. An increase in intake of milk products contributed to the increase in riboflavin. The decrease in the previous very high intakes of vitamin C was mainly due to the replacement of fruit juice with SSBs and decreased intake of iron was associated with the decreased intake of red meat.

Dietary patterns have increased in complexity, with an increased number and variety of food types contributing appreciably

Figure 3: Apparent micronutrient intake in APY communities (% Estimated Average Requirement).*



* Comparison with the Adequate Intake (AI) is provided for Vitamin E (alpha-tocopherol equivalents).

to total energy intake (Figure 4). In 1986, the major foods contributing to total energy intake were cereals, meats and sugars; white sugar, flour and meat alone provided more than 60% of total energy intake.²⁹ In 2012, the contribution to energy intake from flour, fresh meat, confectionary and sugar *per se* had decreased (the latter quite markedly) and the major foods contributing to total energy intake were meats, cereals and beverages (Figure 4). Though relatively low in energy density, fruit and vegetable contribution to total energy intake had increased by 85%. However, contribution to energy intake from just four groups of discretionary foods combined (SSBs, convenience meals, take-away and snack foods) had increased around fourfold (Figure 4).

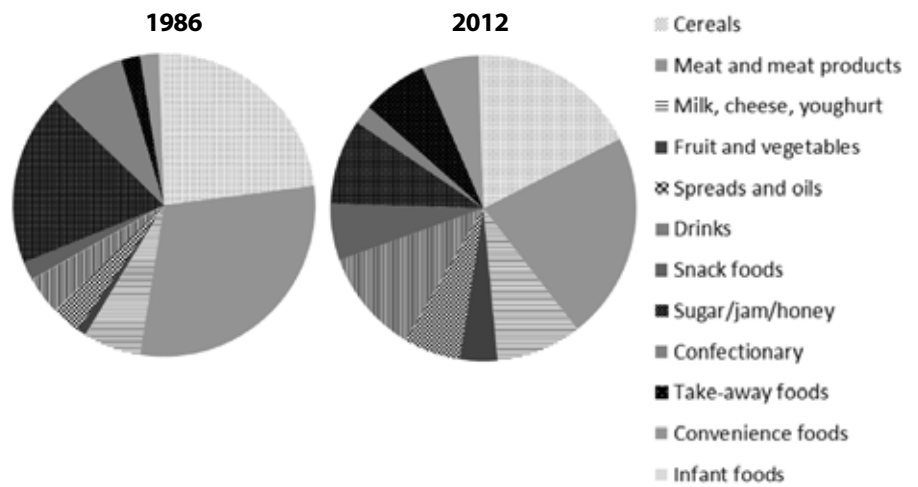
At the request of the communities, the five top-selling discretionary items by contribution to energy intake in 2012 were depicted pictorially in each Mai Wiru store (Figure 5). Sugar *per se*, take-aways and SSBs were the three most common contributing items, except in MW1 where sweet biscuits and cordial contributed more to energy intake than SSBs (Figure 5).

In 1986, 13% of the total intake of fat and <20% of the total intake of saturated fat were derived from discretionary choices. In 2012, these proportions had increased to 28% and >60% respectively. The proportion of total sugar intake derived from healthy foods such as milk and fruit was 14% in 1986 and 16% in 2012. In 2012, 48% of total sugar intake was derived from SSBs alone.

Discussion

The results of the literature search provide clear evidence of a strategic approach to improve food security and dietary intake on the APY Lands over the past three decades. This has been effective in improving some dietary indicators; intakes of fruit, vegetables and other healthy foods have increased. Yet the relative availability, affordability and intake of energy-dense discretionary choices, particularly SSBs, take-aways and convenience meals, have increased more. A lack of adequate long-term funding and intermittent 'buy-in' by different levels of government has contributed to these challenges.^{7,13-15,18,22,23,27,28} Currently, there is little evidence of articulation between the SAFSSP and local initiatives implemented by NHC, the NPYWC and Mai Wiru.^{13,18,22-24,30}

Figure 4: Proportion of energy intake from food types in APY communities in 1986 (n=3) and with a Mai Wiru store in 2012 (n=5).



Limitations

There are several limitations with this study. Food prices were collected opportunistically, rather than regularly at the same time of year, which could affect the relative price of seasonal produce. Some historical store price data were missing (C1 in January and June 2011, C2 in June 2010, MW3 in November 2009 and 2 in June 2011); the reasons for this are unknown. The Mai Wiru nutrition policy requires that healthy foods are stocked at all times, so prices were collected without reference to stock deliveries. However, the quality and variety of perishable products was highest immediately after deliveries, which could have affected results. With

the permission of the APY communities, food prices and implementation against RIST healthy food checklists were assessed in all Mai Wiru and other APY community stores but only food price data was able to be collected in the two smaller 'private' convenience stores. Also, access to sales data to assess store turnover was only provided in Mai Wiru stores. Hence, comparable dietary intake data are not available for all APY communities. Neither is it known what impact the two smaller convenience stores may have on the dietary intake of nearby communities. In 1986, store-turnover data were derived manually from paper-based order invoices over the preceding 12-week period (six

Figure 5: Mai Kura (Problem foods). Pictorial representation of major discretionary choices contributing to energy intake in each APY (de-identified) community with a Mai Wiru store in 2012 (n=5).

MAI KURA TOP 5 PROBLEM FOODS BOUGHT AT THE STORE (BY TOTAL ENERGY)				
MW1	MW5	MW3	MW4	MW2
1 Sugar 6%	1 Sugar 11%	1 Sugar 10%	1 Sugar 8%	1 Sugar 9%
2 Takeaway – fried foods/pastry/pizza/chips 5%	2 Takeaway – fried foods/pastry/pizza/chips 7%	2 Takeaway – fried foods/pastry/pizza/chips 7%	2 Soft drinks 6%	2 Soft drinks 4%
3 Cakes/muffins/high fat biscuits 4%	3 Soft drinks 5%	3 Soft drinks 6%	3 Takeaway – fried foods/pastry/pizza/chips 5%	3 Takeaway – fried foods/pastry/pizza/chips 4%
4 Convenience foods – rice/pasta/frozen pizza 4%	4 Convenience foods – rice/pasta/pizza 4%	4 Corned/canned/salami meat 2%	4 Fruit flavoured drink 4%	4 Convenience foods – rice/pasta/pizza 4%
5 Cordial 3%	5 Corned/canned/salami meat 3%	5 Cordial 2%	5 Corned/canned/salami meat 3%	5 Corned/canned/salami meat 3%

store delivery periods) to ensure items with slow turnover were captured. After scrutiny of the consistency of stock ordering and sales patterns in 2012 (monthly variance was <10% for the year to October), actual sales data from bar codes were assessed electronically for one month (four store delivery periods), as this time period was deemed adequate to reflect habitual sales. While sales data are likely to provide a more accurate estimation of store turnover than invoice data, confounding variables – such as wastage – may differ between methods.²¹ Consistent methods were applied to enumerate the 'usual' Indigenous population relying on each community store as the major source of food in 1986 and 2012, but such estimates are unlikely to be robust.^{19,21,39} Consistent with validated methods,¹⁹ neither were adjustments made for the different proportion of children and adults or the numbers or shopping habits of non-Indigenous visitors or residents in each community. Given these challenges with enumeration of the population denominator, relative data are likely to be more reliable than absolute dietary intake data.^{19,39} Estimations of foods from other sources, including traditional bush foods, were not included, as per the validated approach.¹⁹ Neither was there an attempt to apply a correction factor for food wastage, which may have been lower in 2012 due to improved housing.^{24,29} Apparent micronutrient intake in 2012 was compared against the same nutrient reference values used in 1986²⁹ and may not reflect the exact requirements of the current community population profiles. However, there are limitations in all dietary survey methods,³⁹ and the store-turnover method – validated against biochemical dietary indicators in remote Aboriginal communities previously¹⁹ – still constitutes a useful approach.²¹

Another key limitation, but also arguably one strength of the study, is that some of the data were not collected by independent observers but by service providers and local community members, several who had been involved originally in UPK²⁴ as part of NHC's commitment to ongoing program evaluation and improvement.²³

Affordability of healthy food

Among the factors contributing to the higher costs of foods in rural and remote areas are increased food transport costs, high store overheads (including capital costs of building and maintaining long-term storage facilities and high accountancy costs) and

greater wastage of food stock.¹⁴ Unlike large urban-based retailers, Mai Wiru also has to build and maintain housing for, and cover the utility costs, of store managers. Given these challenges, the improved relative affordability of healthy foods, especially fruit and vegetables, in Mai Wiru stores compared to all other stores is particularly impressive. Previous studies have shown that people in rural/remote areas pay 30–50% more for basic healthy foods than people living in urban areas,⁶ and that the price of healthy food is increasing disproportionately to other foods. (For example, between 2000 and 2006 in Queensland, the price of a healthy food basket rose by 42.7% compared with the CPI for all food of 32.5%).⁶ In 1998 on the APY Lands, a healthy diet cost more than 80% of the average family income.²⁶ This has improved considerably, but a healthy diet still costs more than 50% of the disposable income of a welfare-dependent family living on the APY Lands, compared with 28–40% of that of welfare-dependent families living in non-remote areas,⁴⁰ or 20% of that of Australian families with an average income living in urban areas.^{41,42}

Availability of healthy and discretionary choices

Compared with 1986, the availability and range of healthy foods (especially fruit, vegetables and wholegrain foods) and discretionary items (particularly SSBs, convenience meals and take-away foods) has increased substantially, consistent with the increased shelf and refrigerated display space available in 2014. As previously seen elsewhere,³¹ compliance with stocking requirements of the Mai Wiru nutrition policy varied in individual stores and over time. Possible reasons for this include local community preferences and store council directives (such as the decision to withdraw the three highest selling SSBs in MW1 in July 2008)³² and the beliefs and attitudes of individual store managers.³³ As members of the broader community, store managers are subject to the widespread misinformation about food and nutrition.⁶ The latter point is exemplified by well-meaning store managers ordering speciality dietary items under the mistaken belief they are nutritionally superior. This highlights the key role of store managers as 'gate-keepers' of the communities' health.³³

Dietary changes

Total per capita apparent energy intake is high compared to recent estimates for

the Australian population (uncorrected for under-reporting)⁴³ and one northern and two central desert communities in 2010–11³⁴ and has increased consistent with increasing obesity rates, but this may be due to methodological limitations as discussed above. Successful interventions to increase both demand for and supply of healthy food could be expected to result in increased turnover of healthy foods through the stores relative to discretionary choices.¹⁹ When relative contribution of energy from key macronutrients – especially sugars – is considered, the communities' diet appears to be improving in some areas. The increased protein and improved micronutrient density reflects increase in the number, range and quality of fresh fruits, vegetables, lean meats, poultry, eggs, milk products and wholegrain cereals and breads purchased. The increase in folate intake is due mainly to the fortification of flour used for making bread with folic acid (mandatory in Australia since September 2009), but increased fruit and vegetable turnover also contributed, as seen previously in Minjilang.¹⁹

However, the proportion of energy derived from saturated fat (other than from healthy foods such as full-cream milk)⁶ has increased by 20%, which is inconsistent with dietary recommendations.⁶ This rise is due mainly to the increased intake of discretionary energy-dense, nutrient-poor take-away and convenience meals, including meat pies, pizzas, fried foods and hot potato chips. Another major change is the dramatic increase in the contribution of SSBs to energy intake. The very high intake of sugar *per se* (130 g/person/day)²⁹ had about halved in 2012, but the contribution of SSBs to sugar intake had increased nearly fourfold since 1986.

Altogether, discretionary choices contributed 41% to total energy intake on the APY Lands in 2012, even more than their contribution to 35% of the total energy intake in Australia more broadly.⁴³ This is the most worrying feature of the current diet in the APY communities, and appears to have been driven by the increasing range and variety of discretionary foods and drinks stocked in the stores. Over 85% of the more than threefold increase in the number of food items stocked are discretionary choices; more than 70% of the 12 times increased store shelf space are now filled with discretionary choices.

In comparison to the limited available data, the contribution of sugar to energy intake in communities with a Mai Wiru stores (22%)

is lower than reported by Brimblecombe et al. in other remote northern Aboriginal communities (26–34%)^{21,34} and may reflect recent concerted efforts to restrict intake of confectionary, sugar *per se* and SSBs³² in Mai Wiru stores. A high intake of discretionary foods could also be expected in other remote Aboriginal and Torres Strait Islander communities. Other comparable and recent comprehensive food and dietary data are lacking, but the results of the Indigenous nutrition component of the AHS are expected in 2015.⁴³

Other barriers to healthy eating

Since 1986, new challenges to healthy eating have emerged on the APY Lands. The advent of satellite TV in the 1990s beams advertisements for unhealthy foods and SSBs directly into Anangu homes. Large numbers of feral animals damage the environment, decreasing availability of traditional animal and plant foods.²⁴ There have been several attempts at establishing food gardens without success, despite being politically popular and occasionally well-resourced.³⁵

The results also suggest that Anangu are not cooking as much as they were, and are now relying heavily on take-away and convenience meals. Inadequate cooking facilities contribute. When assessed 10 years ago, only 6% of houses on the APY Lands had a functioning stove and sink, adequate bench space for food preparation and storage for perishable foods.²⁴ Despite constant effort to fix such 'health hardware' this figure remains low.²⁴ There is scope for an increased range of healthy ready-to-eat options to be provided in the APY communities.

The inter-relationships of supply and demand are illustrated clearly in Aboriginal communities where a single store remains the only food outlet. This was seen particularly at community MW1, where alternative sources of sugar such as cordial and sweet biscuits are now popular after removal of key SSBs six years ago³² (Figure 5). Conversely, the documented improvements suggest that residing in these communities can help Aboriginal residents exert control over key aspects of their food supply.

Key food supply issues, barriers and leverage points for improvement are identified in the RIST resources⁹ and Mai Wiru nutrition policy.^{20,27} While most of these have been addressed in Mai Wiru stores, many barriers to restricting the supply of discretionary choices remain. These arise as stores are expected to run as a small business, rather

than as an essential community service. This is recognised uniquely in Outback Stores with the provision of more than \$50 million in government funding.¹¹ Without such subsidisation, Mai Wiru stores are particularly vulnerable to the wider market forces of the Australian food supply system.

This ubiquitous supply, promotion and advertising of energy-dense discretionary foods and drinks high in added sugar and/or salt and saturated fats – and with high profit margins – is a global phenomenon driven by multi-national food companies.⁴⁴ This study has confirmed that remote Aboriginal communities, like Australian communities more broadly, are increasingly subject to such market forces. Yet these small communities are expected to combat the influence of 'Big Food' effectively, something that even large well-resourced countries are unable to achieve.⁴²

Next steps

All data reported here have been provided to NHC, NPYWC and Mai Wiru Store Councils to inform decision making, consistent with all available evidence that clearly demonstrates that community direction is essential for effective and sustained improvement.¹⁵ Nutrition promotion activities requested by APY communities are in place, but could be enhanced with additional resources. Consultations around broader potential actions are underway and include: establishing cafés and community kitchens; further restricting supply of discretionary foods; renewing focus on healthy take-aways; reintroducing healthy shelf-talkers; and considering more prescriptive food ordering systems. Recently commissioned ethnographic research is investigating factors influencing food choices such as the dietary preferences and price elasticities. Funding to the NHC to recruit a dietitian/nutritionist to work on the APY Lands was withdrawn in mid-2014. Greater consultation by those South Australian Government entities responsible for the development of the SAFSSP 2011–2016¹⁷ would also appear to have been required. However, implementation of the SAFSSP has recently ceased altogether.¹³

In 2003, at the request of the APY Council, the South Australian Government drafted a regulation pursuant to Section 43 (1) (e) of the Pitjantjatjara Land Rights Act to enable the Mai Wiru regional stores policy (which has as its goal improving the health and wellbeing of the people on the lands by

ensuring continuous access to nutritious and affordable food and essential health items) to be enacted as a by-law pursuant to section 43 (3) of the Act. The by-law drafted in 2013 by the Office of the Parliamentary Counsel will shortly be considered by the APY Council. To our understanding, if passed, this will be the first time internationally a specific health-based stores policy will be supported by legislation. Similar by-laws could be enacted by other local government associations throughout Australia.

The recent audit of the implementation of COAG's National Strategy for Food Security in Remote Indigenous Communities¹³ recommends that the Department of Premier and Cabinet review the current status of the Strategy and provide advice to the Australian Government on options in relation to the actions that have not been completed. Subsequent action would make an important contribution to improving the health status of Indigenous Australians living in remote areas, including the APY Lands.

Conclusions

Despite significant methodological challenges, the results show that concerted effort over three decades has delivered improvements in accessibility, availability and affordability of healthy foods in Mai Wiru stores. Yet the overall effect has been a *decrease* in diet quality due to increased intake of discretionary choices. Increased intake of specific micronutrients has not helped improve dietary patterns or the macronutrient or energy profile of the diet. This decrease in diet quality is a likely major contributor to the persistently high incidence and prevalence of diet-related chronic disease in people on the APY Lands.

Comparable long-term studies are lacking in other remote Indigenous communities, and better food and nutrition data are required urgently to inform nutrition interventions elsewhere.

The results of this study also provide insights into broader nutrition issues affecting other Aboriginal communities and wider Australia, and reinforce the notion that public regulation and market intervention are required to improve diet and prevent obesity and NCDs.⁴⁴

Renewed efforts to implement COAG's National Strategy for Food Security in Remote Indigenous Communities¹³ may provide some opportunities, but in the

absence of supportive regulation and market intervention, adequate and sustained resources and funding are required to support the efforts of Mai Wiru stores, NPY Women's Council, Nganampa Health Council and community members to continue to improve diet and health on the APY Lands.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary File 1: RIST and Mai Wiru checklist compliance.

Supplementary File 2: Total foods purchased in Mai Wiru Stores October 2012.

Supplementary File 3: Dietary intake in selected APY Communities in 1986 and APY Communities with a Mai Wiru Store in 2012 assessed by the store turnover method.