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Published

2016

Journal Title

Public Health Nutrition

DOI

[10.1017/S1368980015001998](https://doi.org/10.1017/S1368980015001998)

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Dietary habits of Samoan adults in an urban Australian setting: a cross-sectional study

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Submitted 20 October 2014: Final revision received 15 April 2015: Accepted 20 May 2015: First published online 25 August 2015

Abstract

Objective: To describe key characteristics of the dietary habits of Samoans residing in Logan, Queensland and to compare these characteristics with comparable populations.

Design: Dietary intake was measured using a self-administered structured questionnaire between December 2012 and March 2013. Demographic characteristics included age and sex. Questionnaire results were compared with data from samples of Brisbane residents of similar social and economic characteristics and Pacific Islanders in New Zealand. The association between demographic characteristics and diet was investigated.

Setting: Logan, Queensland, Australia.

Subjects: Samoans aged 16 years and older.

Results: A total of 207 Samoans participated, ninety-six (46 %) of whom were male. Of the participants, seventy-nine (38 %) were aged 16–29 years, sixty-three (30 %) were aged 30–49 years and sixty-five (31 %) were aged ≥ 50 years. Younger adults were significantly more likely to eat hamburgers, pizza, cakes, savoury pastries, potato crisps, sweets and soft drinks (all variables $P < 0.001$). Among Samoans, 44.7 % consumed two or more pieces of fruit daily, compared with 43.8 % of comparable Brisbane residents (relative risk = 1.0; 95 % CI 0.8, 1.2). Three or more servings of vegetables each day were consumed by 9.2 % of Samoans compared with 36.6 % of comparable Brisbane residents (relative risk = 3.8; 95 % CI 2.5, 6.0).

Conclusions: Samoans are consuming significantly fewer vegetables and more discretionary foods than other populations. Socio-economic factors, length of stay in Australia and cultural practices may impact upon Samoans' diets. Further comprehensive studies on Samoans' dietary habits in Australia are recommended.

Keywords
Migrant health
Pacific Islanders
Dietary intake
Acculturation
Nutritional inequalities

Partially as a consequence of the adoption of Western-style diets^(1–3), rates of chronic disease, particularly obesity and type 2 diabetes mellitus, have increased dramatically in recent years among migrant Polynesian communities. The increased risk of chronic disease is amplified by an apparent genetic predisposition to obesity, diabetes, heart disease and hypertension^(4,5). The present paper considers key dietary characteristics of a population who identify with Samoan ancestry and reside in Logan, which is part of the Greater Brisbane region of South East Queensland. Henceforth, this population will be referred to as Samoans. Samoans are more susceptible to poor levels of population health as a result of various determinants underpinning their attitudes, access and knowledge of health care, such as socio-cultural issues, low socio-economic status and

low health literacy^(6,7). Consequently, Samoans suffer disproportionate rates of non-communicable diseases and avoidable hospital admissions^(7–9). Queensland has a large Polynesian population of approximately 40 000, 38 % of whom identify with Samoan ancestry^(10,11). Little has been done to address the poor state of health of Samoan people in Australia.

Diet quality is a known risk factor for a number of chronic diseases^(12–14). The antioxidant properties of vegetables can reduce risk of chronic disease while the consumption of energy-dense nutrient-poor foods and beverages can increase the risk of chronic disease. Limited data are available on the diet characteristics of Samoans in Australia. However the diet of Samoans in Samoa and the Pacific has changed over time, with lower consumption of

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green leafy vegetables, some fruits and fish and increased consumption of processed goods⁽¹⁵⁾. Traditionally, the diet of Samoans in Samoa was rich in fresh fruit, starchy vegetables and seafood^(16,17), with early explorers noting the fit and healthy appearance of Samoan people⁽¹⁸⁾. Modernisation and Westernisation have seen the diet shift to be higher in fat, Na and protein, with a greater reliance on processed and purchased foods^(2,15,16,19,20). In the late 20th century, food items of low nutritional quality such as tinned corned beef, mutton flaps and turkey tails became staples in Samoa and are now preferred foods in migrant communities^(16,21). The diets of Samoans living in Australia may be different from other Australians, and it is important to identify which elements of the diet could potentially contribute to chronic disease risk. Previously, there has been no published research investigating the dietary habits of Samoans in an Australian context. The aim of the present study was to describe the key characteristics of dietary habits of Samoans in Logan, South East Queensland and to compare their diet with other Australasian populations who have similar social or economic characteristics.

Methods

Study population

The current cross-sectional study is part of a larger ongoing study into the dietary habits of an urban Samoan community, titled *Soifua Maloloina* (Healthy Living for Samoans). The majority of Samoans reside in the central suburbs of Logan City, which are among the most disadvantaged 5% of areas in Queensland, according to the Australian Bureau of Statistics Index of Relative Socioeconomic Disadvantage⁽¹¹⁾. This index is derived from census variables related to disadvantage such as income, education and employment. Participants were recruited through Samoan church congregations in the Logan area. Family and friends of participants recruited through churches were also invited to participate. Participation through church was deemed appropriate due to 99% of Samoans identifying with and actively engaging with church services⁽²²⁾. Eligibility criteria included Samoan ethnicity and being aged 16 years or older. There were no exclusions due to any existing health conditions. Data were collected between December 2012 and March 2013.

Ethical approval was received from the University of Queensland School of Population Health Research Ethics Committee and Metro South Hospital and Health Service Human Research Ethics Committee (HREC reference: HREC/12/QPAH/102) and all participants gave informed consent. The research adheres to the guidelines set by the Australian National Health and Medical Research Council⁽²³⁾.

Cultural considerations

The research team adopted the community-based participatory research model, which has been successful in

other nutrition⁽²⁴⁾ and Pacific Islander^(25–27) studies as it empowers local community members to actively participate in the research. There were many cultural considerations incorporated into the research strategies. The questionnaire was administered in English or Samoan, the latter of which was officially translated by an accredited translator and tested with key community members for accuracy. Participants were able to choose which language they responded in. Dietary intake measures were piloted with ten community members and changes to the wording, length and layout of the survey were incorporated, providing face validity of the tool. Influential and respected bilingual community members who sat on the project's steering committee were employed as data collectors. A community *matai* (high chief) and other dedicated community members were recruited for these roles. Questionnaires were completed in familiar, welcoming environments, such as in Samoan churches, community meetings and private homes. The bilingual research assistants met with the participants face-to-face to respond to participant questions in Samoan or English and to reduce participant errors in completing the surveys.

Dietary intake

Dietary intake was measured using a self-administered structured, quantitative, short questionnaire to ascertain intakes of fruit, vegetables, energy-dense nutrient-poor foods and fatty cuts of meat. The survey tool was adapted from Ramsey *et al.*⁽²⁸⁾ and was reviewed by a group of experts from a range of backgrounds to ensure the diet characteristics of Samoans were appropriately captured. Focus groups were held with various Samoan community members including high chiefs, church ministers and other respected male and female community members of varying ages. The cultural experts approved the survey in terms of its length, readability, understanding of Australian serving sizes and foods included. An extra question regarding fatty cuts of meat was added, incorporating meat cuts popular with Samoans. Each respondent's age and sex were recorded. Consumption was recorded using a 5-point Likert scale, recording daily consumption of fruit and vegetables and weekly consumption of the remaining variables, with responses increasing on a scale from never/rarely to four or more times each day/week, depending on the variable. For example, the question regarding fruit was as follows: 'How many pieces of fruit do you usually eat per day? (count 1/2 cup of tinned fruit or 1 cup of fresh fruit/berries/grapes or 1/3 cup of dried fruit or 1/2 cup of juice as 1 piece)', with responses as 'don't eat fruit', 'less than 1 piece per day', '1 piece per day', '2 pieces per day', '3 pieces per day' and '4 or more pieces per day'.

Survey responses were compared with responses from three other surveyed groups: a (i) representative sample of the Australian population⁽²⁹⁾; (ii) a sample of socio-economically disadvantaged Brisbane residents⁽²⁸⁾; and

Table 1 Diet indicators and comparison data*

Dietary intake measured (no. of servings or occasions/d or week)	Comparison data
Fruit, vegetables	Australia, Queensland and New Zealand ^(27–29)
Hot chips/fries, fried fish/seafood	Queensland and New Zealand ^(27,29)
Hamburgers, Asian takeaway, pizza, cakes/sweet pastries, savoury pastries, fried chicken	Queensland ⁽²⁷⁾
Soft drinks, fast-food restaurants	New Zealand ⁽²⁹⁾

*Comparison data are from a disadvantaged Queensland population⁽²⁷⁾, a representative sample of the Australian population⁽²⁸⁾ and a migrant Pacific Islander population in New Zealand⁽²⁹⁾.

(iii) a migrant Pacific Island population in New Zealand⁽³⁰⁾. All four samples were population-based. Australian population data were extracted from the Australian Health Survey 2011–2012, which is a large study of the health and well-being of a representative sample of Australian adults⁽²⁹⁾. The present study used some of the same Likert-scale questions to determine daily intake of fruit and vegetables. Data on a representative sample of socio-economically disadvantaged Brisbane adult residents were extracted from a larger study by Ramsey and colleagues undertaken in 2009 into the dietary habits and food security experiences of participants from this region⁽²⁸⁾. Participants were randomly selected from the most disadvantaged 5% of areas in Brisbane according to the Index for Relative Socioeconomic Disadvantage at the census collector district level. There are approximately 225 dwellings in each census collector district. Selected individuals were mailed a survey. The dietary assessment tool⁽²⁸⁾ contained some of Likert-scale questions used in the current study. Responses were received from 505 adults, of whom 45% were male, 17% were aged 20–29 years, 65% were aged 30–49 years and 18% were aged ≥50 years. Data on a representative sample of New Zealand Pacific Island migrants were extracted from the 2008/09 New Zealand Adult Nutrition Survey. This assessment tool was a dietary habits questionnaire based on a qualitative FFQ⁽³⁰⁾. Responses were received from 757 adults identifying as of Pacific Island descent, of whom 46% were male, 36% were aged 15–30 years, 44% were aged 31–50 years and 20% were aged ≥51 years. Table 1 describes diet elements available for comparison for each comparison group.

Statistical analysis

For Samoan data, the median number of servings and 10th and 90th percentiles were calculated for all dietary habits measured. The relationship between sex and dietary habits was analysed using the non-parametric Mann–Whitney test. The association between age category (18–29 years, 30–49 years, ≥50 years) and dietary habits was analysed using the non-parametric Kruskal–Wallis test. Consumption was compared between the Logan Samoans and the comparable Brisbane sample using the Mann–Whitney test. The proportion of participants in each sample group who met guidelines for each criterion was reported as percentage and 95% confidence interval.

The risk ratio (RR) between Samoans and each of the comparator samples, with corresponding 95% confidence interval, was calculated. If the RR was less than 1 the outcome was less likely in the comparator sample than in Samoans. If the RR was greater than 1 the outcome was more likely in the comparison sample. All reported *P* values are two-sided and *P* < 0.05 was determined to be statistically significant. Data were analysed using the statistical software package IBM SPSS Statistics version 21.

Results

A total of 207 Samoan adults participated, ninety-six (46%) of whom were male. Of the participants, seventy-nine (38%) were aged 16–29 years, sixty-three (30%) were aged between 30–49 years and sixty-five (31%) were aged ≥50 years.

Dietary behaviours of Samoans in Logan are summarised in Table 2, both overall and then after stratification by age and sex. Younger age was significantly associated with higher consumption of hamburgers, pizza, cakes, savoury pastries, fast food, potato crisps, sweets and soft drinks (all variables *P* < 0.001). Samoan males consumed more savoury pastries (*P* = 0.036), soft drinks (*P* = 0.023) and fatty cuts of meat (*P* = 0.002) than females. More than half of participants ate fast food two to three times per week.

When Samoans were compared with the general Australian population, a similar percentage met recommendations for fruit consumption (44.7% of Samoans *v.* 48.3% of Australians), but considerably fewer Samoans consumed three or more servings of vegetables daily (9.2% *v.* 44.5%). This pattern remained when stratifying by sex, with similar percentages of males meeting fruit recommendations (43.8% *v.* 43.8%) but fewer consuming three or more servings of vegetables daily (10.5% *v.* 41.7%). Corresponding percentages for females are 45.8% *v.* 52.7% for fruit and 8.4% *v.* 47.2% for vegetables.

Table 3 compares the dietary behaviours of Samoans and a comparable socio-economic subgroup in Brisbane. Samoans consumed significantly greater amounts of hot chips, hamburgers, cakes, savoury pastries, fried fish and fried chicken, and significantly fewer vegetables. The consumption of fruit, Asian takeaway and pizza were

Table 2 Median values of Logan Samoans' dietary behaviours (no. of servings or occasions/d or week), overall and comparison by sex and age; Queensland, Australia, December 2012–March 2013

Dietary factor	Overall median	90% CI	Males		Females		P value (Mann–Whitney test)			P value (Kruskal–Wallis test)		
			Males	Females	Males	Females	Age 16–29 years	Age 30–49 years	Age ≥50 years	Age 16–29 years	Age 30–49 years	Age ≥50 years
Fruit	1/d	<1/d, 3/d	1/d	1/d	1/d	1/d	0.399	2/d	1/d	1/d	1/d	0.195
Vegetables	1/d	<1/d, 2/d	1/d	1/d	1/d	1/d	0.985	1/d	1/d	1/d	1/d	0.109
Hot chips/fries	<1/week	Never, 1–2/week	<1/week	<1/week	<1/week	<1/week	0.674	1–2/week	<1/week	<1/week	<1/week	<0.001†
Hamburgers	<1/week	Never, 1–2/week	<1/week	<1/week	<1/week	<1/week	0.840	<1/week	<1/week	<1/week	<1/week	<0.001†
Asian takeaway	<1/week	Never, 1–2/week	<1/week	<1/week	<1/week	<1/week	0.43	<1/week	<1/week	Never/rarely	Never/rarely	0.173
Pizza	Never	Never, <1/week	Never/rarely	<1/week	<1/week	<1/week	0.86	<1/week	<1/week	Never/rarely	Never/rarely	0.009†
Cakes	<1/week	Never, 1–2/week	<1/week	<1/week	<1/week	<1/week	0.508	<1/week	<1/week	<1/week	<1/week	0.015†
Savoury pastries	<1/week	Never, 1–2/week	<1/week	<1/week	<1/week	<1/week	0.036*	1–2/week	<1/week	<1/week	<1/week	0.001†
Fried fish	<1/week	Never, ≥3/week	<1/week	<1/week	<1/week	<1/week	0.202	1–2/week	<1/week	<1/week	<1/week	0.144
Fried chicken	<1/week	Never, ≥3/week	<1/week	<1/week	<1/week	<1/week	0.081	1–2/week	<1/week	<1/week	<1/week	0.052
Fast food	2–3/week	None, 4–5/week	2–3/week	2–3/week	2–3/week	2–3/week	0.105	2–3/week	2–3/week	1/week	1/week	<0.001†
Potato crisps	<1/week	Never, 4–6/week	<1/week	<1/week	<1/week	<1/week	0.197	1–2/week	<1/week	<1/week	<1/week	<0.001†
Sweets	1–3/week	Never, 4–6/week	1–3/week	1–3/week	1–3/week	1–3/week	0.793	1–2/week	1–2/week	<1/week	<1/week	<0.001†
Soft drinks	1–3/week	Never, 1/d	1–3/week	1–3/week	1–3/week	1–3/week	0.023†	1–2/week	1–2/week	<1/week	<1/week	<0.001†
Fatty meats	<1/week	Never, 4–6/week	1–3/week	<1/week	<1/week	<1/week	0.002†	<1/week	1–3/week	<1/week	<1/week	0.815

*Males consume a significantly greater amount than females.
†Consumption decreases significantly as age increases.

the only variables without statistically significant findings. The median value for all other dietary characteristics (vegetables, hot chips, hamburgers, cakes, savoury pastries, fried fish and fried chicken) was negatively associated with the Samoan community when compared with the group of Brisbane residents with low socio-economic status (all $P < 0.001$).

The comparison of dietary intakes in terms of meeting dietary indicators between Samoans and the Brisbane residents of similar social and economic characteristics and Pacific Islanders in New Zealand, stratified by sex, is presented in Table 4. Samoans consumed two or more pieces of fruit each day in similar rates to these groups (RR = 1.0; 95% CI 0.8, 1.2 and RR = 0.9; 95% CI 0.7, 1.1, respectively). Conversely the Samoan community consumed considerably fewer vegetables: a total of 9.2% reported they ate three or more servings of vegetables daily compared with 36.6% of the Brisbane sample (RR = 3.8; 95% CI 2.5, 6.0) and 45.0% of Pacific Islanders in New Zealand (RR = 6.5; 95% CI 4.2, 10.0). Similar results were observed when compared within sex. Compared with Samoans, the comparable Brisbane sample (RR = 0.3; 95% CI 0.2, 0.4) and Pacific Islanders in New Zealand (RR = 0.7; 95% CI 0.5, 0.8) were less likely to eat fried fish one or more times per week.

Discussion

Australian Samoans have a dramatically lower intake of vegetables compared with other Australians, a sub-population in Brisbane and migrant Pacific Islanders in a similarly developed nation. A large percentage of Samoans (67.1%) are consuming one or fewer vegetable servings each day, which falls drastically short of the recommended five servings each day for Australian adults⁽³¹⁾. Conversely, 17.4% of Samoans are consuming more than the recommended two servings of fruit each day for good health. Consumption of takeaway foods, particularly from fast-food restaurants, and fried fish is generally higher than in the other comparable sub-populations.

A number of factors are thought to contribute to the observed dietary patterns of Samoans. The social determinants of health, including socio-economic position, social support, culture, employment and education, are intrinsically linked to dietary behaviours and obesity^(32–34). The socio-economic characteristics of the geographical location of the Logan Samoan community may greatly impact upon their health and are associated here, as elsewhere, with a high occurrence of dietary risk factors associated with lifestyle-related chronic diseases.

Immigrants often experience better health than Australians; however, the longer immigrants reside in Australia, the poorer their health becomes^(35,36). In particular, Pacific Islanders have a higher diabetes mortality rate than Australians⁽³⁷⁾ and Queenslanders⁽⁷⁾. The influx of Samoan

Table 3 Comparison of dietary behaviours (no. of servings or occasions/d or week) between Logan Samoans and socio-economically disadvantaged Brisbane residents, Queensland, Australia

Dietary factor	Logan Samoans		Disadvantaged Brisbane residents ⁽²⁷⁾		P value (Mann–Whitney test)
	Median	90 % CI	Median	90 % CI	
Fruit	1/d	<1/d, 3/d	1/d	<1/d, 3/d	0.917
Vegetables	1/d	<1/d, 2/d	2/d	<1/d, ≥4/d	<0.001
Hot chips/fries	<1/week	Never, 1–2/week	<1/week	Never, 1–2/week	<0.001*
Hamburgers	<1/week	Never, 1–2/week	Never/rarely	Never, 1–2/week	<0.001
Asian takeaway	<1/week	Never, 1–2/week	<1/week	Never, 1–2/week	0.234
Pizza	Never	Never, <1/week	Never/rarely	Never, <1/week	0.88
Cakes	<1/week	Never, 1–2/week	<1/week	Never, 1–2/week	0.002*
Savoury pastries	<1/week	Never, 1–2/week	Never/rarely	Never, 1–2/week	<0.001
Fried fish	<1/week	Never, ≥3/week	Never/rarely	Never, 1–2/week	<0.001
Fried chicken	<1/week	Never, ≥3/week	Never/rarely	Never, 1–2/week	<0.001

*Samoans in Logan consume a significantly greater amount than comparable Queenslanders.

migrants was at its peak between 1996 and 2000, when 22% of the current Samoans in Australia arrived⁽³⁸⁾. Migrants in Australia are more likely to be affected by obesity due to changes in food preferences and physical activity levels^(39,40). Studies of both local Samoan populations^(16,17) and migrant Samoans living in New Zealand⁽³⁰⁾ show adequate amounts of vegetables being consumed. Conversely, for Samoans residing in Australia, poor vegetable consumption may be associated with their length of residence. In comparison to Samoans in Australia, Pacific Islanders in New Zealand are consuming similar amounts of vegetables as the remainder of the population. This demonstrates that migrant communities do not necessarily always have poorer dietary habits than the remainder of the population.

Studies of migrant Pacific Islanders and Asians in the USA have shown that they consume the same amounts of fruit and vegetables as the rest of the population^(41,42). However, it is difficult to make a direct comparison to the present study, as fruit and vegetables were grouped together rather than separately, and the diet of Asians may be different from that of Pacific Islanders. In other studies, these combined ethnic groups were more likely to eat fewer vegetables than other races^(43,44).

Other socio-cultural factors such as acculturation and intergenerational change can also affect dietary habits⁽⁴⁵⁾. There are socio-cultural differences for migrants relating to body size preferences along with other acculturative stresses, including changes in physical activity and food preferences, collective to individual societal changes, different parenting styles and general changes in lifestyle^(46,47). Pacific Islanders associate larger body sizes with wealth and social power, and the abundance of food is linked to success⁽⁴⁸⁾.

Social and economic exclusion exists for many Pacific Islanders in Australia as a result of the Trans-Tasman Travel Arrangement. This reciprocal agreement between Australia and New Zealand prevents Samoan families who migrated to Australia from New Zealand after 2001 from accessing tertiary university loans and social benefits, even

though they contribute to society and pay Australian taxes⁽⁴⁹⁾. This double burden of disadvantage may greatly affect dietary habits and overall health and well-being of an already marginalised sub-population in Australia. Dietary composition is influenced by the cost of food, with healthy diets having been shown to be more expensive^(50–52). This reinforces disparities between communities.

The difference in dietary habits between Samoans in Australia and Pacific Islanders in New Zealand could be attributable to the health system in New Zealand, which is, by comparison, relatively responsive to their needs. There are dedicated Pacific Islander health services and policies including primary prevention strategies to improve the health and well-being of New Zealand's Pacific Islander migrants^(53–55). Although Samoans and Pacific Islanders represent a growing and significant migrant population in Australia, little has been done to address their health needs in order to reduce the chronic disease burden affecting migrant Samoans.

For the first time in Australia, the present study provides a description of some of the dietary characteristics of a migrant Samoan population. One strength of the study, which is the largest in Australia, is the strong relationship between the research team and the community which has helped to secure significant buy-in from the community. The culturally appropriate settings for the data collection and the availability of the survey in English and Samoan language increased the acceptability of the research and the long-term value and benefit for the community. A vast majority of Samoans (99%) identify with religious faith⁽²²⁾, therefore administering the surveys in churches was a strength of the research in terms of generalisability. When the Logan Samoan sample is compared with the Brisbane sample of similar social and economic characteristics and Pacific Islanders in New Zealand, the sex split in each of the three samples was similar (46% *v.* 45% *v.* 46%); however, the Logan Samoan sample contained more participants aged ≥50 years (31% *v.* 18% *v.* 20%). The main limitation of the current study is that the self-administered questionnaire to ascertain dietary habits

Table 4 Comparison of dietary indicators of fruit, vegetables and discretionary food intake between Logan Samoans and socio-economically disadvantaged Brisbane residents (Queensland, Australia) and Pacific Islanders in New Zealand

	Sex	Logan Samoans		Disadvantaged Brisbane residents ⁽²⁷⁾		Logan Samoans compared with disadvantaged Brisbane residents		Pacific Islanders in New Zealand ⁽²⁸⁾		Logan Samoans compared with Pacific Islanders in New Zealand	
		%	95% CI	%	95% CI	RR	95% CI	%	95% CI	RR	95% CI
Eat two or more servings of fruit daily	Males	43.8	34.3, 53.7	38.4	32.4, 44.9	0.9	0.7, 1.2	54.3	47.5, 61.1	1.2	1.0, 1.6
	Females	45.8	36.7, 55.2	47.7	42.3, 53.3	1.1	0.8, 1.3	62.4	56.9, 67.9	1.4	1.1, 1.7
Eat three or more servings of vegetables daily	Males	10.5	5.8, 18.3	28.9	23.5, 35.1	2.9	1.5, 5.3	40.9	34.4, 47.4	3.9	2.1, 7.1
	Females	8.4	4.5, 15.2	42.3	36.9, 47.9	5.0	2.7, 9.3	48.9	43.5, 54.2	5.8	3.0, 10.8
Eat fried fish one or more times weekly	Males	45.7	36.0, 55.8	16.2	11.9, 21.6	0.4	0.2, 0.5	27.8	21.4, 34.2	0.6	0.4, 0.8
	Females	34.9	26.4, 44.6	7.7	5.2, 11.3	0.2	0.1, 0.4	25.4	21.1, 29.6	0.7	0.5, 1.0
Eat hot chips/fries three or more times weekly	Males	8.4	4.3, 15.6	5.7	3.4, 9.6	0.7	0.3, 1.6	17.2	13.1, 21.2	2.0	1.0, 4.1
	Females	9.3	5.2, 16.4	2.7	1.4, 5.2	0.6	0.3, 1.3	13.4	9.3, 17.6	1.4	0.7, 2.8
Drink soft drinks three or more times weekly	Males	42.1	32.7, 52.2	-	-	-	-	45.0	39.7, 50.4	1.1	0.8, 1.4
	Females	33.0	24.8, 42.4	-	-	-	-	31.7	27.3, 36.1	1.0	0.7, 1.3
Eat fast-food or takeaways three or more times weekly	Males	39.4	30.1, 49.5	-	-	-	-	18.3	12.8, 23.7	0.5	0.3, 0.7
	Females	30.8	22.9, 40.1	-	-	-	-	13.2	10.3, 16.1	0.4	0.3, 0.6

Relative differences are displayed as risk ratios (RR) and 95% confidence intervals.

allows for response bias. Under-reporting of self-reported dietary intake creates unavoidable bias and Pacific Islanders may be more likely to under-report less healthy choices than other populations⁽⁵⁶⁾.

A longitudinal, in-depth study into the dietary habits of Pacific Islanders using a validated FFQ is recommended, in order to describe greater detail of the diets of immigrant Samoans in Australia and to better understand the impact of migration on dietary patterns. Future research into migrant food habits needs to be careful to differentiate dietary behaviours in relation to fruit and vegetables. In future, interventions to improve diets need to consider actual dietary characteristics of a population and not simply core food groups. The current widespread practice of collapsing fruit and vegetable consumption into a single dietary behaviour runs the risk of diluting or confusing messages about an important aspect of dietary change, especially where compliance with recommendations for fruit consumption and compliance with recommendations for vegetable consumption are in the opposite direction. Increasing vegetable consumption, rather than the less specific focus on increasing fruit and vegetable consumption, needs to be targeted for interventions aiming to improve the dietary habits of Samoans and possibly other Pacific Islanders in Australia, New Zealand and the Pacific region.

In an Australian context, Samoans are consuming diets alarmingly low in vegetables. Working with this community to increase their vegetable consumption may lead to a reduction in the burden of some lifestyle-related chronic conditions and the present research contributes important data to inform culturally appropriate messages and interventions. Our short study into Samoans' dietary habits is valuable; however, further comprehensive studies on the dietary habits of Samoans in Australia are recommended, particularly in terms of the effectiveness of translating the current findings into a culturally appropriate nutrition intervention to improve vegetable consumption.

Acknowledgements

Acknowledgements: The authors wish to acknowledge Rebecca Ramsey, Queensland University of Technology (QUT), for the provision of her data set as well as Claire Archer, also from QUT, for assisting with data inputting. Special acknowledgement is also extended to the Samoan community in Logan for participating in the study. *Financial support:* This study was funded as part of *Soifua Malolo*ina (Healthy Living for Samoans) nutrition intervention in Logan, Queensland, Australia which was funded by the Commonwealth Department of Health for a 'Swap It, Don't Stop It' intervention, as well as the Queensland Government Department of Communities and Metro South Health. The funders contributed to resources required to complete the research but had no role in the design, analysis or writing of this article.

Conflict of interest: None. *Authorship:* K.C.P. designed and carried out the study, conducted the analysis and wrote the manuscript. L.S. and R.W. provided assistance with analysis of the data and writing the article. L.F.T., R.S. and L.S.S. assisted with designing the study and data collection. All co-authors have read and approved the final version. *Ethics of human subject participation:* This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the University of Queensland School of Population Health Research Ethics Committee and Metro South Hospital and Health Service Human Research Ethics Committee. Verbal informed consent was obtained from all subjects/patients. Verbal consent was witnessed and formally recorded.

References

- Bell A, Swinburn B, Amosa H *et al.* (2001) A nutrition and exercise intervention program for controlling weight in Samoan communities in New Zealand. *Int J Obes Relat Metab Disord* **25**, 920–927.
- Davis J, Busch J, Hammatt Z *et al.* (2004) The relationship between ethnicity and obesity in Asian and Pacific Islander populations: a literature review. *Ethn Dis* **14**, 111–118.
- Parry J (2010) Pacific Islanders pay heavy price for abandoning traditional diet. *Bull World Health Organ* **88**, 484–485.
- Ezeamama AE, Viali S, Tuitele J *et al.* (2006) The influence of socioeconomic factors on cardiovascular disease risk factors in the context of economic development in the Samoan archipelago. *Soc Sci Med* **63**, 2533–2545.
- Østbye T, Welby T, Prior I *et al.* (1989) Type 2 (non-insulin-dependent) diabetes mellitus, migration and westernisation: the Tokelau Island Migrant Study. *Diabetologia* **32**, 585–590.
- McGarvey ST & Seiden A (2010) Health, wellbeing, and social context of Samoan migrant populations. *NAPA Bull* **34**, 213–228.
- Queensland Health (2011) *The Health of Queensland's Samoan Population 2009* [Division of the Chief Health Officer, editor]. Brisbane: Queensland Health.
- Schaaf D, Scragg R & Metcalf P (2000) Cardiovascular risk factors levels of Pacific people in a New Zealand multicultural workforce. *N Z Med J* **113**, 3–5.
- Sundborn G, Metcalf PA, Gentles D *et al.* (2008) Ethnic differences in cardiovascular disease risk factors and diabetes status for Pacific ethnic groups and Europeans in the Diabetes Heart and Health Survey (DHAH) 2002–2003, Auckland New Zealand. *N Z Med J* **121**, 28–39.
- Queensland Health (2013) *Pacific Islander and Maori Population Size and Distribution*. Brisbane: Queensland Health; available at http://www.health.qld.gov.au/multicultural/health_workers/pac-island-pop.asp
- Australian Bureau of Statistics (2011) *Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Catalogue no. 2033.0.55.001*. Canberra: ABS.
- McCullough ML, Feskanich D, Stampfer MJ *et al.* (2002) Diet quality and major chronic disease risk in men and women: moving toward improved dietary guidance. *Am J Clin Nutr* **76**, 1261–1271.
- World Health Organization (2003) *Diet, Nutrition and the Prevention of Chronic Diseases. Joint WHO/FAO Expert Consultation. WHO Technical Report Series no. 916*. Geneva: WHO.
- Roberts CK & Barnard RJ (2005) Effects of exercise and diet on chronic disease. *J Appl Physiol* **98**, 3–30.
- DiBello JR, McGarvey ST, Kraft P *et al.* (2009) Dietary patterns are associated with metabolic syndrome in adult Samoans. *J Nutr* **139**, 1933–1943.
- Galanis DJ, McGarvey ST, Quesada C *et al.* (1999) Dietary intake of modernizing Samoans: implications for risk of cardiovascular disease. *J Am Diet Assoc* **99**, 184–190.
- Tsai H-J, Sun G, Smelser D *et al.* (2004) Distribution of genome-wide linkage disequilibrium based on micro-satellite loci in the Samoan population. *Hum Genomics* **1**, 327–334.
- Macpherson C & Macpherson L (1990) *Samoan Medical Belief and Practice*. Auckland: Auckland University Press.
- McGarvey ST (1991) Obesity in Samoans and a perspective on its etiology in Polynesians. *Am J Clin Nutr* **53**, 6 Suppl., 1586S–1594S.
- Ulijaszek S (2004) Modernisation, migration and nutritional health of Pacific Island populations. *Environ Sci* **12**, 167–176.
- McCarthy A, Shaban R & Stone C (2011) Fa'afaletui: a framework for the promotion of renal health in an Australian Samoan community. *J Transcult Nurs* **22**, 55–62.
- Central Intelligence Agency (2014) *The World Factbook: Samoa*. <https://www.cia.gov/library/publications/the-world-factbook/geos/ws.html> (accessed April 2014).
- National Health and Medical Research Council (2006) *Cultural Competency in Health: A Guide for Policy, Partnerships and Participation*. Canberra: Commonwealth of Australia.
- Sloane DC, Diamant AL, Lewis LB *et al.* (2003) Improving the nutritional resource environment for healthy living through community-based participatory research. *J Gen Intern Med* **18**, 568–575.
- Fong M, Braun KL & Tsark J (2003) Improving Native Hawaiian health through community-based participatory research. *Calif J Health Promot* **1**, 136–148.
- Tynan A, Atkinson J-A, Toaluni H *et al.* (2011) Community participation for malaria elimination in Tafea Province, Vanuatu: part II. Social and cultural aspects of treatment-seeking behaviour. *Malar J* **10**, 204.
- Sukala WR, Page RA, Rowlands DS *et al.* (2012) Exercise intervention in New Zealand Polynesian peoples with type 2 diabetes: cultural considerations and clinical trial recommendations. *Australas Med J* **5**, 429.
- Ramsey R, Giskes K, Turrell G *et al.* (2012) Food insecurity among adults residing in disadvantaged urban areas: potential health and dietary consequences. *Public Health Nutr* **15**, 227–237.
- Australian Bureau of Statistics (2012) *Australian Health Survey: First Results, 2011–12, Catalogue no. 4364.0.55.001*. Canberra: ABS.
- Ministry of Health (2012) *A Focus on Pacific Nutrition: Findings from the 2008/09 New Zealand Adult Nutrition Survey*. Wellington: Ministry of Health.
- National Health and Medical Research Council (2013) *Australian Dietary Guidelines*. Canberra: Commonwealth of Australia.
- Cleland VJ, Ball K & Crawford D (2010) Social and environmental determinants of health behaviors. In *Handbook of Behavioral Medicine: Methods and Applications*, pp. 3–17 [A Steptoe, editor]. New York: Springer.
- Groth MV, Fagt S & Brøndsted L (2001) Social determinants of dietary habits in Denmark. *Eur J Clin Nutr* **55**, 959–966.
- Johansson L, Thelle DS, Solvoll K *et al.* (1999) Healthy dietary habits in relation to social determinants and lifestyle factors. *Br J Nutr* **81**, 211–220.
- Biddle N, Kennedy S & McDonald JT (2007) Health assimilation patterns amongst Australian immigrants. *Econ Rec* **83**, 16–30.

36. Delavari M, Farrelly A, Renzaho A *et al.* (2013) Experiences of migration and the determinants of obesity among recent Iranian immigrants in Victoria, Australia. *Ethn Health* **18**, 66–82.
37. Singh M & de Looper M (2002) *Australian Health Inequalities: Birthplace, AIHW Bull* no. 2. *Catalogue* no. AUS 27. Canberra: Australian Institute of Health and Welfare.
38. Department of Immigration and Citizenship (n.d.) Community Information Summary: Samoa-born, Historical Background. https://www.dss.gov.au/sites/default/files/documents/02_2014/samoa.pdf (accessed June 2014).
39. Renzaho A & Burns C (2006) Post-migration food habits of sub-Saharan African migrants in Victoria: a cross-sectional study. *Nutr Diet* **63**, 91–102.
40. Renzaho A, Swinburn B & Burns C (2008) Maintenance of traditional cultural orientation is associated with lower rates of obesity and sedentary behaviours among African migrant children to Australia. *Int J Obes (Lond)* **32**, 594–600.
41. Bitton A, Zaslavsky AM & Ayanian JZ (2010) Health risks, chronic diseases, and access to care among US Pacific Islanders. *J Gen Intern Med* **25**, 435–440.
42. Centers for Disease Control Prevention (2007) Prevalence of fruit and vegetable consumption and physical activity by race/ethnicity – United States, 2005. *MMWR Morb Mortal Wkly Rep* **56**, 301–304.
43. Kirsh VA, Peters U, Mayne ST *et al.* (2007) Prospective study of fruit and vegetable intake and risk of prostate cancer. *J Natl Cancer Inst* **99**, 1200–1209.
44. Reynolds KD, Baranowski T, Bishop DB *et al.* (1999) Patterns in child and adolescent consumption of fruit and vegetables: effects of gender and ethnicity across four sites. *J Am Coll Nutr* **18**, 248–254.
45. Renzaho AM, McCabe M & Swinburn B (2012) Intergenerational differences in food, physical activity, and body size perceptions among African migrants. *Qual Health Res* **22**, 740–754.
46. Renzaho A, Green J, Mellor D *et al.* (2011) Parenting, family functioning and lifestyle in a new culture: the case of African migrants in Melbourne, Victoria, Australia. *Child Fam Soc Work* **16**, 228–240.
47. Renzaho A & Mellor D (2010) Applying socio-cultural lenses to childhood obesity prevention among African migrants to high-income western countries: the role of acculturation, parenting and family functioning. *Int J Migrat Health Soc Care* **6**, 34–42.
48. Mavoia HM & McCabe MP (2008) Sociocultural factors relating to Tongans' and Indigenous Fijians' patterns of eating, physical activity and body size. *Asia Pac J Clin Nutr* **17**, 375–384.
49. Kearney J (2012) Unlucky in a lucky country: a commentary on policies and practices that restrict access to higher education in Australia. *J Soc Inclus* **3**, 130–134.
50. Darmon N & Drewnowski A (2008) Does social class predict diet quality? *Am J Clin Nutr* **87**, 1107–1117.
51. Inglis V, Ball K & Crawford D (2005) Why do women of low socioeconomic status have poorer dietary behaviours than women of higher socioeconomic status? A qualitative exploration. *Appetite* **45**, 334–343.
52. Lee JH, Ralston RA & Truby H (2011) Influence of food cost on diet quality and risk factors for chronic disease: a systematic review. *Nutr Diet* **68**, 248–261.
53. Anderson I, Crengle S, Leialoha Kamaka M *et al.* (2006) Indigenous health in Australia, New Zealand, and the Pacific. *Lancet* **367**, 1775–1785.
54. Ministry of Health (2014) *'Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2014–2018*. Wellington: Ministry of Health.
55. Tomlin A, Tilyard M, Dawson A *et al.* (2006) Health status of New Zealand European, Māori, and Pacific patients with diabetes in 242 New Zealand general practices. *N Z Med J* **119**, U2004.
56. Gemming L, Jiang Y, Swinburn B *et al.* (2013) Under-reporting remains a key limitation of self-reported dietary intake: an analysis of the 2008/09 New Zealand Adult Nutrition Survey. *Eur J Clin Nutr* **68**, 259–264.