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Access to a Nutritious Diet in Samoa: Local Insights

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ABSTRACT

The adult obesity prevalence in Samoa is the third highest globally, and diet is a significant contributor. Our study aimed to explore the behavioral and demographic factors which influence diets in Samoa. The most important findings for strategic policy design were: i) cost was the most important reason for food choice, ii) participants reported high rates of consumption of sugary and fatty energy foods – along with high rates of food insecurity, and iii) the food frequency questionnaire findings from our small sample are in line with the existing evidence that the nutrition transition is underway in Samoa.

KEYWORDS

Samoa; obesity; food access; diet

Introduction

Poor diet is the leading risk factor for mortality worldwide (Forouzanfar, Alexander, and Anderson et al. 2015) and diets containing excess energy and fat are a key contributor to the global obesity epidemic (WHO, 2017). Obesity increases the risk of several non-communicable diseases (NCDs) such as cardiovascular disease and diabetes (WHO, 2016). Preventing obesity in low- and middle-income countries is particularly urgent because these countries often have inadequate health system capacity to manage the resultant NCDs (Islam et al. 2014).

Food and nutrition policymaking has the potential to strengthen obesity prevention at the population level, through creating and supporting non-obesogenic food environments for populations (Hawkes et al. 2015). However, designing effective policies is challenging as it requires navigation of the complex and ever-changing nature of food markets, human society, behavior, and culture (Hawkes et al. 2015). Global nutrition research to date has focussed primarily on what people eat, and a knowledge gap remains in the areas of food access and utilization, especially in low- and middle-income nations (Hough and Sosa 2015) including those in the Pacific Islands (Charlton et al. 2016).

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Further complicating action on obesity prevention is the positive association between food insecurity and obesity (Farrell et al. 2017; Hough and Sosa 2015), which is stronger in women than in men (Dinour, Bergen, and Yeh 2007; Franklin et al. 2012; Martin-Fernandez et al. 2014). The prevalence of obesity worldwide is 50% higher in women than men (Wells et al. 2012), and it has been shown that household nutritional status is linked to the level of household economic autonomy in women (UNICEF 2011). There is growing global recognition that research on nutrition must increasingly engage with the nexus between food insecurity, nutrition, and obesity; in particular, through “more context-specific assessments ... to identify the links between household food security and nutrition” (FAO 2017, 3).

This study was conducted in Samoa, a small Pacific Island Country (PIC) with a population of just over 192,000 people. NCDs cause the majority of deaths in Samoa (IHME 2017), and adult obesity prevalence is the third highest in the world (IFPRI 2016). The types of foods available to the Samoan population have undergone a steep transition over the past six decades, from subsistence-based diets high in nutritious foods including root crops and other vegetables, fresh fruit, nuts, and locally sourced lean meats, to obesity-promoting diets high in non-traditional, often imported foods such as white rice and bread, and high-fat meats (Thow et al. 2011, 2017a; Wang et al. 2017). The Samoan economy is currently in transition from a subsistence-based to a cash-based economy (Amosa and Samson 2012), and those in cash-based economies have greater access to imported, processed foods (Charlton et al. 2016). Previous research from the Pacific describes increases in NCDs and NCD risk factors occurring concurrently with increases in imported processed food consumption (Brownell and Yach 2006; Hughes and Lawrence 2005; Seiden et al. 2012; Snowdon et al. 2013). Between 1978 and 2013, obesity prevalence in Samoa almost doubled – increasing from 28% to 53% in men and from 44% to 77% in women (Lin et al. 2017).

Research to date in Samoa has highlighted the urgent need for contextual, effective policy action on both food insecurity and obesity – and identified a lack of evidence regarding food purchasing and consumption patterns to inform such policy development (Ezeamama et al. 2006; Seiden et al. 2012; Thow et al. 2011). The present study sought to address these evidence gaps. The study focussed on women because in Samoa, obesity prevalence is almost 25% higher in women than in men (Lin et al. 2017); those living in female-headed households are less likely to have adequate nutrient intakes than male-headed households (Martyn et al. 2017); and women are more vulnerable to falling below the poverty line than men (Amosa and Samson 2012).

The specific aims were to: 1) explore the behavioral and demographic factors, and cultural values, which may influence diets in the study population – in other words, what are people eating, why are they eating it, and when, how, and where; 2) assess dietary behaviour to identify traditional and non-traditional dietary patterns in adult women; and 3) use a food security measurement tool to measure participants’ access to a nutritious diet.

Methods

Study design

This was a qualitative study that drew on validated instruments for data collection regarding food consumption, dietary patterns (DiBello et al. 2009), and food security (Shoae et al. 2007). We collected data from each participant by working through a structured questionnaire with three components, designed to address the study aims:

Aim 1: Explore factors which may influence diets in the study population. 1A) General questions about each participant's demographic characteristics and information about exercise frequency, alcohol consumption, and smoking. 1B) A series of semi open-ended questions exploring the reasons for participants' diet patterns, and how and where food is acquired, to assess decision-making and reasons for dietary patterns. Questions were based on the following topics: i) what foods constituted typical meals in the morning, during the day, and in the evening, and where and how these foods were acquired; ii) what participants perceive to be a healthy diet; iii) the place of food in Samoan culture; iv) what would need to change in order for participants to consume each food group in proportions that matched the "healthy plate" guidelines recommended by the Samoan Ministry of Health at the time of the survey (50% protective foods, 25% starchy energy foods, 25% bodybuilding foods) (pers comm Christina Soti-Ulberg, Principal Nutrition Officer, Samoa Ministry of Health; *Everyday Health* 2016); v) how availability of cooking equipment influenced participants' diets; and vi) whether participants' diets differed from what their grandparents ate.

Aim 2: Assess dietary behavior to identify traditional and non-traditional dietary patterns in our study population. The design of our food frequency questionnaire was based on the questionnaire used in a study of 785 adults in Samoa (DiBello et al. 2009) with input from Samoa-based members of our research team. The aim of our questionnaire was to ascertain patterns of food consumption in our study participants in order to then explore the reasons for such diet patterns, not to quantify exact dietary intake levels, which has been done elsewhere (DiBello et al. 2009; Wang et al. 2017).

Aim 3: Use a food security measurement tool to measure participants' access to a nutritious diet. Our food security measurement tool was an adapted Radimer/Cornell food security measurement tool informed by that used by Shoae et al. (2007).

Data collection

We conducted in-depth interviews with 41 women. The study population was mothers and female carers of children attending a primary school in Apia, the capital of Samoa. The school was selected as its attendees represent a broad range of demographic groups, including those who live in peri-urban

areas and those who commute to Apia from rural villages on a daily basis. We used a convenience sampling method led by school staff and participants were recruited via invitation letters. Participants were given detailed information about the study during an orientation session conducted by the study coordinators. Participation was voluntary and participants signed consent forms. No invitees refused to participate or withdrew during the study. The study was conducted in Apia in September 2016.

Participants were interviewed one at a time in a confidential environment (closed and empty room) on the school grounds. Interviews were performed and transcribed in English by two members of the research team. The interviewers discussed interpretation of the survey questions in detail prior to, during, and after the interviews to ensure consistency of interpretation. Trained research assistants were also present at each interview and translated the questions and responses into Samoan when it was required. All participants had sufficient English proficiency and translation was only occasionally required to clarify the meaning of certain words or phrases. Participants were reimbursed for their time with 30 WST (USD 12) per participant.

Data analysis

Aim 1: Questions about diet patterns, and facilitators and barriers to healthy eating, were analyzed and categorized in Microsoft Excel in order to determine the most important food consumption patterns in terms of overweight and obesity risk, and the reasons for these in the study population.

Aim 2: Food frequency result categorization was informed by the Pacific dietary guidelines (SPC 2002), which categorizes foods as: 1. energy foods, which are subdivided into starchy, sugary, and fatty energy foods – the former is recommended to be eaten frequently while consumption of sugary and fatty energy foods should be limited, 2. bodybuilding foods (protein), and 3. protective foods (fruit and vegetables). We included a fourth category for sugar-sweetened beverages. In our analysis bodybuilding foods were categorised into “more healthy” (stir-fried beef, beef curry, stir-fried chicken, chicken in earth oven, chicken cooked with fresh coconut, tinned fish, fish in fresh coconut cream, roasted pork, pork baked in earth oven) and “less healthy” (tinned corn beef, salted beef, barbequed chicken, fried chicken, fried fish, turkey tail, barbequed lamb chop, mutton, barbequed sausage) categories based on mode of preparation. Foods cooked in fresh coconut were included in the “more healthy” group due to the small quantity of coconut milk or cream, if any, consumed when foods are prepared in this way. We also note here the findings of DiBello et al.’s 2009 study, which reported that diets high in coconut products were not associated with an increased risk of metabolic syndrome in Samoa, although the mechanism for this is not known. Tinned fish was also included in the “more healthy” group as it has been found to be a good source of protein for populations in the Pacific and is

unlikely to lead to obesity (Charlton et al. 2016). Data for each food category was grouped by frequency of consumption in Microsoft Excel using simple descriptive statistics to identify the most common patterns of consumption.

Aim 3: Based on the food security questionnaire responses, each participant was categorized as household, individual, and/or child food insecure. Results were analyzed in Microsoft Excel to produce simple descriptive statistics and descriptive two-by-two tables to compare food security levels with three different demographic indicators: income levels, household decision-making status, and age.

Ethical approval was obtained from the National University of Samoa University Research Ethics Committee in July 2016 under the research project titled ‘Understanding the socio-demographic determinants of access to healthy food in urban Samoa’. Permission to conduct the research was also granted by the Government of Samoa Ministry of Education, Sports and Culture in August 2016.

Results

Sample characteristics

The 41 study participants were women whose ages ranged from 21 to 63 years, and the mean age was 39 years. Twenty percent ($n = 8$) of participants were engaged in paid employment and the remaining 80% ($n = 33$) cared for family full time and did not have their own source of income. Seventeen percent ($n = 7$) of participants had primary school as their highest education level, 76% ($n = 31$) participants had secondary school as their highest education level, none had an undergraduate degree as their highest level of education, and 7% ($n = 3$) had a postgraduate university degree. The number of adults in participants’ households ranged from 1 to 16, with a mean of 4 and a median of 3; and the number of children ranged from 1 to 35, with a mean of 4 and median of 3.

Seven percent of participants ($n = 3$) did no regular exercise, 15% ($n = 6$) reported exercising less than once per week, 41% ($n = 17$) exercised 1–3 times per week, and 34% ($n = 14$) reported exercising more than 3 times per week. Seventeen percent of participants ($n = 7$) drank alcohol regularly, and 15% ($n = 6$) smoked.

Facilitators and barriers to healthy eating

Food consumption patterns

Of the three food categories, the majority of participants ate only energy foods in the morning ($n = 31$, 76%) and throughout the day ($n = 26$, 63%). Meals eaten in the morning commonly consisted of an energy food item and a hot drink with sugar added. Examples included *panikeke* (deep-fried dough balls containing flour, sugar and mashed bananas) and coffee, or bread and

butter with tea. Typical foods consumed during the day were pre-prepared Chinese food from a local stall, or donuts from the school shop.

Meals eaten in the evening were more diverse. Half (51%, $n = 21$) of participants reported typically consuming an energy food with a bodybuilding food in their evening meal, and a further 17% ($n = 7$) ate an energy food with a bodybuilding food and a fruit or vegetable. Common examples of evening meals were chicken with soy sauce and taro in fresh coconut cream, or tinned tuna cooked either in fresh coconut milk or in oil with bread and butter, or white rice with chicken fried in oil. If the meal included vegetables, these were usually prepared in a soup.

For foods eaten in the morning and during the day, the most common source was a grocery store, followed closely by a local shop or the school canteen. Just under half of the foods eaten in the morning and during the day were typically prepared at home, and just over half were pre-prepared convenience foods. The most common source of food for the evening meal was a grocery store, followed by home-grown.

The two most commonly cited reasons for food item choice were affordability and physical availability. Social influences were also reported to be important, for example, one participant stated: “the ladies at school eat *panikeke*, so I join in as a social thing” (57-year-old participant).

Ease of storage and cooking was also reported to have an important influence on which energy food was eaten in the evening, especially for white rice. The main reasons given for the most common meat choices consumed in the evening were affordability and healthiness for tinned fish, and affordability and taste for chicken. Ease of cooking was also given as a reason for choosing some meats such as sausages.

Access and convenience

In response to questions about what would need to change for participants to meet the “healthy plate” guidelines (50% protective foods, 25% energy foods, 25% bodybuilding foods (Everyday Health 2016), more than half of responses cited affordability (financial accessibility) (60%, $n = 21$). The other reasons given in order of the number of mentions were: taste (23%, $n = 8$), overcoming habits (9%, $n = 3$), availability (6%, $n = 2$) and convenience (3%, $n = 1$). A typical response was: “I need the money to buy it all. There is not enough money to eat all food groups so I mainly eat meat and carbohydrates” (57-year-old participant).

When asked whether the cooking equipment available to participants would affect the type of meals they prepared, around half reported they would and the other half reported they would not. The affirmative comments indicated that cooking equipment may influence diet diversity: “Yes I would definitely cook differently – I would cook all kinds of foods that we would want to eat and it

would be easier to do my job” (41-year-old participant); “Yes – if I had a baking oven I could bake and prepare different types of food” (44-year-old participant).

Nutrition transition

There was evidence that a transition from traditional to non-traditional diets had taken place over the previous two decades. When respondents were asked whether their diet was different to that of their grandparents when they were their age, 73% (n = 30) said it was, whereas 15% (n = 6) said it was not. Twelve percent (n = 5) were undecided.

Some statements from participants who reported that their diets were different from those of their grandparents were: “Because my grandparents ate taro and banana with fresh coconut but nowadays we eat a lot of food like rice and bread” (30-year-old participant), “In the old days people ate what they found at their hands. Nowadays it depends on money” (51-year-old participant), and “My grandparents weren’t sick and now most people are sick” (27-year-old participant).

Participants who reported their diet was not different from their grandparents’ diet cited health reasons, for example, “I follow my grandparents’ footsteps eating balanced food with not too much sugar. I don’t like sugar and the diseases caused by sugar” (41-year-old participant).

Knowledge and culture

Responses to the question “What would you eat if you were going to eat a healthy and balanced meal?” varied. Fifteen percent (n = 6) reported that they would eat an energy food with a bodybuilding food and vegetables. Twenty-seven percent (n = 11) of respondents stated they would eat a meal that contains fruit and/or vegetables only, 22% (n = 9) would eat a meal containing a bodybuilding food and fruit or vegetables, 22% (n = 9) described a meal containing an energy food and vegetables, 10% (n = 4) would eat a meal containing an energy food with a bodybuilding food, and 5% (n = 2) would eat a meal containing an energy food only.

Responses to the question “What does food mean in Samoan culture?” fell into five key themes. The first theme was that food is the center of Samoan culture: “food is the most important thing in Samoan culture” (57-year-old participant), “In Samoa, food means your life depends on the food you eat ... and your family status” (47-year-old participant). The second theme was the view of food as a transactional tool to offer as a gift, and an indicator of social status: “when people come to my place the first thing I think to do is feed them” (50-year-old participant), “I feel shy and ashamed if we have no food to serve” (46-year-old participant). The third theme was that food is essential for survival and health: “food means in the Samoan way (*fa’a Samoa*), eat for your life” (30-year-old participant). The fourth theme was that food cannot be wasted: “It’s a must to use leftovers...” (25-year-old participant); “It’s

a must to use the food – don't waste it.” (29-year-old participant). The fifth theme was pride in Samoan food: “Our own local food is better for health and even for Samoan people to be stronger. If we eat overseas food we will get fat – it's not good for the body.” (41-year-old participant); “Our local foods are healthy – not like the overseas food” (41-year-old participant [different participant to the one that gave the previous quote]).

Food frequency questionnaire results

The most commonly eaten energy foods were white rice, white bread, taro, green cooking bananas, and *panikeke* (Figure 1). Seventy-three percent of participants ($n = 30$) reported consuming white bread five or more times per week, and the same proportion consumed white rice five or more times per week. Around one-third of participants consumed taro and green cooking bananas five or more times per week, respectively (37% [$n = 15$] for taro and 34% [$n = 14$] for green cooking bananas).

Of the sugary and fatty energy foods (SPC 2002), the most frequently consumed were *panikeke*, cheese curl snacks, and instant dried noodles. Almost three-quarters of participants (73%, $n = 30$) ate 7 or more different types of sugary or fatty energy foods at least once a week each.

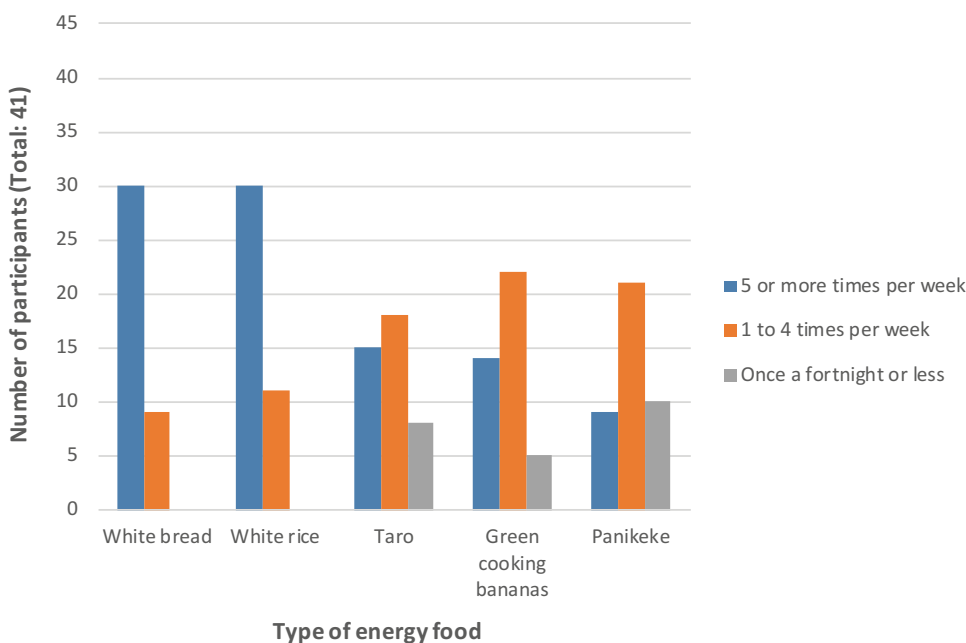


Figure 1. Most commonly eaten energy foods amongst study participants.

All participants ate bodybuilding foods at least once a week. Diversity was high: more than three-quarters of participants ($n = 32$, 78%) ate chicken, fish, and beef at least once a week. All participants ate chicken at least sometimes, 90% ($n = 37$) for beef and 95% ($n = 39$) for fish. Ninety percent of participants ($n = 37$) ate at least 3 or more “more healthy” bodybuilding meals per week, and 88% ($n = 36$) ate 3 or more “less healthy” bodybuilding meals every week.

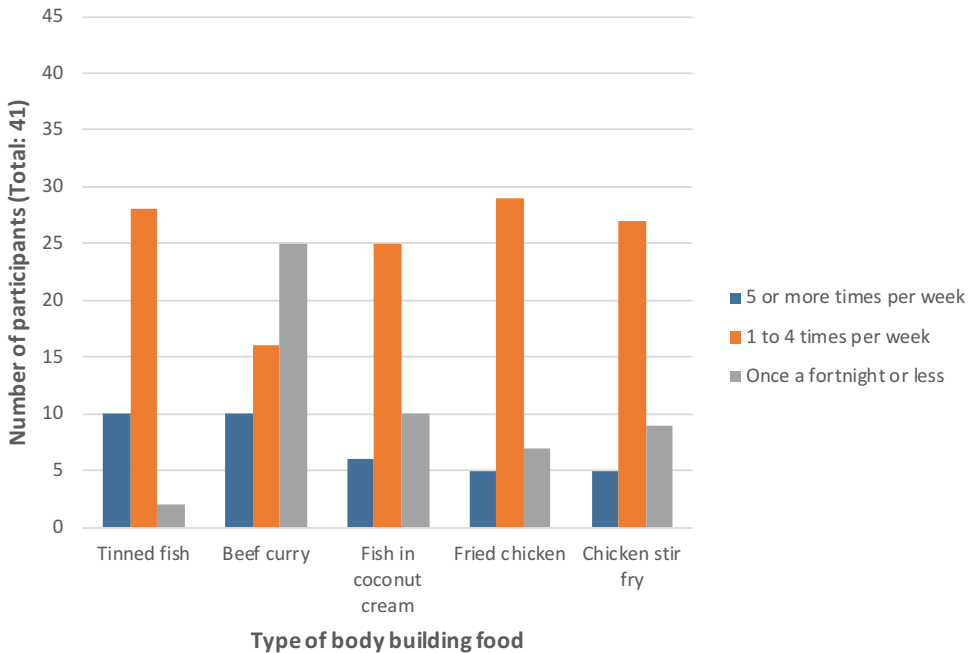


Figure 2. Most frequently eaten bodybuilding meals amongst study participants.

Forty-six percent ($n = 19$) ate less than one serving per day of vegetables. Fifty-nine percent of participants ($n = 24$) ate less than one serving per day of fruit. All participants reported eating vegetables at least once per week. Eighty-eight percent ($n = 36$) reported eating fruit at least 1–2 times per week, while two participants reported never eating fruit. The fruits and vegetables most commonly mentioned were pawpaw, mangoes, cabbage, and local spinach (*laupele*).

Ninety-five percent of participants ($n = 39$) reported some consumption of sugar-sweetened beverages, and 80% of participants ($n = 33$) consumed them daily. The most common beverage types consumed were sugar added to a hot drink, which was consumed daily by just under a third of participants (32%, $n = 13$), followed by 3-in-1 coffee sachets, which were consumed daily by 22% of participants ($n = 9$).

Food security

Eighty-five percent of participants (n = 35) reported experiencing household food insecurity, 73% (n = 30) were individually food insecure and the same proportion (73%, n = 30) reported insecurity in their ability to provide food for their children. Participant food security results grouped by income range, household decision-making status, and age are presented in Table 1.

Table 1. Participant food security status grouped by income range, household decision-making status, and age.

Income range and food security			
<i>Income range per week</i>	<i>Household food insecure % (n)</i>	<i>Individual food insecure % (n)</i>	<i>Child food insecure % (n)</i>
Less than 300 WST (<120 USD)	100% (11/11)	100% (11/11)	82% (9/11)
300 to 499 WST (120 to 200 USD)	82% (9/11)	64% (7/11)	82% (9/11)
500 to 700 WST (201 to 281 USD)	82% (9/11)	91% (10/11)	82% (9/11)
800 to 2000 WST (322 to 804 USD)	75% (6/8)	63% (5/8)	38% (3/8)
Household decision making and food security			
<i>Decision making status</i>	<i>Household food insecure % (n)</i>	<i>Individual food insecure % (n)</i>	<i>Child food insecure % (n)</i>
Participant decides	81% (13/16)	69% (11/16)	69% (11/16)
Joint decision	83% (10/12)	58% (7/12)	58% (7/12)
Other HH member decides	89% (8/9)	89% (8/9)	89% (8/9)
Husband decides	100% (4/4)	100% (4/4)	100% (4/4)
Age and food security			
<i>Age (years)</i>	<i>Household food insecure % (n)</i>	<i>Individual food insecure % (n)</i>	<i>Child food insecure % (n)</i>
20 to 29	82% (9/11)	64% (7/11)	55% (6/11)
30 to 39	83% (10/12)	67% (8/12)	67% (8/12)
40 to 49	88% (7/8)	75% (6/8)	88% (7/8)
50 and to 63	90% (9/10)	90% (9/10)	90% (9/10)

Discussion

Our study aimed to inform health and nutrition policy design by providing a deeper understanding of dietary risk factors for obesity in Samoa. We investigated dietary patterns and influences on food choice in 41 women in Samoa. The three most important findings for strategic policy design follow: i) cost was the

most important reason for food choice for foods consumed throughout the day and in the evening. This was the most important reason for low fruit and vegetable consumption, ii) participants reported high rates of consumption of sugary and fatty energy foods (snack foods), and sugar-sweetened beverages – along with high rates of food insecurity, and iii) the food frequency questionnaire findings from our small sample are in line with the existing evidence that the nutrition transition is underway in Samoa. Amongst our participants, traditional staple foods such as root crops had largely been replaced with non-traditional staples, particularly rice and white bread.

One of the most policy-relevant findings from our study was that cost was the most important influence on food choice. This finding is in line with those of Fa'alili-Fidow, McCool, and Percival (2014) who interviewed stakeholders in Samoa and New Zealand about the implications of Samoa's free trade agreements and the lack of economic means to choose healthier food options in Samoa was raised as a key concern. It also adds important insight to the questions posed by Seiden et al. (2012) who called for further research on reasons for the influence of food price on food consumption behavior in Samoa. In particular, cost was the most important reason for the low fruit and vegetable consumption amongst our participants, and consumption was especially low throughout the day when food was often purchased on an as-needed basis. Fruit and vegetable consumption was reported to be low amongst our study participants, with around half reporting eating vegetables less frequently than once per day. The 2014 Samoa Demographic and Health Survey reported that Samoan women fell far short of the WHO-recommended fruit and vegetable intake with only 1% of Samoan women reported consuming the recommended five or more servings per day (Government of Samoa 2015). A recent study conducted by the Food and Agriculture Organization based on 2013/2014 Samoa Household Income and Expenditure Survey data found that lowering the price of local fruit, vegetable, and animal products would increase their consumption (Martyn et al. 2017).

The seemingly contradictory co-occurrence of high rates of food insecurity found in our study, given the already known high obesity rate amongst women in Samoa (Lin et al. 2017), may be explained by the high rates of consumption of low-cost, energy-dense foods such as white bread and packaged, imported snack foods, and sugary beverages seen in this study. In our study *panikeke* was one of the most frequently consumed energy foods, and the majority of participants ate sugary or fatty energy foods (snack foods) seven or more times per week. Fatty meat consumption was high. These foods were also found to be frequently consumed in larger, more statistically rigorous studies in Samoa (DiBello et al. 2009; Wang et al. 2017). Based on our simple descriptive statistics, all types of food insecurity occurred at a higher rate among the lowest income group in our study than in the highest income group. This is an area in need of further research but it is

possible that this effect could be working in two directions: the consumption of low-cost, energy-dense foods amongst food-insecure people is a likely mechanism in the food insecurity-obesity link seen in low- and middle-income countries (Farrell et al. 2017), while dependence on food imports may increase vulnerability to food insecurity in the Pacific (Hughes and Lawrence 2005). Low level of women's autonomy within the household has the potential to exacerbate this issue. We found that where our study participants were involved in decision-making about household spending on groceries, there was a lower level of food insecurity reported than if the participant's husband or another household member decided, although we note our findings are based on a small qualitative study and further detailed research on a larger scale is required in this area which considers in detail factors such as family roles and social norms of extended families.

The majority (80%) of our participants were not engaged in paid employment. In Samoa, as a result of social, economic and cultural factors, men tend to hold greater power within and outside the home, and women's vulnerability is increasing with the move to a cash economy because women are usually engaged in unpaid family care and are underrepresented in the paid workforce (Amosa and Samson 2012). This reflects the findings of various studies worldwide – a 2011 United Nations Children's Fund report cited evidence from South Asia, Latin America, the Caribbean, and sub-Saharan Africa of an improvement in nutritional status in children in households with increased women's within-household decision-making power (UNICEF 2011).

Recent evidence from Samoa indicates that consumption of diets higher in traditional, local foods instead of imported foods may help prevent metabolic syndrome – a measure of risk for NCDs (Wang et al. 2017). The preference for local foods and belief that local foods were healthier that was evident among participants in this study – similar to that found by Jones et al. (2011) – suggests that policy intervention to increase access to affordable, healthy food may serve to stimulate demand. In particular, such demand could be leveraged to enhance the economic competitiveness and physical availability of local foods.

In light of recent research identifying opportunities for strategic nutrition policy that targets consumer behavior (Hawkes et al. 2015; Thow et al. 2017b), a number of other findings from this study can inform policy design in Samoa. First, the finding that food eaten throughout the day was often not prepared in the home; and the fact that such foods were typically energy dense, high-fat foods suggests that interventions that focus on increasing physical and economic availability of pre-prepared healthy food options close to schools and workplaces have strong potential to improve food consumption behavior in our study setting. This supports the conclusions of other recent research in Samoa, that recommended availability of healthy foods such as fresh fruit and vegetables be improved through policy interventions

targeting the informal food market, as well as the formal sector (Thow et al. 2017a). Second, knowledge of what constitutes a healthy meal was low in the present study. When asked what constituted a healthy and balanced meal, only 15% of the participants described a balanced meal. Low nutrition education has been attributed to contribute to poor health in other PICs, for example, Dancause et al.'s (2013) study examined obesogenic diet behavior patterns in Vanuatu and recommended nutrition policies place priority on education and messaging. Charlton et al.'s 2016 review on food security in the Pacific showed that lack of nutrition education was an important barrier to healthy eating in the Pacific (Charlton et al. 2016). Third, Samoan culture must be considered when designing food policy. Some aspects of Samoan culture have the potential to be leveraged in diet improvement interventions, for example, the strong practice of sharing foods in a social setting suggests people will have similar dietary habits as their families and peer groups – a factor which should be taken into account when designing nutrition education policy and programs. Some cultural norms described by our study participants could encourage obesogenic dietary behaviours, such as the notion that “*e sau lava taeao ma ona 'ai*” (tomorrow will come with its own food), meaning food prepared to be eaten should be eaten at the time and not stored for later – which may lead to overconsumption (Fiti-Sinclair 2004), and nutrition education policy and programs should be sensitive to such conventions.

Our study strengthens current evidence that food pricing should be a priority in nutrition policymaking in Samoa – both in the form of taxes to increase the price of unhealthy foods and beverages, and subsidies to reduce the cost of healthy foods such as vegetables (Jones et al. 2011; Thow, Downs, and Jan 2014; Thow et al. 2017a). It is important that such policies are developed using a transparent and scientifically rigorous approach to rank all foods available on the market, both local and imported, from most to least healthy. It is also important for inter-sectoral collaboration to take place when developing food policy, for example, between health and finance sectors within-country, as well as the need for the health sector to engage actively with international trade negotiations (Thow et al. 2017a). In 2016 the Samoan government introduced a new tax on high-sugar and some high-salt foods (Samoa Arrangement of Provisions 2016), and it will be important to monitor food consumption at a national level to measure its impact (Thow, Downs, and Jan 2014). On the side of subsidies for healthy food consumption, a 2015 study into food policy options to prevent NCDs in Samoa was conducted in partnership between the Ministry of Health Samoa, the World Health Organization, and the Food and Agriculture Organization. The study recommended two other policy approaches aside from increasing availability of healthy foods in the formal and informal food markets. These were: i) increased focus on nutrition in agricultural production programs, and ii) including designated support for fruit and vegetable consumption in

social welfare benefits (Thow et al. 2017a). A prospective cohort study using data from 18 low- and middle-income countries published in *The Lancet* found that legume consumption was inversely associated with cardiovascular and non-cardiovascular mortality (Miller, Mente, and Dehghan et al. 2016). This food group may be a suitable alternative where fresh fruit and vegetables are difficult to access due to cost and storage and transport challenges.

Limitations

This study fills an important policy-relevant gap in the literature through exploring the interaction between women in Samoa and their food environments. The strength of qualitative nutrition research is in increasing our understanding of why and how people follow certain diet behaviors (Swift and Tischler 2010). The present study was designed to understand dietary patterns, preferences, and interactions with food environments (as per our analysis and discussion), not exact food intake levels. Because the comparisons between food security and income, household expenditure decision-making, and age are descriptive and cross-sectional, and our sample was not statistically representative of the Samoan population, it is not possible to ascertain causation. These relationships should be a focus of larger studies in the future.

The food frequency questionnaire relied on self-reported information, which could have introduced bias. The method used for income measurement also relied on participant self-reporting and did not account for funds unavailable for expenditure due to household debt, traditional social wealth distribution systems or church obligations (Amosa and Samson 2012). The food security measurement tool was based on the best available resources, however, there is no officially validated food security measurement tool for Samoa.

Our study population included families who lived in peri-urban or semi-rural environments who commuted to Apia daily. We did not disaggregate our analysis by these groups because by commuting to Apia daily, all participants had access to the urban food environment. Additional forces are likely to be at play for those who live entirely in rural settings, such as higher vulnerability to cash flow fluctuations with a change in local produce prices, and higher prices of imported foods due to high transport costs (Amosa and Samson 2012). As people living in rural areas constitute 81% of the Samoan population (SBS 2017), future research should examine on a larger scale and in detail the differences between the food environments of those who live in rural areas and infrequently access the capital, and those with daily access to the urban food environment.

Conclusions

We used a multi-pronged approach to measure food access and explore the relationships between socio-demographic moderators of dietary patterns

associated with obesity in women in order to gain a nuanced and context-specific understanding of this complex issue. By collecting primary data on influencers of food access from a cohort of 41 women in urban Samoa, we found that cost was the most important reason for food choice, food insecurity levels were high, and participants reported high rates of consumption of sugary and fatty energy foods (snack foods), and sugar-sweetened beverages.

The myriad factors shown to contribute to food consumption patterns explored in our study indicates that any one policy approach alone is very unlikely to work. Rather, future nutrition policymaking in Samoa should focus on a package of policy approaches, including: i) increasing prices of obesogenic foods which currently make up too high a portion of Samoan diets, along with decreasing prices of healthy foods such as vegetables, ii) increasing the amount of affordable healthy food options available from both formal and informal food vendors, iii) improving and continuing to monitor food security, especially amongst high-risk members of the population such as women and those on low incomes, iv) education campaigns with clear messaging, including differentiation between staple energy foods which should be eaten regularly, and sugary energy foods which should be eaten only occasionally (SPC 2002), which promote traditional diets high in local fruits and vegetables. It is important to continue to strive for cross-sectoral action including input of the health sector into trade decisions, and acknowledging the likely health benefits of increasing women's paid employment (Fa'alili-Fidow, McCool, and Percival 2014). Prospective studies on monitoring impact of these policy interventions will be very valuable to improving nutrition policy further in Samoa, with lessons potentially adaptable to other low- and middle-income country settings.

Data sharing policy

The data that support the findings of this study are available from the corresponding author, PF, upon reasonable request.

Disclosure statement

The authors declare no conflict of interest.

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References

- Amosa, D., and M. Samson. 2012. AusAID Pacific social protection series: poverty, vulnerability and social protection in the Pacific: Samoa country case study, Australian Agency for International Development (AusAID), Canberra, ACT, Australia. <https://dfat.gov.au/about-us/publications/Documents/samoa-case-study.pdf>
- Brownell, K. D., and D. Yach. 2006. Lessons from a small country about the global obesity crisis. *Globalization and health* 2:11. Published online September 12, 2006. doi:10.1186/1744-8603-2-11.
- Charlton, K. E., J. Russell, E. Gorman, Q. Hanich, A. Delisle, B. Campbell, and J. Bell. 2016. Fish, food security and health in Pacific Island countries and territories: a systematic literature review. *BioMed Central Public Health* 16 (285). doi:10.1186/s12889-016-2953-9.
- Dancause, K. N., M. Vilar, M. Wilson, L. E. Soloway, C. DeHuff, C. Chan, L. Tarivonda, R. Regenvanu, A. Kaneko, L. K. Lum, et al. 2013. Behavioral risk factors for obesity during health transition in Vanuatu, South Pacific. *Obesity* 21 (1):E98–E104. doi:10.1002/oby.20082.
- DiBello, J. R., S. T. McGarvey, P. Kraft, R. Goldberg, H. Campos, C. Quested, T. S. Laumoli, and A. Baylin. 2009. Dietary patterns are associated with metabolic syndrome in adult Samoans. *The Journal of nutrition* 139 (10):1933–43. doi:10.3945/jn.109.107888.
- Dinour, L. M., D. Bergen, and M. C. Yeh. 2007. The food insecurity-obesity paradox: a review of the literature and the role food stamps may play. *Journal of the American Dietetic Association* 107 (11):1952–61. doi:10.1016/j.jada.2007.08.006.
- Everyday Health. 2016. What Does a Diabetes-Friendly Meal Look Like? Accessed February 13, 2018. <https://www.everydayhealth.com/type-2-diabetes/diet/whats-on-your-healthy-plate/>
- Ezeamama, A. E., S. Viali, J. Tuitele, and S. T. McGarvey. 2006. The influence of socioeconomic factors on cardiovascular disease risk factors in the context of economic development in the Samoan archipelago. *Social science & medicine* 63 (10):2533–45. doi:10.1016/j.socscimed.2006.06.023.
- Fa'alili-Fidow, J., J. McCool, and T. Percival. 2014. Trade and health in Samoa: views from the insiders. *BioMed Central Public Health* 14:309. doi:10.1186/1471-2458-14-309.
- FAO, IFAD, UNICEF, WFP and WHO. 2017. *The state of food security and nutrition in the World 2017*. Building resilience for peace and food security. Rome, Italy. <http://www.fao.org/policy-support/resources/resources-details/en/c/1107528/>
- Farrell, P., A. Thow, S. Abimbola, N. Faruqui, and J. Negin. 2017. How food insecurity could lead to obesity in LMICs: When not enough is too much: A realist review of how food insecurity could lead to obesity in low- and middle-income countries. *Health promotion international* Published online May 24 2017. doi:10.1093/heapro/dax026.
- Fiti-Sinclair, R. 2004. Knowledge, Attitudes, Beliefs and Practices related to the Consumption of Fruit and Vegetables in Samoa. Apia, Samoa: Food and Agriculture Organization of the United Nations. Accessed January 10, 2019. <http://www.fao.org/docrep/015/an432e/an432e00.pdf>.
- Forouzanfar, M.H., L. Alexander, H. R. Anderson, V. F. Bachman, S. Biryukov, M. Brauer, R. Burnett, D. Casey, M. M. Coates, A. Cohen, et al. 2015. Global, regional, and national

- comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet* 386 (10010):2287–2323. doi:10.1016/S0140-6736(16)31679-8.
- Franklin, B., A. Jones, D. Love, S. Puckett, J. Macklin, and S. White-Means. 2012. Exploring mediators of food insecurity and obesity: a review of recent literature. *Journal of community health* 37 (1):253–64. doi:10.1007/s10900-011-9420-4.
- Government of Samoa. 2015. Samoa Demographic and Health Survey 2014. Apia, Samoa: Bureau of Statistics.
- Hawkes, C., T. G. Smith, J. Jewell, J. Wardle, R. A. Hammond, S. Friel, A. Thow, and J. Kain. 2015. Smart food policies for obesity prevention. *The Lancet* 385 (9985):2410–21. doi:10.1016/S0140-6736(14)61745-1.
- Hough, G., and M. Sosa. 2015. Food choice in low income populations – a review. *Food quality and preference* 40:334–42. doi:10.1016/j.foodqual.2014.05.003.
- Hughes, R. G., and M. A. Lawrence. 2005. Globalisation, food and health in Pacific Island countries. *Asia Pacific journal of clinical nutrition* 14 (4):298–306.
- Institute for Health Metrics and Evaluation (IHME). 2017. Samoa. Accessed September 4, 2017. <http://www.healthdata.org/samoa>.
- International Food Policy Research Institute (IFPRI). 2016. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. Washington, DC, USA.
- Islam, S. M. S., T. D. Purnat, N. T. A. Phuong, U. Mwingira, K. Schacht, and G. Fröschl. 2014. Non-Communicable Diseases (NCDs) in developing countries: a symposium report. *Globalization and health* 10 (81). doi: 10.1186/s12992-014-0081-9.
- Jones, M. P. J., H. Dempewolf, R. Armstrong, K. Gallucci, and N. G. Tavana. 2011. Staple food choices in Samoa: do changing dietary trends reflect local food preferences? *Ethnobotany Research and Applications* 9. doi:10.17348/era.9.0.455-462.
- Lin, S., T. Naseri, C. Linhart, S. Morrell, R. Taylor, S. T. McGarvey, D. J. Magliano, and P. Zimmet. 2017. Trends in diabetes and obesity in Samoa over 35 years, 1978–2013. *Diabetic Medicine* 34 (5):654–61. doi:10.1111/dme.13197.
- Martin-Fernandez, J., F. Caillavet, A. Lhuissier, and P. Chauvin. 2014. Food insecurity, a determinant of obesity? – an analysis from a population-based survey in the Paris metropolitan area, 2010. *Obesity facts* 7 (2):120–29. doi:10.1159/000362343.
- Martyn, T., D. Yi, A. Romeo, and L. Fiti. 2017. Dietary patterns of households in Samoa: identifying the factors and food items most important to understanding nutrition. Food and Agriculture Organization of the United Nations, Apia, Samoa.
- Miller, V., A. Mente, M. Dehghan, S. Rangarajan, X. Zhang, S. Swaminathan, G. Dagenais, R. Gupta, V. Mohan, S. Lear, et al. 2016. Prospective Urban Rural Epidemiology (PURE) study investigators. 2017. Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study. *The Lancet* 390 (10107):2037–2049. doi:10.1016/S0140-6736(17)32253-5.
- Samoa Arrangement of Provisions. 2016. Accessed January 23, 2018. <http://www.palemene.ws/new/wp-content/uploads/Bills/2016/03.July/Excise-Tax-Rates-Amendment-Bill-2016-Eng.pdf>.
- Samoa Bureau of Statistics (SBS). 2017. Population & Demography Indicator Summary. Accessed February 13, 2018. <http://sbs.gov.ws/index.php/population-demography-and-vital-statistics>.
- Secretariat of the Pacific Community (SPC). 2002. Background materials for four posters: Healthy Eating in the Pacific, Pacific Guide to Healthy Eating, Eat Less of These Foods for Good Health, The Path to a Healthier Pacific: A detailed manual for local trainers. Secretariat of the Pacific Community, Noumea.

- Seiden, A., N. L. Hawley, D. Schulz, S. Raifman, and S. T. McGarvey. 2012. Long-term trends in food availability, food prices, and obesity in Samoa. *American Journal of Human Biology* 24 (3):286–95. doi:10.1002/ajhb.22237.
- Shoae, N. Z., N. Omidvar, M. Ghazi-Tabatabaie, A. H. Rad, H. Fallah, and Y. Mehrabi. 2007. Is the adapted Radimer/Cornell questionnaire valid to measure food insecurity of urban households in Tehran, Iran? *Public health nutrition* 10 (8):855–61. doi:10.1017/S1368980007441465.
- Snowdon, W., A. Raj, E. Reeve, R. L. T. Guerrero, J. Fesaitu, K. Cateine, and K. Guignet. 2013. Processed foods available in the Pacific Islands. *Globalization and health* 9:53. Published online: 25 Oct 2013. doi:10.1186/1744-8603-9-53.
- Swift, J. A., and V. Tischler. 2010. Qualitative research in nutrition and dietetics: getting started. *Journal of Human Nutrition and Dietetics* 23 (6):559–66. doi:10.1111/j.1365-277X.2010.01116.x.
- Thow, A., S. Downs, and S. Jan. 2014. A systematic review of the effectiveness of food taxes and subsidies to improve diets: understanding the recent evidence. *Nutrition reviews* 72 (9):551–65. doi:10.1111/nure.12123.
- Thow, A., P. Heywood, J. Schultz, C. Quested, S. Jan, and S. Colagiuri. 2011. Trade and the nutrition transition: strengthening policy for health in the Pacific. *Ecology of food and nutrition* 50 (1):18–42. doi:10.1080/03670244.2010.524104.
- Thow, A., E. Reeve, T. Naseri, T. Martyn, and C. Bollars. 2017a. Food supply, nutrition and trade policy: reversal of an import ban on turkey tails. *Bulletin of the World Health Organization* 95:723–25. doi:10.2471/BLT.17.192468.
- Thow, A., H. Schoenfeld, R. Dekock, A. Viljoen, G. Durand, G. Gericke, and J. Negin. 2017b. Policy for the complex burden of malnutrition in Africa: a research agenda to bring consumers and supply chains together. *Public health nutrition* 20 (6):1135–39. doi:10.1017/S1368980016003050.
- United Nations Children’s Fund (UNICEF). 2011. Gender influences on child survival, health and nutrition: a narrative review. Accessed February 10, 2018. http://www.unicef.org/gender/files/Gender_Influences_on_Child_Survival_a_Narrative_review.pdf.
- Wang, D., N. L. Hawley, A. A. Thompson, V. Lamako, M. S. Reupena, S. T. McGarvey, and A. Baylin. 2017. Dietary patterns are associated with metabolic outcomes among adult Samoans in a cross-sectional study. *The Journal of nutrition* 147 (4):628–35. doi:10.3945/jn.116.243733.
- Wells, J. C. K., A. A. Marphatia, T. J. Cole, and D. McCoy. 2012. Associations of economic and gender inequality with global obesity prevalence: understanding the female excess. *Social science & medicine* 75 (3):482–90. doi:10.1016/j.socscimed.2012.03.029.
- World Health Organization (WHO). 2016. Media centre fact sheet No.394: Healthy diet. Accessed January 3, 2018. <http://www.who.int/mediacentrefactsheets/fs394/en/>.
- World Health Organization (WHO). 2017. Obesity and overweight. Accessed November 3, 2017. <http://www.who.int/mediacentre/factsheets/fs311/en/>.