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The tide of dietary risks for noncommunicable diseases in Pacific Islands: an analysis of population NCD surveys

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Abstract

Objective: To describe changes over time in dietary risk factor prevalence and non-communicable disease in Pacific Island Countries (PICTs).

Methods: Secondary analysis of data from 21,433 adults aged 25–69, who participated in nationally representative World Health Organization STEPs surveys in 8 Pacific Island Countries and Territories between 2002 and 2019. Outcomes of interest were changes in consumption of fruit and vegetables, hypertension, overweight and obesity, and hypercholesterolaemia over time. Also, salt intake and sugar sweetened beverage consumption for those countries that measured these.

Results: Over time, the proportion of adults consuming less than five serves of fruit and vegetables per day decreased in five countries, notably Tonga. From the most recent surveys, average daily intake of sugary drinks was high in Kiribati (3.7 serves), Nauru (4.1) and Tokelau (4.0) and low in the Solomon Islands (0.4). Average daily salt intake was twice that recommended by WHO in Tokelau (10.1 g) and Wallis and Futuna (10.2 g). Prevalence of overweight/obesity did not change over time in most countries but increased in Fiji and Tokelau. Hypertension prevalence increased in 6 of 8 countries. The prevalence of hypercholesterolaemia decreased in the Cook Islands and Kiribati and increased in the Solomon Islands and Tokelau.

Conclusions: While some Pacific countries experienced reductions in diet related NCD risk factors over time, most did not. Most Pacific adults (88%) do not consume enough fruit and vegetables, 82% live with overweight or obesity, 33% live with hypertension and 40% live with hypercholesterolaemia. Population-wide approaches to promote fruit and vegetable consumption and reduce sugar, salt and fat intake need strengthening.

Keywords: Pacific Islands, Dietary risk, Noncommunicable diseases, Adults, Change over time

All methods were carried out in accordance with relevant guidelines and regulations

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Background

Noncommunicable diseases (NCDs), including cardiovascular disease, diabetes, cancer and respiratory disease account for over 70% of worldwide mortality [1]. The majority of this mortality burden (80%) is borne by low and middle-income countries (LMICs) [2–4], where NCDs have a substantial impact on individuals, households and health care systems [5, 6]. Additionally, around 48% NCD deaths in LMICs are considered premature,



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affecting people under the age of 70 years [7, 8]. The disproportional impact of NCDs on the 'working-age' population in LMICs compromises productivity, economic growth and development [9, 10]. Addressing NCDs through improved prevention and treatment has been recognised as a key target in the Sustainable Development Goals.

NCDs and their risk factors are the result of a complex interplay between genes, behaviors and environment [11]. Overweight and obesity, linked primarily to an overconsumption of dietary energy, is strongly associated with an increased prevalence of diabetes, hypertension and cardiovascular disease, as well as increased NCD-related mortality [12]. Food and diet are particularly strong determinants of NCDs including type 2 diabetes [12, 13], cardiovascular disease [14, 15] and a number of cancers [12, 15]. Dietary factors with the strongest correlation to mortality include high sodium intake, low intake of whole grains and low intakes of fruit and vegetables [16–18]. Diets that are high in sugar [19] and fat (particularly trans-fats and saturated fats) [20] also increase NCD risk. Collectively, dietary risks are the second leading risk factor attributable to global mortality for females, and the third leading risk for males [13].

Dietary risk factors in particular are of concern in Pacific Island countries, where nearly 3 of every 4 deaths are due to NCDs [21]. Pacific Island countries comprise 9 out of 10 of the most obese nations in the world, and a diabetes prevalence of 40% in adults is common among Pacific countries [22]. Studies have demonstrated a correlation between metabolic syndrome and NCDs including diabetes, cancer and cardiovascular diseases, and substantial dietary transition occurring in Pacific Island countries in recent years [23–26]. The dietary transition involved a displacement of diets traditionally high in fruit and vegetables and other fresh produce high in fibre, vitamins and low dietary sodium and fat [24, 27–29] with processed foods high in sodium, hydrogenated fat and sugar, including edible oils, sauces and condiments, noodles, baked goods and processed meats [23, 24, 26, 27, 29]. These changes were triggered by multiple factors, including socioeconomic changes and increasing participation in globalised food systems [30]. The dietary transition has seen a 40% increase in processed food sales in Pacific countries between 2004 and 2018 [29].

Concerned about the impact of these changes on individual and community health as well as national economies [32], Pacific governments have introduced a range of population-wide initiatives for preventing diet related NCDs [33–35]. Pacific countries have implemented taxes on SSB [31] and/or policies to reduce sales and marketing of unhealthy food in schools [32, 33]. Tonga, Samoa and Fiji have used import excises to reduce sales of unhealthy

fats and oils [34, 35] or fatty meat cuts [36, 37]. Regionally, countries report against a framework for monitoring NCD prevention actions [38, 39]. A stabilisation of diet-related NCD risk factors would be a promising sign preventive efforts are working.

However, there is a dearth of dietary intake data in the Pacific Islands [40], and the high cost of conducting national food surveys [43], together with the limited capacity for data collection and analysis [41, 42], have made it difficult to examine the impact of policy on diet and NCDs. Also, few studies have examined changes in risk factor prevalence over time [43].

In this paper we examine how diet-related NCD risk factors have changed in 8 Pacific countries that have completed two WHO STEPs (STEPwise approach to surveillance) surveys [46].

Methods

Data source

STEPS surveys apply standardized and internationally recognized methods to collect data on a range of NCD risk factors including dietary behaviors (including sodium, sugar, fruit and vegetable intake), risk factors (hypertension, hypercholesterolemia, overweight and obesity) and health outcomes (diabetes) [44]. Since 2002, STEPs have been conducted in countries across the Pacific every 5 to 10 years. We conducted a secondary analysis using summary data from STEPS reports. The survey targets a representative sample of adults aged between 18 and 69 years and gathers data via questionnaires, physical measurements and biochemical measurements. It has been designed so that each country measures a core set of risk factors using standardized methods so that comparisons can be made over time within a country and between countries. Countries have the option of adding modules on additional risk factors or questions that capture more information on the core set of risk factors [43]. Full detail on STEPS survey methodology is described elsewhere [44]. Published STEPS reports were accessed online from WHO and/or governments websites. At the time of this analysis, no Pacific country had published more than two STEPs reports. Because we sourced publicly available data ethics approval was not sought.

Data extraction

We extracted data on modifiable dietary risk factors (fruit and vegetable intake) and specific dietary conditions (overweight and obesity, hypertension, hypercholesterolemia) that were collected in a similar manner across two time points. Most recent surveys in PICTs have added behavioral questions on intakes of sugar or sodium. Because of a growing awareness of the NCD

risk associated with sugar and salt in PICTs [31, 45, 46] and focus in food policy [47, 48] we also report sugar sweetened beverage (SSB) consumption and sodium intake where they were measured in the second round (these were largely absent from the first round). Data was extracted into an excel form by two different authors. Because we were interested in risk profiles by sex, data were disaggregated by sex and age strata, usually capturing samples between 25 and 64 years of age in 5 years, 10 years or twenty-year groups. We elected not to extract data on hyperglycemia given issues with blood glucose measurement in some STEPs surveys [49]. Table 1 provides definitions for the extracted risk factors and conditions.

Data analysis and reporting

We employed a direct standardization technique to calculate age standardized rates for each countries in preference to using crude age specific rates could be misleading because of the differences in underlying composition of the populations. The WHO standard population grouped in 5-year intervals [50] was used to calculate age-standardized rates for each indicator using *stdize* command in Stata v17.0 [51]. A 95% confidence interval was calculated using the methods described by Breslow and Day [52]. For Tokelau, the confidence interval was not calculated as the whole target population was included in the survey. Data was only from the STEPs surveys in bands of 20 years or greater than 20 years (45–64 years / 45–69 years) and the Cook Islands and Wallis and Futuna used a non-standard age group band of 18–44 years in the second-round surveys. Hence, unstandardized rates have been presented for these countries along with confidence intervals that have been computed using exact binomial method.

We present data for individual countries and pooled prevalence between survey periods to give an indication of overall changes in risk factor prevalence for these 8 countries. The age-standardised rates were pooled using *metaprop* command to calculate the

pooled prevalence using a fixed effect model [53]. The pooled weighted estimate was calculated using the inverse variance method after Freeman-Tukey Double Arcsine Transformation to stabilize the variances [53]. Exact binomial confidence interval was calculated for each pooled estimate. Test of proportion was conducted to examine the statistical difference between two rounds of surveys.

Results

Eight countries, Cook Islands, Fiji, Kiribati, Nauru, Solomon Islands, Tokelau, Tonga and Wallis and Futuna, have two published NCD survey reports giving us an overall sample of 12,076 for first round survey and 9357 for second round survey (Tables 2 and 3). The time between surveys in each country ranged from 8 to 11 years (mean = 9.75 years).

Fruit and vegetable consumption

Figure 1 reports age-standardized prevalence of adults consuming less than 5 serves of fruits and vegetables per day. Prevalence decreased significantly in Tonga from 92.2% (95%CI: 90.4, 94.0) to 73.4% (95%CI: 71.6, 75.1) over 8 years, and in the Solomon Islands from 93.8% (95%CI: 92.6, 94.9) to 87.4% (95%CI: 85.9, 88.9) over 9 years. In both countries statistically significant reductions were observed for both women and men (see Supplementary File 1). In Nauru and Wallis and Futuna, prevalence decreased statistically significantly for men only, from 98.4% (95%CI: 97.6, 99.4) to 94.84% (95%CI: 92.5, 97.2) and 96.3% (95%CI: 92.3, 100.3) to 88.3 (95%CI: 83.9, 91.8) respectively. In Tokelau on the other hand, prevalence increased from 90.8 to 96.5% over the 9 years between 2006 and 2015.

The pooled analysis revealed a significant decrease in the proportion of adults consuming less than 5 serves of fruit and vegetables per day, from 94% (95%CI: 93.9,

Table 1 Risk factor definitions

Risk factor/Condition	Definition
Fruit and vegetable consumption	Proportion of participants consuming less than 5 servings of fruits & vegetables per day
Sugar-sweetened beverage consumption	Mean number of servings of sugary drinks consumed per day (defined as one can or one large glass of fizzy drink, squash, cordial, drink concentrates and juice drinks, excluding pure unsweetened fruit juice).
Added salt	Proportion of people who reported always or often added salt to or food before or while eating
Salt intake	Mean salt intake (g/day) based urinary sodium and creatinine
Overweight and obesity	Proportion of participants living with overweight or obesity (BMI greater than or equal to 25)
Hypertension	Proportion of people with SBP > 140 and/or DBP > 90 mmHg and/or currently on medication for raised BP
Hypercholesterolemia	Number of participants with raised total cholesterol (≥ 5.2 mmol/L or ≥ 200 mg/dl)

Table 2 Number of participants with information on dietary NCD risk factors in survey round one

Country	Survey 1	Age range	Five fruit and veg	Overweight and obesity	Hypertension	Hypercholesterol
Cook Islands	2003	45–64	985	939	950	871
Fiji	2002	25–64	NA	4190	5012	NA
Kiribati	2004	25–64	1329	1351	1368	741
Nauru	2004	25–64	1653	1710	1705	1726
Solomon Islands	2005	25–69	1910	1665	1702	470
Tokelau	2006	25–64	392	427	333	427
Tonga	2004	24–64	848	844	848	847
Wallis and Futuna	2009	45–64	146	162	158	NA
Total			7263	11,279	12,076	5236

Table 3 Number of participants with information on dietary NCD risk factors in survey round two, and time lapsed between surveys

Country	Survey 2	Approximate timeframe since Survey 1 (years)	Age range	Five fruit and veg	SSB Daily	Overweight and obesity	Hypertension	Hyperglycemia	Hypercholesterol
Cook Islands	2013	10	45–64	611	NA	430	411	346	368
Fiji	2011	9	25–64	NA	NA	2526	2548	2378	NA
Kiribati	2015	11	30–69	1329	1900	1351	1368	861	741
Nauru	2015	11	25–64	838	1317	861	691	667	668
Solomon Islands	2015	10	30–69	1856	2443	1440	1472	1340	1342
Tokelau	2015	9	30–69	390	547	384	387	382	288
Tonga	2012	8	25–69	2438	NA	2273	2332	2287	2065
Wallis and Futuna	2019	10	45–64	661	NA	626	628	606	NA
Total				8123	6207	9195	8187	8851	9195

94.5) to 88% (95%CI: 87.5, 88.2), significant for both men and women.

Sugary drink consumption

Four of the countries measured sugary drink consumption in Survey 2. Adults in Kiribati, Nauru and Tokelau (across both sexes) reported consuming over 3.5 sugary drinks each per day. In contrast, Solomon Islands adults reported consuming an average of 0.4 sugary drinks per day. SSB consumption did not vary significantly between men and women (Table 4).

Adding salt to meals before consumption

Mechanisms for measuring salt varies significant across the included surveys. Five countries asked about ‘always or often’ adding salt before eating or when eating (Cook, Kiribati, Tokelau, Solomon Islands, Nauru) (Table 5). Nauru and Cook Islands reported the percent of participants ‘always or often’ eating processed food high in salt, and applied a likert scale querying

participants on the importance of lowering dietary salt. Because of this variation we only extracted data on the percent of adults in Survey 2 ‘always or often’ adding salt to meals before eating. The proportion of adults ‘always or often’ adding salt to meals before eating ranged from 31.6% in Tokelau (higher for women than men) to 65.4% (60.5–70.3) in Nauru. Based on urinary analysis, adults in Tokelau, consumed an average of 10.1 g/day of salt, and consumption was higher for men (12.0 g/day) than women (8.6 g/day). In Wallis and Futuna salt consumption was 10.2 g/day, also higher for men (11.7 g/day) than women (8.8 g/day).

Overweight and obesity

Figure 2 reports age-standardized prevalence of adults living with overweight and obesity. There was a statistically significant increase in prevalence from 59.1% (95%CI: 57.5, 60.5) to 67.96% (95%CI: 66.1, 69.8) in Fiji largely attributable to an increase for women from 75.2% (95%CI: 74.1, 76.3) to 85.3% (95%CI: 84.4, 86.3). Prevalence also increased in Tokelau from 93.3% to 95.2%,

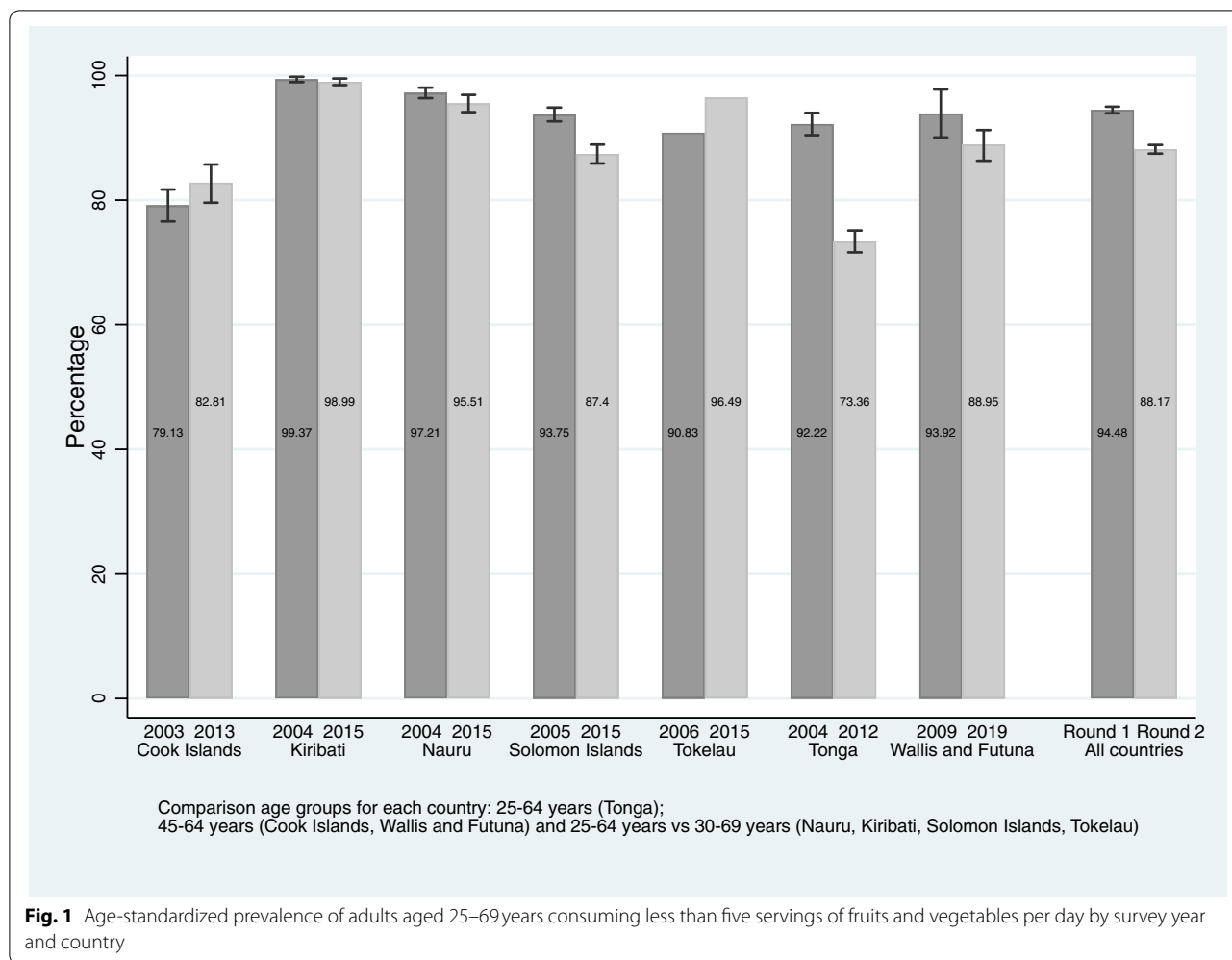


Fig. 1 Age-standardized prevalence of adults aged 25–69 years consuming less than five servings of fruits and vegetables per day by survey year and country

Table 4 Average daily consumption of sugary drinks by adults in Survey 2

Country (survey year)	Age group	Average serves ^a per day (95%CI)		
		Men (%)	Women (%)	Both (%)
Kiribati (2015)	18–69	3.5 (1.6–5.4)	3.9 (1.9–5.8)	3.7 (2.0–5.5)
Nauru (2015)	18–69	3.9 (3.4–4.4)	4.3 (3.4–5.2)	4.1 (3.6–4.6)
Solomon Islands (2015)	18–69	0.3 (0.3–0.4)	0.3 (0.2–0.4)	0.4 (0.3–0.5)
Tokelau ^b (2014)	18–69	3.9	4.1	4.0

^a A sugary drink is defined as fizzy drink, squash, cordial, drink concentrates and juice drinks excluding pure unsweetened fruit juice. One serving is defined as one can of drink, or one large glass

^b No CI as entire target population was included in the survey

particularly for women (94.5% to 95.4%). Women lived with a higher prevalence of overweight and obesity than men in all countries except Nauru. No significant changes in prevalence were observed for the Cook Islands,

Kiribati, the Solomon Islands or Tonga. The pooled analysis revealed a significant increase from 76.9% (95%CI: 76.1, 77.7) to 82.1% (95%CI: 81.3, 82.9) in the proportion of adults living with overweight or obesity.

Adults living with hypertension

Prevalence of hypertension increased in 6 countries (Fig. 3). In Kiribati prevalence increased from 18.4% (95%CI: 16.4, 20.4) to 42.13% (95%CI: 38.9, 45.4), in the Solomon Islands from 9.6% (95%CI: 8.1, 11.1) to 26.83% (95%CI: 23.5, 27.9), in Nauru from 29.5% (95%CI: 27.3, 31.8) to 37.6% (95%CI: 33.9, 41.2)], in Tokelau from 35.6% to 42.4%), in Tonga from 23.9% (95%CI: 21.1, 26.7) to 29.8% (95%CI: 28.1, 31.6) and in Fiji from 25.7% (95%CI: 24.6, 26.8) to 30.81% (95%CI: 29.2, 32.5) (Fig. 3). Increases were significant for women in all countries and for men except in Nauru and Tonga. Against this pattern, hypertension prevalence decreased from 58.6 (95%CI: 55.5, 61.8) to 47.2 (95%CI: 42.3, 52.2) in the Cook Islands driven by a large decrease for men.

Table 5 Percent of adults ‘always or often’ adding salt before eating

Survey	Age group (years)	Adults who add salt ‘always or often’ before eating or when eating (95%CI) ^a		
		Men (%)	Women (%)	Both (%)
Cook Islands	18–64	37.3 (33.9–40.7)	35.7 (32.9–38.5)	36.4 (34.3–38.6)
Kiribati	18–69	34.5 (27.6–41.4)	47.0 (37.4–56.6)	41.3 (33.7–48.9)
Nauru	18–69	63.5 (60.5–66.4)	67.1 (60.1–74.2)	65.4 (60.5–70.3)
Solomon Islands (2015)	18–69	48.8 (43.0–54.7)	44.6 (39.9–49.2)	46.6 (42.0–51.1)
Tokelau (2014) ^b	18–69	25.8	36.6	31.6
Average salt intake based on urinary sodium (g/day)				
Tokelau (2014) ^b	18–69	12.0	8.6	10.1
Wallis and Futuna (2019)	18–69	11.7 (11.5–12.0)	8.8 (8.7–9.0)	10.2 (9.8–10.5)

^a Dietary salt includes ordinary table salt, unrefined salt such as sea salt, iodized salt, salty stock cubes and powders, and salty sauces such as soya sauce or fish sauce. This question relates to salt added directly before consumption (regardless of meal composition)

^b No CI due to measuring entire population

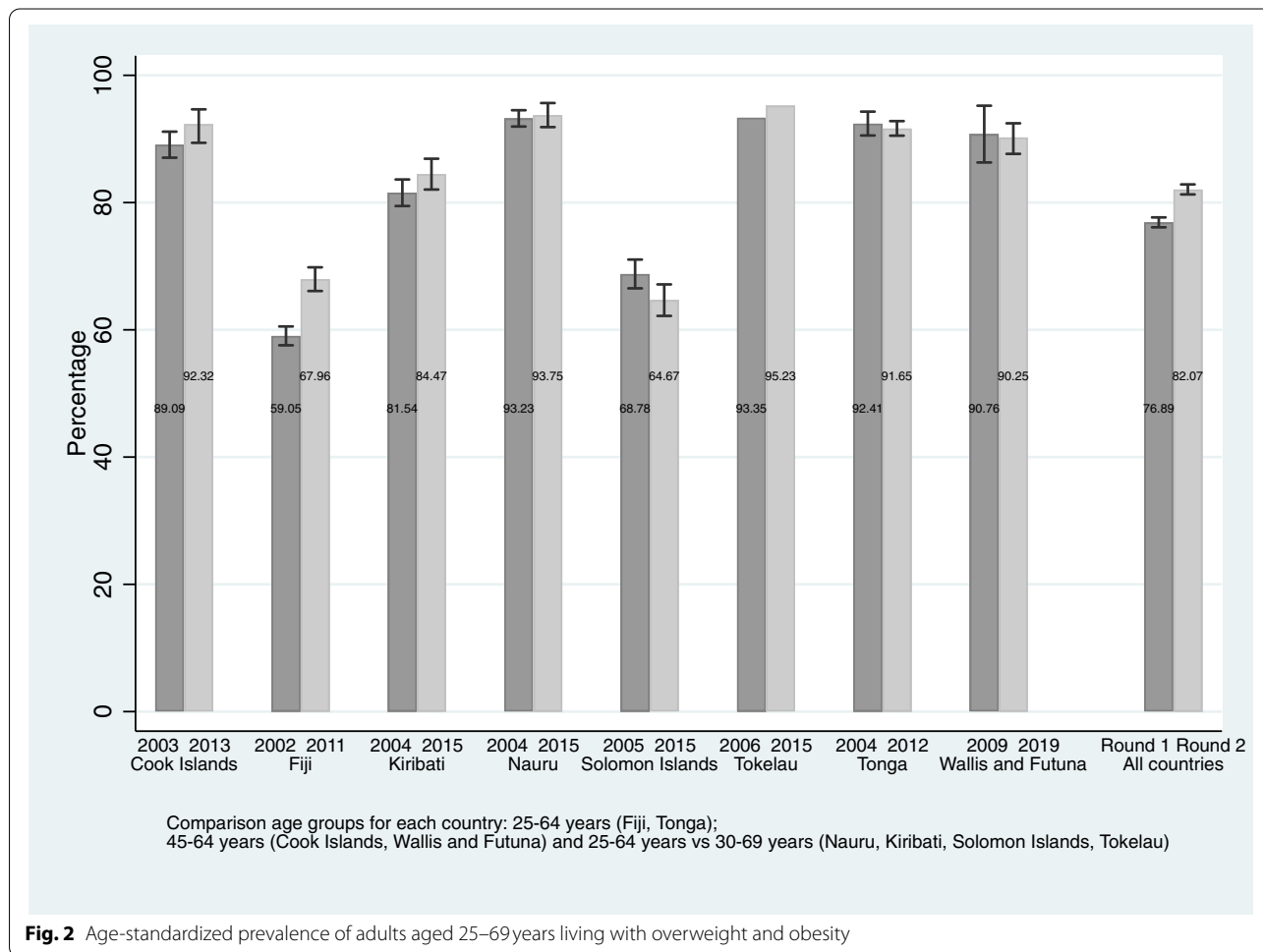


Fig. 2 Age-standardized prevalence of adults aged 25–69 years living with overweight and obesity

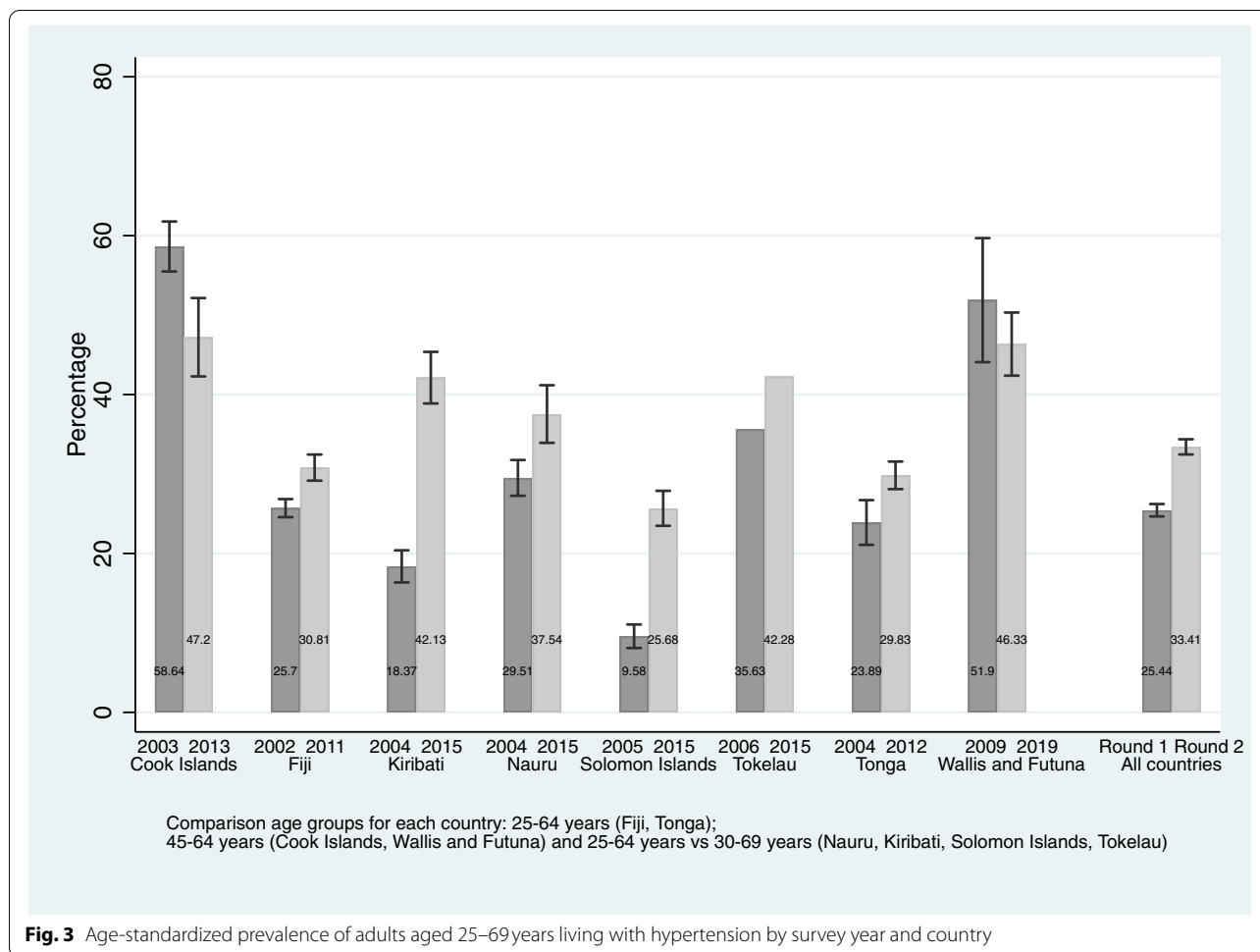


Fig. 3 Age-standardized prevalence of adults aged 25–69 years living with hypertension by survey year and country

The pooled analysis showed an overall increase in the prevalence of hypertension from 25.4% (95%CI: 24.7, 26.2) to 33.41% (95%CI: 32.5, 34.4) across the 8 countries.

Adults living with hypercholesterolemia

Six countries had comparable measures for hypercholesterolaemia (Fig. 4). Prevalence increased from 25.1% (95%CI: 21.1, 29.1) to 35.8% (33.2, 38.4) in the Solomon Islands and from 42.2% to 65.96% in Tokelau. Prevalence decreased from 80.0% (95%CI: 77.3, 82.8) to 58.2% (95%CI: 63.2, 52.9) in the Cook Islands, and from 27.7% (95%CI: 24.4, 30.9) to 17.8% (95%CI: 20.4, 15.2) in Kiribati. Significant reductions were observed for men and women in both countries.

Discussion

We used nationally representative survey data from 8 Pacific Island Countries and Territories to assess changes over time in dietary risk factor prevalence. Some reductions in risk were observed, including statistically significant reductions in the proportion and adults consuming

< 5 servings of fruit and vegetables per day. However, the prevalence of those living with overweight or obesity increased significantly in Fiji and Tokelau as did hypertension in 6 countries and hypercholesterolaemia in the Solomon Islands and Tokelau. Salt consumption was twice the 5g per day recommendation of WHO in the two countries that conducted urinary analysis, and adults in Kiribati, Nauru and Tokelau were consuming up to an average of 4 serves per day of SSBs. Most Pacific adults (88%) do not consume enough fruit and vegetables, 82% live with overweight or obesity, 33% live with hypertension and 40% live with hypercholesterolaemia.

Dietary risk profile in the Pacific Islands

Our results align with literature describing a steady increase in overweight and obesity in Pacific Island countries [23, 24, 54]. However, in our study this increase was driven by just two countries, Fiji and Tokelau, and in particular by an increase in prevalence for women in Fiji. Fiji was one of the first Pacific countries to complete a STEPS survey, and the timing of the survey (earlier in

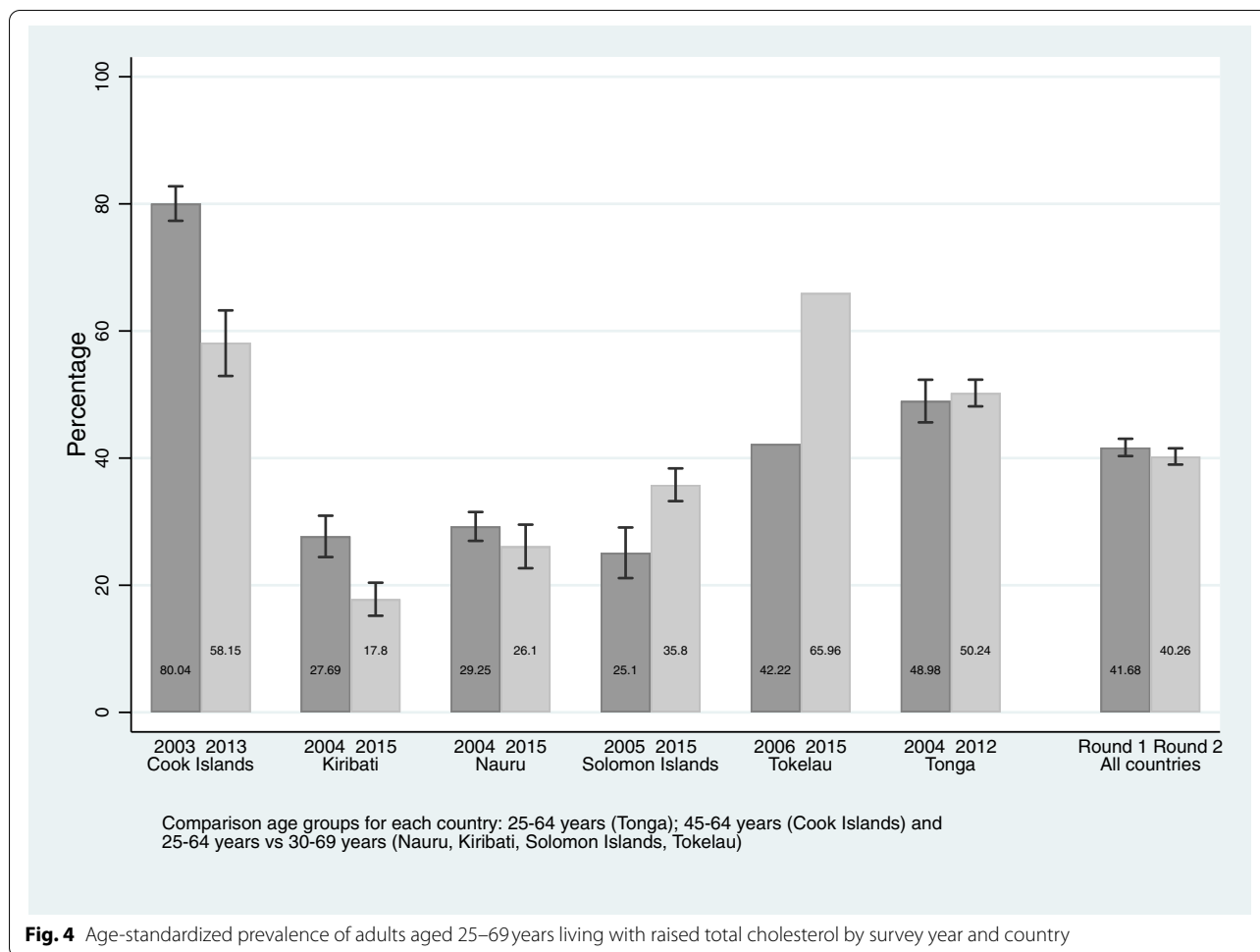


Fig. 4 Age-standardized prevalence of adults aged 25–69 years living with raised total cholesterol by survey year and country

the processed food transition) may have contributed to lower baseline prevalence compared to other countries. Our observation of increasing overweight and obesity in women compared to men in Fiji is consistent with other studies in LMICs [55–57]. Gender weight disparities may be a result of sociocultural factors, or because men are more often engaged in highly physical occupations compared with women, and involvement in sports is still less common in women [57]. In 6 of the 8 countries, there was no significant increase in overweight and obesity prevalence and mean BMIs were also relatively stable. This contrasts with other countries, including the US [58], where rates of obesity (BMI > 30) have accelerated faster than rates of overweight (BMI > 25) in recent years. High baseline levels of overweight and obesity in Pacific countries may have contributed to this stabilisation, noting that some Pacific populations have less fat mass at a given BMI than Caucasian populations [59]. It is also possible that preventive measures are starting to make a difference in some countries.

Pacific health and agricultural agencies have proactively promoted fruit and vegetable consumption [60, 61] in recent years, and offered agricultural support programs for farmers [60, 62] which may have contributed to the decrease over time in the proportion of adults consuming < 5 servings of fruit and vegetables each day. Despite this decrease, 88% of Pacific adults still report inadequate consumption. That this is consistent with the global dietary transition away from plant-based diets makes it no less concerning, and it points to the need to strengthen the efforts mentioned above. Inadequate fruit and vegetable consumption is an important but often neglected risk factor for NCDs [63], and a challenge across most regions of the world [64], particularly in LMICs [65]. A study of fruit and vegetable consumption in 28 LMICs between 2005 and 16 found that only 18% (16.6–19.4%) of adults over 15 years consumed WHO recommended amounts [65]. Consumption increased with GDP and secondary education but decreased with food pricing instability. Fiji and Tonga both relaxed import duties on fruit and

vegetables, although evidence from Tonga suggest that this may have only benefited traders [66]. These findings point to the need to strengthen food systems approaches that promote production of resilient, biodiverse crops, and address post-harvest losses and market access [67].

An emerging concern for Pacific countries is high SSB consumption [68]. Adults in Nauru, Tokelau, and Kiribati consumed more than 3.5 serves of sugary beverages per day. Similarly high average daily serves have been observed in Tuvalu (3 serves/day) based on their STEPS survey. A recent study of trade data from 12 Pacific Island countries documented a 65% increase to sugary drink imports between 2000 and 2015 [69]. In this study, the Solomon Islands stood out from other countries with adults reporting consuming 0.3 average daily serves of SSBs. This may be attributable to the Solomon Islands being at an earlier stage of the global dietary transition than other Pacific countries, remoteness from markets, or the high volume of sweetened tea/coffee beverage powders consumed [70], which may not have been adequately captured by STEPS. Many Pacific Islands countries having adopted taxes on SSBs [31], but these may need to be increased in order to make meaningful shifts to consumption, and the sale of SSBs in and around educational institutions could be tightened [71, 72]. The Solomon Islands in particular may benefit from introducing an SSB tax to keep consumption levels low [70].

The average prevalence of hypertension increased from a quarter to a third of all adults in these Pacific countries, with prevalence levels similar to Australia (34%) [73], possibly due to the high un-met needs in controlling blood pressure in Pacific countries [74, 75]. While further surveys are needed to confirm a trend, persistently high (and potentially increasing) rates of hypertension signal a future pipeline of vascular diseases with a potentially overwhelming impact on Pacific health systems and economies [76]. Dietary sodium, saturated fats and trans fats are major dietary contributors to hypertension [75] and saturated and trans fat are major dietary contributors to hypercholesterolemia [77, 78]. In this study, overall prevalence of hypercholesterolemia was over 40%, and in the two countries where salt intake was measured, it was over 10g/day, more than double that recommended by WHO. These indicators support the need to disrupt current dietary patterns in the Pacific, specifically excessive consumption of fatty meat, hydrogenated vegetable oil [26, 29, 79], and foods high in sodium [28, 80].

Policy response to dietary NCD risk factors

Our analysis highlights the ongoing challenge that Pacific countries face in responding to dietary causes of NCDs. Unhealthy dietary patterns are fueled by increased trade

liberalization [81–83], the penetration of food marketing [84, 85], and by food environments that promote affordable and convenient processed foods that are high in energy, salt, sugar and fat [27]. Additionally, policymakers have faced strong opposition from food and beverage companies trying to diminish policies [86], and pressures to minimize impacts of food policy on trade participation [37]. The multisectoral nature of food policy has made it difficult for Pacific leaders to implement and then enforce all recommended policy measures [87, 88], leading many to favour ‘softer’ approaches (i.e. guidelines and promotional materials) over regulatory approaches. Further, Pacific Island countries have struggled to find capacity to carry out regular dietary surveys and demonstrate the potentially positive impact of food environment policies on consumption [40]. Pacific Island MANA as a component of Framework of action for revitalization of healthy islands in the Pacific has been an important step to promoting political accountability to NCD prevention [38, 39], but countries will need to adopt a stronger cross sectoral approaches towards regulating, monitoring and enforcing food environment policies [33, 39, 89].

Strengthening surveillance of NCD risk factors

The purpose of STEPS is to provide a standardized method for collecting, analysing and disseminating data on key NCD risk. In the Pacific, STEPs surveys are used to inform high-level economic discussions [90], for regional monitoring and accountability strategies [39], to contribute to global monitoring, and to underpin evidence-based policymaking at the national level [70, 91]. By gathering STEPs data from multiple countries and over two time points we identified several opportunities to strengthen NCD risk factor monitoring in Pacific countries. Firstly, standardizing age grouping between survey rounds and countries would aid interpretation of published survey reports. For instance, Nauru, Kiribati and Solomon Islands reported results in the groupings of 25–34, 35–44, 45–54 and 55–64 years in the first round while the groupings were 18–29, 30–44 and 45–69 years in the second round. Secondly, standardizing risk factor thresholds or cut points between countries and survey rounds. In Fiji for instance, 2002 fruit and vegetable consumption was reported as the percent of people reporting <1 serve of fruit and vegetable per day, whereas in 2011, it was the percent consuming <5 serves. Thirdly, standardized time intervals between the surveys. Fourthly reducing the lag between data collection and publication of study reports so timely action can be taken. Finally salt intake, in particular, needs to be reported consistently, perhaps in place of less useful measures such as self-reported oil intake [92].

Strengths and limitations

Strengths

There are several strengths of this study. To our knowledge, this is the first paper comparing shifts in dietary risk factors over time in multiple Pacific countries. We used standardized rates rather than crude rates to make this comparison. Also, this data makes use of the reports generated by the Pacific countries for guiding and evaluating prevention efforts. We used standardized rates rather than crude rates to make this comparison. Additionally, by pooling prevalence, this paper shed light on NCD risk factor prevalence at a semi-regional level, providing critical information to guide the efforts of regional agencies, and those interested in dietary patterns of NCD risk in LMICs more broadly.

Limitations

There were limitations to the approach taken in our study, in addition to those raised above as opportunities to strengthen NCD surveillance [93]. This was a secondary analysis dependent on data summaries in published reports rather than raw data.

We did not report other NCD risk factors such as physical activity levels or tobacco and alcohol use. We were not able to report on hyperglycemia, which is a key risk factor in this Region, due to errors in that date reported previously [36]. Further, we did not present data from United States affiliated Pacific countries as many of these countries use an alternative NCD surveillance system to STEPs. Finally, two time points provide limited insight on change over time.

Conclusions

While some of the eight Pacific countries included in this analysis experienced reductions in diet-related NCD risk factors over time, most did not. Most Pacific adults (88%) do not consume enough fruit and vegetables, 82% live with overweight or obesity, 33% live with hypertension and 40% live with hypercholesterolaemia. Population-wide approaches to promote fruit and vegetable consumption and reduce sugar, salt and fat intake need strengthening. The value of STEPS surveys for monitoring trends in NCD risk will be fully realized when countries have conducted at least three surveys, though this requires a more consistent measurement of risk factors over time.

Abbreviations

BMI: Body Mass Index; CI: Confidence Interval; LMIC: Low and middle-income countries; NCD: Noncommunicable diseases; STEPs: STEPwise approach to surveillance.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-022-13808-3>.

Additional file 1.

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Authors' contributions

ER drafted the manuscript, and ER and CB were involved in all aspects of the study. GW, WS and JW provided supervision and review to the manuscript. PL, BM and GW supported data collection and analysis and undertook technical review of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

This study was based on publicly available published survey reports, and the compiled dataset can be made available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

Nil.

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