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## Evidence review for nutrition-relevant pricing policies and complementary measures in Fiji

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## Executive summary

The aim of this report is to establish an evidence base for the application of food and beverage taxes and complementary measures to encourage dietary substitution towards healthier, local food products in Fiji.

The Government of Fiji has identified action on nutrition and on diet-related Non-Communicable Diseases (NCDs) as a policy priority. The population of Fiji is experiencing a triple burden of malnutrition, due to the rapid dietary transition of the past 5 decades. Consumption of healthy traditional foods such as fish and seafood, staple root crops, coconuts and wild plants has decreased, while consumption of cereals and refined sugar has increased dramatically. In 2011, 85 percent of people reported insufficient consumption of fruit and vegetables, and in 2015 around 60 percent of school age children reported daily consumption of carbonated beverages. The health implications of this transition have been significant. Around half of children under 5 years, and one third of women of child-bearing age suffer from iron deficiency anaemia. The prevalence of hypertension and obesity among adults is more than 30 percent, and one third of teenagers are overweight. In 2011, around 16 percent of adults were found to have diabetes. These high rates of NCDs are associated with significant social and economic costs, including lost productivity and major demands on health care services.

A significant contributor to high salt, sugar and fat intakes are discretionary foods, such as confectionary, snacks and sweet beverages. These foods contribute an average of only 9 percent of daily food intake, but a much higher proportion of nutrients of concern: 16 percent of calories, 25 percent of fat and 20 percent of salt. As a result, reductions in consumption of these products can have a substantial effect on consumptions of nutrients associated with NCD risk. Many of these foods are relatively inexpensive for the significant contribution they make to intakes of energy and nutrients of concern, and thus appropriate targets of taxation. The analysis presented here indicates **the application of significant excise taxes (20 — 50 percent) on discretionary foods not meeting nutrient profiling criteria.**

We base our recommendations for taxation on a Fiji-specific nutrient profiling model, which sets thresholds for energy, sugar, sodium, fat, and saturated fat across food categories, in line with the Fiji Dietary Guidelines (see p.35 of this report).

Globally, there is growing interest in the application of fiscal policies to create incentives for the consumption of healthier (rather than unhealthy) foods, in order to accelerate action on malnutrition in all its forms, and NCDs. This is reflected in the Global Action Plan for Small Island Developing States, and the Fiji National Food Security and Nutrition Policy and Plan of Action. Internationally, the strongest evidence is for the effectiveness of targeted excise taxes on sugar sweetened beverages. There is also opportunity to increase the impact of taxation through investing revenue strategically (e.g. in Berkeley, health promotion programs designed to improve nutrition and decrease consumption of sugary drinks). The literature indicates that significant taxes, for example, 50 percent, would have a meaningful impact on diets and health.

Based on the analysis in this report, the specific discretionary food categories recommended to be taxed are:

- Confectionary and sugar
- Beverages (sweetened drinks, juice, milks)
- Edible ices
- Cakes, sweet bakery and biscuits
- Savoury snacks, including instant noodles

There is opportunity for the revenue generated by taxation to support **implementation of complementary measures recommended in the Food Security and Nutrition Policy and Action Plan:**

- Additional **incentives for reformulation**, such as nutrient targets for salt, fat and sugar in processed foods, based on the nutrient profiling.
- Complementary **social marketing**, such as a social marketing and school-based campaign that de-normalises consumption of discretionary foods would enhance the effect of the tax, promote public awareness and support for the tax, and further promote reductions in discretionary salt and sugar consumption.
- **Restrictions on marketing** of discretionary foods, to enhance the existing the draft regulation on marketing of foods and beverages to children
- Financial support for measures that target healthy food affordability and availability, such as **healthy food subsidies**.

The estimates for decreased consumption due to taxation of discretionary foods (with ranges due to different assumptions of substitution) were:

- 20 percent tax: reduction of 2 — 4 percent for calories, 5 — 7 percent for fat and 4—6 percent for salt.
- 50 percent tax: reduction of 5 — 10 percent for calories, 7 — 11 percent for fat and 9 — 14 percent for salt

The decreases in intakes of nutrients of concern that are estimated here are associated with reduced risk of diabetes, cardiovascular disease and overweight. In particular, for those aged 60—69 years a SBP reduction of 1 mm Hg has been estimated to reduce risk of stroke mortality by 4 percent and 3 percent mortality from ischaemic heart disease or other vascular causes (Lewington S, 2002).

The total annual revenue generated from the proposed 20 percent or 50 percent tax would equal \$FJD51.4 and \$FJD74.3 million, respectively. However, this analysis suggests that fiscal policy interventions on discretionary foods are unlikely to represent a significant financial burden to households, due to decreases in consumption of discretionary foods. Our modelling for all scenarios show either neutral effects or reductions in average household spending.



## Structure of the Report

In **Part 1**, we review the global evidence for the use of food and beverage taxes to encourage dietary substitution towards healthier, local food products.

In **Part 2**, we define an evidence-based criteria (“Nutrient profiling model”) to identify target food and beverage products which contribute to NCD risk in Fiji, which can be used as a basis to develop more targeted policy measures to reduce unhealthy consumption.

In **Part 3**, we analyse the existing policy context and the policy implications of the nutrient profiling model.

In **Part 4**, we model the estimated impact of a tax on discretionary foods at 20 percent, 50 percent and 100 percent on consumption, health, revenue and household expenditure



## Background and context

The Republic of Fiji (Fiji) is a small island developing state in Melanesia, in the South Pacific. The country is comprised of over 330 islands, and the population is approximately 900 000. One of the most significant health issues for Fiji is the extremely high rates of non-communicable diseases (NCDs). Non-Communicable Diseases refer to a group of non-infectious chronic diseases including diabetes, cancer, cardiovascular disease and respiratory disease. There is convincing evidence linking dietary factors to diabetes, cardiovascular disease and some cancers, and the effects of these dietary patterns on NCD incidence are mediated by four key metabolic changes: overweight and obesity, elevated blood pressure, hyperlipidemia and hyperglycemia (Alberti KGM et al, 2005).

NCD risk factor surveys undertaken in Fiji in 2002 and 2011 demonstrated worrying trends in relation to the prevalence of diet-related NCD risk factors. Prevalence of hypertension increased by 50 percent over the 9 years, increasing from 19 percent (WHO, Fiji STEPS Survey) to 31 percent (WHO, Fiji NCD Risk Factors STEPS Report), while rates of obesity have trebled to affect 35 percent of adults. In 2011, around 16 percent of adults were found to have diabetes, with around one-third of Fijians at a high-risk of developing an NCD. Young people in Fiji are similarly demonstrating diet-related risk factors, a 2015 school health survey showed that between 22 percent and 37 percent of students aged between 13—17 years were overweight (WHO, Fiji Global School-based Student Health Survey)

NCDs are the leading cause of death worldwide, responsible for over 38 million deaths worldwide every year (WHO, Global status report on NCD). NCDs are thought to cause a staggering 70 percent of all deaths in Pacific Island Countries (WHO, NCD: Country Profiles). Globally, NCDs represent the most serious threat to social, economic and environmental prosperity. Pacific Island countries, many of which are coping with multiple burdens of NCDs, communicable disease and environmental susceptibilities, are particularly vulnerable to the costs of concomitant lost productivity and demands on health care services. This vulnerability is in part due to their fragile economies, which are dependent on aid and remittances and hampered by recurrent natural disasters (Anderson, I, 2013) (Mavoa HM and McCabe M, 2008).

Like most other Pacific Island Countries, Fiji has undergone a rapid dietary transition over the past 5 decades (Hughes RG, 2003). A traditional pattern of eating reportedly consisted of fish and seafood, a range of root crops, coconuts and plantains, a hybrid mix of wild plants and animals and marine greens, with legumes introduced by Indians in the late 1800's (Jansen A et al, 1990). Fiji's National Nutrition Survey (NNS) showed that by 2004, major sources of energy were cereal (bread and flour products, rice and roti, 34 percent), and root crops (20 percent). Sugar was being consumed daily by over 95 percent of households. A number of nutrients were being consumed at levels below (Fibre, Iron, Zinc) or significantly below (Vitamin A and Calcium) recommended levels (National Nutrition Centre. Fiji National Nutrition Survey 2004), and rates of anaemia were particularly concerning, with anaemia prevalent in up to 50 percent of children under 5 years, and between 33 percent and 42 percent in females between 12 and 44 years. Data regarding healthy food consumption from the 2014 National Nutrition Survey (NNS) (National Food and Nutrition Centre, NNS Data) suggest that healthy food consumption may have continued to decline. Only 10 percent of respondents consumed breadfruit daily, and 24 percent cassava. In contrast, 50 percent of

respondents consumed rice daily and 43 percent roti, and daily consumption of instant noodles increased from around 10 percent in 2004 to around 15 percent in 2014. Consumption of vegetables has remained low, and for some vegetables has declined. A review of import data showed that imports of ‘less healthy foods’ increased significantly between 1980 and 2010 (Ravuvu A et al, 2017), in particular white rice, edible oils and sugar. The 2011 STEPs survey showed that 85 percent of people were not consuming enough fruit and vegetables (WHO, *Fiji NCD Risk Factors STEPS Report*). Among adults, underweight declined from 6 percent to 4 percent between 2004 and 2014, according to the NNS. The prevalence of overweight remained constant, at around 32 percent. However, the prevalence of obesity increased markedly, from 24 percent in 2004 to 32 percent in 2014.

Among children, indicators of undernutrition did not decline between 2004 and 2014. The prevalence of wasting remained at 8 percent and underweight at 7 percent in children under 5 years of age, and stunting at around 10 percent. Stunting among children aged 5 — 17 years declined slightly to 4.5 percent in 2014, while underweight prevalence increased from 7 — 10 percent among children aged 5—14 (Using BMI for age). However, the prevalence of overweight among children and adolescents increased from 6 percent in 2004, to 8 percent (5-14 years) and 12 percent (15—18 years) in 2014. The 2015 Fiji School Health survey found that between 59 percent and 63 percent of youths consumed carbonated beverages almost every day.

Pacific Island governments have committed to taking policy action to prevent and control the escalating burden of NCDs. Most recently, the NCD Roadmap report identified the need for policies to reduce consumption of food and drink products directly linked to obesity, heart disease and diabetes in the Pacific, especially salt and sugary drinks (*NCD Roadmap Report*, 2014). The policy recommendations in the Roadmap include settings-based promotion of healthy diets, including in schools and workplaces; social marketing of healthy local foods; agricultural and related interventions to increase production and accessibility of healthy, local staples, fruits, vegetables and fish; restricting advertising of unhealthy foods; taxation of unhealthy foods; restricting retail of unhealthy foods; and interventions to reduce salt, fat and sugar in processed foods.

This reflects wider commitment by Pacific Island Country Health Ministers to the *Healthy Islands* concept, and the “Pacific Framework for the Prevention and Control of Non-communicable Diseases” (Honiara outcome, 2011). This framework includes addressing NCDs through macroeconomic decisions and policy interventions, as well as lifestyle and clinical interventions, and encourages countries to implement cost-effective interventions for prevention and management of NCD priority interventions.

Taking action on nutrition and NCDs is a priority for the Government of Fiji, as articulated in its 2017 National Development Plan (*National Development Plan: Transforming Fiji, 2017*). The 2017 Fiji Food Security and Nutrition Policy and Plan of Action identify the need to establish the nutrition impact, and impact on revenue, of food and beverage taxes.

The aim of this report is to establish an evidence base for the application of food and beverage taxes and complementary measures to encourage dietary substitution towards healthier, local food products in Fiji. This report reviews the global evidence for the use of

food and beverage taxes to encourage dietary substitution towards healthier, local food products; defines evidence-based criteria to identify target food and beverage products; assesses the potential impact of the proposed health on consumption, nutrition and government revenue; and identifies complimentary measure most effective at improving access to an affordable supply of nutritious, local foods to encourage dietary substitution.



## Part 1: Overview of the literature on pricing policies and their use by developed and developing countries

Consumption of products high in energy, saturated fat, *trans*-fat, sugar and salt is a risk factor for overweight and obesity and some NCDs (Ezzati M and Riboli E., 2017). A key component of policy interventions to prevent diet-related NCDs is thus reductions in consumption of such products, and concomitant increases in consumption of healthy foods, such as fruit, vegetables, legumes, nuts and fish (Mozaffarian D, 2016). The rationale for the use of fiscal policy tools is primarily that they target consumer decision making at the point of purchase, through price incentives, to decrease consumption of such products (and/or increase consumption of healthier products) (Hawkes C et al, 2015 ).

The evidence for the effectiveness of fiscal policy measures as part of a comprehensive policy approach to NCD prevention is growing (WHO, *Using price policies to promote healthier diets*). Information on the impact of fiscal policy intervention comes from a range of sources. As countries have begun to implement such interventions, there have been a growing number of evaluations of the impact of actual interventions. Modelling and simulation studies are particularly helpful for forecasting potential outcomes in real-world settings for use in policy design. Randomised controlled trials provide detailed insights into consumer behaviour in various settings. (Thow et al, Nutrition Reviews) for a detailed description of the strengths and limitations of different study designs for assessing impact of fiscal policy intervention).

### Effect on consumption and health

The strongest and most consistent effect of taxation in reducing unhealthy consumption is seen for sugar-sweetened beverage (SSB) taxation. Sugar sweetened beverage consumption is associated with obesity and diabetes, as well as being a contributor to the high global prevalence of dental caries (Schwendicke et al, 2016). Reviews of the impact of SSB taxes (mainly studies from high income countries) have consistently found an approximately proportional impact of taxation on consumption, for taxes over 10 percent, and the greatest impact from taxes of 20—50 percent (Thow et al, 2008) (Backholer et al, 2016). They have also indicated health benefits of small but meaningful reductions in BMI, diabetes and dental caries. However, recent studies from low and middle income countries have indicated consistent effects.

Mexico and Chile have both recently increased taxes on SSBs – Mexico through a 1 peso per litre excise tax (approximately 10 percent), and Chile through increasing sales and import taxes from 13 percent to 18 percent. Analyses of the impact of these taxes have found a decrease in consumption of SSBs proportional to the size of the tax (around 7 percent in both countries), and an increase in consumption of drinking water (Colchero et al, 2016) (Guerrero-Lopez et al, 2017) Modelled studies from other low and middle income countries have supported these findings, and also indicated meaningful health benefits associated with taxes on soft drinks. A 20 percent soft drink tax in India was estimated to potentially

reduce overweight and obesity prevalence by 3.0 percent and type 2 diabetes incidence by 1.6 percent over the period 2014–2023, taking into account current trends towards increasing soft drink consumption in India (Basu et al, 2014). Similarly, modelling the impact of a 20 percent soft drink tax in South Africa indicated reduced energy intake by about 36kJ per person per day (95 percent CI: 9 to 68kJ) (Manyema et al, 2014). This was estimated to reduce obesity prevalence by 2-3 percent.

More detailed data from high income countries have also highlighted a number of potential differential impacts on consumption, including greater effects among sub-populations consuming high levels of soft drink. A tax implemented in the US city of Berkley (\$0.01/oz) resulted in a 21 percent reduction in soft drink consumption in low-income neighbourhoods, and a substantial increase in consumption of plain water (Fable, 2016). Another US modelling study predicted that between 2015-2025, a nationally applied excise tax of \$0.01 per ounce of SSB could reduce obesity prevalence by 1 percent among adults and 1.4 percent among youth, saving over 100 000 disability-adjusted life years from obesity-related morbidity (Gortmaker et al, 2015). A recent study based on UK data (Briggs et al, 2017) found that reductions in response to an SSB tax would be greatest amongst 11–18 year-olds who consume the largest volumes of SSBs. It also concluded that the tax could reduce the prevalence of obesity by up to 0.5 percent, and diabetes incidence by up to 18 percent. Studies from the UK and Germany have also indicated that SSB taxation can reduce caries development, especially in younger men and those on low income (Schwendicke et al, 2017).

### *Impact of nutrient-based taxes on consumption*

Nutrient-based taxes include those imposed on specific nutrients (e.g. a 'fat tax') and those imposed on the basis of nutrient profiling (for example, a tax on energy-dense, nutrient-poor food, or a subsidy for healthy foods).

A review of modelling studies with various nutrient-based scenarios by Thow et al (Thow et al, 2014) indicated a small but relatively positive effect on consumption of target nutrients. Modelled taxes ranging between 5 percent to 40 percent on individual nutrients (ie. fat, sugar, salt) could reduce consumption of saturated fat by 0–3 percent, sugar/sweet foods by up to 23 percent and sodium by 6 percent however the review also highlights the unintended substitution effect, particularly of the fat tax with increased salt consumption and decreased fruit and vegetable consumption. In contrast, nutrient-profiling taxes are less likely to have this unintended consequence as the target foods are based on the complete nutrient composition of the food, not just a single nutrient. The review found that taxes on 'unhealthy' food profiles ranging from 10 percent to 50 percent had, overall, a decrease in purchase and calories consumed but in one study a decrease in healthy fruit and vegetable consumption was observed (reversed when combined with a subsidy on fruit and vegetables).

Targeted nutrient taxes implemented in Europe have been found to have positive impacts on diets. The first 'fat-tax' was implemented in Denmark and remained effective between October 2011 and January 2013. The tax targeted meat, dairy, animal fat, oils, margarine and butter blends as well as composed foods containing these products at approximately USD2.9 per kilogram of saturated fat (excluding VAT) (Bodker et al 2015). This led, amongst other price rises, to a 13–16 percent increase for high fat minced beef and cream products



(Jensen et al, 2015). The tax resulted in a 4.0 percent reduction in saturated fat intake and increased vegetable consumption however salt consumption increased for most individuals (Smed et al, 2016). Finland has been active in applying various excise taxes on sweets and ice cream since 1926 and currently has a 0.95 per kg excise tax on sweets and ice-cream. Two modelling studies found this tax has reduced consumption of these foods by 23 percent (Thow et al, 2014). In a bid to promote healthier consumption in the Hungarian diet, taxes were applied in 2011 to foods above particular thresholds in sugar and salt (eg. chocolate, salted snacks, sweets, as well as SSBs) (WHO, *Using price policies to promote healthier diets*). Sales of products subject to the taxes have fallen by 27 percent with a 20–35 percent decrease in consumption observed. This has also resulted in considerable product reformulation by manufacturers.

A recent study based on data from New Zealand indicated that a 20 percent tax on major food contributors to salt and saturated fat intakes, combined with a subsidy of 20 percent on fruit and vegetables, could have overall benefits for diets and health. In particular, through reducing daily purchases of fat and sodium by 5 percent and 7 percent, respectively, increasing fruit and vegetable purchases by 12 percent and 18 percent and reducing population energy purchases by around 5 percent (Ni Mhurchu et al, 2015).

### *Impact of healthy food subsidies on consumption*

Reviews indicate that healthy food subsidies can be effective in increasing consumption of the target food however, they may also increase overall caloric intake (Thow et al, 2014). As noted above, subsidies can also be used in combination with taxes to help compensate for the potential impact of taxes on household budgets, and provide an additional incentive for changes to consumption.

For example, a study of the impact of the ongoing ‘Healthy Food benefit’ (Private Health Insurance program) in South Africa found a significant increase in the consumption of vegetables, fruit, starchy, fibre-rich foods, fat-free dairy products, lean protein, legumes and healthy fats and oils. It also reported a statistically significant ( $p < 0.001$ ) relationship between a 25 percent discount and the consumption of the healthy food choices and a lower BMI (An et al, 2013).

Research on subsidies indicates that they are effective in increasing consumption, and likely to be more cost-effective than education or social marketing interventions despite their additional cost. Recent studies from Australia and New Zealand have shown that price reductions of around 20 percent can have meaningful effects on consumption of fruit and vegetables, and resultant measures of population health (Olstad et al, 2010).

### *Impact on, and use of, revenue*

The direct impact of a health-related (food and/or beverage) excise on government revenues is determined by both the size of the change to the tax rate, and the impact on production and consumption of the taxed good (elasticity of demand). To maximise the effect on consumption, a relatively large tax on a relatively elastic food or beverage is required; conversely, to maximise revenue, a smaller tax on a relatively inelastic food or beverage is required. Andreyeva and colleagues estimated that a ‘penny per ounce’

(approximately 20 percent) tax on soft drinks in the United States of America could generate new tax revenue of \$79 billion over 2010–2015 (Andreyeva et al, 2011).

Since most food and beverage products are relatively inelastic (PEE between 0 and 1), applying taxes to specific foods is likely to result in both changes in consumption and the generation of revenue. For example, despite the reductions in consumption reported above, the soft drink tax in Mexico generated \$1.3 billion in revenue in 2014 (Kilpatrick, 2015). (Although, it should be noted that Mexicans consume the highest volume of soft drinks, per capita, in the world).

Similarly, the sugar taxes implemented by Nauru and French Polynesia both also exceeded revenue expectations: the anticipated revenue from the tax in Nauru was AUD80 000 (approximately USD67 400), but after the first year of implementation this budget estimate was increased to AUD240 000 (approximately USD200 000); in French Polynesia, the revenue raised from the production tax was around 1 billion CFP/year (USD10 million), and from the import tax was around 350 million CFP/year in 2008 ((USD4.2 million).. The excise tax on soft drinks implemented by the Government in Samoa (at the time, 0.30 tala/litre) generated 9,392,787 tala (approximately USD3.5 million) between 2003 – 2007 from the domestic excise, while the import excise generated 196 238 T in 2005, 237 167 T in 2006 and 453 542 T (approximately USD170 000) in 2007 (Thow et al, 2011).

A common concern raised by industry is the effect of taxes on employment, due to job losses as the result of decreased profitability of the affected sectors of the food industry. A recent analysis by Powell and colleagues for two states in the United States of America indicates that a sugar-sweetened beverage tax could actually *increase* employment overall, if economic modeling takes into account: 1) increased consumption of other (non-sweetened) beverages (often produced by the same companies), 2) the increases in jobs created elsewhere in the economy as consumers reallocate their spending to non-beverage goods and services, and 3) increased government-related employment resulting from increased revenue (Powell et al, 2014).

There is also opportunity to increase the impact of taxation through investing a component of the revenue strategically. In Berkeley, revenue has supported health promotion programs designed to improve nutrition and decrease consumption of sugary drinks, Philadelphia's tax on soft drinks was linked to funding for community services such as preschools and parks, and in Mexico, it is planned to use a portion of tax revenue to support the provision of safe drinking water (Roache et al, 2017). French Polynesia established a Health Promotion foundation with the revenue from their tax on products containing high levels of sugar (Thow et al, 2011).

## Part 2: Establish evidence-based non-discriminatory criteria for nutrition policy in Fiji: A nutrient profiling model

Nutrient profiling of foods is ‘the science of categorising foods based on their nutritional composition, for reasons related to preventing disease and promoting health’ (WHO, Nutrient profiling, 2010). Nutrient profiling enables evaluation of the nutritional quality of a food. It can therefore be used for different purposes, including labelling systems to help consumers to identify healthier food products, or as a standardised basis for the food industry to identify foods eligible to make health claims (Verhagen and van den Berg, 2008). It can also be used to provide a standardised and transparent basis for the application of food policies or regulations designed to improve diets and reduce population risk for NCDs.

Developing a robust nutrient profiling system requires clarity regarding the purpose of nutrient profiling, to enable the selection of appropriate index nutrients and reference amounts (Scarborough, 2007). In this section, we apply an evidence-based methodology to develop a nutrient profiling tool to improve diets and prevent NCDs in Fiji, using the systematic approach recommended by Rayner and Scarborough (Rayner et al, 2004), and then used by the World Health Organization to develop models in the European (WHO, Nutrient profile model, 2015) and Western Pacific Regions (WHO, Nutrient profile model, 2016 ). A detailed description of the methodology is provided in Appendix 1.

The purpose of this model is to provide clear criteria to identify food and beverage products which contribute to NCD risk (those high in fat, salt and sugar), which can be used as a basis to develop more targeted policy measures to reduce unhealthy consumption.

This model was developed using evidence-informed decision-making across the following 5 steps (Rayner et al, 2004):

- A. Selection of appropriate index nutrients, in relation to desired health outcomes;
- B. Consideration of the most appropriate choice of base (e.g. per 100g, per 100kJ);
- C. Identification of most appropriate type of model, in relation to intended use of model;
- D. Identification of the most appropriate and relevant nutrient thresholds, in relation to desired health outcomes;
- E. Validation and testing of the model against an objective measure of a healthy diet (in this case, food-based dietary recommendations for Fiji and the Pacific region), and in relation to representation of ‘healthy’ and ‘less healthy’ foods.

As the first step in this process, we identified food categories for the model. (Table 1). These were based on the WHO nutrient profiling model and informed by Pacific dietary patterns (outlined in the Background and Context).

### **Table 1: Detailed food categories**

Cat 1: Choc, sweets, sugars  
 Cat 1a: Choc, confect, toppings  
 Cat 1b: Raw sugar, syrups

- Cat 2: Cakes, sweet biscuits, sweet bakery goods
- Cat 3: Savoury snacks
- Cat 4: Beverages
  - Cat 4a: Juices
  - Cat 4b: Milk
  - Cat 4c: Coffee, tea
  - Cat 4d: Other beverages, sugar-sweetened beverages, drink mixes
  - Cat 4e: Alcoholic beverages
- Cat 5: Edible ices
- Cat 6: Breakfast cereals
- Cat 7: Other dairy, yoghurt, cream, sour
- Cat 8: Coconut Products
- Cat 9: Ready-made, composite, convenience
  - Cat 9a: Composite meals not commercial
  - Cat 9b: Composite processed ready-made
- Cat 10: Butter, fats, oils (including coconut oil)
- Cat 11: Staples
  - Cat 11a: Bread, crisp bread, roti, flour
  - Cat 11b: Rice, grains, pasta
  - Cat 11c: Noodles
  - Cat 11d: Root crops and starches
- Cat 12: Fresh and frozen meat, poultry, fish
  - Cat 12a: Fish, seafood
  - Cat 12b: Poultry
  - Cat 12c: Other meat
  - Cat 12d: Eggs
- Cat 13: Processed meat, fish, poultry
  - Cat 13a: Processed fish
  - Cat 13b: Processed meat, poultry
- Cat 14: Fruit, fresh, frozen, dried
- Cat 15: Vegetables, fresh, frozen,
- Cat 16: Soya, tofu, legumes, nuts, seeds
- Cat 17: Sauces, dips, dressing
- Cat 18: Salt

## A: Selection of appropriate index nutrients

### Identifying foods and nutrients associated with NCD risk

Specific foods associated with increased risk of NCDs include those high in fat (particularly trans-fats and saturated fats), sugar and salt, while diets high in fibre, fruit and vegetables, fish provide a protective effect.

Dietary fats have a significant influence on NCD risk, particularly cardiovascular disease, due to their impact on blood lipids, blood pressure, thrombosis and inflammation (Katan, 2000). Cardiovascular disease risk reduces when saturated fats, found mainly in fatty meat and

processed foods, were replaced with polyunsaturated fats (de Souza et al, 2015). Processed meats, however, have an independent risk on NCDs, particularly colorectal cancer, coronary heart disease and diabetes (Micha et al, 2010).

Dietary salt intake plays a major role in influencing blood pressure and overall cardiovascular health (Sacks et al, 2001). Dietary salt intake is largely attributable to processed meats, packaged meal or snack foods, cooking sauces, bread and fast-food. A reduced sodium intake is known to decrease risk of stroke and fatal heart attack (He and MacGregor, 2013).

Dietary factors are also strongly linked to overweight and obesity. High BMI is an established independent risk factor for non-communicable diseases (NCDs) such as type 2 diabetes, cardiovascular disease and many cancers (Swinburn, 2011). Behaviours including snacking and eating frequency, eating foods outside of the home and eating refined sugars and carbohydrates increase obesity risk (FAO and WHO, *Diet, nutrition and the prevention of chronic diseases*).

Diets high in refined carbohydrates and sugar reduce the quality of the diet, increase risk of metabolic risk factors for NCDs and increase body mass because they are more likely to be energy dense and nutrient poor (Tordoff and Alleva, 1990).

A higher consumption of fruit and vegetables (particularly leafy green vegetables) is significantly associated with a lower risk of all-cause mortality, cardiovascular disease and Type 2 diabetes (Wang et al, 2014). Fruit and vegetables are a key source of dietary fibre, and an increased intake of fibre has been shown to reduce cardiovascular disease risk (Threapleton et al, 2013).

In Pacific Island Countries the key dietary pattern associated with increased NCD risk is what is termed the 'modern' diet (Huhes, 2003). The modern dietary pattern includes a high amount of processed foods (for example, instant noodles, processed meats, confectionary, packaged snack foods) and non-traditional foods (for example, cheese and eggs), and a reduced intake of local foods (for example, root crops), fruits and vegetables. A 'modern' dietary pattern is consistently associated with poorer nutrient intake and dietary adequacy, a worsened metabolic profile, higher body mass index and increased risk of NCDs (Bindon and Baker, 1985).

Given this, a nutrient profiling model relevant to diet-related NCD prevention in Pacific Island Countries like Fiji should address energy, sugar, sodium, fat, saturated fat and trans fatty acid, while promoting consumption of fish, fruit and vegetables, and nuts and legumes.

## Consumption of foods and nutrients associated with NCD risk in Fiji

Analysis of data from Fiji's 2014 National Nutrition Survey shows that Fijians aged 12–45 years consume an average of 2092Kcal per day, including 79.2g of protein (15.1 percent energy) and 61g of fat (26.2 percent energy), 302g carbohydrate (54.1 percent energy) and 23g of fibre (Table 2). They consume an average of 2178mg of sodium per day and 192g cholesterol. 'Sugary foods' contribute close to 15 percent to average carbohydrate intake (calculated based on consumption of foods 'high in sugar', due to absence of data — see Table 5).

A comparison of nutrient intakes to recommended values indicate that Fijian adults consume insufficient fibre, and adequate amounts of energy, salt and fat. However, given the high prevalence of overweight and obesity, and the fact that self-reported food intake data generally underestimates energy intake, caloric intake is likely to be much higher (see 'data sources' in Appendix 1).

**Table 2: Average daily nutrient intake for Fijians over 12 years of age, compared to recommendations**

Nutrient	Average Intake for Fijians aged 12–45 years <sup>c</sup>	Recommended dietary intake Levels	Comparison
<b>Energy (Kcal)</b>	2092	USDA: Males aged 19–51 years 2400 kcal (active) <sup>f</sup> NRV ranges from 1238 kcal to 4,428 kcal <sup>a,e</sup> - Girls aged 12 minimally active=1,238Kcal/day - Girls aged 12 very active= 2,700Kcal/day - Males 30 minimally active= 2,404Kcal/day - Males aged 30 very active=4,428Kcal/day - Women aged 60 minimally active= 1,547Kcal/day - Women aged 60 very active= 2,547Kcal/day	For adult males and females, average energy intake is adequate but not excessive. Those requiring less energy that consumed on average include younger (12–14 years) and older women (51–70years) who are inactive or relatively inactive. Average energy intake is around 60% higher than required young women and older women who are inactive.
<b>Protein (g)</b>	79.2g	Estimated Average Requirement: <sup>a</sup> 52–65/day (male) 37–46g/day (female) 35g/day (female 14–18 years) Recommended Dietary Intake: <sup>a</sup> 64–81g/day (male) 46–57g/day (female) 45g/day (female 14–18 years)	Average protein intake is adequate for the biological requirements of all population sub-groups.
<b>Fat (g)</b>	60.9g	<30% of energy <sup>b</sup>	Contributes around 26% to total energy intake
<b>Saturated Fat (g)</b>	Around 23.1% of fat intake is from foods high in saturated fat	<10% total energy intake <sup>b</sup>	23 % of total fat intake is 14g or 126Kcal, well under 10% of total energy intake
<b>Carbohydrate % - Sugar ( %)</b>	301.9g >46g of carbohydrates from foods very high in sugar <sup>c</sup>	Less than 10% of total energy intake from free sugars <sup>b</sup>	45g (170Kcal) of carbohydrates are consumed in sweet foods (Table 4), which is less than 10 % total energy intake (equal to 54g carbohydrate)



[Table 2 Cont'd]

Nutrient	Average Intake for Fijians aged 12–45 years <sup>c</sup>	Recommended dietary intake Levels	Comparison
<b>Fibre (g)</b>	23.0g	Girls 14–18 years= 22g/day Boys 14–15 years= 28g/day Men 19–70 years=30g/day Women 19–70=25g/day	40 % less than recommended for adults 51–70years
<b>Sodium (mg)</b>	2178mg 3,992mg <sup>d</sup>	SDT 5g <sup>a</sup>  5g salt/2 000mg sodium per day <sup>b</sup>	Consumption meets recommended upper limits
<b>Iron (mg)</b>	14.2mg	Estimated Average Requirement: <sup>a</sup> 6mg/day (male) 5–8mg/day (female) Recommended Dietary Intake: <sup>a</sup> 8mg/day (male) 5–18mg/day (female)	Meets recommended requirements — but small scale surveys and high prevalence of Iron Deficiency Anaemia suggest significant sub-populations with very insufficient intakes.
<b>Zinc</b>	8.8mg	Estimated Average Requirement: <sup>a</sup> 12mg/day (male) 6.5mg/day (female) Recommended Dietary Intake: <sup>a</sup> 14mg/day (male) 8mg/day (female)	Meets recommended requirements for women but is inadequate for men
<b>Calcium</b>	548mg	Estimated Average Requirement: <sup>a</sup> 840–1 100/day (male and female) Recommended Dietary Intake: <sup>a</sup> 1,100–1 300/day (male and female)	Very low average intake
<b>Vitamin A (ug)</b>	829mg	Estimated Average Requirement: <sup>a</sup> 625/day (male) 500/day (female) Recommended Dietary Intake: <sup>a</sup> 900/day (male) 700/day (female)	Meets recommended requirements
<b>Vitamin C (mg)</b>	179mg	Estimated Average Requirement: <sup>a</sup> 30mg/day (male and female adults) Recommended Dietary Intake: <sup>a</sup> 45mg/day (male and female adults)	Exceeds requirements

<sup>a</sup> Nutrient Reference Values (NRVs), National Health and Medical Research Council of Australia  
<sup>b</sup> Guidelines from the World Health Organization  
<sup>c</sup> Fiji's NNS 2014 (as yet unpublished), authors own analysis  
<sup>d</sup> Fiji Salt Intake Assessment (FSIA) project (personal communication from The George Institute for Global Health)  
<sup>e</sup> Estimated energy requirements from NRVs factor in Basal Metabolic Rate (from age, size, gender) and Physical Activity Level  
<sup>f</sup> Dietary Guidelines for Americans, USDA, 2010

Throughout this analysis we highlight the contribution of **discretionary foods** to nutrient intakes. Australia's National Health and Medical Research Council describes discretionary foods as “foods and drinks not necessary to provide the nutrients the body needs, but that may add variety. However, many of these are high in saturated fats, sugars, salt and/or alcohol, and are therefore described as energy dense”. Similarly, Fiji's Food and Health Guidelines call on Fijians to choose foods and drinks with less salt, sugar, fat and oil and



higher fruit and vegetable content. Discretionary foods can be consumed in small amounts, however they provide very few beneficial nutrients and are not necessary for human health. When these are consumed in greater amounts, they displace the opportunity to consume beneficial nutrients with excessive amounts of energy, fat, sugar and salt.

### *Energy and sugar intake*

Based on recent data from the 2014 National Nutrition Survey, staple foods provide the largest contribution to the energy intake of Fijians (45 percent), made up of root crops and starches (17.8 percent), bread, roti and flour (12.2 percent), and rice and semolina (11.5 percent). Composite meals, including home-made and ready-made account for 12.1 percent of energy intake by Fijians, followed by savoury snacks (9.0 percent). Fresh and frozen meat, fish and poultry (7.4 percent), beverages (4.9 percent) and sweet baked items including cake and sweet biscuits (4.2 percent) are also significant sources of energy (Table 3).

**Table 3: Top contributors to intakes of calories, fat and sodium, by detailed food group (percentage contribution to total intake)**

Calories	Fat	Sodium
Staples (45.2%)	Composite meals (all) (25.9%) - Composite not commercially processed (23.5%)	Composite meals (not commercially processed) (19.0%)
Ready-made, composite (12.1%)	Staples (14.9%) - Noodles (5.7%)	Bread, crisp bread, roti, flour (18.5%)
Savoury snacks (9.0%)	Fresh and frozen meat, poultry, fish (10.5%)	Savoury snacks (16.9%)
Fresh and frozen meat, poultry, fish (7.4%)	Savoury snacks (10.3%)	Added salt (13.9%)
Beverages (4.9%) - 2.9% sugar-sweetened	Butter, fats, oils (10.0%) - Vegetable oil (6.0%)	Fresh fish, seafood (4.6%)
Cakes, sweet bisc, sweet baked (4.2%)	Coconut Products (8.8%)	Processed fish (3.7%)
Coconut Products (2.6%)	Processed meat, fish, poultry (6.3%)	Root crops and starches (2.7%)
Butter, fats, oils (inc coconut oil) (2.6%)	Cakes, sweet bisc, sweet baked (6.1%)	Composite (processed ready-made) (2.6%)
Sugar, confectionary, sweets (2.5%) - 1.6% from raw sugar and syrups	Beverages (3.4%)	Processed meat, poultry (2.6%)
Processed meat, fish, poultry (2.5%)		Noodles (2.3%)
Soya, tofu, legumes, nuts, seeds (2.5%)		Sauces, dips, dressing (2.3%)

Source: 2014 National Nutrition Survey, National Food and Nutrition Centre, Fiji

Individual foods contributing the most to overall energy intake include cassava (13.6 percent), white rice (11.2 percent), roti bread (6.1 percent) and cabin biscuits (5.4 percent). Bread and flour together contribute to 4.8 percent of energy intake, followed by noodles chow mein (2.0 percent).

The main contributors to sugar intake are sugar-sweetened beverages (4.3 percent carbohydrate intake), cakes, sweet biscuits and breads (3.9 percent), plain sugar (2.8 percent), and chocolate and confectionary (1.4 percent).

Discretionary foods contributing significantly to energy intake in Fiji include savoury snacks (8.8 percent), cakes and sweet biscuits (4.2 percent), noodles (3.3 percent), sugar and confectionary (2.5 percent), sugar-sweetened beverages (2.9 percent), butters, fats and oils (2.6 percent) and highly-processed composite foods (1.6 percent). Together **discretionary foods** contribute 26 percent to total energy intake for the average Fijian.

#### *Fat and saturated fat intake*

The category of food contributing the most to fat intake by Fijians is composite foods <sup>1</sup> (home prepared or commercial) (25.9 percent of fat intake). Other food categories contributing significantly to fat intake by Fijians includes staple foods (14.9 percent, with 5.7 percent contributed by noodles), fresh and frozen meat, poultry and fish (10.5 percent), savoury snacks (10.3 percent), butter, added fat and oils (10.0 percent, with 6.0 percent from polyunsaturated vegetable oil), coconut creams and products (8.8 percent). Processed meat (6.3 percent) and sweet baked items including biscuits and breads (6.1 percent) also contribute to fat intake by Fijians (Table 3).

Individual foods contributing significantly to fat consumption include coconut cream and products (7.5 percent), vegetable oil (6.0 percent), cooked fish with cabbage (5.5 percent), tuna in oil (4.3 percent), chow mein noodles (4.1 percent), cabin biscuits (3.6 percent), boneless chicken curry (3.5 percent) and roti (3.5 percent).

It is not possible to ascertain saturated fat intake through this dataset, however additional analysis shows that 23.1 percent of fat intake is from foods high in saturated fat (Table 6), including coconut cream, meat and commercial biscuits. Many composite meals (especially those commercially processed) would likely be prepared with palm-based vegetable oils, which are very high in saturated fat.

Coconut cream is particularly high in saturated fat (around 17 percent), however it plays a significant role in Pacific Island culture, cooking and eating, and is thought by many to be an important and protective food for Pacific Islanders (SPC, *Leaflet No. 16*). It is likely that the switch from a diet high in fat from coconut cream to a diet high in fat sourced from animal fat and processed foods is a key factor in cardiovascular disease development in the Pacific.

Around 18.8 percent of fat is being consumed through **discretionary foods**, including savoury snacks, sweet baked items and commercially processed composite foods. Foods to target for reductions in fat consumption include discretionary items being consumed excessively, and those foods and drinks, which are proportionally high in saturated fat (coconut cream, butter, ghee, palm-based oils, commercial biscuits and snacks, and commercial composite meals).

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<sup>1</sup> cooked or processed foods containing many different ingredients e.g. instant curries, soup mixes or meat pies. Nutrient composition of composite foods varies significantly between food items based on ingredients and the way each item is prepared. Most often composite meals are prepared with added fats and sodium.

### Sodium intake

Around 70 percent of total sodium intake by Fijians is derived from four main food categories: composite meals (21.6 percent), bread and roti (18.5 percent), savoury snacks (16.9 percent) and added salt (14 percent). Other significant food categories include fresh seafood (5 percent), processed fish (4 percent), processed meat (2.6 percent), noodles (2.3 percent) and sauces and condiments (2.3 percent).

### Intakes of beneficial nutrients

It is important to ensure that interventions to reduce consumption of foods high in fat, salt and sugar do not inadvertently exacerbate deficiencies of nutrients important to growth, development and human function. Preliminary results from the 2014 National Nutrition Survey (unpublished) show that there are subsections of the Fijian population who remain at risk of micronutrient deficiency, particularly iron, vitamin A, folate and zinc (National Food and Nutrition Centre, NNS Data).

Our analysis shows that the food category 'vegetables' is an important contributor to Vitamin A consumption by Fijians, attributable for over 40 percent of intake. Other significant sources include composite foods (likely to be made with vegetables and meats) (25.1 percent), fresh and frozen meats (9.8 percent) beverages (5.5 percent), staples (5.0 percent) and fruits (5.0 percent) (Table 6).

Food groups contributing most to fibre consumption include staple foods (40.1 percent), vegetables and nuts, legumes and seeds (14.8 percent), composite foods (13.3 percent) and savoury snacks (8.8 percent). For Vitamin C, top contributors are beverages (39.1 percent), staple foods (40.0 percent; 19 percent of which is from cassava), vegetables (11.4 percent) and fruits (10.4 percent) (Table 4).

**Table 4: Top contributors to intakes of Vitamin A, Vitamin C and Fibre, by detailed food group (percentage contribution percent)**

	Vit A pp %	Vit C pp %	Fibre pp %
Cat 15: Vegetables- fresh, frozen,	43.89	11.39	12.51
Cat 9: Composite foods- home and commercial	25.17	4.83	13.25
Cat 12: Fresh and frozen meat, poultry, fish	9.81	0.55	0.02
Cat 4: Beverages	5.48	39.06	1.84
Cat 11: Staples	4.95	30.96	40.15
Cat 14: Fruit, fresh, frozen, dried	4.85	10.41	3.89
Cat 10: Butter, fats, oils (inc coconut)	1.77	0.00	0.00
Cat 13: Processed meat, fish, poultry	1.21	0.04	0.02
Cat 3: Savoury snacks	0.39	0.76	8.79
Cat 16: Soya, tofu, legumes, nuts, seeds	0.25	0.26	14.75

Source: Authors' analysis of the 2014 National Nutrition Survey

According to this analysis, protein consumption is on average adequate, with 30.0 percent sourced from fresh meat, fish and poultry, 23.0 percent from staple foods and 20.1 percent from composite foods. Average zinc consumption at 8.8mg meets recommended daily intakes for females, however it is short of what is recommended for the average males (12mg/day). Key contributors to zinc intakes are staple foods (36.9 percent), fresh meat fish and poultry (16.1 percent) and composite foods (16.1 percent).

Key sources of iron include staple foods (23.0 percent), pre-prepared foods (composite meals, such as curries) (21.3 percent) and fresh meat, fish and poultry (12 percent). Vegetables (10.9 percent) and savoury snacks (7.0 percent) also provide iron, the latter due to dried pea and lentil snacks. Fiji have a mandatory flour fortification program in place which increases the iron content of bread, roti and flour.

Surveys demonstrating high rates of anaemia among the Fijian population indicate that many people do not consume enough iron-rich food, or that foods contributing iron have low absorption availability (29). Haem iron is derived from animal proteins and has approximately 25 percent greater absorption rate than non-haem iron (48). Haem iron is found in just 14.5 percent of iron-contributing foods here, with the remainder made up with non-haem iron (Table 8). Non-haem iron is found in plant-based foods including lentils, vegetables and cereals.

#### In Fiji, which foods contain nutrients linked to diet-related NCDs in significant amounts?

An analysis of the packaged and pre-prepared foods available in Fiji showed that they contain significantly higher amounts of energy, fat, saturated fat, sugar and sodium when compared with unprocessed, whole foods (Table 5).

The most **energy**-dense food categories (per 100g) in Fiji include fats and oils, sweet toppings and confectionary, and sweet baked items including cakes, sweet biscuits and sweetened bakery items (eg donuts, buns, pancakes). Savoury snacks including biscuits and crisps, savoury bread items (including roti and bread), breakfast cereals, and noodles are also among foods with the highest energy density in Fiji.

The most **sugar**-dense foods available in Fiji included raw sugars and syrups, confectionary and toppings, cakes and other sweet baked items. Breakfast cereals on average contained more sugar than edible ices and sugar-sweetened drinks. Sauces, dips and dressings also contained significant amounts of sugar.

The foods with the highest **fat** density in Fiji included fats and oils, chocolate and confectionary, coconut products, savoury snacks, meat, processed meat and poultry. Fats and oils, chocolate and confectionary, other dairy items (e.g. cheese, cream), noodles, processed meat and savoury snacks contained the highest proportion of saturated fatty acids.

Apart from table salt, foods containing the highest amounts of **sodium** per 100g includes: noodles; prepared sauces, dips and dressings; savoury snacks; composite and convenience foods; and processed meat and poultry. Bread and roti also contain high levels of sodium, and this category is a key contributor to sodium because of the quantities in which it is consumed by Fijians.

Some specific examples of processed foods containing high levels of 'nutrients of concern' are listed below:

- Savoury snacks contain extremely high levels of sodium (1191mg) and an average of 20 percent fat with 8 percent saturated fat.
- Packaged noodles contains 1320mg of sodium per 100g and 13.8 percent fat, over half of which is saturated (7.2 percent).
- Bread and flour-based products (bread, roti) contain around 760mg sodium per 100g, and contribute over 18 percent of total sodium intake.
- Processed meats are comprised of an average of 17.7 percent fat and 8.3 percent saturated fat. They contain excessive levels of sodium (average 902mg/100g).
- Sugary drinks including soda, tang and juice contain between 7 percent and 13 percent sugar. When consumed as a 325ml serve, a drink with 10 percent sugar equates to 32g of sugar (more than 6tsp of sugar).
- Sauces, dips and dressings are especially high in sodium (1266mg/100g) and contain significant amount of sugar (average 15 percent content).
- Confectionary, toppings and chocolate are especially high in sugar (average 56 percent) but provide little or no quantities of beneficial nutrients (e.g. protein, iron, vitamins).
- Composite and cooked meals are highly variable in their nutrient content due to the potential mix of ingredients and cooking methods. Composite meal examined here are on average high in energy (avg>400Kcal per 100g) and very high in fat (avg 25 percent fat). They are often prepared with high levels of salt, with composite foods processed commercially (category 9b) delivering on average around 1400mg of sodium per 100g serve.
- Cakes, sweet biscuits and sweet baked items contain around 419Kcal per 100g serve, comprised of around 30 percent sugar 15 percent. These foods account for 5 percent of total energy intake by Fijian, but deliver very few other beneficial nutrients to Fijians (ie iron, vitamin C, vitamin A).
- The range of breakfast cereals available in Fiji are especially high in sugar, with the average cereal containing 23 percent sugar. Malt-o-Meal cereals, Fruity Dyho Bites and Tootie Fruity contain between 40 percent and 46 percent sugar. Kellogg's Frosted Flakes and Cocopops each contain 36 percent sugar and Kellogg's Smores and Frosties contain over 40 percent sugar.
- Fats containing especially high ratios of saturated fat includes butter (49 percent saturated), ghee (60 percent) and coconut oil (82 percent), are each consumed in large amounts in Fiji. 'Vegetable' fats and oils imported from Malaysia and Indonesia and generically marked 'vegetable oils' are likely palm-oil based. Palm oils contain between 40 and 46 percent saturated fat (a vegetable fat that is very high in saturated fat)(12).
- Some packaged foods deliver a higher number of beneficial nutrients and relatively low levels of sugar, salt and fat, for example split peas or unsalted nuts.



**Table 5: Energy, fat, sugar and sodium density of packaged and fresh foods in Fiji**

Average nutrient density of foods						
Detailed Food Category	Energy (Kcal/100g)	Fat (%)	Sat fat %	Sugar ( %)	Sodium (mg/100g)	Source
Cat 10: Butter, fats, oils (inc coconut)	653	73	28	0	486	PSS
Cat 9b: Convenience, ready-made	485	26	n/a	n/a	1404	NNC/PFCT
Cat 9a: Composite meals	442	24	n/a	n/a	751	NNC/PFCT
Cat 1a: Choc, confection, toppings	423	29	17	56	168	PSS
Cat 2: Cakes, sweet bisc, sweet baked	420	15	7	30	317	PSS
Cat 3: Savoury snacks	429	20	8	1	1192	PSS
Cat 6: Breakfast cereals	378	4	1	23	378	PSS
Cat 1b: Raw sugar, syrups	358	0	0	87	66	PFCT
Cat 11a: Bread, crisp bread, roti	307	6	n/a	n/a	754	PFCT/PSS
Cat 11c: Noodles	312	13	7	2	1321	PSS
Cat 12c: Other meat	279	20	n/a	0	118	PFCT
Cat 7: Other dairy, yog, cream, sour	250	21	16	9	598	PSS
Cat 8: Coconut Products	234	23	n/a	n/a	n/a	PFCT
Cat 12b: Poultry	234	15	n/a	n/a	110	PFCT
Cat 12d: Eggs	233	15	n/a	n/a	146	PFCT
Cat 5: Edible ices	223	12		22	49	PSS
Cat 13b: Processed meat, poultry	183	18	8	1	903	PSS
Cat 12a: Fish, seafood	160	7	n/a	n/a	211	PFCT
Cat 13a: Processed fish	136	7	2	2	457	PSS
Cat 17: Sauces, dips, dressing	131	6	2	15	1266	PSS
Cat 11d: Root crops and starches	124	1	n/a	n/a	28	PFCT
Cat 11b: Rice, grains	123	0	0	0	5	PFCT
Cat 16: Soya, tofu, legumes, nuts, seeds	118	0	0	3	2	PFCT
Cat 14: Fruit, fresh, frozen, dried	93	1	n/a	n/a	16	PSS & PFCT
Cat 15: Vegetables, fresh, frozen,	61	2	1	4	181	PSS & PFCT
Cat 4b: Milk	58	2	1	5	42	PSS
Cat 4d: Other bev, ssb, choc powder,	52	1	0	10	22	PSS
Cat 4a: Juices	42	2	0	9	42	PSS
Cat 4c: Coffee, tea	1	1	0	0	0	PSS
Cat 18: Salt	0	0	0	0	38 000	USDA
PFCT: Pacific Food Composition Tables, with author analysis to create category averages [15]						
PSS: Pacific Store Surveys, with author analysis to create category averages [14]						
USDA: United States Department of Agriculture Food Composition Database [16]						

Based on the nutrient analysis performed here, '**discretionary foods**' in Fiji include:

- Chocolate, confectionary and toppings, sugar and sugary syrups (e.g. honey)
- Cakes, sweet biscuits and other sweet bakery items (e.g. iced buns)
- Edible ices (e.g. ice creams and frozen ices)
- Savoury snacks (e.g. extruded snacks, including noodles)
- Sugar sweetened beverages (e.g. soft drinks, powder mixes and flavoured milks)
- Instant noodles

In Fiji, the most **nutrient-dense food categories** include root crops and starches (energy, fibre and vitamins), fresh fish and seafood (protein), fruit and frozen fruit and vegetables (fibre, vitamins and minerals), lower fat dairy products (calcium) and fresh, leaner cuts of meat and poultry (protein, iron and zinc).

#### Summary: Foods and Nutrients to target in Fiji

This analysis suggests that policies aiming to reduce diet-related NCD risk should address excessive consumption of **energy, sugar, sodium, fat, saturated fat and trans fatty acid**.

These data indicate that policies targeting foods contributing significant salt, sugar and fat consumption to the diet would not significantly impact on intakes of beneficial nutrients protein, zinc, iron, calcium, Vitamin A or fibre.

Composite meals, bread and roti, and fresh meat and poultry, are all core foods which contribute significantly to intake of beneficial nutrients in addition to nutrients linked to NCDs, sodium, fat, saturated fat, therefore these groups require specific consideration as to how proposed thresholds are applied in an appropriate policy intervention.

Beneficial nutrients to be promoted by associated policies include **calcium, iron, zinc and fibre**.

#### Step B: Consideration of the most appropriate choice of base (e.g. per 100g, per 100kJ)

According to Fiji's Food Safety Regulations (2009), all package foods and beverages must on their label indicate energy, protein (g), fat (g) and carbohydrate (g) content per 100g or 100ml.

The Pacific Store Survey found that nearly all food products provided data per 100g, consistent with food standards in Australia and New Zealand. The predominating source of manufacture for packaged foods in Fiji at that time was Australia (26 percent), Fiji (21 percent) and NZ (13 percent). A 2017 study confirmed that the most common origin of food products imported to Fiji included Australia, NZ, Japan and US(17) (Ravuvu et al, 2017).

Therefore, a base of per 100g/per 100ml is selected as the appropriate base.



### Step C: Identification of most appropriate [type of model](#), in relation to intended use of model

The purpose of this nutrient profiling model is to underpin policy(ies) that aim to incentivise healthy food consumption (and/or disincentivise unhealthy food consumption). Therefore, the primary considerations for Fiji are that the model:

- Is straightforward to implement with respect to policy administration;
- Clearly identifies healthier and less-healthy foods to which the policy incentives can be applied, in a transparent and systematic manner; and
- Improves the food environment (availability, affordability etc) through incentivising production and/or import of healthier products

Based on this, the most appropriate model would be **category specific** (provides incentives for consumers AND producers/importers to switch to healthier products within categories; policies can also be applied to entire categories to incentivise movement from less healthy categories to healthier categories) and **threshold-based** (provides straightforward nutrient criteria for policy administration, that incentivise consumption, production and/or import of healthier foods). This is a similar approach taken by the World Health Organization in the Western Pacific and European Regions for a nutrient profiling model to underpin restrictions on marketing of foods and beverages to children.

### Step D: Identification of the most appropriate and relevant [nutrient thresholds](#)

Goals established by the consumption analysis (Step A) include to:

- Reduce energy and sugar intakes 'discretionary foods', which are energy dense and/or nutrient poor
- Reduce consumption of saturated fat through discretionary foods, processed meat, fresh meat and poultry and composite foods (home and commercially prepared).
- Reduce fat intake from sources high in saturated fat and trans-fatty acids
- Reduce sodium use in prepared foods and manufacture of bread and processed foods
- Promote consumption of fresh fish, fruit, vegetables and legumes
- Increase consumption of foods high in fibre, calcium, zinc and iron

#### [Groups to be exempted from thresholds in the model](#)

Some groups have not been included in the model because they are either core foods providing large amounts of beneficial nutrients, or they are groups shown to be insignificant to Fijians. Reducing the number of categories also reduces administrative burden.

**Fruit, vegetables, starchy vegetables:** These are core foods, and processed varieties are being consumed in minimal amounts (fried, salted varieties are included under savoury snacks)

**Coconut products:** juice and milk and cream

**Table 6: Mean nutrient composition of foods and categories being targeted by Fiji's nutrient profiling model**

Detailed food categories used during analysis.	Composition Mean energy (Kcal/100g)	Composition Mean Fat (%)	Composition Sat fat %	Composition Mean Sugar (%)	Composition Mean Sodium (mg/100g)
Choc, confect, toppings syrups	423	29	17	56	168
Raw sugar,	358	0	0	87	66
Cakes, sweet bisc, sweet baked	420	15	7	30	317
Breakfast cereals	379	4	1	23	420
Savoury snacks	429	20	8	1	1192
Sweetened beverages	52	1	0	10	22
Edible ices	223	12	8	22	49
Composite meals	174	5	2	4	1061
Convenience, ready-made	174	5	2	4	1061
Butter, fats, oils (inc coconut)	653	73	28	0	486
Bread, crisp bread, roti, flour	307	6	n/a	n/a	754
Noodles	312	14	7	2	1321
Fish, seafood	160	7	n/a	n/a	211
Poultry	234	15	n/a	n/a	110
Other meat	279	20	n/a	0	118
Processed fish	136	7	2	2	457
Processed meat, poultry	183	18	8	1	903
Sauces, dips, dressing	131	6	2	15	1266
Table salt	0	0	0	0	38 000
Note: Data sources for each category detailed in Table 5 above					

### Proposed threshold groups and nutrient thresholds

Based on food categories above, foods identified for targeting, and data on current composition of foods in Fiji, thresholds for fat, sugar and sodium are proposed for all food groups, with reference to international models (Table 7).

**Table 7: Summary of considerations in developing nutrient profiling model for Fiji**

Nutrients targeted in proposed food categories	WHO WPRO Model [18]	Other reputable models[19, 20]	Proposed for Fiji	Notes (to be deleted) MM= mean/median when they are similar values
All thresholds per 100g				
<b>Choc, confect, toppings, syrups</b>	Nil given- not permitted	Danish Code Marketing: Desserts and candy <5g fat, < 5g sugar	<5g fat <5g sugar	Mean fat: 29% median: 10% Mean sugar: 56%, median sugar 56%
<b>Raw sugar</b>	Nil given- not permitted	Not applicable		Not allowed in most models
<b>Table salt</b>				
<b>Beverages (sweetened drinks, juice, milk)</b>	Juice 5g sugar Milk 4g fat SSB 0g sugar	Danish Code Marketing: Beverages 0g sugar, 0g fat Netherlands Tripartite: sugars 6g, saturated fat 0.5g	<5g fat <5g sugar	Mean and median sugar 9—10%  5% to allow milk which is naturally 5% sugar
<b>Other dairy (excluded milk and butter)</b>	Yogurt, cream 4g fat, 10g sugar, 80mg sodium Cheese 20g fat, 520mg sodium	Danish Code Marketing: Yogurt, cream, curd 2.5g fat, 10g sugar Cheese, 20g fat	<5g sugar <20g fat	Sugar is a concern in yogurt, in all other dairy it is fat. Established sugar threshold to limit sugary yogurt and fat threshold to limit overly fatty creams and cheese?
<b>Edible ices</b>	10g sugar 4g fat 80mg sodium	Danish Code Marketing: Desserts and candy 5g fat, 5g sugar	<5g fat <8g sugar	Mean and median sugar: 22% (twice the sugar of SSB), Mean and median fat 11—12% Ices are generally consumed in small quantities. This threshold promotes 100% juice watered down (~9% sugar), while ruling out SSB
<b>Cakes, sweet biscuits</b>	Nil given- not permitted	HF: bread <400mg sodium Danish Code Marketing: <10g fat	<400mg sodium <10g fat	Mean fat: 15%, median fat 17% Mean and median sugar 30—31% Mean sodium: 316mg, median sodium 265 (but most from biscuits).
<b>Sweet baked buns, breads</b>	10g sugars	<10g sugar	<10g sugar	Large sugar and fat reduction for biscuits (but they discretionary). However, sodium in this group should match 'bread' as much of the energy consumed in this group was largely sweetened bread, buns and dumplings as opposed to commercial biscuits. Therefore increased to 450mg.

**Table 7 [Cont'd]**

Nutrients targeted in proposed food categories	WHO WPRO Model [18]	Other reputable models[19, 20]	Proposed for Fiji	Notes (to be deleted) <i>MM= mean/median when they are similar values</i>
<b>Breakfast cereals</b>	10g fat 15g sugars 640 sodium	Danish Code Marketing: 10g fat, 15g sugar	<10g fat <15g sugar <450mg sodium	MM around 23 g sugar, 11g fat and 470sodium. Integrating this group with the 2 above due to similarities. Weetbix, cornflakes, oats, rice bubble all below 10g sugar. Of these, only weetbix and oats are also under 450mg sodium above. Around 50% of cereals <450mg sodium, however they are high in sugar. Demonstrates that 450 is feasible for cereal. Future proofing: use 'added sugar' as a number of low sodium mueslis would comply
<b>Bread, crisp bread, roti</b>	480mg sodium 10g fat 10g sugars	HF: <400mg sodium Danish Code Marketing: 10g fat, 10g sugar, Finland better choices: sodium <700gm for Heart symbol [21] Pacific Salt Targets 400mg sodium	<400mg sodium  <10g fat	Punjas roti and standard white bread currently 750mg+, so 450mg represents a 50% reduction. 400—450mg is consistent with other models. According to market research by HF (2010) there were plenty of breads contain around 400mg/100g [22]. Should align to Pacific Salt Targets
<b>Savoury snacks</b>	400mg sodium 0 sugar	Netherlands Tripartite: <4g saturated fat	<450mg sodium	Mean fat: 20%, median 26% Mean sodium: 1191, median sodium 652mg Pacific Salt Targets allow 560—800mg depending on the food, however, there is an argument for remaining strict because this group is completely discretionary.
<b>Noodles</b>	10g fat 10g sugar 480g sodium	Danish Code Marketing: 500mg sodium 10g fat 10g sugar	<450mg sodium <10g fat	Only 2 brands have <450mg, only 4 brands have <10% fat. Strict because noodles are discretionary (I believe) and overeaten

Table 7 [Cont'd]

Nutrients targeted in proposed food categories	WHO WPRO Model [18]	Other reputable models[19, 20]	Proposed for Fiji	Notes (to be deleted) <i>MM= mean/median when they are similar values</i>
<b>Composite meals (prepared, convenience and ready-made)</b>	10g fat 4g saturated fat 10g sugar 400mg sodium 225 Kcal	HF: ready meals 2g saturated fat 300mg sodium HF: canned meat meals and ready meals > 75g veg per serve Danish Code Marketing: 500mg sodium, 10g fat 10g sugar <sup>B</sup> Danish gives special conditions for composite	<10g fat, <4g saturated <225 Kcal  500mg sodium  Minimum 75g vegetable content per serve of food	Allows some oil added salt while discouraging excessive use. Sodium represents 50% reduction from mean (over 750) Consistent with other models Promotes added vegetable content per serve
<b>Butter, fats, oils (inc coconut oil)</b>	20g saturated fat 560mg sodium	HF: <20% of total fat saturated, <1% trans fat Netherlands Tripartite: Spreads and fats 16% saturated	20g saturated	Consistent with other models, many healthier alternatives available locally Mean 28g, Median 16g Future proofing- should consider trans fats limits. Could include sodium but no data provided in Pacific nutrient composition tables
<b>Fresh fish, seafood, poultry, other meat</b>	<20g fat	Danish Code Marketing: 20% fat	20g total fat	Targeting reduction of fatty meat cuts Proposed merge with group below
<b>Processed fish, meat, poultry</b>	<20g fat <680mg sodium	HF: canned meat meals 285Kcal 1.5g saturated fat No trans fat 350mg sodium Danish Code Marketing: 500mg sodium Netherlands Tripartite: 4g saturated fat	20g fat 4g saturated fat 500mg sodium	Aligned to Danish model- WPRO model is very lenient on this criteria 500mg allows most canned fish (460mg/100g) and very few ultra-processed meats)
<b>Sauces, dips, dressing</b>	400mg sodium 10g fat	Danish Code Marketing: 10g fat Netherlands Tripartite: 2g saturated fat	400mg sodium	Mean fat is 6g, mean sodium 1600mg Sauces are discretionary but can be helpful to increase veg consumption Only spices and herbs are under 400mg, though most curry pastes and some mustards <500mg. Could potentially lift to 500mg to allow these 2.
<b>Fresh fruit and vegetables</b>	No threshold proposed			Processed veg and fruit minimal- fruit salad in syrup miniscule
<b>Coconut products</b>	No threshold proposed			Oil included in fats and oils

<sup>b</sup> Danish code specifies for composite foods, all must contain 3 food groups in proportion with “the plate model”

### Step E: Validation and final nutrient thresholds for Fiji

The model was validated with 3 nutrition experts working in Fiji.

#### *Summary of validation*

The 18 food categories and 11 threshold groups were modified to 13 threshold groups for the following reasons:

- ‘Other dairy’ was inserted as a threshold group given likely future market growth in Fiji.
- One threshold group was split into 2 following feedback about sodium thresholds.
  - Bread was reduced to 400mg from 450mg to align to Pacific salt targets
  - Noodles and savoury snacks remain conjoined with shared sodium and fat thresholds

The model was improved for clarity regarding inclusion of pastries, tinned vegetables, honey, and powdered drink mixes.

It was agreed that the model had provided an appropriate indication of the healthfulness of foods.

## Final proposed Nutrient Profiling Model for Fiji

The following model is thus proposed for use in Fiji (Table 8).

**Table 8: Nutrient profiling model with thresholds proposed for Fiji**

Threshold group	Food Category	To be considered 'healthier', product must contain less than:				
		Fat g/100g	Saturated Fat g/100g	Sugar g/100g	Sodium mg/100g	Additional criteria
1	Choc, confection, honey, toppings, syrups	5		5		
2	Raw sugar	Not applicable				
	Table salt					
3	Beverages (sweetened drinks, juice, milks — including powdered mixes)	5		5		In future, 'added sugar' and reduce to zero.
4	Other dairy (cheese, yogurt, cream, canned)	20		5		
5	Edible ices	5		8		
6	Cakes, sweet biscuits, pastries	10		10	400	
	Sweet baked buns, breads					
	Breakfast cereals					In future, use 'added sugar' to distinguish
7	Bread, crisp bread, roti, flour				400	
8	Savoury snacks, nuts	10			450	
	Noodles, rice, grains					
9	Composite meals (prepared, convenience and ready-made)	10	4	10	500	>75g vegetable content per serve
10	Butter, fats, oils (inc coconut oil)		20			In future, consider adding trans-fatty acid limit
11	Fresh fish, seafood, poultry, other meat	20	4		500	In future, consider adding trans-fatty acid limit
	Processed fish, meat, poultry					
12	Sauces, dips, condiments				400	
13	Fresh and minimally processed fruit and vegetables	Not applicable				
	Coconut products (no other ingredients)					

## Part 3: Identify fiscal policy and priority complimentary measures for incentivizing access to affordable healthy foods in Fiji

The Rome declaration of the Second International Conference on Nutrition highlights the importance of using policy to create a healthier food environment, with improved availability, accessibility, affordability and acceptability of healthy foods relative to unhealthy foods (FAO and WHO, Rome Declaration on Nutrition). For example, policies that support public procurement of healthier food in schools and other settings; and marketing, labelling or fiscal policies; targets for reformulation to reduce salt, fat and sugar in processed foods; agricultural policies to increase production of fruits and vegetables; and policies to increase the amount of healthier food sold by retailers or street vendors.

In this section of the report, we summarise the current policy context in Fiji, assess the policy implications of the nutrient profiling model, and identify specific policy measures.

### Review of policy context

The Government of Fiji has identified non-communicable diseases (NCDs) as a priority. Cabinet endorsed the NCD Strategic Plan in 2016, including creation of a multisectoral steering committee, which will be chaired by the Prime Minister. Nutrition is also a policy priority for the Government of Fiji, and it is planned that it will feature significantly in the new National Development Plan, currently under development.

Comprehensive action on nutrition and NCDs is described in the Food Security and Nutrition Policy for Fiji, a whole-of-government policy led jointly by the Ministries of Agriculture; Health and Medical Services; Education, Heritage and Arts; and Women, Children and Poverty Alleviation. The strategic goal of the Food Security and Nutrition Policy is to ensure the availability, accessibility and affordability of safe and nutritious food for every Fijian, sufficient to meet their dietary needs, cultural and food preferences for an active and lasting healthy life.

This policy includes 'supply side' focused policies and programmes to promote availability, accessibility, affordability and acceptability of healthier foods. For example, promotion of sustainable, diversified and resilient food systems, investment in nutrition-sensitive value chains, support for healthier school food environments, and investment in nutrition sensitive social welfare initiatives. The Policy is operationalized by the Food Security and Nutrition Action Plan, which identifies specific policy changes, initiatives and programs to achieve nutrition objectives.

The key policy document for the Ministry of Agriculture is the Strategic Development Plan 2018-2022. The Ministry of Agriculture is supporting the Zero Hunger Initiative, including through a multi-sectoral stakeholder committee.



Within the health sector, other relevant food and nutrition policy documents and governance structures include the Food safety legislation and associated Technical Advisory Group (Food TAG), National Breastfeeding Policy, the School Health Policy (2016), and the Adolescent Health Policy.

The Ministry of Health has also developed government catering guidelines, which are in preparation for submission to Cabinet, and regulations on the marketing of foods and beverages to children, which are currently with the Solicitor-General's Office.

The Ministry of Education and Ministry of Health have formally collaborated on the School Health Policy (2016) and ongoing Health Promoting Schools Initiative. Relevant to this, the Ministry of Health, Women, Social Welfare and Poverty Monitoring is also supporting the initiative "Healthier Fiji schools" through assessing the opportunity to expand the free school milk programme with a fruit plate supplement.

Existing specific taxes on unhealthy foods include import excise taxes of 15 percent (in addition to fiscal import duties of 32 percent) on confectionary and chocolate, prepared foods, sweet biscuits, potatoes, and bottled soft drinks (Gov of Fiji, Customs Tariff Schedule). There are fiscal import duties (no excise taxes) on fresh fruit and vegetables of 5 percent, except for tomato, lettuce, cucumber, aubergine, pumpkin and potato, which have a fiscal import duty of 32 percent. It should be noted that this follows significant liberalization and reductions in tariffs since the 1960s (Thow et al, 2011).

### Policy implications of the model

**Sweets, confectionary, frozen ices:** These contain high amounts of sugar and in some products fat. They are mostly ultra-processed and contain no beneficial nutrients, and are subject to a sugar threshold (thus capturing those varieties that may also be high in fat, as all are high in sugar). They are a discretionary food and an appropriate target for taxation.

**Salt and Sugar:** Salt and sugar in their free forms are not amenable to thresholds, and policy intervention should target consumer behavior. For example, the addition of salt at the table, or addition of sugar to hot beverages. Social marketing may be the most appropriate approach.

**Beverages:** Sugar sweetened beverages are a discretionary food, contributing to sugar intakes but not beneficial nutrient intakes. The literature suggests that consumption is highly amenable to reductions through taxation.

**Sweet baked items:** Sweet baked items including cakes, biscuits and buns are high in energy from fat, sugar and carbohydrates, thus subject to sugar and fat thresholds. They are discretionary foods and thus appropriate targets for taxation.

**Breakfast cereals:** Although these are not commonly consumed in large amounts by Fijians, global trends suggest consumption will slowly increase (Euromonitor International, *Cultural Variations or Peculiar Tastes: Global Prospects for Breakfast Cereals*). Breakfast cereals in Fiji are

extremely high sodium and sugar content. At the moment, they can be considered a discretionary food, and are an appropriate target of taxation; this may also help to limit market growth in unhealthy cereals.

**Bread and roti:** These are core foods in Fiji, but they also contribute significantly to sodium intake because of the high rate of consumption. As core foods, policies targeting sodium consumption in bread should focus on reducing sodium content – in particular, incentivizing reformulation – as opposed to reducing quantities consumed, due to their significant contribution to protein, calcium, zinc, fibre, Vitamin A and iron intake.

**Savoury snacks:** Savoury snacks are highly processed and contain high levels of fat, saturated fat and sodium, with each shown to be a significant source of intake for Fijians. As discretionary foods, they are likely to be amenable to taxation and also to incentives for reformulation.

**Noodles:** Packaged noodles are contributing significantly to intakes of energy, fat and sodium, all of which will be targeted with nutrient thresholds.

**Composite meals (home prepared and commercial):** Composite meals have been shown to be significant contributors to most beneficial nutrients (protein, iron, calcium, zinc, vitamin A and fibre). However, these foods are also a major contributor to intakes of energy, sodium and fat in Fiji. Composite meals (non-commercial) may be difficult to target with tax or other measures based on composition, because they are prepared or sold without food labels and therefore nutrient composition data. Composite meals are, however, amenable to reformulation, such as through increasing vegetable content and reducing salty flavorings or saturated fat content, and policies should target this approach.

**Fats and oils:** The contribution of fats and oils to NCD-risk is highly variable, dependant on the product's source and level of saturation or hydrogenation. Butter, ghee and low-quality vegetable oils (i.e. palm oil) can be a major contributor to intake of saturated and trans fatty acids, and therefore subject to a saturated fat threshold.

**Fresh meat, fish and poultry:** Most fresh meat and poultry is sold free of packaging and nutrient labelling. However, these foods contribute 10 percent to overall fat intake by Fijians and many are high in saturated fat. Policies should promote reduction in consumption of the higher fat cuts of meat (for example chicken wings) – these may be an appropriate target for social marketing. For example, the social marketing that accompanied the sales ban on mutton flaps helped to shift population perceptions and demand for high fat sheep meat (Thow et al, 2010).

**Processed meat and fish:** Processed meat and processed fish contribute relatively equally to intakes of sodium, fat, and beneficial nutrients. However, both are high in sodium, and processed meat in particular contains fat which is largely saturated. The thresholds for fat and sodium are likely to be a strong basis for incentivizing reformulation, for example, through application of nutrient targets or mandatory nutrient limits.

## Recommendations for fiscal policy and complementary measures

### Fiscal policy measures

This analysis suggests the application of significant specific excise taxes on discretionary foods not meeting nutrient profiling criteria, as these foods contribute significantly to intakes of unhealthy nutrients and are likely to be more price sensitive than core foods.

Discretionary food categories contribute an average of 149g of food to the daily intake (9.2 percent of 1615 grams/person/day). However, these products contribute a much higher proportion of nutrients of concern: 343 calories (16.4 percent of 2091 calories/person/day), 15.4 grams of fat (25.2 percent of 61grams/person/day) and 440 milligrams of salt (20.2 percent of 2176 milligrams/person/day). As a result, reductions in consumption of these products can have a substantial effect on consumptions of nutrients associated with NCD risk. Many of these foods are relatively inexpensive for the significant contribution they make to intakes of energy and nutrients of concern, and thus appropriate targets of taxation (as the cost does not internalize their significant health impacts).

The literature reviewed indicates that significant taxes, of up to 50 percent or 100 percent, on these products would have a meaningful impact on consumption and health. The specific food categories (discretionary foods) recommended to be taxed are:

- Confectionary and sugar
- Beverages (sweetened drinks, juice, milks)
- Edible ices
- Cakes, sweet bakery and biscuits
- Savoury snacks, including instant noodles

In addition to these considerations of impact and price elasticity, the recommendation to target only discretionary foods is also influenced by considerations of feasibility. The application of fiscal policy measures to all food categories in the nutrient profiling model is limited somewhat by the requirements for labeling in Fiji. Fiji's Food Safety Regulations (2009, amended 2012) require only that food labels specify energy, protein, fat and carbohydrate content, and not sugar or saturated fat.

In Part 4, we model the estimated impact of a tax on discretionary foods at 20 percent, 50 percent and 100 percent on consumption, health, revenue and household expenditure.

### Complementary policy measures targeting discretionary food consumption

There is opportunity to utilize part of the revenue generated by taxation through complementary measures targeting the taxed foods. As described in the review in Part 1, this would act to increase the effect of taxation on diets and health.

#### 1. Additional incentives for reformulation

We recommend establishing nutrient targets for salt, fat and sugar in processed foods, based on the nutrient profiling. This would compound the effect of the tax in encouraging

reformulation, and also improve the nutrient composition of core foods and composite foods, which are not affected by the tax.

### *2. Complementary social marketing*

A social marketing and school-based campaign that de-normalises consumption of discretionary foods would enhance the effect of the tax, promote public awareness and support for the tax, and further promote reductions in discretionary salt and sugar consumption.

### *3. Restrictions on marketing of discretionary foods*

There is an opportunity to enhance the draft regulation on marketing of foods and beverages to children with a broader regulation that limits the marketing of discretionary foods that do not meet the nutrient profiling criteria. This would complement the social marketing campaign and further incentivize reformulation, through targeting public acceptability of discretionary foods.

## *Complementary policy measures to promote healthy foods*

The significant revenue that would likely be raised by the tax would provide financial support for implementation of measures recommended in the Food Security and Nutrition Policy and a Food Security and Nutrition Action Plan that target healthy food affordability and availability. This would further support consumers to make healthier choices, through making these more acceptable and accessible. In particular, subsidies to increase affordability of staple root crops, wholegrain foods, fruit, vegetables and legumes; and subsidies/technical support to increase use of healthier inputs (healthy oils) and reductions in unhealthy components in processed food manufacturing.

## Part 4: Model the impact of a science-based health excise on consumption, nutrition and revenue

### Price elasticity estimates, based on international evidence

Price elasticity of demand refers to changes in consumer demand, in response to a change in price of a good. Price elasticity estimates (PEEs) are almost always negative, because demand falls as price rises. Food items that can be considered necessities such as staples such as bread and rice tend to be price inelastic, meaning that it has a price elasticity of demand between zero and one (demand falls less than one percent, for a one percent increase in price), and may be in the range of 0 to -0.4, for example (Andreyeva et al, 2010). In contrast, discretionary foods such as chocolate and confectionary may be more price elastic in their demand; for example, around -1. Specific foods may have higher price elasticities of demand, due also to the ability of consumers to substitute between such foods. It is this substitution that provides the mechanism by which fiscal measures (taxes and subsidies) can be employed to encourage healthy diets. Examples of such substitution might be low-fat meats for high-fat meats, or unsweetened beverages for sweetened beverages.

Overall, price elasticity values tend to be higher in low and middle-income countries compared to high-income countries, as consumers have a higher level of price sensitivity (Green et al, 2013). However, as indicated earlier, staple foods, which vary according to cultural factors, are usually very inelastic. In Table 1 we provide estimates for Fiji.

International research suggests that price elasticities alone do not account for consumer reactions to large health-related taxes, because these are likely to be fortified by complementary consumer awareness and education interventions (Thow et al, 2014). This highlights the potential for the modelling here to underestimate the impact of fiscal policy that is implemented as part of a package of interventions, as proposed in Part 3. While recent research on the use of PEEs to estimate the impact of taxation of soft drinks in the Pacific suggests that these might overestimate consumption effects (Gibson and Romeo, 2017), the cumulative effect of multiple interventions is unaccounted for. As such, these estimates should be reasonably robust for targeted fiscal policies implemented as part of a policy package designed to disincentivise consumption of discretionary foods.

### Price elasticity values for discretionary foods in Fiji

Based on a review of the international literature, and with particular emphasis on price elasticity estimates from low- and middle-countries (LMIC), we have identified PEEs for the specific food categories in the nutrient profile model relevant to Fiji (Cornelsen et al, 2013).

Sweetened beverage price elasticities, relevant to LMIC, have been identified in a number of reviews. Snowdon estimated a PE of between 0.7 and 1<sup>2</sup> for soft drinks in both Fiji and Tonga. This is consistent with recent analyses from Brazil and India, which generated PEEs of 0.85 and 0.94 for sugar-sweetened beverages, respectively (Basu et al, 2012). It is also

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<sup>2</sup> Note that as per convention we present PEEs in absolute values – but all of the PEEs presented represent negative PEEs (demand falls as price rises)

consistent with a more general price elasticity estimate for “drinks and sweets” of 0.96 in low-income countries and 0.61 in middle income countries, in Muhammad (2011). However, a more recent analysis from Ecuador found an own-PEE of 1.2 for the total population, and 1.3 for the low socioeconomic group (Paraje, 2016).

We therefore propose a PEE of 1 for sweetened beverages in Fiji. There is also potential for complementary interventions, such as public awareness campaigns regarding health risks and consumer-oriented labelling, to increase this price elasticity.

Confectionary and sugar have limited PEEs available. As above, Muhammad (2011) estimated a general price elasticity for “drinks and sweets” of 0.96 in low-income countries and 0.61 in middle income countries. Snowdon estimated a PEE of 0.8—2 for confectionary, as a luxury good, and 0.5—0.7 for sugar, as a staple, in Tonga. Green and colleagues estimate a price elasticity for sweets, confectionary and sweetened beverages of 0.74 in low-income countries and 0.68 in middle income countries. Based on these, for Fiji we propose a PEE for sugar of 0.7 and a PE of 1 for confectionary and edible ices

Savoury snacks and sweet baked goods include a varied group of food products, and price elasticity is likely to depend on the degree to which substitution is possible. Estimates for price elasticity of high energy density foods are limited for LMIC. Snowdon estimated a PEE of 1—2 for fried packet snacks and cheese in Tonga. Estimates from high income countries range from 0.5 to 2.11. If less healthy snack foods are narrowly defined (such that substitution to healthier products is possible), we propose a PEE for savoury snacks in Fiji of 1.5.

While savoury and sweet breakfast biscuits and packet noodles are generally viewed nutritionally as snacks or convenience foods, in Fiji they are frequently eaten for breakfast and lunch. Cereals and staples are generally fairly price inelastic, and our review found PEEs for cereals between 0.01 to 0.61, or 0.18 to 0.61 in LMIC. While the price elasticity for cereals is generally low, in Fiji there is substantial opportunity for substitution (i.e. bread, baked goods and rice) thus a PE of 0.8, 1 and 1.5 was estimated for packaged noodles, sweet biscuits and staple biscuits, respectively..

## Logic models and assumptions

### Logic models for the impact of the tax

We developed logic models to explain the basis of the models estimating impact of the tax on consumption and health, revenue and household expenditure.

Consumption and health:

Tax on production and import -> increased cost to consumers -> decreased purchase -> some level of substitution -> decreased consumption -> **decreased intake of fat/salt/sugar - > change to NCD risk/prevalence**

Based on current average prices of goods (at a category level) we also calculate the potential impact on revenue and household income.

Tax on production and import -> **increased government revenue** -> increased cost of goods to consumers -> consumer response to price increase (change to consumption using price elasticity estimate) -> **change in household food expenditure**

#### Assumptions for modelling

We based our assumptions for the modelling of the impact of the taxes on consumption on the recent systematic review by Thow and colleagues (Thow et al, 2014) and also on the approach to modelling the effects of interventions, including taxation, by Snowden and colleagues (Snowden, 2010).

For all models, we assume the following

1. Tax/tax removal is fully passed to consumers
2. Consumers substitute with untaxed goods
3. Nothing else changes
4. Price control changes to allow price increases or decreases
5. Tourist consumption is negligible
6. Policy change is sustained

When modelling the **impact on revenue**, we assumed:

1. Consumers substituted taxed products with untaxed products (ie. substitution would not contribute to revenue)
2. Consumers aged 0—14 years and >65 years consumed 60 percent of a full '**average adult**' equivalent (informed by consultation with the National Food and Nutrition Centre)

When modelling the **impact on household expenditure**, we assumed:

1. Individual and household expenditure would be decreased by the cost of the taxed good (proportional to the estimated decrease in consumption)
2. We estimated that the average household comprised 4 adult-equivalents, based on the HIES finding that the average household was equal to 5 persons (we have dietary data available for the average "adult-equivalent"). Our estimate of 4 adult-equivalents per household was determined in consultation with a nutritional statistician in Fiji, based on the likely combinations of adults and children in Fijian households (eg. 3 adults, 2 children or 2 adults, 3 children) with an average intake of discretionary food. As for Assumptions on the impact on revenue, children 0-14 years and adults >65 years consumed 60 percent of the full average adult-equivalent.

#### Ranges for estimates of impact

For the modelling of **impact on consumption and household expenditure**, we provide a range of estimates of changes in nutrient consumption and expenditure effects based on different possible consumer responses regarding substitution:

1. High estimate: consumers make no substitution for their decreased consumption
2. Mid-estimate 1: consumers compensate for decreased purchase/consumption of less healthy foods by increasing their consumption of comparable healthier foods by the

same volume (so, for example, replacing 50g of savoury snacks with high salt and fat, with 50g of bread, or replacing sweet snacks with fruit)

3. Mid-estimate 2: consumers substitute their decreased purchase/consumption of less healthy foods by increasing their consumption of other foods by 50 percent of this volume, such that they are replacing foods with higher levels of nutrients of concern with foods containing the average nutrient density of population dietary intake for these nutrients (so, for example, replacing 50g of savoury snacks with high salt and fat, with 25g of foods containing the average salt/fat density of population dietary intake)
4. Low estimate: consumers compensate for decreased purchase/consumption of less healthy foods by increasing their consumption of other foods by the same volume, such that they are replacing foods with higher levels of nutrients of concern with foods containing the average nutrient density of population dietary intake for these nutrients (so, for example, replacing 50g of savoury snacks with high salt and fat, with 50g of foods containing the average salt/fat density of population dietary intake)

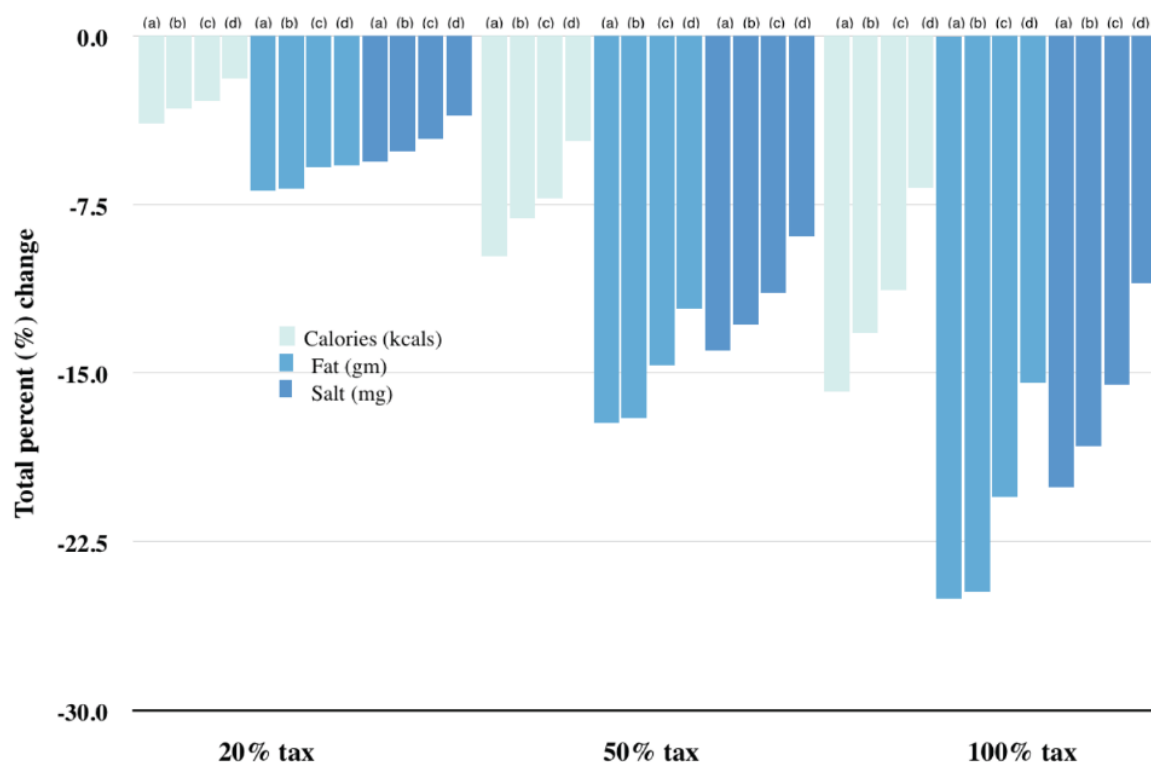
### Estimated impact on consumption

We modelled the expected impact of a specific tax equal to an increase in the average price of 20 percent, 50 percent and 100 percent (20 percent being the minimum recommended in the literature for a meaningful effect on consumption) for each discretionary food category identified in Phase 4: confectionary (including sugar), cakes and sweet biscuits, savoury snacks, juices and sugar-sweetened beverages (excluding koko), edible ices, and instant noodles.

The estimated decrease in calorie consumption from the minimum recommended 20 percent tax ranged from 82 (4 percent) kcal/person/day with no substitution, to 39 (2 percent) kcal/person/day with 100 percent of the decreased volume substituted with foods at the average energy density of the diet (Figure 1). The estimated decreased fat consumption ranged from 4 (7 percent) to 3 (5 percent) grams/person/day and salt consumption decreased ranged from 122 (6 percent) to 78 (4 percent) mg/person/day (See Summary Table).

***Figure 1: Percent (%) change in total dietary consumption of nutrients of concern, across tax scenarios (20%, 50% and 100% taxes) and substitutions***





**Notes:**

(a) No substitution (high estimate)

(b) Healthy substitution (mid-estimate 1)

(c) 50 percent replacement with average diet (mid-estimate 2) and

(d) 100 percent replacement with average diet (low estimate).

Source: Authors' calculations based on consumption data from 2014 National Nutrition Survey. See Detailed Summary Table on p.45 for data by food category.

The estimated decreased calorie consumption from the 50 percent tax ranged from 205 (10 percent) kcal/person/day with no substitution, to 98 (5 percent) kcal/person/day with 100 percent of the decreased volume substituted with foods at the average energy density of the diet (Figure 1). The estimated decreased fat consumption ranged from 11 (17 percent) to 7 (12 percent) grams/person/day and salt consumption decreases ranged from 305 (14 percent) to 194 (9 percent) mg/person/day.

The highest tax of 100 percent gave estimated decreases in calorie consumption ranging from 331 (16 percent) kcal/person/day with no substitution, to 142 (7 percent) kcal/person/day with 100 percent of the decreased volume substituted with foods at the average energy density of the diet. The estimated decreased fat consumption ranged from 15 (34 percent) to 10 (24 percent) grams/person/day and salt consumption decreases ranged from 437 (20 percent) to 239 (11 percent) mg/person/day.

### Confectionary

The reduction in consumption of confectionary and sugars predicted by the model for the 20 percent, 50 percent and 100 percent tax was 20 percent and 14 percent, 50 percent and 35 percent, and 100 and 75 percent, respectively. Depending on the type of substitution,

this resulted in a total decrease of between 8.5 to 5.5 calories/person/day (-2.1 to -0.2 percent), a negligible change to fat and sodium (-0.4 to 0.3 percent and 0.4 to 0.1 percent respectively). Increased salt intake is likely due to possible replacement with higher density foods in line with the average diet.

#### Cakes, sweet biscuits and baked goods

The reduction in consumption of cakes and sweet biscuits for the 20 percent, 50 percent and 100 percent tax and a PEE of 1 (all products) was 20 percent, 50 percent and 100 percent, respectively. For cakes and biscuits, this equated to a total reduction in consumption of approximately 2.9, 7.2, and 14.5 grams/person/day, respectively. Depending on the type of substitution, this resulted in an approximate total decrease of between 45.0 and 5.3 calories/person/day (-2.2 to -0.1 percent), 1.3 to 0.2 grams of fat/person/day (-2.2 to -0.3 percent) and 34.5 to 3.0 milligrams salt/person/day (-1.6 to -0.1 percent).

#### Savoury snacks

The reduction in consumption of savoury snacks for the 20 percent, 50 percent and 100 percent tax equated to a total reduction in consumption of approximately 11, 27 and 36 grams/person/day, respectively. Depending on the type of substitution, this resulted in an approximate total decrease of between 155 to 32.8 calories/person/day (-7 to -0.3 percent), 11 to 3 grams fat/person/day (-19 to -5 percent) and 345 to 89 milligrams salt/person/day (-16 to -4 percent).

#### Beverages

The estimated reduction in consumption of beverages with the 20 percent, 50 percent and 100 percent tax and a PEE of 1 (all products) equated to a total reduction in consumption of approximately 16.0, 40.0 and 80.0 millilitres/person/day, respectively. Predicted decreases in caloric intake varied from 73.3 (100 percent tax, healthy alternative) to 4.3 (20 percent tax, 50 percent replacement with average dietary density) calories/person/day. In contrast, predicted increases resulted from scenarios with 100 percent average dietary density substitution (30.3 to 6.1 calories/person/day with 100 percent tax, 20 percent tax, respectively). However, global evidence suggests that people are unlikely to substitute food for decreased beverage intake, so these are unlikely scenarios.

For our healthier substitution, we assumed the more likely scenario that consumers compensated for decreased sweetened beverage consumption by increased consumption of water and other non-caloric beverages. This scenario generates an estimated reduction in total calorie consumption of -0.70 percent for the 20 percent tax, -1.75 for the 50 percent tax and -3.50 for the 100 percent tax.

#### Edible ices

The reduction in consumption of edible ices (ice blocks) for the 20 percent, 50 percent and 100 percent tax equated to a total reduction in consumption of approximately 0.7, 1.8 and 3.7 grams/person/day, respectively. Depending on the type of substitution, this resulted in a decrease of 5.7 — 0 calories/person/day (-0.3 — 0 percent) and a decreased fat consumption of 0.3 — 0 grams/person/day (-0.5 — 0 percent). Salt, as for beverages, was

predicted to increase with substitution at 50 percent and 100 percent of average diet density (-0.1 to 0.1 percent).

Unhealthy food tax model summary																
20% Tax Model Summary					Estimated % change in calories (kcal) per person per day by substitution				Estimated % change in fat (gm) per person per day by substitution				Estimated % change in salt (mg) per person per day by substitution			
Food Category	Estimated tax	PEE Fiji	Change in product quantity consumed (g/person/day)	New quantity of product consumed (g/person/day)	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density
Category 1 - Confectionary	20%	1	1.1	4.2	-0.2	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-0.0	-0.0	0.0	-0.0	0.0
Category 1 - Sugar	20%	0.7	1.3	8.0	-0.2		-0.2	-0.1	0.0		0.0	0.1	-0.0		0.0	0.1
Category 2 - Cakes, sweet biscuits and baked goods	20%	1	2.9	11.6	-0.4	-0.3	-0.3	-0.3	-0.4	-0.4	-0.3	-0.3	-0.3	-0.2	-0.2	-0.1
Category 3 - Savoury snacks	20%	1.5	10.7	25.0	-2.2	-1.8	-1.9	-1.6	-5.6	-5.6	-5.3	-5.0	-4.8	-4.5	-4.4	-4.1
Category 4 - Beverages	20%	1	16.0	64.0	-0.7	-0.7	-0.2	0.3	-0.5	-0.5	-0.0	-0.5	-0.3	-0.3	0.2	0.6
Category 5 - Edible ices	20%	1	0.7	2.9	-0.1	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1	-0.0	-0.0	0.0	0.0	0.0
Category 11c - Noodles	20%	0.8	0.2	0.8	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total all categories			32.9	116.6	-3.9	-3.2	-2.9	-1.9	-6.9	-6.8	-5.9	-5.8	-5.6	-5.1	-4.6	-3.6

50% Tax Model Summary					Estimated % change in calories (kcal) per person per day by substitution				Estimated % change in fat (gm) per person per day by substitution				Estimated % change in salt (mg) per person per day by substitution			
Food Category	Estimated tax	PEE Fiji	Change in product quantity consumed (g/person/day)	New quantity of product consumed (g/person/day)	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density
Category 1 - Confectionary	50%	1	2.7	2.7	-0.5	-0.8	-0.4	-0.3	-0.2	-0.2	-0.1	-0.0	-0.1	0.0	-0.0	0.0
Category 1 - Sugar	50%	0.7	3.3	6.1	-0.6		-0.5	-0.4	0.0		0.1	0.2	-0.0		0.1	0.2
Category 2 - Cakes, sweet biscuits and baked goods	50%	1	7.2	7.2	-1.1	-0.8	-0.9	-0.6	-1.1	-1.1	-0.9	-0.7	-0.8	-0.6	-0.6	-0.3
Category 3 - Savoury snacks	50%	1.5	26.8	8.9	-5.6	-4.5	-4.8	-3.9	-14.1	-13.9	-13.2	-12.4	-11.9	-11.2	-11.1	-10.2
Category 4 - Beverages	50%	1	40.0	40.0	-1.8	-1.8	-0.5	0.7	-1.3	-1.3	-0.1	1.1	-0.9	-0.9	0.4	1.6
Category 5 - Edible ices	50%	1	1.8	1.8	-0.1	-0.1	-0.1	-0.0	-0.2	-0.2	-0.2	-0.1	-0.0	0.0	0.0	0.1
Category 11c - Noodles	50%	0.8	0.4	0.6	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2
Total all categories			82.1	67.3	-9.8	-8.1	-7.2	-4.7	-17.2	-17.0	-14.7	-12.1	-14.0	-12.8	-11.5	-8.9

100% Tax Model Summary					Estimated % change in calories (kcal) per person per day by substitution				Estimated % change in fat (gm) per person per day by substitution				Estimated % change in salt (mg) per person per day by substitution			
Food Category	Estimated tax	PEE Fiji	Change in product quantity consumed (g/person/day)	New quantity of product consumed (g/person/day)	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density	No dietary substitution	Healthy alternative	50% replacement with average diet density	100% average diet density
Category 1 - Confectionary	100%	1	5.3	0.0	-0.9	-1.6	-0.8	-0.6	-0.4	-0.4	-0.3	-0.1	-0.2	0.0	-0.1	0.1
Category 1 - Sugar	100%	0.7	6.5	2.8	-1.1		-0.9	-0.7	0.0		0.2	0.4	-0.1		0.1	0.3
Category 2 - Cakes, sweet biscuits and baked goods	100%	1	14.5	0.0	-2.2	-1.6	-1.7	-1.3	-2.2	-2.1	-1.7	-1.3	-1.6	-1.2	-1.1	-0.7
Category 3 - Savoury snacks	100%	1.5	53.6	0.0	-7.4	-6.0	-6.3	-5.2	-18.7	-18.6	-17.6	-16.5	-15.9	-14.9	-14.8	-13.6
Category 4 - Beverages	100%	1	80.0	0.0	-3.5	-3.5	-1.0	1.4	-2.7	-2.7	-0.2	2.3	-1.7	-1.7	0.8	3.2
Category 5 - Edible ices	100%	1	3.7	0.0	-0.3	-0.1	-0.2	-0.0	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.0	0.1
Category 11c - Noodles	100%	0.8	0.8	0.2	-0.4	-0.4	-0.4	-0.4	-0.6	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Total all categories			164.3	3.0	-15.8	-13.2	-11.3	-6.8	-25.0	-24.7	-20.5	-15.9	-20.1	-18.2	-15.5	-11.0

### Instant noodles

The reduction in consumption of instant noodles (uncooked) for the 20 percent, 50 percent and 100 percent tax with a PEE of 0.8 was 16 percent, 40 percent and 80 percent, respectively. This equated to a total reduction in consumption of approximately 0.2, 0.4 and 0.8 grams/person/day, respectively. Depending on the type of substitution, this resulted in a decrease of between 8.8 and 1.6 calories/person/day (-0.4 — 0 percent), a decreased fat consumption of between 0.3 to negligible grams/person/day (-0.6 — 0 percent) and a decreased salt intake of between 11.4 and 2.1 milligrams/person/day (-0.5 to — 0.1 percent).

### Estimated impact on health

We were able to estimate the implications of these consumption changes for reductions in hypertension resulting from reduced salt intake. Our model estimates that with a 100 percent tax and no substitution, or at least substitution to a no-salt alternative that on average there will be a 0.609 gram daily reduction in salt reduction. Based on existing evidence of a linear relationship between consumption and blood pressure, such a reduction in consumption translates to around 1 mm Hg reduction in Systolic Blood Pressure (Mozaffarian et al, 2014).

Even seemingly small reductions in SBP may have significant population level effects given the recognised dose-response relationship between blood pressure reduction observed at levels above the relatively low threshold of SBP of 115 mmHg. For instance in adults aged 60-69 years a SBP reduction of 1 mm Hg has been estimated to reduce risk of stroke mortality by 4 percent and 3 percent mortality from ischaemic heart disease or other vascular causes (Lewington et al, 2002).

Evidence suggests that there are likely to be additional health benefits from reduced intakes of fat, calories, and (specifically) sugar sweetened beverages.

A meta-analysis of eight randomised controlled trials on the effect of replacing saturated fat with polyunsaturated fat on coronary heart disease, published in 2010 (Mozaffarian et al, 2010), found an overall pooled risk reduction of 19 percent (RR = 0.81, 95 percent confidence interval [CI] 0.70–0.95,  $p = 0.008$ ), corresponding to 10 percent reduced CHD risk (RR = 0.90, 95 percent CI = 0.83–0.97), for each 5 percent energy of increased PUFA, without evidence for statistical heterogeneity (Q-statistic  $p = 0.13$ ;  $I^2 = 37$  percent). Meta-regression identified study duration as an independent determinant of risk reduction ( $p = 0.017$ ), with studies of longer duration showing greater benefits.

A meta-analysis of data nine cohorts on soft drink consumption and diabetes (Greenword et al, 2014) found that the summary relative risks for sugar-sweetened and artificially sweetened soft drinks were 1.20/330 ml per d (95 percent CI 1.12, 1.29,  $P < 0.001$ ) and 1.13/330 ml per d (95 percent CI 1.02, 1.25,  $P = 0.02$ ), respectively. The association with sugar-sweetened soft drinks was slightly lower in studies adjusting for BMI, consistent with BMI being involved in the causal pathway. Consistent with this finding, another meta-analysis of eight studies found that individuals in the highest category of SSB intake (around

one to two servings per day) had a 26 percent (risk ratio [RR] 1.26, 95 percent CI 1.12–1.41) greater risk of developing diabetes compared with those in the lowest category (none or less than one per month) (Hu, 2013). This review noted that experimental evidence from RCTs evaluating the effects of reducing SSBs on clinical diabetes is lacking, but that there is a strong and consistent association and a demonstrated dose–response that is likely mediated through increases in insulin resistance and chronic inflammation.

Hall and colleagues calculated a simple approximation for the effect of a reduction in caloric intake on body weight (Hall et al, 2011). Every permanent change of energy intake of 100 kJ per day (23.9 kCal) will lead to an eventual weight change of about 1 kg; it will take about 1 year to achieve half of the total weight change and 95 percent of the total weight change will result in about 3 years.

### Estimated impact on revenue

We identified a specific (weight/volume based) tax rate for each category of foods equivalent to a 20 percent, 50 percent and 100 percent increase in price, based on the mean retail price per 100g of a range of foods in each category.<sup>3</sup> For each tax scenario we calculated the estimated average annual revenue, based on the quantity consumed (new estimated consumption after tax is implemented), per person and for the total Fijian population as at 2016. As described in the Assumptions, we assumed that the non-working age population consumed proportionally less than the ‘adult equivalent’.

The annual revenue generated from the proposed 20 percent, 50 percent and 100 percent tax per person would be FJD67, FJD96, and FJD4, respectively. For the total Fijian population (898,760 as at 2016 (World Bank, 2016), the proposed 20 percent, 50 percent and 100 percent tax would equal FJD51.4 million, FJD74.3 million and FJD3.5 million, respectively (Table 9).

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<sup>3</sup> See Appendix 3 for pricing data.

**Table 9: Estimated annual revenue generated (FJD)**

Tax applied	Estimated annual revenue (FJD)
	Total
20% tax	51,441,639
50% tax	74,296,012
100% tax	3,471,354

<sup>a</sup> 60% consumption relative to average adult assumed

Source: Author's calculations, based on World Bank statistics (World Development Indicators, population data) (World Development Indicators) and price data from the National Food and Nutrition Centre

As the tax increases, it is predicted that consumption decreases, showing a trade-off between reductions in consumption and revenue generation (particularly at the 100 percent tax rate).

### Estimated impact on household expenditure

We modelled the expected impact of a specific tax (equal to an increase in the average price of 20 percent, 50 percent and 100 percent) on individual and household expenditure, based on data from the Fiji Household Income and Economic Survey (HIES) (2008-09) (Fiji Bureau of Statistics (2011).

We estimated that for taxes of 20 percent, 50 percent and 100 percent on discretionary foods in Fiji, an *individual's annual* expenditure would be reduced by between FJD1 and FJD27, FJD73 and FJD138, and between FJD312 and 419, respectively, depending on substitution.

Similarly, we estimated that for taxes of 20 percent, 50 percent and 100 percent on discretionary foods, a *household's annual* expenditure would be reduced by between FJD5 and FJD109, FJD293 and FJD552, and between FJD1248 and FJD1676 respectively, depending on substitution.

Depending on substitution, taxing unhealthy discretionary foods at 20 percent, 50 percent and 100 percent reduced total *food* expenditure by between -0.1 percent and -2.3 percent, -6.2 and -11.7 percent and -24.0 and -35.6 percent, respectively (see Table 11).

Similarly, taxing unhealthy discretionary foods at 20 percent, 50 percent and 100 percent reduced total *household* expenditure by between 0 percent and -0.7 percent, -2.0 and -3.7, and -8.5 percent and -11.4 percent, respectively (see Tables 10 and 11).

**Table 10: Estimated impact on annual individual and total household expenditure (FJD)**

Dietary Substitution	Estimated change in annual total individual expenditure (FJD)			Estimated change in annual total household expenditure (FJD)		
	20% tax	50% tax	100% tax	20% tax	50% tax	100% tax
<b>None</b>	-27	-138	-419	-109	-552	-1676
<b>50%*</b>	-15	-108	-365	-61	-432	-1462
<b>100%*</b>	-3	-78	-312	-13	-313	-1248
<b>Healthy</b>	-1	-73	-314	-5	-293	-126

\* at average diet cost

Source: Author's calculations



**Table 11 Estimated change in weekly expenditure as a percentage of average income across taxes and substitutions**

Dietary Substitution	20 percent tax			50 percent tax			100 percent tax		
	Weekly spend (FJD)	% of total food spend <sup>a</sup>	% of total household spend <sup>b</sup>	Weekly spend (FJD)	% of total food spend <sup>a</sup>	% of total household spend <sup>b</sup>	Weekly spend (FJD)	% of total food spend <sup>a</sup>	% of total household spend <sup>b</sup>
<b>None</b>	-2.1	-2.3	-0.7	-10.6	-11.7	-3.7	-32.2	-35.6	-11.4
<b>50%*</b>	-1.2	-1.3	-0.4	-8.3	-9.2	-2.9	-28.1	-31.0	-9.9
<b>100%*</b>	-0.2	-0.3	-0.1	-6.0	-6.6	-2.1	-24.0	-26.5	-8.5
<b>Healthy</b>	-0.1	-0.1	-0.0	-5.6	-6.2	-2.0	-24.2	-26.7	-8.5

<sup>a</sup> Total food expenditure = 31.9% of total household expenditure (HIES data, 2008/09).

<sup>b</sup> Total household expenditure = 84.9% of average household income (HIES data, 2008/09).

\* % substitution, at average diet cost

Source: Author's calculations from HIES data (2008/09)

This analysis suggests that fiscal policy interventions on discretionary foods are unlikely to represent a significant financial burden to households, in the case that households reduce consumption of the taxed goods – even when households substitute with healthier foods.

## Conclusion and recommendations

Taking action on nutrition and NCDs is a priority for the Government of Fiji, as articulated in its 2017 National Development Plan (Republic of Fiji, 2017. *5-Year & 20-Year National Development Plan: Transforming Fiji.*). The 2017 Fiji Food Security and Nutrition Policy and Plan of Action identify the need to establish the nutrition impact, and impact on revenue, of food and beverage taxes. The population of Fiji is experiencing a triple burden of malnutrition, and high rates of obesity and NCDs. These high rates of NCDs are associated with significant social and economic costs, including lost productivity and major demands on health care services.

A significant contributor to high salt, sugar and fat intakes are discretionary foods, such as confectionary, snacks and sweet beverages. These foods contribute an average of only 9 percent of daily food intake, but a much higher proportion of nutrients of concern: 16 percent of calories, 25 percent of fat and 20 percent of salt. As a result, reductions in consumption of these products can have a substantial effect on consumptions of nutrients associated with NCD risk. Many of these foods are relatively inexpensive for the significant contribution they make to intakes of energy and nutrients of concern, and thus appropriate targets of taxation. The analysis presented here indicates **the application of significant excise taxes (20-50 percent) on discretionary foods not meeting nutrient profiling criteria.**

We base our recommendations for taxation on a Fiji-specific nutrient profiling model, which sets thresholds for energy, sugar, sodium, fat, and saturated fat across food categories, in line with the Fiji Dietary Guidelines (see p.35 of this report).

Globally, there is growing interest in the application of fiscal policies to create incentives for the consumption of healthier (rather than unhealthy) foods, in order to accelerate action on malnutrition in all its forms, and NCDs. This is reflected in the Global Action Plan for Small Island Developing States, and the Fiji National Food Security and Nutrition Policy and Plan of Action. Internationally, the strongest evidence is for the effectiveness of targeted excise taxes on sugar sweetened beverages. There is also opportunity to increase the impact of taxation through investing revenue strategically (e.g. in Berkeley, health promotion programs designed to improve nutrition and decrease consumption of sugary drinks). The literature indicates that significant taxes, for example, 50 percent, would have a meaningful impact on diets and health.

Based on the analysis in this report, the specific discretionary food categories recommended to be taxed are:

- Confectionary and sugar
- Beverages (sweetened drinks, juice, milks)
- Edible ices
- Cakes, sweet bakery and biscuits
- Savoury snacks, including instant noodles

There is opportunity for the revenue generated by taxation to support **implementation of complementary measures recommended in the Food Security and Nutrition Policy and Action Plan:**

- Additional **incentives for reformulation**, such as nutrient targets for salt, fat and sugar in processed foods, based on the nutrient profiling.
- Complementary **social marketing**, such as a social marketing and school-based campaign that de-normalises consumption of discretionary foods would enhance the effect of the tax, promote public awareness and support for the tax, and further promote reductions in discretionary salt and sugar consumption.
- **Restrictions on marketing** of discretionary foods, to enhance the existing the draft regulation on marketing of foods and beverages to children
- Financial support for measures that target healthy food affordability and availability, such as **healthy food subsidies**.

The estimates for decreased consumption due to taxation of discretionary foods (with ranges due to different assumptions of substitution) were:

- 20 percent tax: reduction of 2 — 4 percent for calories, 5 — 7 percent for fat and 4- 6 percent for salt.
- 50 percent tax: reduction of 5 — 10 percent for calories, 7 — 11 percent for fat and 9 — 14 percent for salt

The decreases in intakes of nutrients of concern that are estimated here are associated with reduced risk of diabetes, cardiovascular disease and overweight. In particular, for those aged 60—69 years a SBP reduction of 1 mm Hg has been estimated to reduce risk of stroke mortality by 4 percent and 3 percent mortality from ischaemic heart disease or other vascular causes (Lewington et al, 2004).

The total annual revenue generated from the proposed 20 percent or 50 percent tax would equal \$FJD51.4 and \$FJD74.3 million, respectively. However, this analysis suggests that fiscal policy interventions on discretionary foods are unlikely to represent a significant financial burden to households, due to decreases in consumption of discretionary foods. Our modelling for all scenarios show either neutral effects of reductions in average household spending.

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## Appendix 1: Detailed method for developing nutrient profiling criteria

### Method used for developing a food classification system for Fiji

In this section, we apply an evidence-based methodology to develop a nutrient profiling tool to improve diets and prevent NCDs in Fiji.

The purpose of this model is to provide clear criteria to identify food and beverage products which contribute to NCD risk (those high in fat, salt and sugar), which can be used as a basis to develop more targeted policy measures to reduce unhealthy consumption. The development of a nutrient profiling system needs to be sensitive to local contexts, and to address needs of consumers, regulatory agencies and the food and agricultural industries; such a system needs to provide functional and transparent assessments of relative healthfulness of foods, and support both healthier choices and reformulation.

The methodology being applied to develop a model for Fiji is informed by a review of the literature on development of nutrient profiling systems, in particular a systematic approach recommended by Rayner and Scarborough (Scarborough et al, 2007) and then used by the World Health Organization to develop models in the European (WHO, *Regional Office for Europe nutrient profile model*) and Western Pacific Regions (WHO, *Nutrient Profile Model for the Western Pacific Region*).

This method requires evidence-informed decision-making across the following 5 steps (Rayner et al, 2004):

- A. Selection of appropriate index nutrients, in relation to desired health outcomes;
- B. Consideration of the most appropriate choice of base (e.g. per 100 g, per 100 kJ);
- C. Identification of most appropriate type of model, in relation to intended use of model;
- D. Identification of the most appropriate and relevant nutrient thresholds, in relation to desired health outcomes;
- E. Validation and testing of the model against an objective measure of a healthy diet (in this case, food-based dietary recommendations for Fiji and the Pacific region), and in relation to representation of 'healthy' and 'less healthy' foods.

### Key data sources for analysis of nutrient consumption, availability and price

#### Dietary Intakes

To identify which foods contribute most to the high intake levels of nutrients identified as contributing most to NCDs in Fiji – sodium, fat and sugar – it is necessary to establish a baseline of individual nutrient consumption.

Consumption was examined using the results of Fiji's National Nutrition Survey, conducted between October 2014 and March 2015. The survey involving 6185 individuals (1 percent of Fiji's population) aged 5–45 years, collected nutrient intake data via 24-hour recall.

Statisticians from Fiji's National Nutrition Centre analysed data from Fiji's National Nutrition Survey to determine average consumption of 542 food items by adults aged between 12 and 45 years of age (Appendix 1). In order to determine daily nutrient intakes, each food item was first converted to calorie and micro and macro nutrient values using conversion tables. The FAO's (2004) *Pacific Island Food Composition Tables* express the Calorie, micro and macronutrient quantity contained within each food product available in the Pacific Islands, per 100g serve (Dignan et al, 2004). These values are based on extensive research undertaken by Pacific regional institutions, dating back to the 1940's. The results in the Pacific Food Composition Tables were then cross-checked against the US Food Composition Tables and nutrient composition values identified through the (2011) regional survey of packaged foods (Snowdon et al, 2013). A limitation of the Pacific tables is that they do not contain values for saturated fat or sugar.

Evidence shows that self-reported dietary data most often results in significant under-reporting. A study looking at the credibility of the United States National Health and Nutrition Survey identified that underreporting was likely to be approximately 281 and 365 kcal per day for men and women. Disparities between reported and likely consumption is suggested to be much greater in obese participants, well over 700kcal per day (Archer et al, 2013). For 24 recalls this problem is primarily associated with poor recall and difficulties in estimating quantities (Subar, 2015). However, dietary surveys remain useful for identifying dietary patterns and the types of food consumed.

#### Composition of foods available in Fiji

The Pacific Food Composition Tables (cross-checked against the US Food Composition Tables) provided nutrient composition of food and beverage items. The nutrient composition of store-bought foods was sourced from a 2011 store survey conducted as a part of a regional study of packaged foods.<sup>7</sup>

While the Pacific Food Composition Tables provide nutrient data for most local foods, they do not include values for sugar and saturated fat content.

#### Recommended nutrient intake values

Nutrient intake recommendations specific to the Fijian population are not available. For this project, we drew on Nutrient Reference Values (NRVs; recommended intakes or upper limits for all nutrients associated with human health) developed by Food Standards Australia New Zealand (FSANZ, *Nutrient reference values 2006*) and nutrient intake recommendations developed by the United States of America Department of Agriculture (USDA), appropriate to their multi-racial population (U.S. Department of Health and Human Services. Dietary Guidelines for Americans). These were used as a reference point for assessing nutrient consumption as they had undergone rigorous standards development process. Recommendations from World Health Organization papers also provided nutrient requirements and dietary guidelines for fat, sodium, saturated fat, trans fat and sugar (given as a proportion of daily energy intake).

#### ***Step A: Selection of appropriate index nutrients, in relation to desired health outcomes***

To address the dual concerns of problem foods and problem diets, we identified nutrients to include in the nutrient profiling model by assessing:

- Those foods with a demonstrated association with health conditions of concern among the target population, based on a review of the international peer-reviewed literature regarding correlations between diets, nutrients and NCD risk
- Foods available in Fiji containing high levels of ‘nutrients of concern’ using data from the 2011 Pacific store survey (Snowden, et al 2013) and Pacific Food Composition Tables.
- Nutrients being consumed in amounts that are more than those recommended for good health
- Foods contributing most to high intakes of fat, salt and sugar by Fijians
- Foods contributing most to intake of beneficial nutrients by Fijians (Protein, fibre, Vitamin A, Iron, Calcium)

To ascertain which nutrients were being consumed in amounts that are more than those recommended for good health, we used data from the 2014 National Nutrition Survey. Each of the 534 foods included in the survey were grouped into like food categories, with classification aligned initially those in the Nutrient Profiling Model produced by the European Office of the World Health Organization (WHO, Regional Office for Europe nutrient profile model) (Appendix 2).

Groups were divided into subgroups based on their makeup, food variety and type/degree of processing. For example, staples were grouped into root crops and starches, bread and flour, rice and grains and pasta.

This analysis also identified foods acting as a significant source of beneficial nutrients for Fijians (Protein, fibre, Vitamin A, Iron, Calcium). Nutrient intakes were compared to the Nutrient Reference Values (NRVs) developed by FSANZ (*Nutrient reference values*, 2006) and recommendations from the United States of America Department of Agriculture (USDA, Dietary Guidelines for Americans, 2010). We have used these as a reference point for assessing nutrient consumption due to Fiji’s ongoing trade linkages with these countries (Ravuvu, 2017).

### ***Step B: Consideration of the most appropriate choice of base (e.g. per 100g, per 100kJ)***

A base was selected based on food labelling standards in Fiji, with consideration of the dominating source of origin of food imports.

Countries have adopted different bases (e.g. amount of nutrients per serving or per 100g) for food labelling; in the United States nutritional values on food products are presented as a percentage per serve where for Australia and New Zealand values are presented per 100g.<sup>4</sup> The use of a ‘per 100g’ base is common because it is simple to conceptualise and easy to compare foods within categories. The main disadvantage of using per 100g as a base is that some foods are eaten in very small portions (e.g. butter) while others are eaten in very large quantities (e.g. sweetened beverages). In contrast, using ‘per serve’ recognises that portions

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<sup>4</sup> As required by the food labelling legislation in the US and labelling legislation in Australia and New Zealand

of foods vary widely across foods and that if eaten in large amounts they supply more nutrients than if eaten in smaller amounts. The challenge however in relying on 'per serve' thresholds is that recommended serving sizes are largely determined by the food producer and vary considerably.

***Step C: Identification of most appropriate type of model, in relation to intended use of model***

There are two main decisions regarding the type of nutrient profiling model that is most appropriate for a given situation. The first is whether the model is threshold-based or continuous, and the second is whether the nutrient profiling model is category-specific or across-the-board.

***Continuous and Threshold-based Models***

**Continuous models** assign 'points' from different threshold bands across a number of different nutrients in a food. Those points are added to produce a summative score regarding relative healthfulness based on their nutrient composition, and thus foods can fall along a continuous range of scores to determine whether one food is nutritionally better than another (Rayner et al, 2004).

The advantage of continuous models is that they can differentiate between foods within categories, for instance where two cereals might be accepted as 'low in fat' in a threshold model, continuous models can differentiate which is healthier out of the two by factoring in levels of fat, as well as other nutrients, like protein, fibre and fruit content, as well as the proportion of those nutrients, to give the cereals a clear ranking.

Continuous models are also more accurate in that there are fewer anomalies, where a food might meet a threshold but not actually be considered a 'healthy' food for other reasons (for example, a highly refined sweet biscuit that contains little fat or sodium should not be labelled as 'healthy' because biscuits are generally not very nutritious (Rayner et al, 2004). However, continuous models are complex to administer, as a score needs to be calculated for foods and the assessment of healthfulness requires a comparison between the scores for different foods. Australia's 'Health Star Rating' system is an example of a continuous model.

A **Threshold-based Model** uses pre-defined nutrient thresholds to classify foods as 'healthier' or 'less healthy'. Threshold-based models can apply multiple thresholds to a food, which might all need to be met for a food to be classed as 'healthier' – for example, thresholds for salt, fat and sugar, or just a single threshold, for instance sugar thresholds for drinks. Threshold-based models are relatively simple to use, because a given food either meets the threshold or doesn't, and there is thus no calculation or comparison involved.<sup>19</sup> The Heart Foundation's Tick program is an example of a threshold-based model; it provides the Tick only to foods that have a sugar, fat and sodium content under certain thresholds.<sup>5</sup>

***Category-Specific and Across-the-Board models***

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<sup>5</sup> Heart Foundation of Australia. <http://heartfoundation.org.au/healthy-eating/heart-foundation-tick> Australia Australia Heart Foundation; 2016 [cited 2016 March 30th ]. Heart Foundation Tick Site].

**Category-specific models** assess the healthfulness of foods within defined food groups, whereas **across-the-board models** assess the healthfulness of all foods using one given standard. In deciding whether to use one nutrient criteria applicable to all foods/beverages ('across-the-board') or nutrient criteria specific to different food categories ('category-specific'), an important factor to consider is whether the model is seeking to support dietary change across food groups (for example, from fatty meats to vegetables) or dietary change within food groups (for example, from fatty meats to less fatty meats) (Scarborough et al, 2010).

For instance, an 'across-the-board' model might specify that all foods with less than 10g fat per 100g be classed as 'low fat', where a 'category specific' model might change the threshold depending on the food category, for instance by making the allowable fat content of a 'healthier' biscuit different to the allowable fat threshold of a 'healthier' starchy staple. In the first example, it would be easier to see that biscuits generally have more fat than starchy staples, whereas in the second, it would be easier to identify healthier biscuits rather than less healthy biscuits, and healthier staples rather than less healthy staples.

The main advantage of using category-specific nutrient criteria over across-the-board is that the nutrient thresholds can be tailored to the food type, allowing for better targeting of 'problem' nutrients in specific food categories. For instance, it is perfectly acceptable that cooking oils have a higher fat content than breakfast cereals, and for breakfast cereals it is more important to use a criterion that includes sodium, fibre and sugar. Additionally this type of model might incentivise manufacturers to reformulate food in order to meet a threshold.

A disadvantage of using a category-specific model over an 'across-the-board' is that category specific might oversimplify classification of what is 'healthy', and encourage people to substitute within categories even though a particular category may be unnecessary as part of a healthy diet (i.e. if a consumer uses it to switch between different brands of tinned meats when ideally they would switch to less processed sources of protein).

Another disadvantage is that the categorisation of foods may not be clear or reflect composition of the food, for instance composite foods (e.g. curry, pepe keke and meat pies) comprise of foods from more than one group. Additionally the assignment of foods into categories is culture dependant and can vary widely. In 2008, the Dutch used 14 food categories, the Swedish Government 26 food categories and the Eurofood System used 33 (Drewnowski and Fulgoni, 2008).

**Table 12: Summary of types of models for nutrient profiling**

	Continuous	Threshold-based
<b>Category-specific</b>	Assesses foods within food groups (categories) using a calculated score based on nutrient composition e.g. FSANZ Nutrient Profiling Scoring Criterion for the Australian Health Star Rating system <sup>a</sup>	Assesses foods within food groups (categories) based on whether they meet prescribed thresholds for specific nutrients e.g. Australian Heart Foundation's 'Pick the Tick' <sup>b</sup>

<b>Across the board</b>	Assesses all foods using a standard calculated score based on nutrient composition e.g. UK OfCom Model used to underpin the marketing of foods to children regulations <sup>c</sup>	Assesses all foods based on whether they meet a standard prescribed threshold for specific nutrients e.g. Codex Alimentarius Commission's nutrient claims thresholds used to inform what foods are allowed to make nutrient claims
<sup>a</sup> Nutrition, health and related claims, F2016C00082 (2016). <sup>b</sup> Heart Foundation of Australia. <a href="http://heartfoundation.org.au/healthy-eating/heart-foundation-tick">http://heartfoundation.org.au/healthy-eating/heart-foundation-tick</a> Australia Heart Foundation; 2016 [cited 2016 March 30th ]. [Heart Foundation Tick Site]. <sup>c</sup> Rayner M, Scarborough P, Lobstein T. The UK Ofcom Nutrient Profiling Model: Defining 'healthy' and 'unhealthy' foods and drinks for TV advertising to children. 2009.		

An example of a model which is category specific and continuous is the new Nutrient Profiling Scoring Criterion (NPSC) developed by FSANZ (FSANZ, *Nutrient reference values*). The NPSC takes into account energy, saturated fat, sodium and sugar content of food along with components such as fruit and vegetables, dietary fibre and protein; allocating points based on the nutritional composition per 100 g or 100 mL. 'Baseline points' are allocated for energy, saturated fat, total sugar and sodium content of the food and then 'Modifying points' are obtained for the percentage of the food that is fruit, vegetables, nuts and legumes including coconut. Some foods also score further modifying points for fibre and protein content.

An example of a model that is across-the-board and continuous is the UK's OfCom Model. The model uses a similar methodology as the NPSC to generate a final single score which determines whether the food can be advertised to children. Although it is across-the board, there is one thresholds set for what is acceptable for food and another for beverages. An example of a model which is threshold-based and across-the-board is the Codex Alimentarius Commission's nutrient claims thresholds, where global thresholds have been set for nutrient claims on all foods and drinks (such as 'low in salt') and these aren't specific to food categories.

The nutrient profiling model underlying the Australian Heart Foundation's 'Pick the Tick' scheme and the WHO EURO model are both threshold-based and category specific. In both schemes, foods have been categorised and each category has its own specific nutrient criteria to meet one or more thresholds. In the WHO EURO model for example, all foods in category 1 (chocolate and confectionary) are subject to nutrient thresholds for sugar and fat, where foods in category 4 (breakfast cereals) are subject to a different set of nutrient thresholds across fat, sugar and salt.

#### ***Step D: Identification of the most appropriate and relevant nutrient thresholds, in relation to desired health outcomes***

The key considerations in determining nutrient criteria for a nutrient profiling model relate to the desired outcome in terms of designating foods as 'healthy' or 'less healthy (Rayner et al, 2004)'. First, whether the aim is to identify 'healthier' foods – for example, the heart

foundation ‘tick’ program – or ‘less healthy’ foods – for example, in order to apply restrictions on marketing as the WHO Euro model is designed to do.

Second, the level of specificity required of the model. For example, whether the aim is to reduce population intake in line with specific targets (for example, the global NCD target to reduce sodium intake by 30 percent), or more general reductions in consumption of foods that contribute substantially to intakes of unhealthy nutrients (and/or to increase consumption of healthy foods).

Once the aim and purpose of the model is established, approaches to determining the nutrient criteria for a model are to either a) calculate appropriate criteria based on detailed dietary intake for the relevant population (i.e. identifying required reductions in specific nutrient intakes and calculating the reductions in food intakes required to achieve this); or b) adapt the criteria used in a relevant model (i.e. with similar aims) to the target population.

The type of modelling required to develop nutrient thresholds requires detailed dietary intake data (from a nutrition survey) for comparison against NRVs. This is used to determine the desired percent level of decrease per nutrient per person (i.e. 30 percent reduction in Sodium Intake), and that percentage of decrease is then applied to average nutrient contents for each food type to determine a ‘threshold’ for that food type. The Tripartite Classification Model from Denmark was developed using this method, labelling foods as being either ‘preferable’, ‘middle course’ or ‘exceptionally’ (meaning unhealthy). The Scheme was for use in government regulation on food claims, for consumer education, and to encourage food industry reformulation.

The other method for developing thresholds is to select a nutrient model that has been developed, tested and validated by a respected source. For example, the Codex Alimentarius Commission have defined thresholds used for declaring foods ‘high’ or ‘low’ in particular nutrients, and the Australian Heart Foundation has developed thresholds to distinguish ‘healthier’ from ‘less healthy’ foods within categories.

However, challenges associated with selecting thresholds from previous models include the lack of disclosure relating to selection of thresholds, a misalignment in purpose, and the lack of thresholds across all food categories. For example, the Heart Foundation’s Pick the Tick Program developed nutrient thresholds across 12 categories and 72 subcategories, but only publicly disclosed thresholds for 5 categories.

In terms of purpose, the Pick the Tick thresholds are designed to identify foods which are ‘healthier’, as opposed to identifying foods which are the ‘least healthy’, as may be required for a model that underpinned policies to restrict marketing or change relative prices of healthy and less healthy foods. A model that would be more appropriate for identifying less healthy food is the WHO-EURO model. This model discloses nutrient thresholds across 12 of its 17 categories (i.e. foods that fall below the stated thresholds are allowed to be marketed), while imposing a marketing ban on the others.



In this study, a determination of nutrient thresholds was based on the desired outcome to designate foods as 'less healthy', to underpin policies to disincentivise 'less healthy' foods. Selection of thresholds was based on the desired level of decrease per nutrient per person necessary to reduce population intake in line with FSANZ Nutrient Reference Values (FSANZ *Nutrient Reference Values*). We applied that rate of decrease to the mean and median nutrient contents for each food category using the Fiji Store Food Survey and the Pacific Nutrient Composition Tables. We used other well-known nutrient profiling models including the Heart Foundation Tick<sup>6</sup> and WHO's nutrient profiling models to inform our thresholds (WHO, *Nutrient Profile Model for the Western Pacific Region*).

### **Step E: Validation and testing**

Validation and testing of the model was undertaken with expert input from Fiji's National Food and Nutrition Centre and nutrition experts working at WHO and the George Institute for Global Health, all 3 having previously been involved in nutrient standards development for the Region. The key criteria were contextual appropriateness, functionality and feasibility.

**Contextual appropriateness:** Nutrition and health experts in Fiji were presented with the results of the dietary analysis and stepped through the decision-making process during the development of the model.

**Functionality:** A document featuring all foods which do and do not meet the nutrient thresholds in the NP model was provided to experts from NNS for assessment. The list was assessed for anomalies by examining whether the model had provided an appropriate indication of the healthfulness of foods.

**Feasibility:** The model was shown to members of the Fijian Government, food industry and stakeholders to assess interpretation and ease-of-use.

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<sup>6</sup> Heart Foundation of Australia. <http://heartfoundation.org.au/healthy-eating/heart-foundation-tick> Australia Australia Heart Foundation; 2016 [cited 2016 March 30th ]. Heart Foundation Tick Site].

## Appendix 2: Detailed tables for discretionary foods not meeting thresholds

**TG 1: Chocolate and confectionary – Thresholds: <5 g sugar and <5 g fat**

FOOD_NAME	Energy (kCals)	Fat (g)	Carbohydrates (g)	Sodium (mg)
Toffee,mixed	2111.00	91.23	321.71	1536.53
Chocolate,milk	473.95	24.88	56.29	81.72
Chocolate bar, 'bounty bar'	417.83	21.47	49.93	124.58
Chocolate,dark	211.65	11.56	25.38	22.30
Seed bar,fruit and nut	224.72	10.39	26.71	48.23
Peanut butter,smooth,with sal	117.01	9.56	2.83	91.39
Chocolate bar, 'mars bar'	186.12	7.57	27.54	83.60
Foods above this line exceed thresholds 5 g fat				
Lolly,mint,confectionery	156.86	1.04	38.56	24.91
Mango,dried	27.48	0.09	6.13	0.42
Chewing gum,regular	111.99	0.09	29.08	1.80
Sweets,boiled	258.60	0.00	65.63	53.37
Syrup,golden	1496.88	0.00	377.50	655.20
Honey	679.95	0.00	171.76	29.29
Jam,unspecified	49.85	0.00	12.44	2.45
Foods above this line exceed threshold of 5 g sugar but not fat				

Source: Nutrient composition data from National Nutrition Survey (2014)

**TG3 Beverages – Thresholds: <5 g sugar and <5 g fat**

FOOD_NAME	energyKcals	Total fat (g)	Carbohydrate (g)	Sodium (mg)
Tang powder	1192.51	0.00	311.42	616.15
Fruit drink,orange	169.00	0.00	42.03	30.33
Cordial,blackcurrant,prepared	160.35	0.00	40.62	32.07
Soft drink,Coca-Cola	146.91	0.00	37.63	41.02
Softdrink,lemonade	149.71	0.00	37.60	59.19
Softdrink,cola	142.33	0.00	36.08	39.72
Juice,orange and mango	142.46	0.42	32.68	12.57
Juice,orange,commercial	132.18	0.00	30.84	11.02
Milkshake,other flavours,commercial	137.97	2.21	23.22	99.53
Cordial,citrus,25 % prepared	65.77	0.00	16.83	17.41
Coffee powder,instant	145.22	0.66	11.11	20.90
Milk,condensed,skim,sweet,can	184.66	0.20	39.39	86.35
Foods above this line exceed threshold of 5 g sugar				
Milk,condensed,whole,sweet,ca	483.22	13.46	80.01	154.80
Ovaltine powder	696.94	5.20	143.69	304.58
Chocolate,drinking,powder	557.60	9.15	112.24	381.25
Milo powder	422.85	10.25	71.68	283.20
Cocoa powder,Australian	549.87	18.11	69.74	336.39
Ovaltine powder	696.94	5.20	143.69	304.58
Cocoa beverage, cocoa powder & milk	199.04	10.66	17.68	127.36
Milo,made with milk	170.15	6.37	16.94	145.46
Foods above this line exceed threshold of 5 g fat and sugar (WHO)				
Wine,white	186.88	0.00	3.16	69.00
Coffee,with milk,instant & regular,ns str & amt milk	35.06	1.63	2.99	32.61
Cocoa powder,Malaysian	26.30	1.30	2.83	5.50
Tea,white,brewed from leaf/teabags,reg,ns amt milk	26.84	1.52	1.82	27.32
Coffee,brewed	5.08	0.00	1.02	5.08
Rum	2902.74	0.00	0.00	28.74
Whisky	1421.00	0.00	0.00	0.00
Tea,Indian,infused	0.00	0.00	0.00	5.33
Softdrink,cola,diet	0.00	0.00	0.00	20.58

Softdrink,lemonade,diet	0.00	0.00	0.00	85.00
Tea,lemon grass,brewed,C. col	6.68	0.67	0.00	10.01
Tea,lemon leaf,brewed,Citrus	10.59	1.06	0.00	3.53
Water,imported,bottle	0.00	0.00	0.00	78.90

*Source: Nutrient composition data from National Nutrition Survey (2014)*

**TG 3: Ices <8 g sugar and <5 g fat**

FoodID	FOOD_NAME	Energy (kCals)	Fat (g)	Carbohydrates (g)	Sodium (mg)
M020	Ice cream,vanilla	456.32	26.21	46.80	163.81
ZZ19	Ice block	64.70	0.00	15.82	5.58
Foods above this line exceed threshold of 8g sugar					

Source: Nutrient composition data from National Nutrition Survey (2014)

**TG5 Cakes, sweet bakery, breakfast cereals – Thresholds: <450 mg sodium <10 g sugar and <10 g fat**

FOOD_NAME	Energy (kCals)	Fat (g)	Carbohydrates (g)	Sodium (mg)
Corn flakes,sugar coated,Kell	1656.91	0.88	390.87	3569.40
Rice bubbles	1047.00	1.20	244.80	3180.00
Corn flakes	940.78	2.50	211.43	2977.48
Cheesecake,commercial	3580.92	231.77	315.29	2818.80
Cake,cream cake,sponge	1701.31	58.61	264.02	1365.60
Doughnut,home made	470.10	23.45	59.86	1025.86
Pikelet,plain	4950.00	8.37	92.06	629.74
Bun,fruit,glazed	462.14	6.84	84.59	475.48
Bun,fruit,glazed	462.14	6.84	84.59	475.48
Pudding,self saucing	541.62	15.61	94.10	470.48
Foods above this line exceed threshold of 450 mg sodium				
Cake,iced,commercial	416.36	16.63	62.40	413.01
Cake,iced,commercial	416.36	16.63	62.40	413.01
Muesli,toasted	940.50	37.35	123.75	375.75
Pie,egg custard fill, bottom crust	638.82	36.80	69.61	98.84
Pie,apple,deep,baked	599.56	34.44	66.64	309.69
Pancake,home prepared	347.18	17.54	38.48	108.27
Biscuit,cream and jam filled	357.87	17.26	48.31	155.59
Biscuit,chocolate coated	313.74	15.79	39.27	164.43
Cake,lamington	394.32	14.76	59.52	198.40
Pie, coconut	402.94	14.60	65.15	202.18
Buns, Cook Is coconut bun	604.30	14.50	108.00	386.13
Biscuit,chocolate	364.88	14.33	54.40	258.25
Cake,chocolate,home prepared	260.82	12.48	32.64	348.69
Cake,chocolate,home prepared	260.82	12.48	32.64	348.69
Biscuit,plain sweet	346.63	12.37	54.26	222.89
Cake,fruit,dark,home prepared	348.84	11.83	54.77	316.20
Cake,fruit,dark,home prepared	348.84	11.83	54.77	316.20
Biscuit,fruit-filled	420.15	10.86	75.25	175.52
Cake,banana	258.80	10.66	37.74	219.03
Foods above this line exceed threshold of 10 g total fat (but not sodium)				
Custard powder	178.71	0.37	44.02	168.51
Cake,plain,commercial	169.88	7.30	22.38	231.44
Cake,plain,commercial	169.88	7.30	22.38	231.44
Biscuit,shortbread	151.10	7.63	19.03	147.12
Biscuit,cream,wafer	126.18	6.72	15.66	24.23
Cake,madeleine	141.71	8.44	14.47	29.60

Coco pops	42.46	0.21	39.68	74.25
Foods above this line LIKELY exceed threshold of 10 g sugar (but not sodium or fat)				
Rice pudding, dessert, smooth	51.42	0.84	9.31	16.50
Oats, rolled, cooked	296.07	6.26	48.40	5.69
'Weet-bix'	260.10	1.85	47.87	211.62
Oats, rolled, raw	254.73	4.00	44.70	7.41

Source: Nutrient composition data from National Nutrition Survey (2014)

**TG6 Savoury snack foods – Thresholds: <450 mg sodium and <5 g fat**

FOOD_NAME	Energy (kCals)	Fat (g)	Carbohydrates (g)	Sodium (mg)
Taro chips,Samoan,Leilei bran	5533.00	323.40	567.60	4785.00
Peas,dried,fried	568.66	28.74	49.50	2913.29
Popcorn,regular,commercial	777.55	39.61	86.52	1590.80
Taro,chips,fried	1605.20	93.82	164.67	1388.19
Scone,plain,home prepared	657.10	20.19	103.23	1323.73
Biscuit,cabin,hard,Pacific Is	798.43	15.43	144.45	1249.72
Potato crisps,plain,salted	977.22	63.32	88.57	1087.02
Cheese snack,Twistie-type	406.00	22.30	44.44	799.22
Chips,pea-flour,fried	585.08	37.07	44.39	768.26
Cheese flavour snacks,twistie	402.41	23.68	43.95	729.83
Cracker,sao,jatz	384.72	15.20	55.27	670.32
Noodles,instant,uncooked	372.27	14.71	51.05	484.59
Cashew,roasted,salted	898.86	72.85	37.35	411.80
Foods above this line exceed threshold of 450mg sodium				
Island dumpling,cooked	1087.93	98.96	32.20	3.39
Nuts,mixed,salted	945.72	81.84	19.39	347.80
Peanut,kernels,roasted,salted	447.49	37.15	9.92	239.23
Peanut,kernel & skin,raw	340.80	28.26	5.34	0.60
Corn chips,flavoured	318.75	18.13	32.56	318.75
Peanut,kernel and skin,roasted	209.67	17.23	4.80	126.67
Noodles,Maggi-type,boiled	287.20	11.02	39.16	5.80
Biscuit,wheatmeal	313.20	11.72	45.99	291.27
Foods above this line exceed threshold of 10g fat (but not sodium)				

Source: Nutrient composition data from National Nutrition Survey (2014)



## Appendix 3: Summary of price data used in modeling

Food category	Product	Ave price (FJD) per 100gm
<b>Category 1</b>	Confectionary (lollies)	1.87
— Confectionary	Confectionary (chocolate)	2.83
	Confectionary (spreads)	1.37
- Sugars	Confectionary (other: gum)	3.54
	Sugar (raw or brown)	0.17
	Sugar (white)	0.47
	Honey	2.28
	Sugar (other: golden syrup)	1.49
<b>Category 2</b>	Biscuits (Sweet, plain)	0.57
- Cakes, sweet biscuits	Biscuits (Shortbread)	7.00
	Biscuits (Sweet, other)	1.64
	Cakes (commercial eg. chocolate)	3.45
	Buns (sweet, iced, fruit & glazed)	0.67
	Pikelets	2.00
	Cakes (cheesecake)	4.81
	Pies (sweet, egg custard)	1.45
<b>Category 3</b>	Savoury crackers (eg. cabin)	0.57
— Savoury snacks	Chips (assorted: eg. corn)	2.64
	Potato crisps, plain, salted	2.22
	Flavoured snacks (eg. twisties)	0.90
	Popcorn, regular, commercial	2.20
<b>Category 4</b>	Beverages (juice)	0.40
— Beverages	Beverages (drink powders e.g. tang)	2.42
	Beverages (soft drinks: cola)	0.17
	Beverages (other: cordial)	0.59
	Beverages (fruit drink, orange)	0.35
	Beverages (milk, condensed)	1.25
<b>Category 5 — Edible ices</b>	Edible ices (Ice block)	0.81
<b>Category 11.c — Noodles</b>	Noodles instant, uncooked)	1.07

Source: Fiji National Food and Nutrition Centre, Targeted Store Survey

Prices for calculating substitution costs, :

Substitute	To replace (where applicable)	Cost per gram (FJD)
<b>Healthy alternatives:</b>		
• <b>Fruit</b> (pineapples, bananas, pawpaws, oranges)	• Confectionary • Sweet biscuits/baked goods • Savoury snacks • Edible ices	0.0038 (Average price)
• <b>Brown bread</b>	• Noodles	0.0020
• <b>Porridge</b>	• Buns/pikelets	0.0044
• <b>Water</b>	• Beverages	0.00

*Source: Fiji National Food and Nutrition Centre, Targeted Store Survey*



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