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RESEARCH ARTICLE

The development of sodium reduction targets for New Zealand fast foods and a comparison with the current sodium contents of products

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Abstract

Sodium intake attributed to fast food is increasing globally. This research aims to develop maximum sodium reduction targets for New Zealand (NZ) fast foods and compare them with the current sodium content of products. Sodium content and serving size data were sourced from an existing database of major NZ fast-food chains. Target development followed a step-by-step process, informed by international targets and serving sizes, and previous methods for packaged supermarket foods. Sodium reduction targets were set per 100 g and serving, using a 40% reduction in the mean sodium content or the value met by 35–45% of products. Thirty-four per cent (1797/5246) of products in the database had sodium data available for target development. Sodium reduction targets were developed for 17 fast-food categories. Per 100 g targets ranged from 158 mg for 'Other salads' to 665 mg for 'Mayonnaise and dressings'. Per serving targets ranged from 118 mg for 'Sauce' to 1270 mg for 'Burgers with cured meat'. The largest difference between the current mean sodium content and corresponding target was for 'Other salads' and 'Grilled Chicken' (both –40% per 100g) and 'Fries and potato products' (–45% per serving), and the smallest, 'Pizza with cured meat toppings' (–3% per 100 g) and 'Pies, tarts, sausage rolls and quiches' (–4% per serving). The results indicate the display of nutrition information should be mandated and there is considerable room for sodium reduction in NZ fast foods. The methods described provide a model for other countries to develop country-specific, fast-food sodium reduction targets.

Key words: **Benchmarking: Fast-foods: New Zealand: Salt: Sodium: Target**

Introduction

Excess sodium consumption leads to hypertension, which in turn is associated with cardiovascular disease, the leading cause of preventable mortality in New Zealand (NZ) and globally.[1,2] New Zealand adults 15 years and over consume 3,035 mg of sodium per day,[3] far more than the World Health Organization (WHO) upper limit of 2,000 mg per day; this is despite NZ committing to a 30% relative reduction in mean population sodium intake by 2025, as part of the WHO Global Action Plan for reducing non-communicable diseases.[4] A recent WHO report shows that NZ, like many other countries, is not on track to meet its commitment to the WHO to reduce population sodium.[5]

Like other high-income countries with Western diets, NZ adults consume around 75% of sodium from processed foods, defined as foods that have been altered from their natural state by industrial processes and including ultra-processed foods, formulations of ingredients not commonly found in a home kitchen and often with added salt, sugar and chemical additives.[6] The higher sodium content of processed and

[†]A related abstract was presented at the Annual Scientific Meeting of the Nutrition Society of New Zealand and published in Multidisciplinary Digital Publishing Institute (MDPI). It included the development of the sodium reduction targets (presented here), and semi-structured interviews regarding the implementation of the targets (not presented here).
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ultra-processed foods found in supermarkets and the out-of-home sector (defined as outlets where food or beverages are prepared for immediate consumption) means that reformulation considered a 'Best Buy' by the WHO, is an important strategy for reducing sodium intake.[7,8] Furthermore, reducing the sodium content of processed foods if done gradually has little impact on consumer acceptability and does not require consumer agency, meaning it is more likely to deliver pro-equity benefits.[5,9,10]

Equitable interventions are particularly important for NZ which is a diverse country with considerable health inequities.[11] However, NZ does not have a national sodium reduction strategy, and the reformulation of processed foods is currently driven by two voluntary programmes, both of which focus only on supermarket products, that is, the Heart Foundation food reformulation programme including sodium reduction targets for 40 categories of supermarket foods,[12] and the Health Star Rating, a Trans-Tasman voluntary front-of-pack label scheme of which one component is sodium.[13]

However, in 2020 the average NZ household spent 27% of its weekly food budget on restaurant meals and takeaways, an increase of 5% since 2000,[14] and with the rise of online food delivery applications making fast food even more accessible,[15] this percentage is likely to continue to rise. In addition, the sodium content of NZ fast foods has been consistently high, with a 2018 study reporting that while the sodium per 100 g remained consistent between 2012 and 2016, an increase in serving size means consumers are receiving more sodium per serving than before.[16] Combination meals (combo meals), which are meal deals that bundle individual products together, are particularly problematic, with half of these types of meals in 2020 found to contain close to the WHO 2,000 mg/d upper daily sodium intake limit.[17]

Two countries with world-leading sodium reduction programmes are the United Kingdom (UK) and the United States of America (USA); their success is based on multi-stakeholder collaboration with industry partnership, Government leadership, and consumer advocacy.[18,19] Both countries have implemented sodium reduction targets for out-of-home foods, encompassing both independent fast-food outlets and chains.[18,20] Despite challenges such as resistance from retailers, consumer preferences, and lack of mandate, these targets have driven a decrease in the sodium content in out-of-home products in the UK.[21] As such, well-implemented and monitored sodium reduction targets for fast foods are an essential component of country-specific sodium reduction strategies.

In NZ the 2020 Food Environments Policy Index, backed up by considerable local evidence,[16,22,23] noted a significant implementation gap for published sodium reduction targets for out-of-home foods.[24] However, there is no published data on how to develop such targets, and while many fast-food companies are international, significant inter-country discrepancies exist in the sodium content of fast food, meaning country-specific targets are needed.[25] Therefore, this study aimed to describe the development of maximum sodium reduction targets for NZ fast foods and compare them with the current sodium content of products.

Methods

This study was conducted in 2020 and was an analysis of cross-sectional individual-product data from the NZ Nutritrack fast-food database.

Development of the sodium reduction targets

The Nutritrack database. The Nutritrack database contains annually updated information on the nutrient content of packaged foods and beverages sold at major NZ supermarkets and fast-food chains.[26] A major fast-food chain is defined as a chain with 20 or more outlets nationwide with outlets where people buy and pay for food at the counter i.e. table service is not provided; independent outlets such as fish and chips shops are excluded. Based on Euromonitor data Nutritrack fast-food data are estimated to comprise approximately 24% of the NZ fast-food market share based on sales.[27]

Fast-food data for the Nutritrack database are collected in a standardised format on Microsoft Excel at the same time each year (February to May). Fieldworkers copy data for all products sold directly from company websites and make one store visit to collect any additional information available e.g. on a menu board. The following data are collected from each chain and product: product name, package size, serving size, and all nutritional information available (per 100 g or mL and per serve or serving, the latter considered identical). However, complete data are not available for all products because NZ labelling laws do not mandate the provision of nutritional information for fast foods unless they are making a health claim.[28] Nutritional information is provided by manufacturers; no laboratory analysis is completed and it does not include discretionary salt added by consumers. All products collected are manually categorised into 16 food groups and 39 major categories consistent with the global food monitoring group.

The following fields from the original 2019 Nutritrack fast-food database, which included 28 fast-food chains and 5246 products (Supplementary Table 1), were used for estimating the sodium reduction targets: sodium per 100 g and per serve (mg), energy per 100 g and per serve (kJ), serving size (g or ml), and package size (g or ml specifically for multi-serve products such as buckets of fried chicken).

Data preparation and development of food groups and categories for the sodium reduction targets. Figure 1 presents the process used to prepare the fast-food data, develop and refine the food categories, and complete the initial summary sodium data for estimating the sodium reduction targets. First, when possible, missing values were calculated using related existing data. For example, if sodium per serving was not available, it was calculated from serving size and sodium per 100 g data. However, no missing values were imputed. Second, to develop sensible food groupings containing similar types of products for sodium reduction, the food groups and categories in Nutritrack were compared with those used for the UK out-of-home sodium reduction targets; this was because considerable work and consultation with stakeholders had gone into enhancing the practicality of the UK Targets and the types of fast foods and dietary patterns in the two countries are

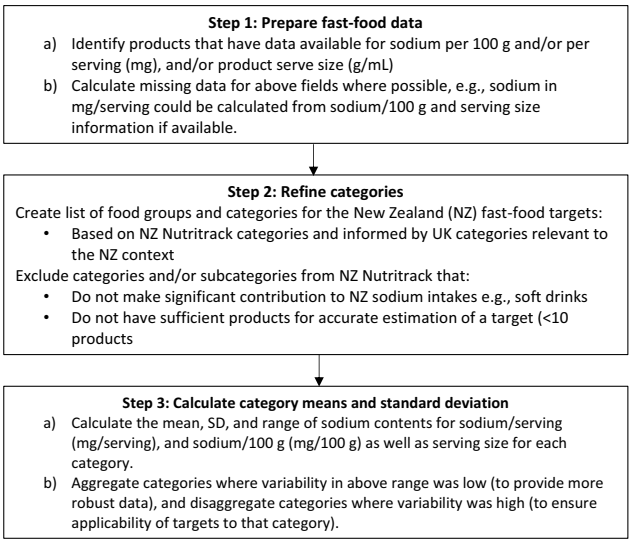

Fig. 1. Preparation of fast-food data and development of food categories for the targets.

similar.[29] For example, products in the general 'Burgers, pizzas, and sandwiches' category in Nutritrack were recategorized into the UK categories because the latter were split by type of meat, and cured meat products have a higher baseline sodium content before reformulation. Food groups and categories that do not make a large contribution to population sodium intakes in NZ (<5%) such as desserts were excluded.[30] Sodium reduction targets were only calculated for categories with ≥10 products; this pragmatic approach maximised the validity of the estimated target while ensuring products that were likely to be frequently consumed, were still included e.g. 'Burgers with cured meat', 'Grilled chicken', and 'Sauce'. The mean and standard deviation sodium content per 100 g and per serving were then calculated for each category. The original Nutritrack food groups and categories are displayed in Supplementary Table 2, and the final food groups and categories are displayed in Table 1.

Development of the sodium reduction targets. Figure 2 shows the process used to develop feasible fast-food sodium reduction targets for the NZ context. Because sodium reduction targets per 100 g are required to drive decreases in the sodium concentration of products, and sodium reduction targets per serving are necessary to ensure any reduction in sodium concentration is not 'undone' by increases in serving size,[16] sodium reduction targets were estimated both per 100 g and per serving; both types of targets are intended to be the maximum level for an individual product and the maximum mean for that fast-food category.

Development of sodium reduction targets per 100 g. First, draft sodium reduction targets per 100 g were calculated by reducing the mean sodium per 100 g for each category by 40%. Methods were based on the intention to estimate sodium reduction targets that were feasible from a food technology and consumer perspective, yet aspirational from a health perspective, with the 40% cut-off informed by the methods used by the Australia Healthy Food Partnership (HFP)[31] and previous NZ research by Eyles *et al.*[32] The NZ research involved the development of a salt reduction model to estimate the required reduction in sodium consumed from all sources for the population to meet the WHO 30% relative reduction target; the model indicated that alongside salt reduction targets for packaged foods, a 40% decrease in the sodium content of foods consumed away from the home would be required to reduce total population salt intake in NZ by 35% (which was also assumed in the initial model developed by England).[33] Therefore, draft sodium reduction targets per 100 g were calculated for each category by reducing the mean sodium per 100 g by 40%.

The Australian HFP, when creating their packaged foods targets, determined that a target was technically feasible and appropriate if approximately 33.3% ± 10% of products already met the target. However, as fast foods have generally struggled more to achieve sodium reductions when compared to packaged foods both nationally and internationally including in the UK,[34] a more lenient approach was adopted here i.e. the cut-offs were adjusted to 35–45%, that is, a sodium reduction target was determined to be feasible yet aspirational if 35–45% of products already met the sodium reduction target. If > 45% of products in the category met the draft sodium reduction target, then the sodium reduction target was feasible but not aspirational enough, and if <35% of products in the category met the draft sodium reduction target, then the sodium reduction target was considered infeasible.

Therefore, if not enough products (<35%) or too many products (>45%) met draft target, then the sodium reduction target was revised to a level met by 40% of products; this was achieved by arranging products from lowest to highest sodium per 100 g and selecting the sodium value at the 40% mark in the distribution. This value was then set as the final sodium reduction target.

Development of sodium reduction targets per serving. The same process as for the development of the sodium reduction targets per 100 g was used for the development of the sodium reduction targets per serving (Fig. 1). However, no standardised serving sizes are available meaning that fast food in NZ use serving sizes recommended by manufacturers. Therefore, to estimate sodium reduction targets by serving size we used the mean serving size in the Nutritrack data and international standard serving sizes (if available) from the USA's Food and Drug Administration (FDA)[35] and the Australian HFP programme[36]; this was to ensure serving sizes were not artificially inflated by those recommended by manufacturers, the smallest size was chosen for the latter. A sodium reduction target was set by adjusting the estimated sodium reduction target for sodium per 100 g to the international standard serving size on a proportional basis (a) if the international standard serving size was available and was smaller than the Nutritrack means, and (b) if a reduction in serving size was (subjectively) considered health-promoting for that category, for example, it did not reduce potential intake of vegetables in a salad or wrap.

Statistical analysis. Descriptives were used to describe the current mean (standard deviation (SD)) sodium content per

Table 1. Descriptions of the food groups and categories for the final NZ fast-food sodium targets

Food group	Category	Description
Pasta, rice, and risotto dishes	All	Includes Any meal dish containing pasta, rice and risotto, meat on rice dishes e.g. katsu chicken on rice Excludes Curry on rice dishes, 'bites' with pasta, e.g. mac and cheese bites and risotto bites, salads with pasta, rice and noodles
Pies, tarts, sausage rolls and quiches	All	Includes Baked goods with pastry Vegetarian pastry rolls e.g. feta rolls Excludes Savoury muffins and cakes and toppas (savoury filling wrapped in pasta and breadcrumbs)
Asian	Sushi and rice paper rolls	Includes All sushi and rice paper rolls
Burgers	Burgers with cured meat	Includes Single or multiple beef/pork/lamb) patty burgers and chicken burgers with cured meat additions such as bacon or chorizo (e.g. bacon and cheese)
	Single patty burgers	Includes Single meat (beef/pork/lamb) patty burgers and chicken burgers Excludes Burgers with cheese or cured meat (e.g. bacon) additions
	All other burgers	Includes Single patties with cheese, multiple patties with or without cheese and vegetarian/bean or fish alternatives
Chicken	Crumbed Chicken	Includes All breaded chicken portions and pieces
	Grilled chicken	Includes Chicken that is not crumbed e.g. grilled, roast and buffalo chicken
Pizzas	Cured meat Toppings	Includes All pizza toppings with cured meat
	All other toppings	Includes All pizza toppings without cured meat e.g. chicken, beef, fish and margherita
Salads	Salads with meat	Includes All salads containing meat
	Other salads (excluding garden salads)	Includes Salads with a grain-based, bean and/or lentil addition
Sandwiches	Cured meat sandwiches	Includes Sandwiches that do contain cured meat
	All other sandwiches	Includes Sandwiches that do not contain cured meat e.g. tuna, cheese, and vegetables
Condiments	Mayonnaise and dressings	Includes Mayonnaise, aioli, ranch, cheesy, and dressings
	Sauce	Includes Tomato, sweet and sour, BBQ, and other non-creamy dipping sauces
Sides	Fries and potato products	Includes Fries, hash browns, and baked potatoes

food category per 100 g and serving. Serving sizes were calculated as the mean or standard serving size relevant to that category based on the serving size data available. Forty-percent reductions calculated during the development of the targets were calculated as the current mean sodium content per 100 g or per serving multiplied by 0.6. The percentage of products meeting the target for each category was calculated by taking the maximum sodium target value in mg per 100 g away from the current sodium content for each product in mg per 100 g; products with a zero or negative result were considered to 'meet the target', and those with a value greater than zero were considered to 'not meet the target'.

Results

Of the 5246 products in Nutritrack, 3449 (66%) did not have sodium content information available, either per 100 g or per serving. For 10/28 chains in Nutritrack, there was no sodium information available (Supplementary Table 1). Food groups with the largest number of products also had the largest number of products with missing sodium information, that is, 'Pizzas' ($n = 956$ total, $n = 533$ missing) and 'Sandwiches and wraps' ($n = 744$ total, $n = 621$ missing). There were sufficient data i.e. ten or more products within each category to estimate sodium reduction targets for 17 categories within 10 food groups.

Current mean sodium content per 100 g

Mean (SD) sodium per 100 g ranged from 220 mg (54 mg) for 'Sushi and rice-paper rolls' to 729 mg (192 mg) for 'Mayonnaise and dressings'. There was a wide range in sodium content for all 17 categories, with 'Grilled chicken' having the largest range of 1146 mg/100 g, 'Sushi and rice paper rolls' the smallest (198 mg/100 g).

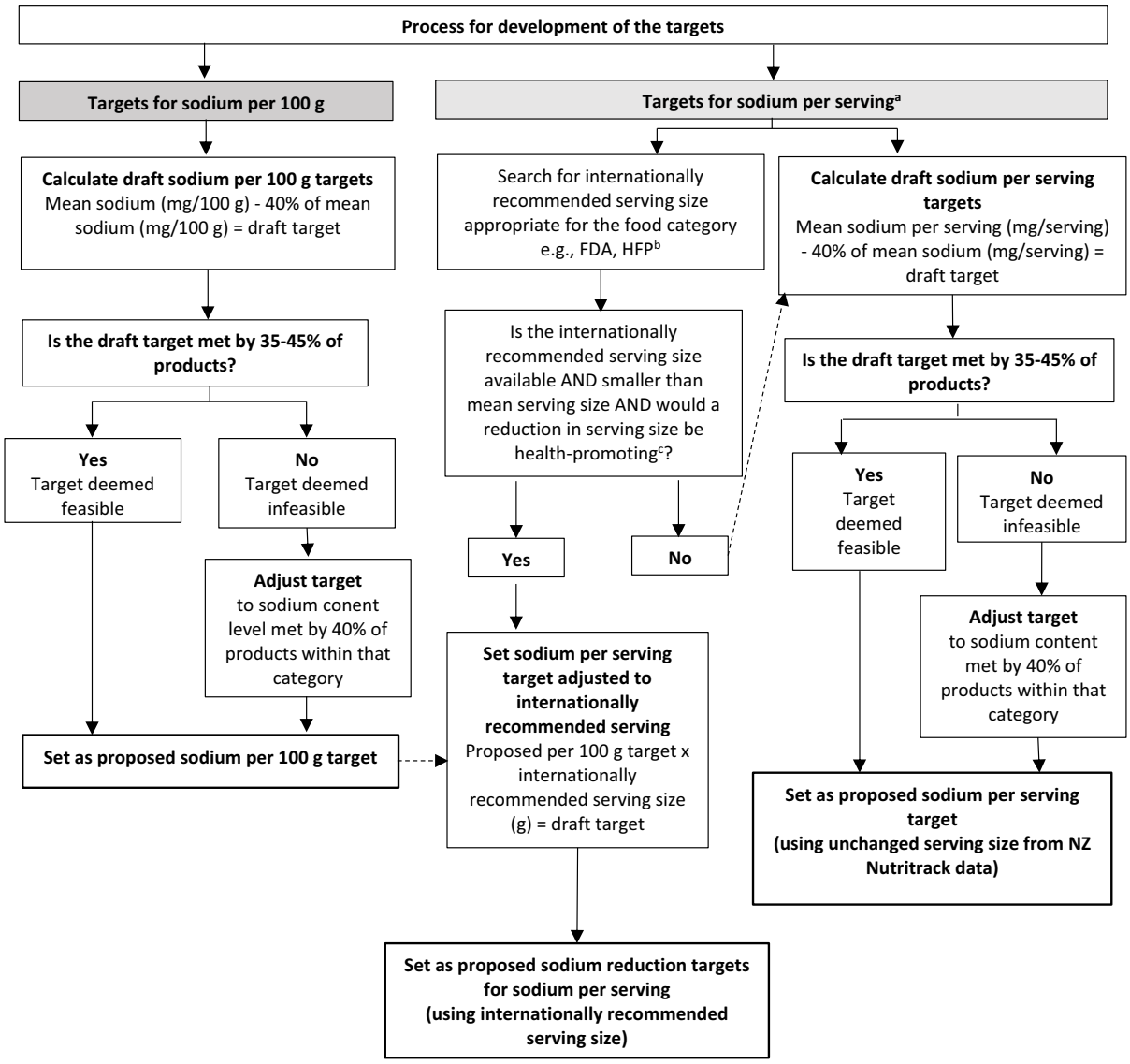

Fig. 2. Process for development of fast-food sodium reduction targets.

Current mean sodium content per serving

The mean (SD) sodium per serving ranged from 148 mg (86 mg) for 'Sauce' to 1416 mg (522 mg) for 'Burgers with cured meat' (Supplementary Tables 3 and 4).

Sodium reduction targets per 100 g

The final estimated sodium reduction targets per 100 g ranged from 158 mg/100 g for 'Other salads' to 665 mg/100 g' for 'Mayonnaise and dressings'. The mean reduction in sodium required to meet the sodium reduction targets (per 100 g) across all categories was 67 mg/100 g (15%). 'Grilled chicken' and 'Other salads' were the only two categories where a 40% reduction of the mean was considered feasible and set as the final estimated target (Table 1). The estimated sodium reduction targets per 100 g for the remaining 15 categories were adjusted to the level met by 40% of products (Table 1), resulting in the majority of the remaining 15 categories needing to reduce sodium by between 9% and 26% to achieve the sodium reduction target. However, the 'Pizzas with cured meat toppings' category would only require a 14 mg/100 g (3%) reduction, and 'Pizzas with all other toppings' a 25 mg/100 g (6%) reduction.

Sodium reduction targets per serving

A 40% reduction in the mean sodium per serving was set as the final estimated sodium reduction target for six categories (Table 1). The final estimated sodium reduction targets for the remaining 11 categories were adjusted to the level met by 40% of products. For the majority of these remaining 11 categories, the sodium content would need to be reduced by between 10% and 26% to achieve the sodium reduction target, except for 'All pies, tarts, sausage rolls and quiches' which would only need to reduce sodium by 30 mg/serving (4% reduction) (Table 1). The sodium reduction targets for sodium per serving (which used the serving size in the Nutritrack database) ranged from 118 mg/serving for 'Sauce' to 1270 mg/serving for 'Burgers with cured meat'.

Overall, setting the sodium reduction targets for sodium per serving using international standard serving size was only possible for two categories i.e. 'Mayonnaise and dressings' (target: 200 mg/serving with a serving size of 30 g) and 'Fries and potato products' (360 mg/serving with a serving size of 150g) (Table 2) (Supplementary Table 5).

Difference between the current mean sodium content and the sodium reduction targets

The food categories with the biggest difference between the mean sodium content per 100 g and the target per 100 g were 'Other salads' and 'Grilled chicken' (both –40%), and per serve was 'Fries and potato products' (using sodium reduction target using internationally recommend serving size) (–45%), and 'Mayonnaise and dressings' (–43%). The food category with the smallest difference between the mean sodium content per 100g and the target per 100g was 'Pizza with cured meat toppings' (–3%) and per serve was 'Pies, tarts, sausage rolls and quiches' (–4%) (Table 2).

Discussion

We have outlined a step-by-step process for the development of feasible, yet aspirational country-specific sodium reduction targets for sodium per 100 g, and sodium per serving. Sodium reduction targets were developed for 17 categories of NZ fast food and compared with the current sodium content of products sold by major national chains.

The current sodium content of NZ fast foods was more variable per serving than per 100 g and more products were able to meet a 40% reduction in sodium per serving versus per 100 g. This can likely be attributed to the wide range of serving sizes within each category and the use of predominantly manufacturer, rather than standard, serving sizes which would have affected the percentage of products meeting the target.

The categories with the highest current sodium content per 100 g were 'Mayonnaise and dressings' (729 mg/100 g), 'Sauces' (710/100) mg, and 'Crumbed chicken' (540 mg/100 g), similar to those of an earlier analysis of the 2016 Nutritrack fast-food database, which found that found the food groups with the highest mean sodium content per 100g were 'Sandwiches', 'Dressings', 'Pizza', 'Chicken' and 'Burgers'.[16] Chicken and dressings were also reported by Prentice *et al.*[23] in their analysis of 2008/2009 National Nutrition Survey data as being the most consumed NZ fast foods with the highest sodium content per 100 g. Furthermore, chicken was found to be in the top three fast-food categories with the highest sodium per 100 g in a study across six countries using data from 2010; the remaining two were savoury breakfast items and pizza and burgers (note that sauces and dressings were not part of this analysis).[25]

A limitation of the data used for the development of the sodium reduction targets is that it excluded independent retail outlets. Nevertheless, focusing only on fast-food chains is most feasible in terms of setting targets and monitoring sodium, as the foods are comparable across chains, recipes from chains are standardised, and there is (at least) some nutritional information available for the sector. However, it is important to consider how to address independent outlets particularly for commonly consumed products such as battered fish, a popular product for independent outlets, and one of the four categories that contribute most to sodium intake from fast foods according to the NZ analysis by Prentice *et al.*[23] Reducing the salt added to battered fish and chips, through either avoiding pre-salting or using reduced-hole saltshakers has also been recommended by a previous sodium reduction intervention.[37]

Other limitations of our analysis include the low availability of sodium and serving size data and the lack of retailer sales data, the latter of which would provide a better understanding of the potential impact of sodium reduction targets on the diets of New Zealanders and greater confidence that the sodium reduction target values reflect the wide range of products available to NZ consumers. Sales data are particularly important to monitor dietary intakes in NZ because there is a lack of up-to-date nationally representative data on population dietary and sodium intake, including sodium consumption from fast food[23]; the most recent adult National Nutrition Survey was in 2008/09[38] and children's Nutrition Survey was in 2002,[39] although an analysis of savoury foods consumed by fast-food consumers in the 2008/09 adult nutrition survey found hamburgers followed by filled rolls and pizza contributed the most to sodium intake (194, 183, and 129 mg/d, respectively).[23]

Although not unusual globally[34,40,41] the low availability of nutritional information for fast foods is a major barrier to developing sodium reduction targets and monitoring their impact. Other barriers to monitoring include changing menus, seasonal products, and variances in preparation if done manually by food handlers.[16] As such, mandating the provision of nutritional information for fast foods would greatly benefit monitoring efforts, and enable customers to identify healthier options as recommended by the WHO.[5] Further, nutritional information provided by the industry, if based on recipes, may include errors, and thus laboratory analysis of the sodium contents of commonly consumed fast-food items may be considered.

Our analysis was also limited by an absence of national standard serving sizes for fast foods, which meant that our sodium reduction targets were based primarily on serving sizes set by manufacturers. To ensure sodium reduction targets per serve represent realistic serving sizes related to dietary energy and nutrient requirements, the development of NZ-specific serving sizes should be investigated, which if applied would also help to manage the high amount of total energy, added sugar, and saturated fat in NZ fast foods.[23] However, it is important to consider that reductions in serving sizes are not to the extent that they encourage consumers to purchase multiple packs instead of just one.[42]

Nonetheless, the key strengths of this research were the structured step-by-step process and clear criteria based on previous studies used to estimate feasible yet aspirational sodium reduction targets. The categories were also informed by the UK's out-of-home sector which considered the variability in sodium contents of individual products within each category. Further, analysis was completed using up-to-date sodium content data for NZ fast foods, although if retailers were able to

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Table 2. The current sodium contents of New Zealand fast foods and the final estimated sodium reduction targets per 100 g and per serving

			Current sodium content and serving size (Mean(SD))				Estimated target		
Food group	Category	*n*[a]	Na/serving (mg)	Serving size (g)	Serving size (kJ)	Na/100 g (mg)	Na/100 g target (mg)	Na/serving target: serving size from national data (mg)	Na/serving target (mg) (standard serving size (g) from guidelines)[b]
Pasta, rice, and risotto dishes	All	21	1127 (402)	381 (97)	2456 (842)	298 (90)	256[c]	895[c]	
Pies, tarts, sausage rolls, and quiches	All	45	719 (255)	168 (61)	1835 (463)	389 (148)	343[c]	689[c]	
Asian	Sushi and rice paper rolls	25	677 (269)	302 (56)	1897 (833)	220 (54)	200[c]	607[c]	
Burgers	All other burgers	40	962 (365)	252 (92)	2651 (1060)	393 (109)	358[c]	577[d]	
	Burgers with cured meat	29	1416 (522)	289 (70)	3186 (1254)	499 (138)	447[c]	1270[c]	
	Single patty burgers	30	938 (409)	196 (74)	1727 (673)	508 (177)	432[c]	830[c]	
Chicken	Crumbed Chicken	36	568 (394)	107 (82)	970 (598)	540 (146)	440[c]	341[d]	
	Grilled chicken	16	691 (480)	214 (153)	1209 (1069)	445 (279)	267[d]	415[d]	
Pizzas	All other toppings	228	426 (162)	107 (44)	950 (457)	414 (104)	389[c]	350[c]	
	Cured meat Toppings	193	527 (198)	107 (39)	991 (364)	508 (131)	494[c]	430[c]	
Salads	Other salads (excluding garden salads)	10	745 (630)	244 (109)	1521 (947)	264 (179)	158[d]	447[d]	
	Salads with meat	18	649 (330)	258 (88)	1288 (524)	256 (115)	190[c]	483[c]	
Sandwiches	All other sandwiches	98	916 (441)	252 (103)	1977 (699)	376 (157)	315[c]	725[c]	
	Cured meat sandwiches	34	1157 (459)	214 (93)	1937 (746)	554 (151)	497[c]	998[c]	
Condiments	Mayonnaise and dressings	15	236 (291)	37 (56)	373 (519)	729 (192)	665[c]	134[c]	200 (30g)
	Sauce	22	148 (86)	20 (8)	141 (71)	710 (285)	561[c]	118[c]	
Sides	Fries and potato products	31	655 (592)	232 (123)	1690 (915)	288 (158)	240[c]	393[d]	360 (150g)

[a]Total number of products with Na/serving information available.
[b]Used 40% reduction of mean Na/100 g multiplied by international standard serving size where available (either Australian Healthy Food Partnership,[36] USA: Food and Drug Administration[35]).
[c]Targets calculated as the value met by 40% of products.
[d]Targets calculated as a 40% reduction of the mean.

provide more comprehensive sodium data and sales information, then the sodium reduction targets developed in this research could and should be revised using the step-by-step methods we describe, and alongside an implementation plan with the industry.

Concerning implementation, evidence suggests that it is possible to reduce the sodium content of processed food products by 40–50% without consumers noticing if done in a stepwise manner.[43] Therefore, the sodium reduction targets developed here may be more likely to be adopted if divided into less ambitious reductions over set time frames. For example, a 25–30% decrease in the current sodium contents over the first four to five years, followed by a further 10–15% reduction over the next four to five years, as recommended by other authors including those of the New York National Sodium Reduction Initiative.[44,45] Most importantly, whether the programme begins as a voluntary initiative or is mandated, progress toward the targets will need to be closely and independently monitored, with the potential to hold the fast-food industry to account if progress is slow.[8] This process is supported by sodium reduction initiatives in both the UK and Australia, where the first set of targets was set to be achieved within four years of implementation, with a mid-point review every two years, aided by independent monitoring.[31,46] Further, implementation would ideally be government-led with resources committed to taking a long-term approach.

In addition to the adequately monitored, structured, Government-led approach, both sodium reduction targets per 100 g and serving must be implemented, and targets for commonly consumed fast foods from independent outlets such as fish and chips, should be added. Per 100 g targets are required to drive decreases in the sodium concentration of products within each category and sodium reduction targets per serving are required to ensure the reduction in sodium concentration is not 'undone' by increases in serving size, as has been previously observed for NZ fast-food products.[16] The control of serving size is particularly important for fast-food products and in particular combo meals because these offerings are generally intended to be consumed in one sitting; this was illustrated by a 2020 analysis of NZ combo meals created using previous fast-food data from Nutritrack, which found that most combos (88.6%) offered by chains provided more than the maximum recommended daily intake of sodium (2,000 mg/d) in one meal.[17]

In summary, the burden of disease, in particular hypertension, is associated with excess sodium consumption, a major contributor to which is the increasing consumption of sodium-dense fast food. Therefore, there is a need for country-specific fast-food sodium reduction targets to be developed and implemented. The methods outlined here provide a step-by-step process for the development of feasible, yet impactful country-specific sodium reduction targets per 100 g and serving and include recommendations for research, monitoring, and implementation. While it should not prevent immediate action, the mandatory provision of nutritional information by fast-food manufacturers is critical to ensure the relevance of sodium reduction in fast foods and to help consumers make informed choices. Finally, reformulation schemes need to be a part of a wider package of interventions that improve population nutrition and the food system, enabling a shift away from processed foods towards more whole and fresh foods alongside food preparation in the home.

Abbreviations

NZ: New Zealand; **WHO:** World Health Organization; **Combo meal:** Combination meal; **UK:** United Kingdom; **USA:** United States of America; **HFP:** Healthy Food Partnership; **FDA:** Food and Drug Administration; **SD:** Standard deviation

Supplementary material

The supplementary material for this article can be found at https://doi.org/10.1017/jns.2024.35

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Conflict of interest

All authors declare no conflict of interest.

Authorship

Conceptualisation, H.E.; methodology, H.E., S.M., S.G. (Shona Gomes), and S.G. (Sarah Gerritsen); formal analysis, S.G. (Shona Gomes); investigation, S.G. (Shona Gomes); writing—original draft preparation, S.G.; writing—review and editing, H.E., S.M., and S.G. (Sarah Gerritsen); supervision, H.E., S.M., and S.G. (Sarah Gerritsen). All the authors have read and agreed to the published version of the manuscript.

References

1. He FJ, Campbell NRC, MacGregor GA. Reducing salt intake to prevent hypertension and cardiovascular disease. *Rev Panam Salud Publica.* 2012;32:293–300.
2. Ministry of Health NZ. Mortality 2017 data tables (Provisional). Published 2019. Accessed May 9, 2022. https://www.health.govt.nz/publication/mortality-2017-data-tables.
3. McLean R, Williams S, Mann J, *et al.* 1051 estimates of New Zealand population sodium intake. *J Hypertens.* 2012;30:e306.
4. World Health Organization. *2013–2020 Global Action Plan for the Prevention and Control of Noncommunicable Diseases.* Geneva: World Health Organization; 2013.
5. World Health Organization. *WHO global report on sodium intake reduction.* Geneva: World Health Organization; 2013.
6. Monteiro CA, Cannon G, Levy RB, *et al.* Ultra-processed foods: what they are and how to identify them. *Public Health Nutr.* 2019;22:936–941.
7. Brown IJ, Tzoulaki I, Candeias V, *et al.* Salt intakes around the world: implications for public health. *Int J Epidemiol.* 2009;38:791–813.
8. World Health Organization. *The SHAKE Technical Package for Salt Reduction.* Geneva: World Health Organization; 2016.

9. Nghiem N, Blakely T, Cobiac LJ, *et al.* The health gains and cost savings of dietary salt reduction interventions, with equity and age distributional aspects. *BMC Public Health.* 2016;16:423.
10. He FJ, MacGregor GA. Role of salt intake in prevention of cardiovascular disease: controversies and challenges. *Nat Rev Cardiol.* 2018;15:371–377.
11. Ministry of Health. *New Zealand Health Strategy 2023*. Wellington: Ministry of Health; 2023.
12. Heart Foundation NZ. Reducing sodium and sugar in processed foods. Published n.d. Accessed January 13, 2022. https://www.heartfoundation.org.nz/professionals/food-industry-and-hospitality/reducing-sodium-and-sugar-in-processed-foods.
13. Australian Government. Health Star Rating - Health Star Rating. Published 2014. Accessed March 4, 2022. http://www.healthstarrating.gov.au/internet/healthstarrating/publishing.nsf/content/home.
14. Statistics NZ. *Kiwis Growing Taste for Takeaways and Eating Out.* Wellington: Stats NZ; 2020.
15. Partridge SR, Gibson AA, Roy R, *et al.* Junk food on demand: a cross-sectional analysis of the nutritional quality of popular online food delivery outlets in Australia and New Zealand. *Nutrients.* 2020;12:1–16.
16. Eyles H, Jiang Y, Blakely T, *et al.* Five year trends in the serve size, energy, and sodium contents of New Zealand fast foods: 2012–2016. *Nutr J.* 2018;17:65.
17. Mackay S, de Castro TG, Young L, *et al.* Energy, sodium, sugar and saturated fat content of New Zealand fast-food products and meal combos in 2020. *Nutrients.* 2021;13:4010.
18. Public Health England. *Salt Reduction Targets for 2024*. London: Public Health England; 2020.
19. U.S. Department of Health and Human Services, Food and Drug Administration, Center for Food Safety and Applied Nutrition. *Sodium Reduction*. Rockville, MD: FDA; 2023.
20. U.S. Department of Health and Human Services, Food and Drug Administration, Center for Food Safety and Applied Nutrition. *Voluntary Sodium Reduction Goals: Target Mean and Upper Bound Concentrations for Sodium in Commercially Processed, Packaged, and Prepared Foods: Guidance for Industry.* Rockville, MD: FDA; 2021.
21. Public Health England. *Salt Targets 2017: Progress Report a Report on the Food Industry's Progress Towards Meeting the 2017 Salt Targets.* London: Public Health England; 2018.
22. Woodward E, Eyles H, Ni Mhurchu C. Key opportunities for sodium reduction in New Zealand processed foods. *Aust N Z J Public Health.* 2012;36:84–89.
23. Prentice CA, Smith C, Mclean RM. Sodium in commonly consumed fast foods in New Zealand : a public health opportunity. *Public Health Nutr.* 2015;19:958–966.
24. Mackay S, Sing F, Gerritsen S, *et al. Benchmarking Food Environments 2020: Progress by the New Zealand Government on Implementing Recommended Food Environment Policies & Priority Recommendations.* Auckland: The University of Auckland; 2020.
25. Dunford E, Webster J, Woodward M, *et al.* The variability of reported salt levels in fast foods across six countries: opportunities for salt reduction. *Cmaj.* 2012;184:1023–1028.
26. Eyles H. *The Nutritrack Database: An Annually Updated Database of Information on Packaged Foods and Beverages sold at Major Supermarkets in New Zealand (2013–2023).* Auckland: The University of Auckland; 2024.
27. National Institute for Health Innovation. *Nutritrack.* Auckland: National Institute for Health Innovation; 2019.
28. Food Standards Australia New Zealand. Labelling information for consumers. Published 2023. Accessed July 7, 2024. https://www.foodstandards.gov.au/consumer/labelling.
29. Wyness LA, Butriss JL, Stanner SA. Reducing the population's sodium intake: the UK food standards agency's salt reduction programme. *Public Health Nutr.* 2012;15:254–261.
30. Eyles HC, Cleghorn CL. Dietary sources of sodium across the diverse New Zealand adult population. *Prev Med Rep.* 2022;29:101927.
31. Healthy Food Partnership. *Healthy Food Partnership Reformulation Program: Evidence Informing the Approach, Draft Targets and Modelling Outcomes.*Canberra: Australian Government; 2018.
32. Eyles H, Shields E, Webster J, *et al.* Achieving the WHO sodium target: estimation of reductions required in the sodium content of packaged foods and other sources of dietary sodium. *Am J Clin Nutr.* 2016;104:470–479.
33. Food Standards Agency. *UK Salt Intakes: Modelling Salt Reductions.* London: Food Standards Agency; 2005.
34. Public Health England. *Salt targets 2017: Second Progress Report*. London: Public Health England; 2020.
35. U.S. Department of Health and Human Services, Food and Drug Administration, Center for Food Safety and Applied Nutrition. *Contains Nonbinding Recommendations: Food Labeling: Serving Sizes of Foods That Can Reasonably Be Consumed At One Eating Occasion; Dual-Column Labeling; Updating, Modifying, and Establishing Certain Reference Amounts Customarily Consumed; Serving Size for Industry Small Entity Compliance Guide.* Rockville, MD: FDA; 2018.
36. Healthy Food Partnership. *Healthy Food Partnership: Industry Best Practice Guide for Serving Size.* Canberra: Australian Government; 2021.
37. Goffe L, Wrieden W, Penn L, *et al.* Reducing the salt added to takeaway food: within-subjects comparison of salt delivered by five and 17 holed salt shakers in controlled conditions. *PLoS One.* 2016;11:e0163093.
38. University of Otago and Ministry of Health. *A Focus on Nutrition: Key Findings of the 2008/09 New Zealand Adult Nutrition Survey.* Wellington: Ministry of Health; 2011.
39. Parnell W, Scragg R, Wilson N, *et al. NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey.* Wellington: Ministry of Health; 2003.
40. Maalouf J, Cogswell ME, Gunn JP, *et al.* Monitoring the sodium content of restaurant foods: public health challenges and opportunities. *Am J Public Health.* 2013;103:e21–30.
41. Rosewarne E, Huang L, Farrand C, *et al.* Assessing the healthy food partnership's proposed nutrient reformulation targets for foods and beverages in Australia. *Nutrients.* 2020;12:1–12.
42. Eyles H, Trieu K, Jiang Y, *et al.* Reducing children's sugar intake through food reformulation: methods for estimating sugar reduction program targets, using New Zealand as a case study. *Am J Clin Nutr.* 2020;111:622–634.
43. Kloss L, Meyer JD, Graeve L, *et al.* Sodium intake and its reduction by food reformulation in the European Union - a review. *NFS J.* 2015;1:9–19.
44. Cogswell ME, Patel SM, Yuan K, *et al.* Modeled changes in US sodium intake from reducing sodium concentrations of commercially processed and prepared foods to meet voluntary standards established in North America: NHANES. *Am J Clin Nutr.* 2017;106:530–570.
45. Nghiem N, Blakely T, Cobiac LJ, *et al.* Health and economic impacts of eight different dietary salt reduction interventions. *PLoS One.* 2015;10:e0123915.
46. He FJ, Brinsden HC, Macgregor GA. Salt reduction in the United Kingdom: a successful experiment in public health. *J Hum Hypertens.* 2014;28:345–352.