

1 **Abstract Aim** –Fruit and vegetables are strongly promoted because of the nutrients they
2 provide, yet many processed products contain added sugar and sodium. The current study
3 aims to quantify the sugar and sodium content of pre-packaged fruit and vegetable-based
4 products that are available in New Zealand (NZ) supermarkets.

5 **Methods** – Nutrition Information Panel data was collected from non-frozen, processed fruit
6 and vegetable products in NZ supermarkets (including soups, sauces, jams & spreads, pickles,
7 chutneys & dips, and canned/bottled fruit and vegetables) where fruit and/or vegetables were
8 the majority ingredient(s).

9 **Results** – With the exception of canned/bottled vegetables, more than 60% of products
10 contained added sugar. Per serve, the median sugar content was highest in canned/bottled
11 fruit (17.8g). More than 75% of soups, vegetable-based sauces, pickles/chutneys and
12 canned/bottled vegetables contained added sodium, with soups (722 mg) recording the
13 highest median values per serve.

14 **Conclusions** – Consumers need to be aware that although they are encouraged to eat a diet
15 high in fruit and vegetables, there may be large quantities of added sugar and sodium in
16 manufactured fruit and vegetable products that can have significant negative impacts on their
17 health. Government health promotion campaigns encouraging the consumption of fruit and
18 vegetables should be careful to target fresh, frozen and home-prepared foods, and work on
19 educating the public about the lower nutritional quality associated with most processed fruit
20 and vegetable products.

21

22 **Keywords** – processed fruit and vegetables, added sugar, added sodium

23 **Introduction**

1 Public health campaigns regularly promote fruit and vegetable consumption due to the variety
2 of vitamins, minerals and dietary fibre that they provide, with the aim of reducing population
3 incidence of chronic disease.¹ Indeed, fruit and/or vegetable intake has been positively
4 associated with a decreased risk of Type 2 diabetes,² slower weight gain / reduced adiposity,³
5 and reduced risk of coronary heart disease.⁴

6 Government guidelines in New Zealand and Australia recommend and actively promote
7 consuming at least two servings of fruit and three⁵ to five⁶ servings of vegetables, respectively,
8 per day. General public perceptions of fruit and vegetable products is that they are healthy,⁷
9 although actual intakes are questionable as recommended intakes and portion sizes are often
10 not correctly identified.⁸ Further, evidence suggests that supermarkets are now dominated by
11 ultra-processed foods including many packaged and processed fruit and vegetable products.⁹
12 Such foods are nearly always less healthy than those that are minimally or not processed,⁹
13 often containing increased levels of sugar and salt in an attempt to increase the palatability of
14 food.¹⁰ However, whilst consumers do perceive processed foods to be less healthy,⁷ anecdotal
15 evidence suggests that there are mixed messages between the 'unhealthiness' of a processed
16 fruit or vegetable product and the requirement to add more fruit and vegetables into the diet.
17 Importantly, there appears to be limited information specifically describing the nutritional
18 profile of processed fruit and vegetable products in Australia and New Zealand. Only a small
19 number of studies have reported on the sodium content of processed foods¹¹⁻¹³ and there
20 appears to be a complete lack of published literature describing the sugar content of
21 processed foods in Australia and New Zealand. Given the significance of sugar and salt on the
22 development and progression of chronic disease,¹⁴ and the knowledge that up to 90% of the
23 energy from added sugars comes from processed foods,¹⁵ the current study aims to evaluate
24 the sugar content and sodium levels in processed fruit and vegetable products available in
25 New Zealand supermarkets.

1

2 **Methods**

3 Nutritional composition data were collected from all processed fruit and vegetable-based
4 products from three large supermarket chains (Countdown, Pak 'n' Save and New World) in
5 Rotorua, New Zealand stores during November to December 2017. These supermarkets
6 represent approximately 92% grocery market share.¹⁶ Data were obtained from both the
7 online grocery shopping websites and by visiting the stores in person and taking photos of the
8 packaging, ingredients list and nutritional information panel (NIP) of each product. Products
9 with multiple package sizes were included only once into the product dataset (unless different
10 product sizes had different nutritional information). For reliability, 10% of products from which
11 the NIP data were sourced online were manually checked against actual product information
12 in store.

13 Products were included in the dataset if they were a non-frozen, processed fruit and
14 vegetable-based product with a full NIP available. Products were deemed to be fruit or
15 vegetable-based if fruits or vegetables were listed either first or second on the ingredients list,
16 and if the total fruit and vegetable content (FVC) of the product was at least 25% (where
17 described in the ingredients list). Products were excluded if they were not packaged as a
18 ready-to-eat product, including all concentrates (e.g tomato paste) and marinades.

19 For each product, the following data were recorded: brand name, product name, packet size,
20 manufacturer-declared serving size, ingredients list, content of energy (kJ), protein, fat (total),
21 carbohydrate, sugar and sodium (per 100 g and per manufacturer-declared serve). The
22 percentage of products that had sugar (defined as sugar, cane sugar, honey, glucose-fructose
23 syrup, glucose, sucrose, fructose, and/or high fructose corn syrup) or sodium (including
24 'monosodium glutamate' and 'salt') added to them were also recorded. Labels where the

1 amount of a nutrient was recorded as < 1 g, < 0.1 g or < 5 mg were entered as 0.5 g, 0.05 g and
2 2.5 mg, respectively, into the spreadsheet.

3 All product categories, as well as certain sub-categories (e.g baked beans, other beans, pasta
4 sauce and canned tomatoes) were assessed and compared for differences in sugar and sodium
5 content as well as the proportion of products with added sugar/sodium. The number of
6 products promoting a 'low sugar' option (including use of the terms "no added sugar", '50%
7 less sugar", "low sugar") or reduced sodium ('reduced salt', 'no added salt', 'low sodium',
8 'reduced sodium') were also analysed.

9 Canned/bottled fruit data was further analysed to determine whether there was a difference
10 in the proportion of products that were canned/bottled in syrup versus in juice with regard to
11 i) the median sugar content, ii) the proportion of products with added sugar, and iii) the
12 proportion of products that were promoted as being 'low sugar'.

13 The nutritional quality of a small number of processed products that contained only one fruit
14 or vegetable ingredient were then compared to fresh alternatives. The nutritional information
15 for fresh products was taken from the United States (US) Food and Drug Administration (FDA)
16 'Nutrition Information for Raw Fruits, Vegetables and Fish'.¹⁷ Processed fruit and vegetable
17 nutrition information was sourced from current study data, with values reported being those
18 with the highest sugar/sodium content across all comparable products (e.g. all whole canned
19 tomato products).

20 As NIP information is largely dependent on manufacturer-declared serve size, this study also
21 assessed the difference in serving size across a number of categories and sub categories for the
22 impact that this may have on interpretation of nutritional information. Manufacturer-declared
23 serve size information from various product categories/sub-categories were compared to the
24 2018 US FDA recommended serve size information.¹⁸ These values are reported as Reference

1 Amount of Customarily Consumed (RACC) values. US FDA guidelines were used rather than
2 New Zealand guideline values, as current serving size guidelines in New Zealand are difficult to
3 quantify for processed fruit and vegetable products.⁵

4 The data were analysed using R version 3.2.0 for OSX. As most variables were not normally
5 distributed, category level summary statistics are reported as median and interquartile range
6 (IQR). Kruskal Wallis testing with Dunn posthoc analysis was used to determine variance for the
7 sugar and/or sodium content of all categories, canned fruit sub-categories, and chi-square
8 comparisons for the proportion of canned fruit with added sugar.

9 **Results**

10 A total of 899 products were analysed across seven categories, including soups (n=106),
11 vegetable-based sauces ('vegetable sauces'; n=176), fruit-based sauces ('fruit sauces'; n=16),
12 jams & spreads ('jams'; n=72), chutneys, pickles & dips ('chutneys'; n=121), canned/bottled
13 vegetables ('canned vegetables'; n=286) and canned/bottled fruit ('canned fruit'; n=122).

14 The proportion of products with added sugars was high across all categories: 88.9% (jams),
15 87.5% (fruit sauces), 80.7% (vegetable sauces); 78.3% (soups), 76.9% (chutneys), 60.7%
16 (canned fruits) and 42.9% (canned vegetables). Per serve, canned fruits had the highest
17 median sugar content with 17.8 g (IQR = 14.2, 24.6) with all other product categories averaging
18 under 6.5 g per serve (Figure 1). Jams had the highest sugar content per 100 g (median 61.8 g;
19 (IQR = 52.0, 64.4), this being significantly higher than all categories except fruit-based sauces
20 (31.6 g; IQR = 14.9, 40.0; $H= 327.6$, $p < 0.0001$). The median sugar content (per 100 g) of other
21 product categories ranged from 2.2 g (soups) to 14.2 g (chutneys) (Figure 1).

22 When compared across product groups, fruit canned in syrup contained significantly more
23 sugar per single serve compared with fruit canned in juice (median 23.4 g vs 14.6 g; $H = 27.3$; p
24 < 0.001), and a lower proportion of fruits in syrup were promoted as being lower in sugar

1 (14.8% vs 29.8% of fruit in juice; $\chi^2 (1, N = 108) = 3.5, p = 0.05$). However, there was no
2 statistically significant difference between the median sugar content per serve of 'all' fruits
3 canned in syrup compared to those promoted as being 'low sugar' (23.4g vs 25.8g; $H = 0.27; P$
4 $= 0.60$). This result was offset by differences in the manufacturer recommended serve size,
5 with 'low sugar' syrup products being marketed with a higher manufacturer-declared serve
6 size than fruit canned in syrup (median 205 g vs 135 g; Table 1). Importantly, 'low sugar' fruits
7 in syrup still contained over a third more sugar per serve than fruit in juice (25.8 g vs 14.6 g; H
8 $= 3.7, p = 0.05$) and twice as much sugar as 'low sugar' fruits in juice (25.8 g vs 12.9 g; $H = 3.4, p$
9 $= 0.06$); though again median serve size differed across these categories (Table 1).

10 Further analysis of the canned fruit data in our study indicated that the products with the
11 lowest sugar content per serve (< 10 g, n=14 [11.5%]) contained mostly fruit and water, half
12 contained 'sweeteners', and only two products contained sugar. In contrast, of the products
13 with the highest sugar content per serve (> 25g, n=26 [21.3%]), 100% contained added sugar,
14 and all were fruits canned in syrup. One quarter of these 26 'highest sugar' products (n=6)
15 were fruits canned in 'light syrup'.

16 The proportion of vegetable-based products with additional salt was high, including nearly all
17 soups (94.4%) and vegetable sauces (96.0%) as well as more than three quarters of all canned
18 vegetables (75.4%) and chutneys (79.3%). A third of fruit-based sauces contained added salt,
19 but less than 4% of other fruit-based products (Table 2).

20 Due to the proportionately larger serve size (median 250 g; IQR 250, 300), soups had the
21 highest median level of sodium per serve (721.8 mg; IQR 654.4, 834.2). However, vegetable-
22 based sauces also contained a high sodium content (median 318.6 mg; IQR 156.2, 440.9)
23 despite an average serve size of only 83.5 g (IQR 20, 125). Per 100 grams of product, the
24 highest median sodium was observed in chutneys (444.5 mg; IQR 268, 533), this being

1 significantly higher than all categories except vegetable-based sauces (403.0; IQR 333, 702)
2 and canned vegetables (357.5; IQR 191.0, 600.0) ($H = 252.3$; $p < 0.0001$). The lowest sodium
3 content was observed in fruit-based sauces, jams and canned fruits, with comparable values
4 across all three categories. The sodium content of all primary categories is given in Figure 1
5 and Table 2.

6 Sub-category analysis showed that baked beans contained the highest median level of sodium
7 per serve (805.8 mg), this being nearly twice that of other bean products (448.1 mg; $H = 15.2$;
8 $p = 0.0001$). Pasta sauces also contributed, on average, more than 400 mg of sodium per serve.
9 The sodium content within most sub-categories varied greatly (see below) and wasn't entirely
10 described by differences in manufacturer-declared serve size. Sodium content of baked beans,
11 for example, varied 5-fold from 260 mg to 1380 mg per serve, (min, max) despite only a 2.5-
12 fold difference in serving size (125-300g).

13 Of the eight different fresh/processed products compared, all had a lower nutritional profile
14 after processing compared to their fresh alternatives (Table 3). The sugar content of canned
15 fruit was 26 -101% higher compared with fresh fruit (per 100 g of product), whilst the sodium
16 content of beans, corn and whole tomatoes increased dramatically from an average of 2.0-5.6
17 mg per 100 g in fresh products to 115-250 mg in the canned alternatives. In contrast, small
18 reductions in sugar content were seen in canned vegetables compared to their fresh
19 counterparts (Table 3).

20 Manufacturer-declared serving size was highly variable across all categories and sub-categories
21 that were assessed (Table 2). Based on US FDA RACC guidelines, more than 80% of baked
22 beans and soups exceeded the suggested serve size, as well as approximately a third of all
23 pasta sauces, canned vegetables, canned fruit and other beans.

24

1 Discussion

2 Processed foods are known to be significant contributors of sugar and sodium,¹⁰ and our data
3 suggests that this is also true for processed fruit and vegetable products, despite the fact that
4 they are often perceived to be healthy food products.⁷

5 It is concerning that up to 90% of all products surveyed in this study contained added sugars.
6 Whilst a high sugar content is generally expected for products such as jams and spreads, high
7 levels were also seen in other product categories. A third of all chutneys and pickles also
8 contained more than 20% sugar, with 10% of products in this category containing more than
9 30% sugar. It has been reported that chutneys and pickles sales have declined in the UK in
10 recent years, particularly with younger generations.¹⁹ Thus, whilst specific sales data for New
11 Zealand was not available, it is possible that the relatively high sugar content of many of these
12 products is manufacturer-driven in order to deliver a product that better meets consumer
13 preference for sweetened products. The data in the current study also reported that the
14 median sugar content from canned fruits was high with more than 75% of all canned fruit
15 products providing 3-5 teaspoons (15-25 g) of sugar per serve. These products are an
16 important contributor to daily sugar intake given that current World Health Organization
17 recommendations suggested limiting free sugars to approximately 5% of the total energy
18 intake per day (equal to ~30 g of sugar in a person aged over 11 years).²⁰ However, it is
19 important to note that New Zealand NIP labels currently do not distinguish between added
20 sugars and those occurring naturally in food ingredients such as fruits and dairy.

21 Our data showed that there was a difference in the sugar content of canned fruits with many
22 of the highest sugar products being canned in 'light syrup'. In addition, there was no significant
23 difference in the sugar content of fruits canned in 'light syrup' vs those in full sugar syrup,
24 whilst products canned in 'light syrup' contained up to twice as much sugar as fruits canned in

1 juice. This is a strong, yet misleading message that fruits canned in 'light syrup' may be
2 healthier, or nutritionally better than their full syrup counterparts. Instead, products canned in
3 juice should be more strongly promoted as being healthier options.

4 As Table 3 shows, canned fruits were also generally a poorer nutritional choice than their fresh
5 alternatives. New Zealand nutrition guidelines recommend at least two servings of fruit per
6 day and processed foods look likely to remain an important contributor of the typical western
7 diet. This suggests that policy and nutrition guidelines should continue to advocate for
8 increased fruit and vegetable intake, including from canned goods, but that consumers should
9 be made aware of the importance of selecting fruits canned in juice or water rather than
10 syrup. More research is needed on fresh versus processed fruit and vegetable consumption
11 and the factors that influence purchasing and consumption patterns.

12 The 5+ a day model promotes that at least three servings of the 5+ per day should be
13 vegetables.⁵ However, there appears to be little current data describing the vegetable intake
14 patterns of New Zealanders, including what proportion of vegetables are from processed
15 sources. What is most concerning from our data is the sodium content of many processed
16 vegetable products, particularly as studies report a causative link between sodium intake and
17 reduced health.²¹ Current New Zealand guidelines suggest that the recommended daily intake
18 of sodium ranges from 930 - 2300 mg⁵ and in our study a number of vegetable-based products
19 reached these lower limits in only one serve.

20 It is also important to note that data about which foods contribute to sodium intake in New
21 Zealand is considerably out of date. The 2015 Eating and Activity Guidelines for New Zealand⁵
22 refer to the 1997 National Nutrition Survey to describe key sources of dietary sodium.

23 However, both this and another study which used dietary recall data¹¹ suggest that New
24 Zealanders regularly consume more than the recommended amounts of sodium. A recent

1 review of 182 New Zealand processed foods (including breads, cereals, butters, canned meats,
2 cheese, crackers and canned vegetables) indicated that there has been little change in the
3 sodium content of these foods overall between 2003 and 2013, though their data does report
4 that the median sodium content of canned vegetables (n=39) decreased from 241 to 137
5 mg/100 g during this time.²² Sub-category analysis showed that a number of baked bean
6 products (n=9) decreased their sodium content by approximately 10% during this 10 year
7 period achieving a median sodium value in 2013 of 415 mg/100g.²⁸ This is comparable to the
8 results seen in our study with 2017 data. This is an important finding suggesting that
9 manufacturers may be reformulating to meet consumer needs; however, the results of this
10 study are indicative at best, the authors themselves noting that any conclusions are
11 confounded by changes in market availability and a lack of sales-weighted data. That said, very
12 few products in our study were promoted as being low in sodium and this is something that
13 could easily be implemented, thereby allowing consumers to easily recognise low-sodium
14 options.

15 In addition, it is important to identify that all serving size information used in our study refers
16 to manufacturer-reported information on the NIP labels. This itself is variable, with at least a 2-
17 3 times difference in size across comparable products in many sub-categories. Adherence to
18 such portion sizes is also questionable, with evidence suggesting that consumers regularly
19 consume higher serve sizes than those recorded on product packaging,²³ instead often using
20 factors such as container size²⁴ to determine the portion consumed. It would be useful in
21 future studies to evaluate public perceptions of portion size, and knowledge of dietary
22 guidelines to determine what impact these have on purchasing choice or consumption
23 patterns.

1 Government campaigns in New Zealand continue to promote the intake of fruit and
2 vegetables, but little emphasis is placed on the quality or source of these foods. New Zealand
3 Ministry of Health guidelines do suggest that New Zealanders should actively choose canned
4 fruit and vegetables that offer reduced sugar and sodium levels,⁵ though it is questionable
5 whether this message is promoted alongside that to increase fruit and vegetable intake.
6 Further, while it has been shown that many consumers are often aware of the sodium content
7 of processed foods, most do not use or check NIP labels to determine sugar²⁵ or salt²⁶ content.
8 Thus, it is suggested that front-of packaging labels using “reduced” claims may be a more
9 effective means at targeting the general populace to influence product choice.²⁷ Strategies
10 should also be implemented to encourage the specific intake of fresh fruit and vegetables
11 (and/or home-made products) rather than processed alternatives. Additionally, more research
12 is needed on factors influencing consumer purchasing and consumption patterns, to identify
13 and address why consumers may prioritise processed fruit and vegetables over fresh products.
14 Lastly, it would be valuable in future studies to assess fruit- and vegetable-products that were
15 not included in this study (eg crisps, marinades and product concentrates) , and to include
16 products from multiple regions of New Zealand so as to avoid any location bias.

17 **References**

- 18 1. Tobias M, Turley M, Stefanogiannis N, et al. Vegetable and fruit intake and mortality
19 from chronic disease in New Zealand. *Aust NZ J Public Health*. 2006;30(1):26-31.
- 20 2. Carter P, Gray LJ, Troughton J, Khunti K, Davies MJ. Fruit and vegetable intake and
21 incidence of type 2 diabetes mellitus: systematic review and meta-analysis. *Br Med J*.
22 2010;341:c4229.
- 23 3. Ledoux T, Hingle M, Baranowski T. Relationship of fruit and vegetable intake with
24 adiposity: a systematic review. *Obesity Reviews*. 2011;12(5).

- 1 4. Bhupathiraju SN, Wedick NM, Pan A, et al. Quantity and variety in fruit and vegetable
2 intake and risk of coronary heart disease. *Am J Clin Nutr.* 2013;98(6):1514-23.
- 3 5. New Zealand Ministry of Health. Eating and Activity Guidelines for New Zealand Adults.
4 Ministry of Health, Wellington 2015. Available from www.health.govt.nz [accessed Jan
5 22, 2018]
- 6 6. Australian Government. Australian dietary guidelines. 2013. National Health and Medical
7 Research Council. Available from www.nhmrc.gov.au [accessed Mar 11, 2018]
- 8 7. Provencher V, Jacob R. Impact of perceived healthiness of food on food choices and
9 intake. *Current Obesity Reports.* 2016;5(1):65-71.
- 10 8. Ashfield-Watt P, Welch A, Day N, Bingham S. Is 'five-a-day' an effective way of increasing
11 fruit and vegetable intakes? *Public Health Nutr.* 2004;7(2):257-61.
- 12 9. Luiten CM, Steenhuis IH, Eyles H, Mhurchu CN, Waterlander WE. Ultra-processed foods
13 have the worst nutrient profile, yet they are the most available packaged products in a
14 sample of New Zealand supermarkets. *Public health Nutr.* 2016;19(3):530-8.
- 15 10. Gibney MJ, Forde CG, Mullally D, Gibney ER. Ultra-processed foods in human health: a
16 critical appraisal. *Am J Clin Nutr.* 2017;106(3):717-24.
- 17 11. Thomson BM. Nutritional modelling: distributions of salt intake from processed foods in
18 New Zealand. *Br J Nutr.* 2009;102(5):757-65.
- 19 12. Trevena H, Neal B, Dunford E, Wu JH. An evaluation of the effects of the Australian Food
20 and Health Dialogue targets on the sodium content of bread, breakfast cereals and
21 processed meats. *Nutrients.* 2014;6(9):3802-17.
- 22 13. Maples J, Wills R, Greenfield H. Sodium and potassium levels in Australian processed
23 foods. *Med J Aust.* 1982;2(1):20-2.
- 24 14. Di Nicolantonio JJ, Lucan SC. The wrong white crystals: not salt but sugar as aetiological
25 in hypertension and cardiometabolic disease. *Open Heart.* 2014 Nov 1;1(1):e000167.

- 1 15. Steele EM, Baraldi LG, da Costa Louzada ML, Moubarac J-C, Mozaffarian D, Monteiro CA.
2 Ultra-processed foods and added sugars in the US diet: evidence from a nationally
3 representative cross-sectional study. *Br Med J*. 2016;6(3):e009892.
- 4 16. Euromonitor International. Grocery Retailers in New Zealand. Sydney, Australia; 2016.
5 Available from www.euromonitor.com
- 6 17. United States Food and Drug Administration. Nutrition Information for raw fruits,
7 vegetables, and fish. Silver Springs, Maryland, USA; 2017. Available from www.fda.gov
8 [accessed April 01 2018].
- 9 18. United States Food and Drug Administration. Reference Amounts Customarily Consumed:
10 List of Products for Each Product Category: Guidance for Industry. Rockville, MD; 2018.
11 Available from www.fda.gov [accessed Mar 11, 2018].
- 12 19. Bainbridge J. Sector Insight: Pickles, Chutneys and relishes 2008. available from:
13 [https://www.campaignlive.co.uk/article/sector-insight-pickles-chutneys-](https://www.campaignlive.co.uk/article/sector-insight-pickles-chutneys-relishes/862382)
14 [relishes/862382](https://www.campaignlive.co.uk/article/sector-insight-pickles-chutneys-relishes/862382). [accessed April 17, 2018]
- 15 20. World Health Organization. Guideline: Sugars intake for adults and children: Geneva,
16 Switzerland; 2015 Available from
17 http://apps.who.int/iris/bitstream/10665/149782/1/9789241549028_eng.pdf.
18 [accessed Feb 02, 2018]
- 19 21. Aburto NJ, Ziolkovska A, Hooper L, Elliott P, Cappuccio FP, Meerpohl JJ. Effect of lower
20 sodium intake on health: systematic review and meta-analyses. *Br Med J*.
21 2013;346:f1326.
- 22 22. Monro D, Mhurchu CN, Jiang Y, , Gorton D, Eyles H. Changes in the sodium content of
23 New Zealand processed foods: 2003–2013. *Nutrients*. 2015;7(6):4054-67.
- 24 23. Zlatevska N, Dubelaar C, Holden SS. Sizing up the effect of portion size on consumption:
25 a meta-analytic review. *J Marketing*. 2014;78(3):140-54.

- 1 24. Marchiori D, Corneille O, Klein O. Container size influences snack food intake
2 independently of portion size. *Appetite*. 2012;58(3):814-7.
- 3 25. Patterson N, Sadler M, Cooper J. Consumer understanding of sugars claims on food and
4 drink products. *Nutr Bull*. 2012;37(2):121-30.
- 5 26. Kim M, Lopetcharat K, Gerard P, Drake M. Consumer awareness of salt and sodium
6 reduction and sodium labeling. *J Food Sci*. 2012;77(9).
- 7 27. Webster JL, Li N, Dunford EK, Nowson CA, Neal BC. Consumer awareness and self-
8 reported behaviours related to salt consumption in Australia. *Asia Pac J Clin Nutr*.
9 2010;19(4):550-4.

Figure 1 Sugar and sodium content content per 100 grams and per manufacturer-declared serve of fruit and vegetable-based products (Box plots report median, IQR, maximum and minimum).

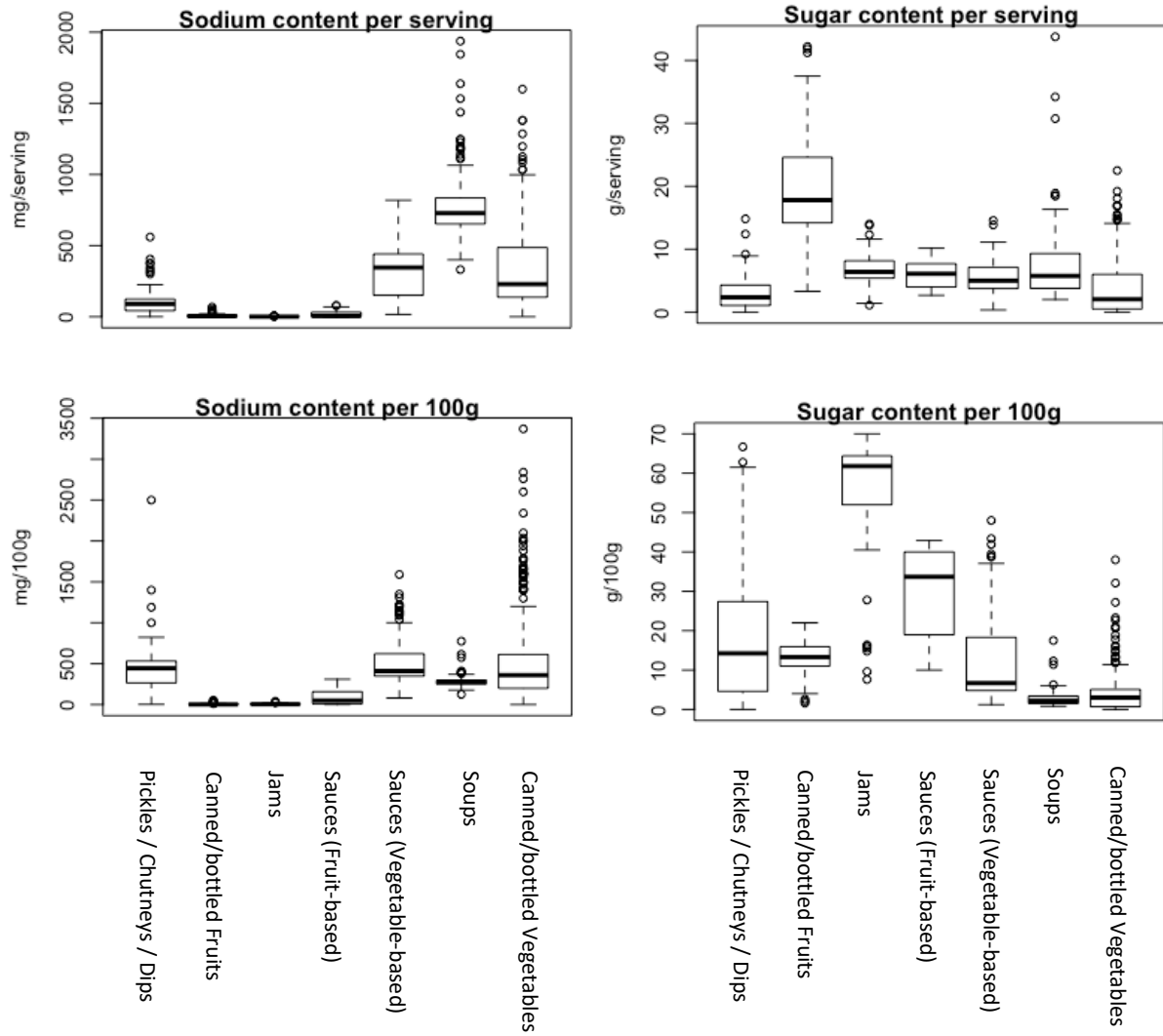


Table 1: Sugar content of canned fruit products

Product		Number of products	Manufacturer-declared Serve Size (grams; median [IQR])	Sugar per serve (grams; median [IQR])	Proportion of products with added sugar (%) ³	Proportion of products promoting 'low sugar' (%) ^{3,4}
All canned fruit¹		122	125 [120, 205]	17.8 [14.2, 24.6]	54.9	20.5%
	- all	61	135 [120, 205]	23.4 [18.7, 27.0]	95.1% ^a	14.8% ^a
Canned fruit in syrup²	- 'full sugar' syrup	52	132.5 [117, 205]	23.6 [18.8, 30.3]	100%	-
	- 'low sugar' versions³	9	205 [205, 205]	25.8 [14.2, 26.4]	66.7% ^b	-
Canned fruit in juice²	- all	47	125 [117, 147]	14.6 [11.4, 16.4]	6.4% ^c	29.8% ^b
	- 'low sugar' versions³	16	120 [112, 200]	12.9 [9.3, 15.2]	6.3% ^c	-

¹ Includes all canned fruit products, including those in syrup, in juice, and those for which the liquid was not defined (or was not present – e.g. pureed fruit).

² Based on wording on the product label

³ Superscript letters within the same column are significantly different from each other as per Dunns posthoc test (p < 0.001)

⁴ Include the terms “no added sugar”, ‘50% less sugar’, ‘low sugar’

Table 2: Sodium content and manufacturer-declared serve size information of processed vegetable-based products

Product	Number of products	Manufacturer-declared Serve Size (g)			Sodium Content			Serving Size	
		Median (IQR)	Min	Max	Sodium per serve (mg; median [IQR])	Proportion of products with added sodium (%)	Number of products promoting 'low sodium/salt' (%) ³	RACC Serve Size(g) ^{4,5}	Proportion of Products exceeding (%) RACC
Soups	106	250 [250, 300]	200	450	721.8 [654.4, 834.2]	94.4%	3 (2.8%)	245	88.7
Fruit-Based Sauces	16	25 [14, 30]	10	30	5.0 [2.9, 45.2]	31.3%	0 (0%)	-	-
Jams	72	10 [10, 15]	10	50	0.5 [0.4, 1.5]	1.3%	0 (0%)	20	5.6
Vegetable-Based Sauces	176	83.5 [20,125]	10	300	318.6 [156.2, 440.9]	96.0%	4(2.3%)	-	-
- Tomato sauces¹	32	15 [15, 15]	10	50	142.1 [94.1, 164.3]	86.7%	3 (10%)	30	9.4
- Pasta sauce²	79	125 [100, 127]	80	188	437.5 [372.4, 477.9]	97.4%	1 (1.3%)	125	29.1
All canned vegetables	286	120.5 [50, 130]	45	300	221 [135.7, 461.8]	75.4%	9 (11.3%)	130	35.3
- Baked beans	25	210 [205, 210]	125	300	805.8 [504.7, 981.1]	96.0%	2 (8%)	130	84.6
- Canned tomatoes	36	100 [80, 130]	80	200	120.0 [15.0, 172.0]	44.5%	1 (2.8%)	130	25.7
- Canned beans (non-baked)	45	130 [108, 200]	60	225	448.1 [201.1, 585.7]	82.2%	1 (2.2%)	130	37.8
All canned fruit	122	125	85	212	4.1	3.8%	0 (0%)	140	32.2

		[120, 205]				[3.1, 10.2]				
Pickles/Chutneys/Dips	121	20 [15, 25]	10	47.5		89.8 [42.6, 123.7]	79.3%	0 (0%)		-

¹ Includes all sauces that include the terms 'tomato sauce', 'ketchup', or 'pizza sauce'

² Includes all sauces that include the terms 'pasta sauce' or 'bolognese sauce'

³ Includes the terms 'reduced salt', 'reduced sodium', 'low sodium'

⁴ Data taken from 2018 FDA recommendations¹⁹

⁵ Only products with equivalent RACC serve size information is reported.

Table 3: Sodium and sugar content of example processed¹ vs fresh² fruit and vegetables

Product	Product / Serve Size (g)	Energy (KJ)		Sugar content (g)		Sodium content (mg)		
		per serve	per 100g	per serve	per 100g	per serve	per 100g	
Fruits								
Apples	Fresh, 1 large	242	546	225.6	25.0	10.3	0	0
	Pie filling, Apple	125	425	340.0	16.3	13.0	3.75	3.0
Peaches	1 medium	147	252	171.4	13.0	8.8	0	0
	Canned (slices in syrup)	205	410	200.0	21.8	10.6	4.1	2.0
Pears	1 medium	166	420	253.0	16.0	9.6	0	0
	Canned (quarters in syrup)	205	492	240.0	27.1	13.2	4.1	2.0
Plums	2 medium	151	294	195.3	16.0	10.6	0	0
	Canned (in syrup)	212	355	167.5	42.2	19.9	4.2	2.0
Pineapple	Fresh, 2 slices	112	210	187.5	10	8.9	0	0
	Canned (slices in syrup)	125	288	230.4	23.4	18.7	2.9	2.3
Vegetables								
Beans	Fresh, green, whole	100	105	105.0	2.4	2.4	3.0	3.0
	Canned (4-bean mix)	125	863	690	1.0	0.8	143.8	115.0
Corn	Fresh, kernels from one ear	90	328	464.0	5	5.6	5.0	5.6
	Canned (kernels)	80	288	360.0	2.6	3.25	100.0	125.0
	Canned (creamed corn)	100	405	405.0	2.9	2.9	165.0	165.0
Tomatoes	Fresh, 1 medium	148	105	70.9	20	13.5	3.0	2.0
	Canned (whole, peeled in juice)	80	64	80.0	2.4	3.0	200.0	250.0

¹ Data extracted from study data. Values reported are those for products with the greatest sugar / sodium content across all comparable products.

² Information taken from USDA 'Nutrition Information for Raw Fruits, Vegetables and Fish' ¹⁷