Seven-year trends in the availability, sugar content and serve size of single-serve non-alcoholic beverages in New Zealand: 2013 to 2019

Teresa G. Castro[1,2*], Helen Eyles[1,3], Cliona Ni Mhurchu[3,4,] Leanne Young[3], Sally Mackay [1]

[1]Department of Epidemiology and Biostatistics, The University of Auckland, Auckland 1142, New Zealand.

[2]Nutrition Section, The University of Auckland, Auckland 1010, New Zealand.

[3]National Institute for Health Innovation, The University of Auckland, Auckland 1142, New Zealand.

[4]The George Institute for Global Health, Sydney, Australia

Corresponding author:

Teresa Gontijo de Castro

Address: Department of Epidemiology and Biostatistics. Level 1, Building 507, School of Population Health, University of Auckland, Grafton campus. 22-30 Park Avenue. Grafton (1142). Auckland, New Zealand.

Email: t.castro@auckland.ac.nz

This is an Accepted Manuscript for Public Health Nutrition as part of the Cambridge Coronavirus Collection. This peer-reviewed article has been accepted for publication but not yet copyedited or typeset, and so may be subject to change during the production process. The article is considered published and may be cited using its DOI 10.1017/S1368980020005030
Public Health Nutrition is published by Cambridge University Press on behalf of The Nutrition Society

Running title: Non-alcoholic beverages in NZ: 2013-2019

Acknowledgments: We would like to thank Alana Cavadino, Biostatistician from the Department of Epidemiology and Biostatistics (University of Auckland) for the valuable statistical advice provided to TGC; Michelle Jenkins and John Faatui for data management and the fieldworkers for 2019 Nutritrack data. Thanks also to the team of the Global Food Research Program, led by Dr. Shu Wen, for providing an updated preliminary list of added sugars.

Funding: This research was funded by the National Health and Medical Research Council (NHMRC) funded Centre of Research Excellence in Reducing Salt Intake using Food Policy Interventions (APP1117300). The opinions, analysis, and conclusions in this paper are those of the authors and should not be attributed to the NHMRC.

Conflict of Interest: None.

Author Contributions: Study design: TGC, HE, CNM, LY and SM; data cleaning and preparation: TGC; statistical analysis: TGC; data interpretation: TGC, HE, CNM, LY and SM; writing-original drafting preparation: TGC, SM; funding acquisition, CNM. All authors have read and agreed to the published version of the manuscript.

Ethical Standards Disclosure: Ethical approval to conduct the study was not necessary as Nutritrack datasets were anonymized secondary data and did not involve human participants.

Abstract

Objective: To assess trends in relative availability, sugar content and serve size of ready-to-drink non-alcoholic beverages available for sale in supermarkets from 2013 to 2019.

Design: Repeat cross-sectional surveys. Data on single-serve beverages to be consumed in one sitting were obtained from an updated brand-specific food composition database. Trends in beverages availability and proportions with serve size ≤ 250 mL were assessed by chi-square tests for trends. Sugar content trends were examined using linear regressions. The proportion of beverages exceeding the sugar threshold of the United Kingdom Soft Drinks Industry Levy (SDIL) was assessed.

Setting: New Zealand.

Results: From 2013-2019, there was: i) an increase in the availability of sugar-free/low sugar beverages [n=25 (8.4%) to n=75 (19.1%); p<0.001] and craft sugar-sweetened soft drinks [n=11 (3.7%) to n=36 (9.2%); p<0.001], and a decrease in availability of fruit/vegetable juices/drinks [n=94 (31.8%) to n= 75 (19.4%); p<0.001]; ii) small decreases in sugar content (mean g/100 mL; 95% confidence interval) of sugar-sweetened soft drinks (3.03; 3.77-2.29); fruit/vegetable juices/drinks (1.08; 2.14- 0.01) and energy drinks (0.98; 1.63-0.32) and; iii) slight reduction in the proportion of beverages with serve size ≤250 mL (21.6% to 18.9%; p<0.001). In 2019: Most beverages were sugar-sweetened or had naturally occurring sugars (79.1%) and serve size >250 mL (81.1%) and most sugar-sweetened beverages exceeded the SDIL lower benchmark (72.9%).

Conclusions: Most single-serve beverages available for sale in 2019 were sugary drinks with high sugar content and large serve sizes, therefore, changes made across the years were not meaningful for population`s health.

Keywords: Sugary Drinks. Sugar-sweetened Beverages. Sugar Reduction. Reformulation. Population Health.

Introduction

Free sugars comprise monosaccharides and disaccharides that are added to foods and beverages, and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates[1]. The World Health Organization (WHO) recommends that adults and children limit their intake of free sugars to less than 10% of total energy intake and to less than 5% for further health benefits; this is because high free sugar intake is associated with poor dietary quality, obesity and risk of noncommunicable chronic diseases (NCDs)[2]. Sugar-sweetened beverages (SSBs) are the largest source of added sugars in the diet and recent conclusive evidence from cohort studies and trials support an etiologic role of SSBs in relation to weight gain, risk of type 2 diabetes mellitus (T2D) and coronary heart disease (CHD)[2]. Further, dental caries are the most prevalent NCD globally[1] and there is consistent evidence supporting a relationship between the amount of sugars consumed and the development of caries [3,4]

Global sales (2000-2013) of beverages with caloric sweeteners show stable but still high levels of consumption in Australasia, North America and some Western European countries. Data also highlight differences in sales trends by type of beverage and region, with consumption of SSBs rising fastest in regions beyond Western countries, extending to low and middle income countries[5]. Global data from 80 countries on sales of ultra-processed drinks (UPDs) showed that for every standard deviation increase in sales volume, there was a significant increase in mean body-mass-index, with a higher magnitude of association observed for men than for women (0.195 versus 0.072 kg/m^2)[6].

Given the accumulated scientific evidence of the need for actions to reduce consumption of free sugars from foods and beverages, the WHO has recommended reductions in beverage availability and portion sizes, and the reformulation (reduction) in sugar content of products with high sugars, alongside the monitoring of these changes over time[7]. In addition, the WHO endorses, among other population interventions, fiscal regulations to reduce the intake of free sugars from foods and beverages[1, 8-10]. One example of fiscal regulation aiming at reducing population`s intake of free sugars from beverages is the United Kingdom Soft Drinks Industry Levy (UK-SDIL). The SDIL was implemented in April 2018 and charges manufacturers and importers £0.24/litre for beverages over 8g sugar/100 mL (high levy category), £0.18/litre for beverages with 5 to 8 g sugar/100 mL (low levy category) and no charge for beverages with less than 5g sugar/100 mL (no levy

category)[11]. The beverages liable to the UK sugar levy are those that contain sugar or have had sugar added during production, exempting from charges fruit/vegetable juices with no added sugars, milk and milk- based drinks and milk replacement drinks[2-11].

Data from Euromonitor International Passport indicated that, in 2019, 71.1% of the soft drink's distribution in New Zealand-NZ (including carbonated drinks, juices and waters) was made through supermarket chains[13]. In 2012, 83% of the ready-to-drink beverages available for sale in NZ supermarkets were sugar-sweetened or contained naturally occurring sugars and only 12% of the non-alcoholic ready-to-drinks beverages had serve sizes ≤240 mL[14].

NZ has the world`s third highest rate of obesity in adults[15] and is ranked second among countries of the European Union and the Organization for Economic Co-operation and Development for the prevalence of childhood overweight/obesity (39.5%)[16]. The most recent NZ Health Survey (2018/19) found that 10.2% of children (2-14 years old) were consuming sugar-sweetened soft drinks, fizzy drinks, sports drinks, or energy drinks three or more times per week. Consumption of these drinks once or more per week was reported for 31.8% of the children: 15.6% for 2-4-year olds, 28.9% for 5-9-year olds and 44% for 10-14 year-olds[17].

Since the launch of the Global Strategy on Diet, Physical Activity and Health[8], self-regulation of the availability, reformulation and, marketing of SSBs has been the approach espoused by the global soft drink industry as part of their solution to obesity[18-20]. In NZ, the only industry pledge made in this context was the "Healthy Kids Pledge" at schools by the New Zealand Beverage Council (NZBC) in 2017 (updated in February 2018). In this pledge, the industry members of the NZBC committed to sell only bottled water directly to primary and intermediate schools, to not sell sugar-sweetened carbonated soft drinks to secondary schools and to not undertake any commercial advertising in schools[21]. In December 2018, the NZ food industry provided a list of 51 recommendations to the government as part of the food industry taskforce solution for addressing factors contributing to obesity. Among the recommendations, **t**he NZBC committed to launch a pledge in the first quarter of 2019 to a 20% sugar reduction of non-alcoholic beverages available for sale by 2025[22]. However, to date, this pledge has not been launched. In addition, NZ lacks information on how the availability, sugar content and serve size of sugary drinks available for sale are tracking overtime; such information is needed in order to guide policies and interventions that aim to improve population`s diet.

In this study we aimed to: i) examine trends in the relative availability, sugar content and serve size of single-serve ready-to-drink non-alcoholic beverages available for purchase in NZ supermarkets from 2013 to 2019; ii) assess if there has been any significant reformulation of sugar content amongst the sugar-sweetened beverages that tracked for two years or more in the market during the period analysed and; iii) assess in 2019 the proportion of sugar-sweetened beverages with sugar content exceeding the threshold for the UK SDIL[11].

Methods

Data source and definition of single-serve size

Data from 2013 to 2019 on the availability, total sugar content, added sugar content, and serve size of ready-to-drink non-alcoholic beverages were extracted from Nutritrack, a branded food composition database. Nutritrack was developed by the National Institute for Health Innovation at the University of Auckland and includes information for packaged foods sold in four major New Zealand (NZ) supermarket stores (New World, Four Square, Countdown and PAK'nSAVE)[23]. Cross-sectional surveys are conducted annually in Auckland from February to May each year and product information collected encompasses approximately 75% of unique packaged foods and beverages purchased in NZ[24]. Using a customized smartphone application, trained fieldworkers take photos and collect information from all packaged foods and non-alcoholic beverages that display a nutrition information panel (NIP). Names, brands, ingredient and nutrient information are entered into a secure on-line system using photographs of all sides of the product, and all packaged foods and beverages are categorized into a standardized hierarchical structure comprising 15 foods groups, 59 categories and 177 subcategories[7,25,26.].

Analyses were limited to ready-to-drink beverages designed to be consumed in one sitting, where label-reported serve size was equal to one and package volume ≤600 mL. As in previous work[27], beverages with pack size > 600 mL (with one serve or with 2 or more serves) were considered as bulk pack sizes and likely to be consumed in more than one occasion, therefore, were excluded from this study. In addition, the industry has agreed to a maximum standardized serve size of 600 mL for beverages during the process of development of the voluntary Australasian Health Star Rating front of pack nutrition label[28].

Selection of products and exclusion criteria

This study included water-based, plant milk-based and dairy milk-based (including plain unflavoured unsweetened dairy milk) ready-to-drink beverages. Thus, the following beverages were not selected: i) evaporated or condensed milks, beverage powders and concentrated beverages as they are not ready-to-drink and because nutrient data recorded in Nutritrack are "as purchased", prior to reconstitution (n= 2592); ii) products used as ingredients rather than being ready-to-drink e.g. coconut creams and some coconut milks (n= 262; iii) yoghurts (n= 2238), with the exception of drinking yoghurts; iv) dairy probiotic drinks due to the small number of products under this category (n=23) and; v) beverages specifically targeted to infants and young children (1-3 years old). Among the 8734 selected non-alcoholic beverages from 2013-2019, the following were excluded: reconstituted products (n=45), fruit/vegetable juices/drinks used as ingredients (n= 59), fruit/vegetable juices/drinks where aloe vera and water were the only ingredients (n= 72), products displaying multiple NIPs (n=30) and products with missing information for pack size (n=132) and for serve size (n=263). Additional exclusions were due to the following: pack size $\leq$ 600 mL and 2 or more serves/pack (n=399); pack size > 600 mL and 2 or more serves/pack (n=4980) and pack size > 600 mL and 1 serve/pack (n=288). In total, 2466 ready-to-drink beverages with single-serve size and packet size $\leq$ 600mL were included in the analysis. Among these beverages, n=66 (2.7%) had missing values for sugar content and were therefore excluded from the analysis assessing sugar content and its trends (which included 2400 beverage products) (**Figure S1**).

Categorization of the non-alcoholic ready-to-drink-beverages

A beverage classification system for the current analysis was developed and applied. Details on the beverage groups and subgroups, as well as the rationale used, are provided in **Table 1.** This classification system was developed based on the original Nutritrack classification of food group levels[23,25], total sugar content reported on NIPs for beverages under group 1 (electrolyte drinks, energy drinks, soft drinks and waters) and by the presence of any of 93 types of added sugars in the ingredients list of the products under group 2 (dairy and plant-based milks, drinking yoghurts and breakfast beverages), under group 3 (fruit/vegetable juices/drinks), and for flavoured waters (under group 1). The added sugars examined were sourced from previously published list of added sugars from supermarket packaged foods of four countries (including the NZ Nutritrack data)[29] and from an updated

and extended version of this published list, developed by the Global Food Research Program. For the beverages under group 2 and for flavoured waters (group 1) the following ingredients were also considered as added sugars: fruit juices, fruit nectars, fruit purees and fruit concentrates. The developed system classified non-alcoholic beverages into three main groups, six subgroups (level 1) and 22 smaller subcategories (level 2). We also classified waters and soft drinks further into a third level as follows: waters (plain still/sparkling; flavoured still/sparkling with no added sugars and, flavoured still/sparkling with added sugars) and; soft drinks (sugar-free/low-sugar classic, sugar-free/low-sugar craft, sugar-sweetened classic and sugar-sweetened craft). Classic soft drinks included colas, lemonades, lemon squash and similar while craft soft drinks included ice teas, kombuchas, switchels, wellness tonic and similar (**Table 1**).

Criteria for assessment of serve size and sugar content

The proportion of single-serve beverages with a serve size ≤250 mL was assessed across the seven years. The 250mL threshold was used as this was the most common serve size for SSBs available for sale in NZ in 2016[30] and it was the value used as the cut-off for single-serve beverages in a simulation study estimating the health benefits and cost savings of a cap on the package/serve size of SSBs in NZ[27].

The sugar content of beverages was assessed in three different ways. Firstly, we calculated the mean (standard deviation-SD by 100 mL) of sugar content of all beverage groups and subgroups overall and for each year (from 2013 to 2019). We then assessed changes in mean sugar content of beverage groups and subgroups across the seven years. Secondly, we assessed if there was any significant sugar reformulation of unique sugar-sweetened beverages that were available for sale in two or more years for the period of 2013-19. Thirdly, we assessed the proportion of beverages available for sale in 2019 with sugar levels above the low and high benchmarks established by the United Kingdom (UK) SDIL[31]. To allow comparability with other studies, this assessment was limited to the beverages liable to the UK sugar levy [11-12].

Statistical analysis

Descriptive statistics were undertaken to determine the number of products, proportions, means, SD and ranges for the following outcomes: relative availability of beverages, their sugar content and serve size. Analyses were undertaken on all available single-serve products from 2013-19 and separately for each year. Samples were considered

sufficiently large (≥ 30) for the central limit theorem to apply[32]. T-tests for independent samples and one-way ANOVA and Tukey HSD post-hoc tests were applied to examine statistically significant differences in mean values of sugar content between beverage subgroups.

Trend analysis for beverages availability, sugar content, and serve size were performed only for beverage groups and subgroups with at least 100 products available across 2013-2019. Trends in the relative availability and in the proportion of beverages with serve size ≤ 250 mL within beverage groups and subgroups were examined using chi-square tests for trends (linear-by-linear associations using Mantel Haenzel tests).

To estimate the average change in sugar contents from 2013-2019, linear regression models were performed with the sugar content of all beverages as the dependent variable. Year was included in the models as a continuous variable (coded as 2013=0, 2014=0.167, 2015=0.334, 2016=0.501, 2017=0.668, 2018=0.835 and 2019=1). Interaction terms between year and beverage subgroups were tested in the main model and, where significant interactions were present, analyses were also presented according to beverage subgroups.

Analysis of sugar reformulation was performed using linear random effects mixed models, where a random product effect was included in the models to account for within product change, and year, as a continuous variable (coded as above indicated), was considered in the fixed models. Reformulation analyses were limited to 365 unique sugar-sweetened beverages that were available for sale in two or more years and with information on sugar content available in two or more years (46.3% of the unique sugar-sweetened beverages available for sale from 2013-2019) (Figure S2). As a complementary assessment, we examined the number and proportion of the unique sugar-sweetened drinks where a change in sugar content had occurred in the period analysed. Change was defined as a sugar content variation of at least ± 0.1g/100 mL when assessing the difference in values between the most recent year and the first year. Within products that had any reduction or increase of sugar within the period, we presented means (SD) of sugar increase and decrease.

Average percentage change in sugar content across the seven years was calculated by dividing the adjusted mean change in sugar from 2013-2019 by the mean sugar content in 2013 and multiplying by 100%. All analyses were performed using SPSS software (version 25, IBM SPSS Statistics), and all tests were two-sided at 5% significance level.

3. Results

3.1. Relative availability of ready-to-drink non-alcoholic beverages across 2013-19

The number of single-serve ready-to-drink beverages available for sale each year were: 2013 (n=296), 2014 (n=310), 2015 (n= 356), 2016 (n= 400), 2017 (n=335), 2018 (n=378) and 2019 (n=391). Among the beverages available for sale in 2019, 19.1% were sugar-free/low-sugar beverages and 79.1% were sugar-sweetened beverages or beverages with naturally occurring sugars. Sugar-sweetened soft drinks and plain waters represented 29% and 3.8% of all ready-to-drink beverages available for sale in 2019, respectively **(Table S1**). The relative availability of sugar-sweetened electrolyte, energy, soft drinks and waters and of dairy milks, plant-based milks, drinking yoghurts and breakfast beverages (with added sugars) did not change across the seven years. There was a statistically significant increase in the relative availability of sugar-free/low-sugar electrolyte, energy, soft drinks and waters (from 8.4% in 2013 to 19.1% in 2019) (**Figure 1a**). In contrast, across 2013-19, there was a decrease in the availability of fruit/vegetable juices/drinks [n=94 (31.8%) to n= 75 (19.4%); p<0.001] (data not shown in figure). Fruit/vegetable juices/drinks with added sugars decreased from 11.5% in 2013 to 6.9% in 2019 and items without added sugars decreased from 20.3% in 2013 to 12.3% in 2019) (**Figure 1a**). Within soft drinks subgroups, a statistically significant increase was observed in the relative availability of sugar-free/low-sugar products (ranging from 4.4% in 2013 to 10.8% in 2019) and of sugar-sweetened options (ranging from 22.3% in 2013 to 29% in 2019). The increase in the availability of sugar-sweetened soft drinks was explained predominantly by the increase in the availability of craft sugar-sweetened soft drinks (ice-teas, kombuchas, switchel, tonic wellness and similar) as there were no statistically significant changes in the availability of sugar-sweetened classic soft drinks (**Figure 1 b**).

3.2. Sugar content of ready-to-drink non-alcoholic beverages across 2013-19

Among all beverages available for sale from 2013-19 (excluding sugar-free/low sugar beverages), despite a one-way ANOVA test indicating that there were statistically significant differences in mean sugar content between the subgroups (p<0.001), post-hoc tests showed that there were no differences between the mean sugar content of sugar-sweetened electrolyte, energy, soft drinks and waters; dairy and plant-based milks, drinking yoghurts and breakfast beverages-with added sugars; fruit/vegetable juices/drinks-no added sugars and; fruit/vegetable juices/drinks-with added sugars (p-values >0.05 for all comparisons).

The mean sugar contents in these subgroups varied from 8.5 to 9.2 g/100 mL. However, the mean amount of sugar for each of these four beverage subgroups was significantly higher than the mean amount of sugar of plain/flavoured dairy and plant-based milks, drinking yoghurts and breakfast beverages-no added sugars (5.1 g/100 mL; $p<0.001$for all post-hoc comparisons). Within the sugar-sweetened electrolyte, energy, soft drinks and waters subgroup, waters had the lowest mean sugar content while energy drinks had the highest (3.2g *vs* 11.5g/100mL; one-way ANOVA test and all subsequent post-hoc tests with $p<0.001$). Within the sugar-sweetened soft drinks subgroup, craft soft drinks had a lower mean sugar content than classic soft drinks (4.6 g *vs* 9.5 g/100mL; Student t-test with $p<0.001$) (**Table 2)**.

Across the seven years and among all beverages available for sale (excluding sugar-free/low sugar beverages), there was a significant mean sugar reduction (in g/100 mL; 95% confidence interval) of 1.59g/100 mL (2.00-1.19). However, there were no statistically significant changes in mean sugar content among the subgroup of flavoured dairy and plant-based milks, drinking yoghurts and breakfast beverages (with added sugars) or fruit/vegetable juices/drinks (without added sugars). Statistically significant mean sugar reduction across the seven years was observed for the following subgroups: fruit/vegetable juices/drinks-with added sugars (1.08; 2.14-0.01 g/100 mL) and sugar-sweetened electrolyte drinks, energy drinks, soft drinks and waters (2.48; 3.11-1.86 g/100 mL). Within this last subgroup, a significant mean sugar reduction across 2013-19 was observed for sugar-sweetened energy drinks (0.98; 1.63-0.32 g/100 mL) and sugar-sweetened soft drinks (3.03; 3.77-2.29 g/100 mL). Within the sugar-sweetened soft drinks subgroup the mean sugar reduction across the seven years for craft soft drinks was 3.18 g/100 mL (3.94; 2.43) and for classic soft drinks it was 2.27 g/100ml (2.98; 1.57) (**Figure 2**).

3.3. Reformulation of sugar-sweetened beverages across 2013-19

Analysis of product reformulation in the same sugar-sweetened beverages across the seven years indicated that there was a statistically significant, but modest, average sugar reduction within these beverages of 0.37g/100 mL (95%CI: 0.57-0.16 g/100 mL), corresponding to an average percentage sugar reduction of 3.7% (data not shown in table). Among the unique 365 sugar-sweetened beverages, there was a change in sugar content in 85 beverages (23.3%) in the period analysed by at least $\pm$ 0.1g/100 mL, with a reduction in 54 beverages [mean (SD) reduction: -1.43 (1.34)] and an increase in 31 beverages [mean (SD) increase: 0.92 (0.93)].

3.4. Sugar content of sugar-sweetened beverages in 2019 relative to the UK SDIL benchmarks

In 2019, there were 192 single-serve sugar-sweetened beverages available for sale in NZ supermarkets which would be liable for the UK SDIL. Among them, 140 (72.9%) would be taxed (**Figure 3**), with 35 (18.2%) taxed at the lower level and 105 (54.7%) at the higher level (data not shown in table). All sugar-sweetened electrolytre drinks (n=4) and fruit/vegetable juices/drinks-added sugars (n=27), 97.6% (n=42) of the sugar-sweetened energy drinks and 82.9% (n=64) of the sugar-sweetened classic soft drinks would be taxed at the low or high tax categories. Four (11.1%) of the sugar-sweetened craft soft drinks would be taxed while none of the sugar-sweetened waters would be taxed (**Figure 3**).

3.5. Serve size of ready-to-drink non-alcoholic beverages across 2013-19

Across the seven years, the mean (SD) serve size of the single-serve beverages available for sale was 355.9 mL (119.2), with minimum serve size of 70 mL and maximum of 600 mL (data not shown in table). In 2019, less than two in 10 single-serve beverages available for sale had a serve size ≤250 mL (n=74; 18.9%). Across 2013-19, there was a significant decrease in the proportion of beverages with serve size ≤250 mL among the following: all beverages (from 21.6% in 2013 to 18.9% in 2019); dairy milks, plant-based milks, drinking yoghurts and breakfast beverages subgroup-all (from 50% in 2013 to 25% in 2019); dairy milks, plant-based milks, drinking yoghurts and breakfast beverages subgroup-with added sugars (from 47.9% in 2013 to 24.6% in 2019) and; for flavoured dairy milks with added sugars (from 34.6% in 2013 to 7.3% in 2019).There was a significant increase in the proportion of sugar-free/low-sugar soft drinks with a serve size ≤ 250 mL across 2013-19. However, it is important to highlight that the number of beverages within this subgroup with a serve size ≤ 250 ml was none in 2013, 2014, 2016 and 2018, one in 2015 and 2017, and nine in 2019 (**Table 3**).

Discussion

Statement of principal findings

From 2013-19 there was a significant increase in the availability of sugar-free/low sugar drinks (from 8.4% of all drinks in 2013 to 19.1% in 2019) and a reduction in the mean sugar content of some beverage subgroups (ranging -1.08 g/100 mL for sugar-sweetened energy drinks to -3.18g/100 mL for sugar-sweetened craft soft drinks). For analyses limited to 365 products (46.3% of total unique sugar-sweetened beverages) where data were

available for two or more years, we observed modest reformulation of sugar with a reduction of 0.37 g/100 mL (3.7% average sugar reduction across the seven years). Nevertheless, it is a population health concern that in 2019 almost 80% of single-serve beverages sold at NZ supermarkets were sugar-sweetened or contained naturally occurring sugars and among beverages liable for the SDIL, 72.9% had sugar content higher than the UK lower sugar benchmark. The serve size of single-serve beverages is another area for improvement, as we identified a significant reduction in the proportion of products with serve size ≤ 250 mL. In 2019, 81.1% of non-alcoholic single-serve beverages available for sale had serve size > 250 mL.

Findings in relation to other studies

Across 2013-19, there was a significant increase in the relative availability of sugar-free/low-sugar electrolyte drinks, energy drinks, soft drinks and waters and of sugar-sweetened craft soft drinks (which are usually soft drinks with lower sugar content than sugar-sweetened classic soft drinks). A previous study using Nutritack data in 2012 reported the proportion of sugar-sweetened beverages and beverages containing naturally occurring sugars represented 83% of the non-alcoholic beverages available for sale in NZ supermarkets, including beverages of all volumes[14]. This proportion was just slightly higher than the proportion we reported for single-serve size beverages seven years later, in 2019 (79.1%). Despite the significant reduction in the relative availability of fruit/vegetable juices/drinks (with and without sugar) across 2013-19 identified in this study, these products still constituted a large proportion of non-alcoholic beverages on supermarket shelves in 2019 (19.4% of all ready-to-drinks single-serve beverages available for sale). Estimates of beverage consumption for adults in 2010, including 187 countries, indicated that fruit juice consumption in NZ was the highest globally (0.83 serving - 190 ml/ serve size/day[33]). These findings are concerning as in the present study the mean sugar content of fruit/vegetable juices/drinks-with or without added sugars (8.8g/100mL) was as high as the mean sugar content of sugar-sweetened electrolyte, energy and soft drinks and waters (9.5g/100 mL). Despite the perception that 100% fruit juice is a healthy drink option, studies report positive associations between consumption of fruit juice and weight gain, T2D and all-cause mortality[2,5].

In 2019, 72.9% of single-serve sugar-sweetened beverages from NZ supermarkets eligible for the UK SDIL had a sugar content higher than the lower SDIL benchmark. This figure was higher than the 51.7% reported for the same beverages in UK supermarkets in

2016 before the announcement of their sugar levy[11], although the UK figure included beverages of all volumes. Thus, the significant mean sugar reduction observed among the single-serve beverage groups and subgroups available for sale across the seven years in NZ must be interpreted with caution when translating it to a meaningful impact on population`s diets and health. For example, the mean sugar reduction of 3.03 g/100 mL across 2013-19 seen for sugar-sweetened soft drinks was influenced by the upwards trend of sugar-sweetened soft drinks with lower sugar content (craft) in the market, with no significant change in the relative availability of classic sugar-sweetened soft drinks over the same period. A report from Euromonitor Passport about the soft drinks market in NZ for 2014-19[13] reported the increase in the number of products with lower sugar content in the market as being determined by the consumer`s preference for these products overtime, with industry responding to it to maintain a high volume of soft drinks sales. In our study we verified that some level of sugar reformulation contributed to the drop in mean sugar content from sugar-sweetened beverages over time, though it was of a modest magnitude (as the overall mean sugar content reduction among these beverages was only 0.37g/100 mL).

In our study, we found that the proportion of beverages to be consumed in one sitting with serve size limited to 250 mL was low at every year (ranging from 26.7% in 2016 to 18.9% in 2019) and that it reduced significantly across 2013-19. This finding is of concern given the evidence that the availability of foods and drinks with larger portions could increase caloric intake and lead to weight gain[10,34] and that people consume more foods and drinks when offered larger-sized portions and packages than when offered smaller sized options[34]. A simulation study using the most recent NZ National Nutrition Survey intake data from 2008/9 estimated that a cap on single serve SSBs of 250 mL would reduce SSB intake, improve quality-adjusted-life-years by 82,100 and save health systems costs NZ$1.65 billion[27].

Strengths and limitations of the study

The strengths of this study include the use of annually updated Nutritrack data, which represents approximately 75% of unique packaged foods and beverages purchased in NZ[24], and the assessment of single-serve ready-to-drink non-alcoholic beverages available for sale in NZ supermarkets across seven years. Consequently, this study provides comprehensive information on non-alcoholic beverages that are part of the ready-to-drink beverages supply but often not included in other studies around the globe (such as dairy and plant-based milks, drinking yoghurts, breakfast beverages and fruit/vegetable juices/drinks-with and without

added sugars). This study also presented information on trends in availability of craft soft drinks with lower sugar content (kombuchas, ice teas, switchels and wellness tonic), for a better understanding on how the availability of these products and changes in sugar content impacted on the mean sugar trends within the soft drinks subgroup.

One important limitation of this study is that results were not sales-based or complemented with sales data. This could provide useful information on how availability of the different beverages was related to volume sales in the period, providing an estimate of sugar volume consumption coming from the different beverage groups and subgroups overtime. Another limitation of the data is that information on the packaged food and beverage supply is collected from February to May each year, instead of through the year. Another aspect to consider when interpreting findings is that, to guarantee statistical power, trends in the availability, sugar content and serve size within beverage subgroups were only assessed if information was available for at least 100 products across the 7 years. Therefore, trends for waters, electrolyte drinks, dairy milks, plant-based milks, drinking yoghurts and breakfast beverages could not be assessed. The interpretation of the estimates of sugar reformulation must take into consideration the fact that the analysis included only the single-serve sugar-sweetened beverages available in the market for at least two years, which corresponded to less than half of the single-serve sugar-sweetened beverages available for sale from 2013-19.

Implications of the findings and future investigations

Findings from this repeated cross-sectional study have implications for food policies and policy makers. Despite the increase in availability of sugar-free/low sugar drinks and the reduction in the mean sugar content of specific beverage subgroups across 2013-19, in 2019 almost 80% of the single-serve beverages available were sugar-sweetened or had sugars naturally occurring, less than one-fifth had serve size ≤250 mL and 72.9% of the sugar-sweetened beverages liable to the UK SDIL had sugar content above its lower benchmark.

These results indicate that the industry self-regulatory approach current in place in NZ is not working and that government-led regulatory measures are needed to reduce the availability, sugar content and serve size of sugary drinks. The WHO[9] recommends that governments take action to improve availability and access to healthy foods and beverages. An important component of comprehensive programmes is taxation of sugary drinks, as it impacts in the reduction of purchase of taxed drinks by consumers and in sugar reformulation by the industry[31,36-38]. Real-world evaluation studies provide evidence that taxation of SSBs results in a reduction of purchases so could be an effective policy initiative to prevent noncommunicable diseases[11,35-37] in NZ. A systematic review and meta-analysis assessing the impact of a SSB tax in 11 formal jurisdictions from cities or national governments indicated that a 10% sugar tax was associated with an average decline in targeted beverage purchases and dietary intake of 10%, with a non-significant 1.9% increase in total untaxed beverage consumption[35]. Beverage sales in the UK after the implementation of the SDIL in April 2018 estimate that the sales volume of taxed sugar-sweetened beverages fell by 50% while the sales volume of sugar-free/low sugar soft drinks rose by 40%. After adjustment for sales, the weighted mean sugar content of all beverages included in the UK SDIL decreased significantly from 4.4 g/100 mL to 2.9 g/100 mL (overall reduction of 43%). The levy also resulted in significant changes to the product portfolios of manufacturers, including reformulation of existing products to reduce sugar content and the introduction of new lower sugar products[37]. Following the 2014 sugary drinks tax implementation in Mexico, the purchase of taxed beverages decreased by 45% in the 2 years post taxation (mainly at supermarkets) and sales of non-taxed drinks increased by 11% when compared the last year pre-tax with the first year post-tax (for almost all store-types)[36].

Findings from the present investigation reinforce the position of Health Coalition Aotearoa, a coordinating organisation for non-government organisations, healthcare and

academic sectors to collectively achieve the vision of health and equity in NZ[38,39]. The Coalition recommends a sugar levy on sugar-sweetened beverages similar to the UK SDIL[11,37] to be implemented in NZ. The introduction of a substantial tax on these beverages was also one of the top actions prioritised by public health experts of NZ in 2017 and in 2020[40,41].

Conclusions

This repeated cross-sectional study showed that in NZ across 2013-19 there was a significant increase in the availability of single-serve sugar-free/low sugar beverages and soft drinks with lower sugar content (craft) and a reduction in the mean sugar content of some beverage subgroups. Nevertheless, in 2019, 79.1% of single serve non-alcoholic beverages available for sale in the supermarkets were sugar-sweetened or had sugars naturally occurring and 81.1% had serve size >250 mL. Among the single-serve beverages liable for the UK SDIL, 72.9% had a sugar content above the lower benchmark. Thus, these findings clearly demonstrate that the current industry-led self-regulatory approach for reducing sugar intake from soft drinks industry in NZ has minimal effect and that government-led regulatory measures are now needed to reduce, in a meaningful way, the availability, sugar content and serve size of sugary drinks. It is also important that the state of the non-alcoholic beverages supply continues to be monitored.

References

1. World Health Organization (2015). Sugar intake for adults and children. Geneva: World Health Organization, 2015.
2. Malik VS, Hu FB (2019). Sugar-Sweetened Beverages and Cardiometabolic Health: An Update of the Evidence. Nutrients; http://dx.doi.org/10.3390/nu11081840.
3. Sheiham A, James WP (2014). A reappraisal of the quantitative relationship between sugar intake and dental caries: the need for new criteria for developing goals for sugar intake. BMC Public Health; 14:863. http://www.ncbi.nlm.nih.gov/pubmed/25228012.
4. Moynihan PJ, Kelly S (2014). Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. J Dent Res; 93, 8–18.
5. Popkin BM, Hawkes C (2016). The sweetening of the global diet, particularly beverages: patterns, trends and policy responses for diabetes prevention. Lancet Diabetes Endocrinol; 4(2): 174–186.doi: 10.1016/S2213-8587(15)00419-2.
6. Vandevijvere S, Jaacks LM, Monteiro CA, et al (2019). Global trends in ultraprocessed food and drink product sales and their association with adult body mass index trajectories. Obes Rev; 20 (Suppl 2):10-9. doi: 10.1111/obr.12860.
7. The Food Monitoring Group (2013). Progress with a global branded food composition database. Food Chem; 140, 451-7.
8. World Health Organization (2004). Global strategy on diet, physical activity and health. Geneva: WHO.
9. World Health Organization (2017). Taxes on sugary drinks? Why do it? Geneva: WHO. https://apps.who.int/iris/bitstream/handle/10665/260253/WHO-NMH-PND-16.5Rev.1-eng.pdf;sequence=1 (accessed March 2020)
10. World Health Organization (2020). Limiting portion sizes to reduce the risk of childhood overweight and obesity. https://www.who.int/elena/titles/portion_childhood_obesity/en/ (accessed 03 March 20).
11. Scarborough P, Adhikari V, Harrington RA, et al (2020). Impact of the announcement and implementation of the UK Soft Drinks Industry Levy on sugar content, price, product size, and number of available soft drinks in the UK, 2015-19: A controlled interrupted time series analysis. Plos Med; doi.org/10.1371/journal.pmed.1003025.

12. The United Kingdom Government (2018). https://www.gov.uk/guidance/check-if-your-drink-is-liable-for-the-soft-drinks-industry-levy (accessed February 2020).

13. Euromonitor Passport International (2020). Soft drinks in New Zealand. https://www-portal-euromonitor-com.ezproxy.auckland.ac.nz/portal/magazine/homemain (accessed June 2020).

14. Ni Mhurchu C, Eyles H (2014). Sweetened and unsweetened non-alcoholic beverages in New Zealand: assessment of relative availability, price, serve size, and sugar content. Pac Health Dialog; 20(1):51-8.

15. Organization for Economic Co-operation and Development (2017). Obesity update 2017. OECD, 2017. https://www.oecd.org/els/health-systems/Obesity-Update-2017.pdf (accessed March 2020).

16. United Nation Children`s Fund (2019). The State of the World's Children 2019. Children, Food and Nutrition: Growing well in a changing world. UNICEF, New York.

17. Ministry of Health (2019). Tier 1 statistics 2018/19: New Zealand Health Survey. Wellington: Ministry of Health.

18. Lacy-Nichols J, Scrinis G, Carey R (2019). The politics of voluntary self-regulation: insights from the development and promotion of the Australian Beverages Council`s Commitment. Public Health Nutr; 23 (3): 564-75. doi: 10.1017/ S1368980019002003.

19. Nestle M (2015). Soda Politics: taking on big soda (and winning). New York: oxford University Press.

20. Ronit K and Jensen JD (2014). Obesity and industry self-regulation of food and beverage marketing: a literature review. Eur J Clin Nutr; 68: 753–9.

21. New Zealand Beverage Council (2018). Ministry of Health Healthy Kids Industry-Pledge Update. https://www.nzbeveragecouncil.org.nz/assets/PDFs/4b5bd872d0/NZBC-Pledge-Update-February-2018.pdf (accessed May 2020)

22. Food industry taskforce on addressing factors contributing to obesity. Final report to Ministers of Health and Food safety (2018). https://www.health.govt.nz/system/files/documents/pages/food-industry-taskforce-final-report.pdf (accessed May 2020)

23. Nutritrack Database. https://diet.auckland.ac.nz/sites/default/files/2019-08/The_Nutritrack_Database.pdf. (accessed March 20).

24. Euromonitor. Passport. Packaged food in New Zealand-Country Report. http://www.portal.euromonitor.com.ezproxy.auckland.ac.nz/poral/analysis/tab (accessed November 2018).

25. Dunford, E, Webster J, Metzler AB et al (2011). International collaborative project to compare and monitor the nutritional composition of processed foods. Eur J Prev Cardiol; 19 (6), 1326-32.

26. Swinburn B, Sacks G, Vandevijvere S, et al (2013). INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. Obes Rev; 14 (S1):1–12.

27. Cleghorn C, Blakely T, Mhurchu CN, et al (2019). Estimating the health benefits and cost-savings of a cap on the size of single serve sugar-sweetened beverages. Prev Med; 120:150-6. doi: 10.1016/j.ypmed.2019.01.009.

28. The FoPL Scretariat ADoH, (2017). Health Star Rating System Style Guide. Canberra, Australia.

29. Dunford EK, Taillie LS, Milles DR, et al (2018). Non-nutritive sweeteners in the packaged food supply—an assessment across 4 countries. Nutrients; *10* (2), 257; https://doi.org/10.3390/nu10020257.

30. Eyles H, Neal B, Jiang Y, et al (2016). Estimating population food and nutrient exposure: a comparison of store survey data with household panel food purchases. Br J Nutr; 115 (10): 1835-42.

31. HM Treasury. Budget (2016). https://www.gov.uk/government/publications/budget-2016-documents (accessed March 2020).

32. Boston University (2016). http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_Probability/BS704_Probability12.html (accessed February 2020).

33. Singh GM, Micha R, Khatibzadeh S et al. (2015) Global, regional, and national consumption of sugar-sweetened beverages, fruit juices, and milk: a systematic assessment of beverage intake in 187 countries. PLoS One; 14 (3): e0214344. https://doi.org/10.1371/journal.pone.0214344.

34. Hollands GJ, Shemilt I, Marteau TM, et al (2015). Portion, package or tableware size for changing selection and consumption of food, alcohol, and tobacco. Cochrane Database of Systematic Reviews; 9. doi: 10.1002/14651858.CD011045.pub2.

35. Teng AM, Jones AC, Mizdrak A, et al (2019). Impact of sugar-sweetened beverage taxes on purchases and dietary intake: systematic review and meta-analysis. Obesity Rev; 20(9):1187-1204. doi: 10.1111/obr.12868.

36. Pedraza LS, Popkin BM, Batis C, et al (2019). The caloric and sugar content of beverages purchased at different store-types changed after the sugary drinks taxation in Mexico. Int J Behav Nutr Phys Activ; 16 (103): doi.org/10.1186/s12966-019-0872-8.

37. Bandy LK, Scarborough P, Harrington RA, et al (2020). Reductions in sugar sales from soft drinks in the UK from 2015 to 2018. BMC Medicine; 18:20. doi.org/10.1186/s12916-019-1477-4.

38. Wilson N, Morenga LT, Mackay S, et al (2020). Food taxes and subsidies to protect health: relevance to Aoteroa New Zealand. NZMJ; 133 (1511): 71-85.

39. Health Coalition Aoteroa. https://www.healthcoalition.org.nz/ (accessed April 2020).

40. Vandevijvere S, Mackay S, D'Souza E, et al (2018.) How healthy are New Zealand food environments? A comprehensive assessment 2014-2017. The University of Auckland, Auckland, New Zealand. https://figshare.com/s/f877a2b8b8129d456bb4 (accessed 06/04/2020).

41. Mackay S, Sing F, Gerritsen S, et al (2020.) Benchmarking Food Environments 2020: Progress by the New Zealand Government on implementing recommended food environment policies & priority recommendations. The University of Auckland, Auckland, New Zealand. https://figshare.com/s/c164d8e8ab5745ad1eb2 (accessed 21/10/2020)

Table 1. Beverage classification system developed and applied to the non-alcoholic beverages from Nutritrack 2013-19.

Group 1: **Electrolyte drinks, energy drinks, soft drinks and waters**[1]	**Group 2:** **Dairy milks, plant-based milks, drinking yoghurts and breakfast beverages**[2]	**Group 3:** **Fruit and vegetable juices/drinks**[3]
1.a. Sugar-free or low-sugar electrolyte drinks, energy drinks, soft drinks and waters	***2.a. Plain/flavoured dairy milks, plant-based milks, drinking yoghurts and breakfast beverages, no added sugars***	***3.a. Fruit and vegetable juices/drinks, no added sugars***
Electrolyte drinks	*Dairy milks*	*Coconut water*
Energy drinks	*Plant-based milks*	*Fruit juices/drinks*
Soft drinks	*Drinking yoghurt*	*Vegetable juices/drinks*
Craft soft drinks (ice teas, kombuchas, switchels, wellness tonic and similar)	*Breakfast beverages*	
Classic soft drinks (colas, lemonades, lemon squash and similar)		
Waters (all)		
Plain still/sparkling water		
Flavoured still/sparkling water with no added sugars		
1.b. Sugar-sweetened electrolyte drinks, energy drinks, soft drinks and waters	**2.b. F*lavoured dairy milks, plant-based milks, drinking yoghurts and breakfast beverages, added sugars***	***3.b. Fruit and vegetable juices/drinks, added sugars***
Electrolyte drinks	*Dairy milks*	*Coconut water*
Energy drinks	*Plant-based milks*	*Fruit juices/drinks*
Soft drinks	*Drinking yoghurt*	*Vegetable juices/drinks*
Craft soft drinks (ice teas, kombuchas, switchels, wellness		

tonic and similar)	*Breakfast beverages*
Classic soft drinks (colas, lemonades, lemon squash and similar)	
Waters (all)	
Flavoured still/sparkling water with added sugars	

[1] Classification based on the amount of total sugars displayed in the nutrition information panels (NIPs) of products, which represents data routinely collected by Nutritrack. Within group 1, products denominated by manufacturer as "diet" and/or with sugar content ≤1.0g/100 mL were classified as sugar-free/low sugar and products with sugar content >1.0 g/100 mL were classified as sugar-sweetened. Soft drinks group includes carbonated and non-carbonated drinks and it was further split in two subgroups to identify classic soft drinks (colas, lemonades, lemon squash and similar) and newer, contemporary soft drinks (named here as craft soft drinks and it includes ice teas, kombuchas, switchels, wellness tonic and similar). For waters, further classification considered presence of added sugars in products` ingredients list.

[2] Classification was made based in the presence of flavours and added sugars. Information on whether the product was plain or flavoured is routinely collected by Nutritrack. Product ingredients lists were consulted to search for the presence of added sugars.

[3] Classification was made based in the presence of added sugars, independently of the concentration of fruit/vegetable juices in the beverages. Product ingredients lists were consulted to search for the presence of added sugars.

Table 2. Mean, standard deviation and ranges of sugar content (g/100 mL) of non-alcoholic single-serve ready-to-drink beverage groups and subgroups, according to year and in total.

Ready-to-drink beverage groups and subgroups/year	**Sugar content (g/100 mL) x̄ -SD**																		
	2013		**2014**		**2015**		**2016**		**2017**		**2018**		**2019**		**Total 2013-19**				
	x̄	**SD**	**x̄**	**SD**	**x̄**	**SD**	**x̄**	**SD**	**x̄**	**SD**	**x̄**	**SD**	**x̄**	**SD**	**x̄**	**SD**	**Min**	**Max**	**N**
Group 1: Electrolyte, energy and soft drinks and waters	**8.7**	**4.5**	**7.7**	**5**	**7.7**	**4.6**	**7.9**	**4.5**	**7.2**	**4.8**	**6.3**	**4.6**	**5.5**	**4.7**	**7.2**	**4.80**	**0**	**16.7**	**1281**
1.a: Sugar-free / low sugar	***0.01***	***0.03***	***0.1***	***0.3***	***0.1***	***0.4***	***0.2***	***0.5***	***0.1***	***0.3***	***0.3***	***0.5***	***0.3***	***0.4***	***0.2***	***0.40***	***0***	***1.7***	***274***
Electrolyte drinks	0	--	0	--	0	--	--	--	--	--	--	--	--	--	0	0.00	0	0	4
Energy drinks	0.02	0.05	0.01	0.04	0.01	0.04	0.01	0.04	0.01	0.03	0.01	0.03	0	0	0.01	0.03	0	0.1	85
Soft drinks	0.01	0.03	0.2	0.4	0.3	0.6	0.3	0.6	0.2	0.5	0.4	0.6	0.5	0.5	0.33	0.51	0	1.7	141
Craft soft drinks (ice teas, kombuchas, switchels, wellness tonic and similar)	*0.1*	*--*	*0.4*	*0.5*	*--*	*--*	*--*	*--*	*0.1*	*0*	*0.5*	*0.5*	*0.7*	*0.4*	*0.5*	*0.50*	*0*	*1.0*	*42*
Classic soft drinks (colas, lemonades, lemon squash and similar)	*0*	*0*	*0*	*0*	*0.3*	*0.6*	*0.3*	*0.6*	*0.2*	*0.6*	*0.4*	*0.6*	*0.3*	*0.5*	*0.3*	*0.50*	*0*	*1.7*	*99*
Waters[†]	0.02	0.05	0	0	0.01	0.04	0.1	0.1	0	0	0.2	0.1	0	0	0.03	0.07	0	0.3	44
1.b: Sugar-Sweetened	***10.4***	***2.7***	***9.7***	***3.4***	***9.5***	***3.2***	***9.4***	***3.2***	***9.2***	***3.3***	***7.9***	***3.8***	***7.9***	***3.7***	***9.1***[2a]	***3.50***	***1***	***16.7***	***1007***
a. Electrolyte drinks	5.9	1.6	5.3	0.9	5	1	4.2	--	--	--	3.4	2.2	8.5	2.8	5.2 [b,c,d]	2.30	1.6	10.9	32
b. Energy drinks	11.7	2.2	12	1.6	11.8	1.7	11.6	1.6	11.5	1.8	10.7	2.5	11.1	2.2	11.5 [a,c,d]	2.00	1.3	16.7	315
c. Soft drinks	10.2	2	9	3.2	8.9	2.8	9.5	2.6	8.9	2.9	7.5	3.4	6.7	3.4	8.5 [a,b,d]	3.20	1.1	13.5	607
c.1.Craft soft drinks (ice teas, kombuchas, switchels, wellness tonic and similar)	*6.4*	*1.5*	*5.7*	*1.9*	*5.8*	*1.3*	*5.2*	*1.3*	*4.5*	*1.3*	*4*	*1.3*	*3.2*	*1.4*	*4.6* [c.2]	*1.80*	*1.1*	*8.9*	*121*
c.2. Classic soft drinks (colas, lemonades, lemon squash and similar)	*11*	*1.1*	*10*	*2.8*	*9.3*	*2.6*	*10.2*	*2*	*9.8*	*2.2*	*8.5*	*3.1*	*8.3*	*2.9*	*9.5* [c.1]	*2.60*	*1.1*	*13.5*	*486*
d. Waters[‡]	4.2	0.2	3.3	1.7	3.3	1.7	3.1	1.8	3	1.9	2.6	1.7	3.8	0.8	3.2 [a,b,c]	1.60	1	5.7	53
Group 2: Dairy and plant-	**8.8**	**2.7**	**8.9**	**2.3**	**8.5**	**2.2**	**8.2**	**2.2**	**8.4**	**2.6**	**8.3**	**2.5**	**8.2**	**2.6**	**8.4**	**2.40**	**1.2**	**16.2**	**518**

based milks, drinking yoghurts and breakfast beverages																			
2.a. Plain or flavoured, no added sugars (all)	***4.8***	***0.1***	***5.8***	***1.7***	***3.9***	***1.6***	***7.6***	***5***	***3.7***	***1.6***	***4.8***	***2***	***5.2***	***0.9***	***5.1***[1b,2b,3a,3b]	***2.50***	***2***	***11.9***	***27***
2.b. Flavoured, added sugars (all)	***9***	***2.6***	***9***	***2.2***	***8.7***	***2***	***8.2***	***2.1***	***8.7***	***2.4***	***8.6***	***2.4***	***8.5***	***2.2***	***8.6***[2a]	***2.20***	***1.2***	***16.2***	***491***
Dairy milks	8.6	0.9	8.4	0.8	8.4	1	8.1	1.8	8.5	1.8	8.6	1.7	8.4	1.5	8.4	1.40	4	12.8	232
Plant-based milks	3.2	2.3	3.2	2.3	--	--	5	2	5.2	1.3	5.7	1.8	4	0.3	4.9	1.90	1.2	7.7	31
Drinking yoghurts	12.6	2.7	11.1	2.1	11.4	2.2	11.3	1.3	10.3	2.6	10.7	2.1	10.8	1.8	11	2.20	4.8	16.2	113
Breakfast beverages	7.5	1	8	1.1	7.9	1.8	7.4	0.8	7.9	1.1	7.6	0.2	7.7	1.5	7.7	1.20	4.7	12.5	115
Group 3: Fruit/vegetable juices/drinks	**9.4**	**3**	**9.1**	**3.1**	**8.6**	**3.3**	**8.8**	**3.2**	**8.2**	**3.2**	**8**	**3**	**8.4**	**2.8**	**8.8**	**3.10**	**1.6**	**16.3**	**601**
3.a. Fruit/vegetable juices/drinks, no added sugars	***9.1***	***3.2***	***8.9***	***3.4***	***8.3***	***3.6***	***8.8***	***3.4***	***8.4***	***3.5***	***8.7***	***3.3***	***7.9***	***3.1***	***8.5***[2a]	***3.40***	***1.6***	***16.3***	***412***
3.b Fruit/vegetable juices/drinks, added sugars	***10***	***2.5***	***9.9***	***2.4***	***9.3***	***2.6***	***8.9***	***2.9***	***8***	***2.7***	***9.3***	***1.9***	***9.3***	***2***	***9.2***[2a]	***2.50***	***2.6***	***14.1***	***189***
Total	**9**	**3.8**	**8.3**	**8.1**	**8.1**	**3.9**	**8.2**	**3.8**	**7.8**	**4.0**	**7.3**	**4.1**	**6.6**	**4.2**	**7.8**	**4.0**	**0**	**16.7**	**2400**

$\overline{x}$ = mean; SD: standard deviation; Min: minimum; Max: maximum.

[†]Includes still/sparkling plain waters and still/sparkling flavoured waters with no added sugars/ low sugar content.

[‡]Includes still/sparkling flavoured waters with added sugars.

[1b, 2a, 2b,3a,3b]One-way ANOVA and Tukey HSD post-hoc tests $p<0.05$: applied for the comparison of means among the following beverage subgroups 1b; 2a; 2b; 3a; 3b.

[a,b,c,d] One-way ANOVA and Tukey HSD post-hoc tests $p<0.05$: applied for the comparison of means among the beverage within subgroups 1b.

[c.1, c.2]T test for independent samples $p<0.05$: applied for the comparison of means within sugar-sweetened soft drinks subgroups.

Table 3. Number and proportion of non-alcoholic single-serve ready-to-drink beverage groups and subgroups with serve size ≤ 250 mL, according to year and in total.

Ready-to-drink beverage groups and subgroups/year	Serve size ≤ 250 mL														P value*	Total 2013-19	
	2013		2014		2015		2016		2017		2018		2019				
	N	%	N	%	N	%	N	%	N	%	N	%	N	%		N	%
Group 1: Electrolyte, energy and soft drinks and waters	**16**	**10.5**	**27**	**16.9**	**32**	**17.7**	**27**	**13.5**	**30**	**16.9**	**24**	**10.9**	**36**	**15**	0.908	**192**	**14.40**
1.a: Sugar-free / low sugar	**3**	**12**	**4**	**10.8**	**5**	**13.5**	**6**	**15.8**	**8**	**20.5**	**5**	**9.8**	**15**	**20**	0.280	**46**	**15.20**
Electrolyte drinks	1	100	1	100	2	100	--	--	--	--	--	--	--	--	--	0	0
Energy drinks	3	60	3	37.5	4	50	6	46.2	6	35.3	5	31.3	6	33.3	--	33	38.8
Soft drinks	0	0	0	0	1	7.1	0	0	1	5.9	0	0	9	21.4	**0.005**	11	7.8
Craft soft drinks (ice teas, kombuchas, switchels, wellness tonic and similar)	*0*	*0*	*0*	*0*	--	--	--	--	*0*	*0*	*0*	*0*	*5*	*26.3*	--	*5*	*11.6*
Classic soft drinks (colas, lemonades, lemon squash and similar)	*0*	*0*	*0*	*0*	*1*	*7.1*	*0*	*0*	*1*	*8.3*	*0*	*0*	*4*	*17.4*	--	*6*	*6.1*
Waters†	0	0	1	8.3	0	0	0	0	1	20	0	0	0	0	--	2	2.8
1.b: Sugar-Sweetened	**13**	**10.2**	**23**	**18.7**	**27**	**18.8**	**21**	**13**	**22**	**15.8**	**19**	**11.2**	**21**	**12.7**	0.430	**146**	**14.20**
Electrolyte drinks	0	0	0	0	1	25	0	0	--	--	0	0	1	25	--	2	6.3
Energy drinks	12	24	15	30	13	28.9	12	27.9	10	25.6	8	17	8	18.6	0.180	78	24.60
Soft drinks	1	1.5	7	11.5	12	13.8	8	7.7	11	12.2	11	10.6	12	10.6	0.237	62	9.90
Craft soft drinks (ice teas, kombuchas,switchels, wellness tonic and similar)	*0*	*0*	*0*	*0*	*3*	*27.3*	*1*	*7.1*	*5*	*31.3*	*4*	*18.2*	*4*	*11.1*	0.262	*17*	*13.70*
Classic soft drinks (colas, lemonades, lemon squash and similar)	*1*	*1.8*	*7*	*14.9*	*9*	*11.8*	*7*	*7.8*	*6*	*8.1*	*7*	*8.5*	*8*	*10.4*	0.625	*45*	*9.00*
Waters‡	0	0	1	16.7	1	12.5	1	7.1	1	10	0	0	0	0	--	4	7.30
Group 2: Dairy and plant-based milks, drinking yoghurts and breakfast beverages	**25**	**50**	**39**	**62.9**	**47**	**58**	**47**	**51.6**	**35**	**42.2**	**28**	**33.7**	**19**	**25**	**<0.001**	**240**	**45.60**
2.a. Plain or flavoured, no added sugars (all)	**2**	**100**	**3**	**100**	**5**	**100**	**4**	**100**	**4**	**80**	**3**	**60**	**2**	**28.6**	--	**23**	**74.20**
2.b. Flavoured, added sugars (all)	**23**	**47.9**	**36**	**61**	**42**	**55.3**	**43**	**49.4**	**31**	**39.7**	**25**	**32.1**	**17**	**24.6**	**<0.001**	**217**	**43.80**
Dairy milks	*9*	*34.6*	*13*	*46.4*	*10*	*30.3*	*8*	*25.8*	*8*	*21.1*	*5*	*13.2*	*3*	*7.3*	**<0.001**	*56*	*23.80*
Plant-based milks	*2*	*100*	*2*	*100*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*16.7*	*0*	*0*	--	*6*	*19.4*
Drinking yoghurts	*10*	*100*	*15*	*78.9*	*9*	*69.2*	*9*	*60*	*19*	*82.6*	*16*	*80*	*9*	*69.2*	0.394	*87*	*77.00*
Breakfast beverages	*2*	*20*	*6*	*60*	*23*	*76.7*	*26*	*72.2*	*4*	*36.4*	*2*	*25*	*5*	*45.5*	0.463	*68*	*58.60*
Group 3: Fruit/vegetable juices/drinks	**23**	**24.5**	**27**	**30.7**	**41**	**43.6**	**33**	**30.3**	**13**	**17.3**	**20**	**26.7**	**19**	**25.3**	0.268	**176**	**28.90**
3.a. Fruit/vegetable juices/drinks, no added sugars	**19**	**31.7**	**16**	**26.2**	**26**	**41.9**	**25**	**32.9**	**7**	**14**	**17**	**29.8**	**13**	**27.1**	0.308	**123**	**29.70**
3.b Fruit/vegetable juices/drinks, added sugars	**4**	**11.8**	**11**	**40.7**	**15**	**46.9**	**8**	**24.2**	**6**	**25**	**3**	**16.7**	**6**	**22.2**	0.616	**53**	**27.20**
Total	**64**	**21.6**	**93**	**30**	**120**	**33.7**	**107**	**26.7**	**78**	**23.3**	**72**	**19.0**	**74**	**18.9**	**<0.001**	**608**	**24.7**

†Includes still/sparkling plain waters and still/sparkling flavoured waters with no added sugars/ low sugar content.

‡Includes still/sparkling flavoured waters with added sugars.

*Chi-square test for linear trend (linear-by-linear associations using Mantel Haenzel tests). Tests were not performed for beverage groups and subgroups with less than 100 products across 2013-19.

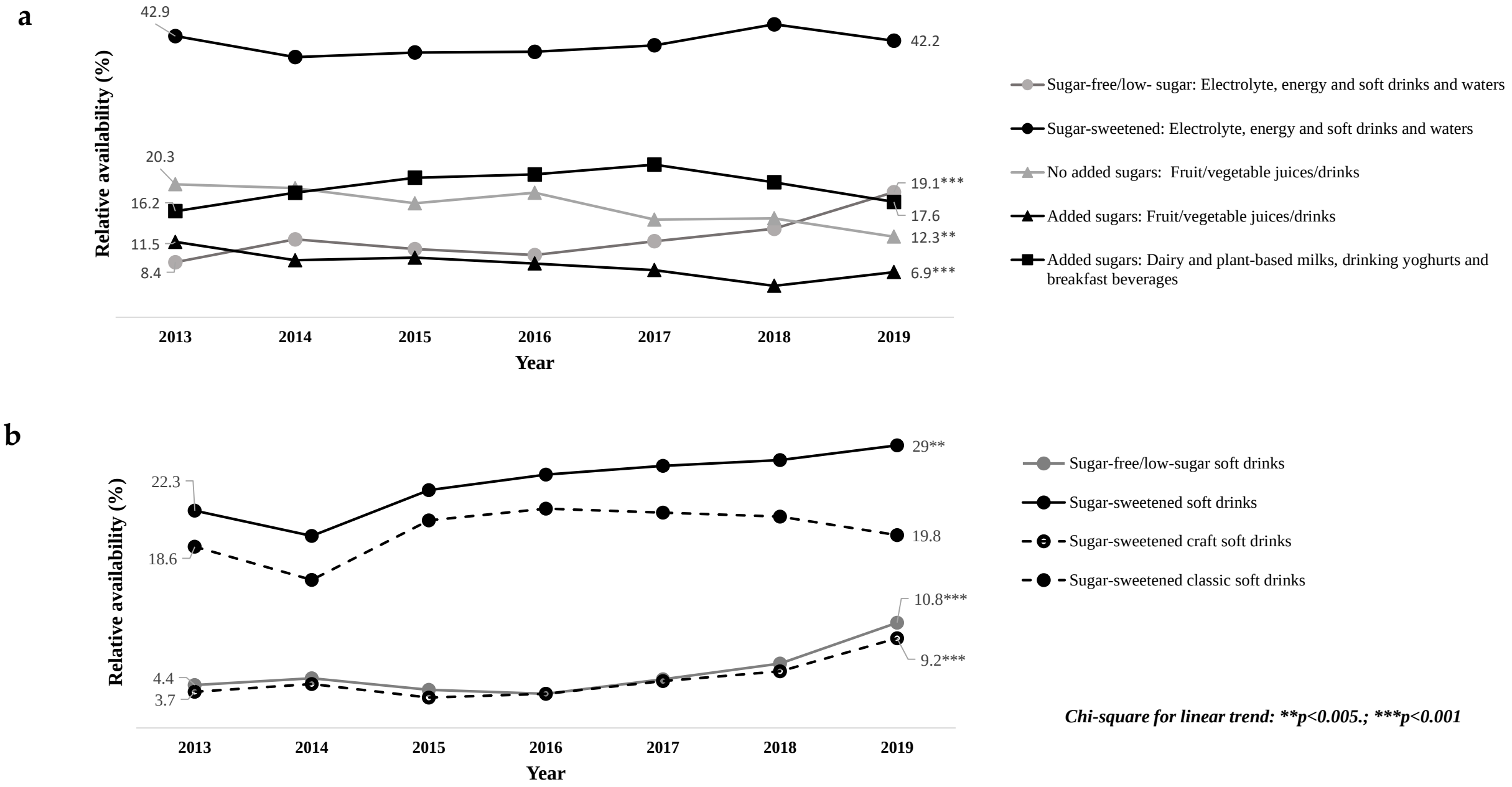
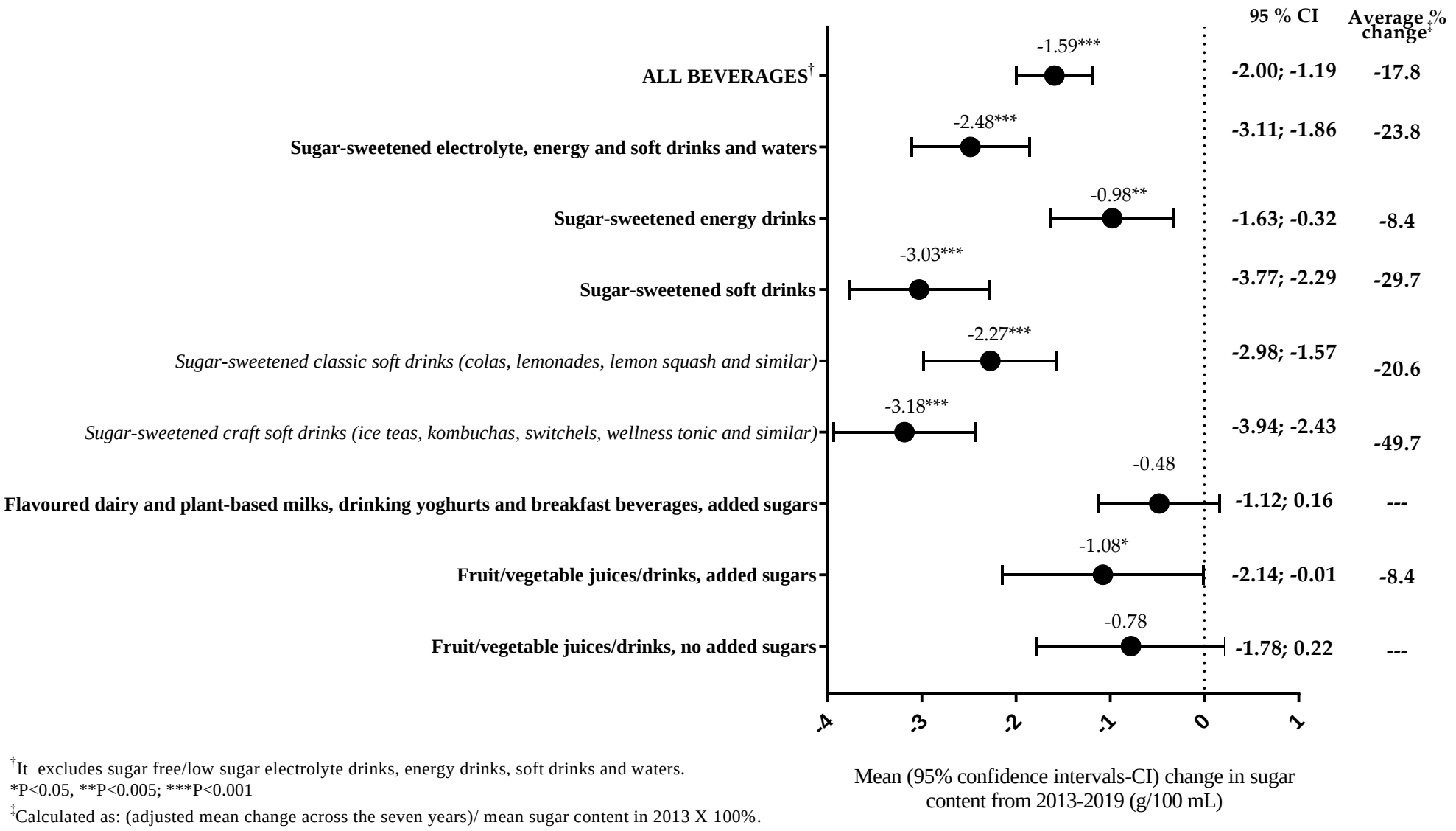


Figure 1. Relative availability (%) of single-serve ready-to-drink non-alcoholic beverages (2013-2019): **(a)** Within beverage subgroups and; (**b)** Within soft drinks subgroups.



†It excludes sugar free/low sugar electrolyte drinks, energy drinks, soft drinks and waters.
*P<0.05, **P<0.005; ***P<0.001
‡Calculated as: (adjusted mean change across the seven years)/ mean sugar content in 2013 X 100%.

Figure 2. Seven-year changes in sugar content (g/100 mL) of groups and subgroups of single-serve beverages available for sale in NZ supermarkets (2013-2019).

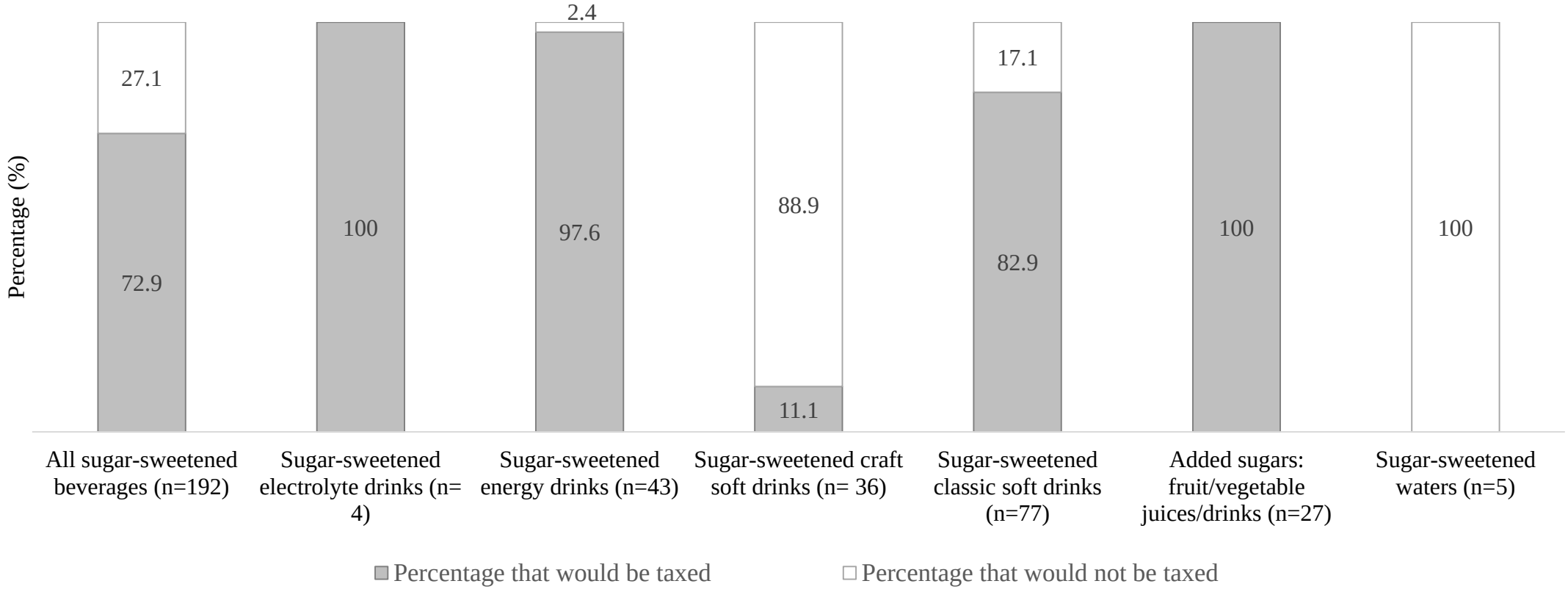


Figure 3. Percentage (%) of the single-serve sugar-sweetened beverages available for sale and liable for the United Kingdom Soft Drinks Industry Levy that would be taxed at low or high categories and percentage that would not be taxed in 2019, overall and according to beverage subgroups.