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# Beverage Intakes in Ontario: What Do We Know?

A report based on the Canadian Community Health Survey 2015 – Nutrition

Nutrition Connections, June 2021

This report is part of a series prepared to provide a better understanding of the state of healthy eating and food literacy in Ontario. These reports are intended to inform policy and program development surrounding healthy eating and chronic disease prevention.

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**Other reports in the Series:**

Eating in Ontario: What Do We Know? Comparing intake of key nutrients, vegetables and fruit in Ontario with Canadian intake and dietary recommendations: a report based on the CCHS 2015 Nutrition Survey. Nutrition Connections, Ontario Public Health Association; June 2021.

Eating in Ontario: What Do We Know? Vegetable and fruit consumption, food insecurity, self-rated health, and physical activity based on CCHS 2017 with implications related to COVID-19. Nutrition Connections - Ontario Public Health Association; March 2021.

Healthy Eating in Ontario: What do We Know? An Analysis of Eating Behaviours, Food Literacy and Food Insecurity Indicators. Nutrition Resource Centre, September 2017

Food Literacy Programming in Ontario: A Focus on Programs Offered to Children, Youth, Parents and Caregivers. Nutrition Connections, September 2019

Policies that Influence Food Literacy among Children and Youth in Ontario. Nutrition Connections, November 2019

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# Summary

Nutrition Connections has an ongoing interest in examining the state of healthy eating and food literacy in Ontario. Previous reports on “Eating in Ontario – What do We Know?” provide insights into food literacy and food insecurity among the Ontario population, as well as dietary patterns including the intake of key nutrients and vegetables and fruit. This report provides information on the beverage intakes of Ontarians over the age of two, based on the Canadian Community Health Survey (CCHS) 2015 nutrition component.

The findings show that water is consumed in the greatest quantity compared to other beverage choices among individuals in Ontario. A number of concerns related to beverage intakes in the Ontario population were identified, including low intakes of milk and plant-based beverages, which supply important nutrients such as vitamin D and calcium, and high intakes of sweetened beverages, which contribute added sugars to the diet. Particularly concerning is that compared to other age groups, mean consumption of sugar sweetened beverages is highest among males ages 2 to 5 years. Among male children ages 2 to 12 years, sugar sweetened beverages were consumed in the third highest amount after water and diet drinks. For female children ages 2 to 12 years, diet beverages and plain milk were consumed in higher amounts than sugar-sweetened beverages. It is concerning that sugar sweetened and diet beverages as well as coffee and tea are replacing more nutritious beverages in the diet of young children. The findings also indicate that males and females over the age of 13 may not be consuming adequate amounts of fluids, although some sources of fluids such as protein shakes and alcoholic beverages were not included.

Patterns of beverage consumption in Ontario have not previously been reported and are similar to national results.[i] Examining and identifying concerns about dietary intake at the provincial level is important to inform policy and programming in Ontario to improve eating patterns, promote health and prevent chronic disease.

[i] Mavra Ahmed, Alena (Praneet) Ng, Mary R L'Abbe, Nutrient intakes of Canadian adults: results from the Canadian Community Health Survey (CCHS)–2015 Public Use Microdata File, *The American Journal of Clinical Nutrition*, May 2021; nqab143, https://doi.org/10.1093/ajcn/nqab143

The findings in this report highlight the need for policies to improve the consumption of water and nutrient-rich beverage choices, and decrease the consumption of sugary and diet beverages, as well as coffee and tea in the diets of children and youth.

A number of policy actions are recommended to improve beverage intake patterns and promote and protect the health of children, youth and the population in general:

- Promote guidelines and standards for beverages served in child care and schools, including increasing access to water and restricting access to sugar sweetened beverages
- Reduce the marketing of unhealthy food and beverages to children
- Ban the marketing and sale of sugar sweetened beverages in schools and student nutrition programs
- Restrict the marketing and sale of sugar sweetened beverages in recreation centres frequented by children
- Promote standards for children's restaurant meals, including healthy beverages as the default beverages offered
- Provide government sanctioned healthy eating campaigns targeted to children, youth and parents and the general public to improve eating patterns and beverage choices
- Continue promotion and education on the use of food labels, nutrition and menu labelling to enable consumers to make healthy food choices, including decisions about healthy beverage choices
- Increase efforts to promote Canada's Food Guide and Canada's Dietary Guidelines to all population groups to make healthy beverage choices such as increasing water consumption and decreasing intake of beverages high in sugar, salt and fat
- Include food literacy as a mandatory component of school curriculum at every grade level, including in the training of childcare providers and educators

This report was prepared by Nutrition Connections at the Ontario Public Health Association. The findings presented are based on an analysis of CCHS 2015 in detail for the Ontario population conducted by Mary R. L'Abbe, CM, PhD, Alena (Praneet) Ng, MSc and Mavra Ahmed, PhD from the L'Abbe Lab, Department of Nutritional Sciences, Faculty of Medicine, University of Toronto.

# Introduction

Nutrition Connections has an ongoing interest in examining the state of healthy eating and food literacy in Ontario. Previous reports on "Eating in Ontario – what do we know?" provide insights into food literacy and food insecurity among the Ontario population, as well as dietary patterns, including intake of key nutrients and vegetables and fruit.[1 2 3] While several researchers have examined beverage intakes at the national level[4 5 6], a closer look at what is happening at the provincial level is important to inform policy, programming and communication in Ontario in order to improve eating patterns and beverage consumption, promote health and prevent chronic disease.

Understanding beverage intakes in the population is important, as beverages contribute to overall dietary intakes. Beverages ensure proper hydration and provide important nutrients including protein, vitamins and minerals.[4] While beverages contribute to energy intakes, they may also be a source of excess calories, sugar, and fat in the diet.[6]

According to the CCHS 2004 nutrition survey, beverages contributed almost 20% of the calories consumed by children and teens aged 4 to 18 years, but for children ages 1 to 3, beverages accounted for closer to 30% of total calories.[7] Examinations of data from the CCHS 2015 nutrition survey relative to 2004 indicate a shift towards plain water and declines in intake in amounts per day of milk, fruit juice, and soft drinks.[4 5] In 2015, compared with 2004, consumption of daily beverages per capita decreased 10% by volume and the calories contributed by beverages decreased by 24%.[6] Mean daily total sugar intakes in grams from beverages also decreased in 2015 from 2004 among the Canadian population over the age of two years.[8]

Despite some positive trends showing decreases in sugary drink intakes since 2004, beverages continue to contribute extra calories and sugar in Canadians' diets.[6 9] High intakes of sugars can lead to tooth decay and excess consumption of calories, which is a risk factor for chronic diseases such as obesity, type 2 diabetes, and cardiovascular disease.[10]

Dietary choices, including beverages, have always been important to prevent nutrient deficiencies but unhealthy eating is now among the top contributors to chronic disease. In 2015, three-quarters of deaths in Ontario were attributable to chronic diseases.[11] The

total direct health care costs and indirect costs (e.g. lost productivity due to disability and premature mortality) in Ontario are estimated to be $5.6 billion for unhealthy eating, including $1.8 billion for inadequate vegetable and fruit consumption.[11]

Because of the serious impact of unhealthy eating on chronic diseases, thereby impacting the health system, it is important to consider what influences food choices. Advertising for less-healthy foods and beverages is continuously being targeted to children through digital marketing on games and apps which children access via cell phones, tablets and computers; these advertisements can influence children's choices negatively.[12] [13] Parents are also influenced through websites, social media and blogs, as their primary source of food and nutrition information is online.[14] This presents an opportunity to enact policies and communicate information that will support food literacy and healthy eating practices in the population.

The purpose of the present report is to examine beverage intakes among the Ontario population over the age of two and is based on the Canadian Community Health Survey (CCHS) 2015 Nutrition component.

# Methods and Data Sources

Data from the 2015 Canadian Community Health Survey-Nutrition Public Use Microdata Files (PUMF) were used for all analyses.[15] [16] The CCHS 2015 is a complex, cross-sectional health survey with a multi-stage clustered sampling design aimed to provide a representative sample of respondents from the 10 provinces and by age-sex groups. Exclusion criteria for CCHS 2015 included those living in the territories and the institutionalized population (i.e. Canadian Forces; those living in long-term care facilities, on-reserve, or in correctional facilities).

One individual per household was randomly chosen to complete a general health questionnaire and 24-hour dietary recall administered by a trained interviewer, using the Automated Multiple Pass Method (AMPM)[17]; weight and height measurements were also taken with respondent consent. Proxy interviews were conducted for those respondents under 6 years, while parent-assisted interviews were used for children 6-12 years; those 12+ years were able to complete their own questionnaires and dietary recall.[17]

For assessment of dietary intake, all respondents were asked to complete a computer- and interviewer-assisted 24-hour dietary recall during their home interviews; a subsample of approximately 30% of those who completed their first recall were then asked to complete a second recall over the phone 7-10 days later. All foods and beverages reported were checked for accuracy by trained dietitians and nutrient values were assigned using the Canadian Nutrient File.[18]

The sample for CCHS 2015 PUMF included 20,487 respondents. The following inclusion criteria were applied to all analyses in this report: respondents ≥2y, non-breastfeeding women, and respondents with no missing values for either measured or self-reported height/weight or physical activity. The final analytical sample was *n*=3,485 for the Ontario sample and *n*=17,485 for the Canadian sample and was weighted to be representative for Ontario and Canada, respectively.

**Handling of misreporting of energy intakes and weight/height**

To account for the misreporting of energy, the methodology of Jessri et al. was used.[19] Briefly, respondents' reported energy intakes (EI) were compared to their estimated energy requirements (EER) based on their age, sex, height, weight and physical activity levels as previously described.[18] [20] [21] If respondents' EI:EER was <0.7, they were considered under-reporters of energy intake; if their EI:EER was between 0.7-1.42, they

were considered plausible reporters of energy intake and if their EI:EER was >1.42, they were considered over-reporters of energy intake. A variable for misreporting status was created using this information and entered into all analyses as a covariate.[18]

**Estimation of mean beverage intake**

Beverages in CCHS 2015 were categorized for analyses based on the Bureau of Nutritional Sciences food codes[22] and through consultation with Nutrition Connections and the L'Abbe Lab. The following beverage categories were chosen for analyses:

| Beverage category | Description |
|---|---|
| Plain water | Includes consumption of municipal water, well water, distilled water and bottled water |
| Plain milk | Includes unsweetened dairy milk (skim, 1%, 2%, whole), goat and sheep's milk |
| Plant-based beverages | Includes intakes of sweetened and unsweetened soy, rice, almond, coconut and cashew-based milk alternatives |
| Fruit juices | Includes consumption of pure fruit juice only |
| Diet beverages | Includes low-calorie and artificially sweetened drinks, such as diet soft drinks, vegetable juice[1] and flavoured water (i.e. vitamin water, mineral water or water artificially sweetened with fruit flavours) |
| Sugar-sweetened beverages | Includes intakes of soft drinks, fruit drinks, energy drinks, protein shakes, sports drinks, flavoured yogurt drinks, milk shakes and sweetened milk drinks (e.g. malted milk, chocolate milk and hot chocolate) |
| Coffee and tea | Includes intakes of sweetened and unsweetened beverages containing coffee or tea |

[1] Vegetable juice was included in the "diet beverages" category as consumption of vegetable juice was too low in the Canadian population to be estimated via the National Cancer Institute (NCI) method

While alcoholic beverages also add to the energy intakes and cause many concerns related to health of people in Ontario, alcohol was not included as a beverage category, as our primary interest was addressing beverage intakes in children and youth.

To estimate the mean intake of different beverage categories for Ontarians and Canadians, the National Cancer Institute (NCI) method for estimating distributions of usual intake was used.[23] [24] All available recall days from the CCHS 2015 PUMF files were analyzed. This method was chosen instead of estimating mean beverage intakes from a single day of recall, as it provides a better estimate of long-term dietary intake, especially for non-frequently consumed items, such as certain beverage categories (e.g., sugar-sweetened beverages). Because beverages are episodically consumed, the NCI two-part model was used for all analyses. The two-part NCI model is appropriate to use for estimating usual intakes of infrequently consumed items, and predicts usual intakes using both information on the probability of consuming the item on any given day, in addition to the amount consumed per consumption event. Both days of dietary recall were used.

All results were stratified by the following age groups: males 2-5 years, females 2-5 years, males 6-12 years, females 6-12 years, males 13-18 years, females 13-18 years, and males 19+ and females 19+. Estimates were also generated for the total sample (2+ years). All models were adjusted for age, dietary misreporting status, day of the week (weekend/weekday) and sequence of dietary recall (first/second), as these variables can affect dietary intake.[25]

All analyses were bootstrapped with 500 replications to account for the complex sampling design in CCHS and weighted using a sample survey weight provided by Statistics Canada to ensure population-level estimates. Statistically significant differences across means were assessed by comparing the 95% confidence intervals (CIs) between two estimates.

# Results: What We Found

**Comparison Within Beverage Categories**

Table 1: Plain water, mean usual intake (grams/day), Ontario and Canada, Canadian Community Health Survey – Nutrition 2015 [1,2]

| | Ontario | | | Canada | | |
|---|---|---|---|---|---|---|
| | *n* | Mean (grams/day) | 95% Confidence Intervals | *n* | Mean (grams/day) | 95% Confidence Intervals |
| **Males** | | | | | | |
| 2-5 years | 106 | 598 | (471, 724) | 628 | 683 | (550, 817) |
| 6-12 years | 181 | 592 | (464, 720) | 1079 | 683 | (552, 814) |
| 13-18years | 181 | 589 | (476, 702) | 1038 | 683 | (559, 806) |
| 19+ years | 1172 | 582 | (504, 660) | 5674 | 650 | (557, 744) |
| **Females** | | | | | | |
| 2-5 years | 120 | 634 | (468, 799) | 621 | 723 | (574, 872) |
| 6-12 years | 184 | 632 | (466, 798) | 1052 | 721 | (583, 859) |
| 13-18years | 216 | 625 | (461, 789) | 1075 | 715 | (580, 849) |
| 19+ years | 1325 | 615 | (513, 717) | 6318 | 683 | (587, 780) |
| **Total sample** | | | | | | |
| 2+ years | 3485 | 602 | (509, 694) | 17485 | 674 | (573, 774) |

[1]Includes only the consumption of municipal water, well water or distilled water and bottled water

[2]Usual intakes were estimated using the National Cancer Institute (NCI) method adjusted for age, sex, energy misreporting status, weekend/weekday and sequence of recall analyzed (first/second)

Table 1 demonstrates the mean usual intakes for the plain water category in grams per day (g/d), for Ontario and Canada. The mean intake of plain water for the total sample of Ontarians was 602 g/d, with the highest mean intake among females 2 to 5 years (634 g/d) and the lowest among adult males (19+ years) (582 g/d). Similar patterns were observed for the national sample. There were no significant differences between the amounts consumed in Ontario compared to Canada.

Table 2: Plain milk, mean usual intake (grams/day), Ontario and Canada, Canadian Community Health Survey – Nutrition 2015[1,2]

| | Ontario | | | Canada | | |
|---|---|---|---|---|---|---|
| | *n* | Mean (grams/day) | 95% Confidence Intervals | *n* | Mean (grams/day) | 95% Confidence Intervals |
| Males | | | | | | |
| 2-5 years | 106 | 241 | (170, 312) | 628 | 253 | (223, 283) |
| 6-12 years | 181 | 218 | (175, 261) | 1079 | 234 | (208, 259) |
| 13-18years | 181 | 201 | (164, 238) | 1038 | 212 | (193, 230) |
| 19+ years | 1172 | 145 | (124, 166) | 5674 | 152 | (144, 161) |
| Females | | | | | | |
| 2-5 years | 120 | 212 | (143, 281) | 621 | 220 | (181, 258) |
| 6-12 years | 184 | 202 | (174, 231) | 1052 | 206 | (184, 228) |
| 13-18years | 216 | 183 | (160, 206) | 1075 | 187 | (167, 207) |
| 19+ years | 1325 | 131 | (112, 151) | 6318 | 135 | (127, 143) |
| Total sample | | | | | | |
| 2+ years | 3485 | 152 | (140, 164) | 17485 | 158 | (150, 166) |

[1]Plain milk intake included consumption of unsweetened dairy milk (skim, 1%, 2% and whole), as well as goat and sheep's milk

[2]Usual intakes were estimated using the National Cancer Institute (NCI) method adjusted for age, sex, energy misreporting status, weekend/weekday and sequence of recall analyzed (first/second)

Table 2 demonstrates the mean usual intakes for the plain milk category, in grams per day (g/d), for Ontario and Canada. The mean intake of plain milk for the total sample of Ontarians was 152 g/d, with the highest mean intake among males 2 to 5 years (241 g/d) and the lowest among adult females (19+ years) (131 g/d); similar patterns were observed for the national sample. There were no significant differences between the amounts consumed in Ontario compared to Canada for any age group.

Table 3: Plant-based beverages, mean usual intake (grams/day), Ontario and Canada, Canadian Community Health Survey – Nutrition 2015[1,2]

| | Ontario | | | Canada | | |
|---|---|---|---|---|---|---|
| | *n* | Mean (grams/day) | 95% Confidence Intervals | *n* | Mean (grams/day) | 95% Confidence Intervals |
| **Males** | | | | | | |
| 2-5 years | 106 | 8.1 | (0, 47) | 628 | 26 | (9.1, 42) |
| 6-12 years | 181 | 8.0 | (0, 40) | 1079 | 25 | (8.9, 42) |
| 13-18 years | 181 | 8.0 | (0, 38) | 1038 | 25 | (8.4, 41) |
| 19+ years | 1172 | 8.3 | (0, 32) | 5674 | 23 | (7.7, 39) |
| **Females** | | | | | | |
| 2-5 years | 120 | 8.8 | (0, 33) | 621 | 22 | (12, 33) |
| 6-12 years | 184 | 9.1 | (0, 28) | 1052 | 23 | (11, 35) |
| 13-18 years | 216 | 9.1 | (0, 26) | 1075 | 22 | (11, 34) |
| 19+ years | 1325 | 9.2 | (0, 22) | 6318 | 21 | (9.9, 32) |
| **Total sample** | | | | | | |
| 2+ years | 3485 | 8.7 | (0, 28) | 17485 | 23 | (9.5, 36) |

[1]Included intakes of sweetened and unsweetened soy, rice, almond, coconut and cashew-based milk alternatives

[2]Usual intakes were estimated using the National Cancer Institute (NCI) method adjusted for age, sex, energy misreporting status, weekend/weekday and sequence of recall analyzed (first/second)

Table 3 demonstrates the mean usual intakes for the plant-based beverages category, in grams per day (g/d), for Ontario and Canada. Intakes of plant-based beverages were low, owing to the overall low consumption of this beverage category in the country. The mean intake of plant-based beverages for Ontario and Canada were 8.7 g/d and 23 g/d, respectively. There were no significant differences between the amounts consumed in Ontario compared to Canada.

Table 4: Fruit juice, mean usual intake (grams/day), Ontario and Canada, Canadian Community Health Survey – Nutrition 2015[1,2]

| | Ontario | | | Canada | | |
|---|---|---|---|---|---|---|
| | *n* | Mean (grams/day) | 95% Confidence Intervals | *n* | Mean (grams/day) | 95% Confidence Intervals |
| **Males** | | | | | | |
| 2-5 years | 106 | 131 | (102, 160) | 628 | 142 | (129, 155) |
| 6-12 years | 181 | 115 | (91, 139) | 1079 | 129 | (117, 140) |
| 13-18 years | 181 | 106 | (86, 126) | 1038 | 114 | (104, 124) |
| 19+ years | 1172 | 76 | (60, 92) | 5674 | 73 | (66, 80) |
| **Females** | | | | | | |
| 2-5 years | 120 | 84 | (44, 124) | 621 | 110 | (96, 124) |
| 6-12 years | 184 | 79 | (57, 102) | 1052 | 102 | (93, 111) |
| 13-18 years | 216 | 71 | (51, 91) | 1075 | 90 | (81, 98) |
| 19+ years | 1325 | 49 | (39, 59) | 6318 | 57 | (52, 62) |
| **Total sample** | | | | | | |
| 2+ years | 3485 | 69 | (61, 77) | 17485 | 75 | (70, 79) |

[1]Fruit juice intake included consumption of pure fruit juice only

[2]Usual intakes were estimated using the National Cancer Institute (NCI) method adjusted for age, sex, energy misreporting status, weekend/weekday and sequence of recall analyzed (first/second)

Table 4 demonstrates the mean usual intakes for the fruit juice category, in grams per day (g/d), for Ontario and Canada. The mean intake of fruit juice for the total sample of Ontarians was 69 g/d, with the highest mean observed among males 2 to 5 years (131 g/d) and the lowest among adult females (19+ years) (49 g/d). Similar patterns were observed for the national sample. There was no statistical difference between the amounts consumed in Ontario compared to Canada.

Table 5: Diet beverages, mean usual intake (grams/day), Ontario and Canada, Canadian Community Health Survey – Nutrition 2015[1,2]

| | Ontario | | | Canada | | |
|---|---|---|---|---|---|---|
| | *n* | Mean (grams/day) | 95% Confidence Intervals | *n* | Mean (grams/day) | 95% Confidence Intervals |
| **Males** | | | | | | |
| 2-5 years | 106 | 308 | (195, 420) | 628 | 280 | (247, 312) |
| 6-12 years | 181 | 307 | (207, 407) | 1079 | 285 | (255, 316) |
| 13-18 years | 181 | 311 | (206, 416) | 1038 | 292 | (263, 322) |
| 19+ years | 1172 | 339 | (237, 441) | 5674 | 323 | (291, 356) |
| **Females** | | | | | | |
| 2-5 years | 120 | 272 | (197, 347) | 621 | 243 | (215, 271) |
| 6-12 years | 184 | 276 | (207, 345) | 1052 | 249 | (218, 279) |
| 13-18 years | 216 | 279 | (217, 340) | 1075 | 252 | (223, 282) |
| 19+ years | 1325 | 302 | (240, 364) | 6318 | 283 | (248, 317) |
| **Total sample** | | | | | | |
| 2+ years | 3485 | 314 | (242, 387) | 17485 | 296 | (270, 322) |

[1]Diet beverage intake included consumption of low-calorie and artificially sweetened drinks, such as diet soft drinks, vegetable juice and flavoured water (i.e. vitamin water, mineral water or water artificially sweetened with fruit flavours)

[2]Usual intakes were estimated using the National Cancer Institute (NCI) method adjusted for age, sex, energy misreporting status, weekend/weekday and sequence of recall analyzed (first/second)

Table 5 demonstrates the mean usual intakes for the diet beverages category, in grams per day (g/d), for Ontario and Canada. The mean intake of diet beverages for the total sample of Ontarians was 314 g/d, with the highest mean observed for adult males (339 g/d) and the lowest for females ages 2 to 5 years (272 g/d). Similar patterns were observed for the national sample. There was no statistical difference between the amounts consumed in Ontario compared to Canada.

Table 6: Sugar-sweetened beverages, mean usual intake (grams/day), Ontario and Canada, Canadian Community Health Survey – Nutrition 2015[1,2]

| | Ontario | | | Canada | | |
|---|---|---|---|---|---|---|
| | *n* | Mean (grams/day) | 95% Confidence Intervals | *n* | Mean (grams/day) | 95% Confidence Intervals |
| **Males** | | | | | | |
| 2-5 years | 106 | 288 | (245, 331) | 628 | 273 | (223, 323) |
| 6-12 years | 181 | 253 | (218, 287) | 1079 | 254 | (208, 299) |
| 13-18 years | 181 | 233 | (201, 265) | 1038 | 230 | (193, 268) |
| 19+ years | 1172 | 156 | (132, 180) | 5674 | 159 | (143, 176) |
| **Females** | | | | | | |
| 2-5 years | 120 | 184 | (129, 240) | 621 | 178 | (151, 205) |
| 6-12 years | 184 | 174 | (146, 202) | 1052 | 167 | (151, 184) |
| 13-18 years | 216 | 154 | (128, 180) | 1075 | 150 | (136, 165) |
| 19+ years | 1325 | 99 | (84, 113) | 6318 | 102 | (93, 110) |
| **Total sample** | | | | | | |
| 2+ years | 3485 | 143 | (129, 158) | 17485 | 145 | (134, 156) |

[1]Included intakes of soft drinks, fruit drinks, energy drinks, protein shakes, sports drinks, flavoured yogurt drinks, milk shakes and sweetened milk drinks (e.g. malted milk, chocolate milk and hot chocolate)

[2]Usual intakes were estimated using the National Cancer Institute (NCI) method adjusted for age, sex, energy misreporting status, weekend/weekday and sequence of recall analyzed (first/second)

Table 6 demonstrates the mean usual intakes for the sugar-sweetened beverages category, in grams per day (g/d), for Ontario and Canada. The mean intake of sugar-sweetened beverages for the total sample of Ontarians was 143 g/d, with the highest mean observed among males ages 2 to 5 years (288 g/d) and the lowest among adult females (19+ years) (99 g/d). Similar patterns were observed for the national sample. There was no statistical difference between the amounts consumed in Ontario compared to Canada.

Table 7: Coffee and tea, mean usual intake (grams/day), Ontario and Canada, Canadian Community Health Survey – Nutrition 2015[1,2]

| | Ontario | | | Canada | | |
|---|---|---|---|---|---|---|
| | *n* | Mean (grams/day) | 95% Confidence Intervals | *n* | Mean (grams/day) | 95% Confidence Intervals |
| **Males** | | | | | | |
| 2-5 years | 106 | 121 | (89, 154) | 628 | 118 | (99, 136) |
| 6-12 years | 181 | 152 | (115, 188) | 1079 | 152 | (132, 172) |
| 13-18 years | 181 | 200 | (159, 241) | 1038 | 197 | (174, 220) |
| 19+ years | 1172 | 454 | (398, 510) | 5674 | 448 | (412, 484) |
| **Females** | | | | | | |
| 2-5 years | 120 | 103 | (74, 131) | 621 | 109 | (97, 122) |
| 6-12 years | 184 | 133 | (107, 159) | 1052 | 141 | (128, 155) |
| 13-18 years | 216 | 172 | (146, 199) | 1075 | 181 | (166, 195) |
| 19+ years | 1325 | 402 | (370, 434) | 6318 | 417 | (399, 435) |
| **Total sample** | | | | | | |
| 2+ years | 3485 | 372 | (342, 402) | 17485 | 378 | (359, 398) |

[1]Included intakes of sweetened and unsweetened beverages containing coffee or tea

[2]Usual intakes were estimated using the National Cancer Institute (NCI) method adjusted for age, sex, energy misreporting status, weekend/weekday and sequence of recall analyzed (first/second)

Table 7 demonstrates the mean usual intakes for the coffee and tea category, in grams per day (g/d), for both samples of Ontario and Canada. The mean intake of coffee and tea for the total sample of Ontarians was 372 g/d, with adult males (19+ years) consuming the most (454 g/d) and females ages 2 to 5 years consuming the least (103 g/d). Similar patterns were observed for the national sample. There was no statistical difference between the amounts consumed in Ontario compared to Canada.

### Comparison Across Beverage Categories

Plain water was the beverage consumed in the highest amount (g/day) compared to all other beverage categories (Table 8). Total mean usual intakes of water across all age categories two years and older was 602 grams per day, followed by coffee and tea (372 g/day), diet beverages (314 g/d), plain milk (152 g/d), sugar sweetened beverages (143 g/d), fruit juice (69 g/d), and plant-based beverages (8.7 g/d). (Tables 1 to 7).

Table 8. Mean usual intake across beverage categories for children ages 2-5 and 6-12 years of age, Ontario

| Beverage Category | 2-5 years males | | | 2-5 years females | | | 6–12 years males | | | 6-12 years females | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | g/d | % | Svgs/ d* | g/d | % | Svgs/ d* | g/d | % | Svgs /d* | g/d | % | Svgs/ d* |
| Plain Water | 598 | 35.2 | 2.39 | 634 | 42.3 | 2.53 | 592 | 35.9 | 2.36 | 632 | 41.9 | 2.52 |
| Diet Beverages | 308 | 18.1 | 1.23 | 272 | 18.1 | 1.09 | 307 | 18.6 | 1.23 | 276 | 18.3 | 1.10 |
| Sugar Sweetened Beverages | 288 | 16.9 | 1.11 | 184 | 12.2 | 0.71 | 253 | 15.3 | 0.98 | 174 | 11.5 | 0.67 |
| Plain milk | 241 | 14.2 | 0.93 | 212 | 14.1 | 0.82 | 218 | 13.2 | 0.85 | 202 | 13.4 | 0.78 |
| Coffee and Tea | 121 | 7.1 | 0.48 | 103 | 6.8 | 0.41 | 152 | 9.2 | 0.61 | 133 | 8.8 | 0.53 |
| Fruit Juice | 131 | 7.7 | 0.49 | 84 | 5.6 | 0.32 | 115 | 6.9 | 0.44 | 79 | 5.2 | 0.30 |
| Plant-based beverages | 8.1 | 0.4 | 0.03 | 8.8 | 0.5 | 0.03 | 8.0 | 0.4 | 0.03 | 9.1 | 0.6 | 0.04 |
| **Total**[1] | 1695 | | 6.66 | 1498 | | 5.91 | 1645 | | 6.5 | 1505 | | 5.94 |

*Servings based on 1 cup/250 ml; water 250.4g, milk 257.8g, soy beverage 256.8g, juice 264.2g, diet carbonated drink 250.3g; sweetened carbonated drink 259.3g; coffee/tea plain 250.3g

[1]"Total beverages" does not account for all beverage consumption, as some beverages were not included in these analyses (e.g. alcohol and protein shakes)

For children ages 2 to 5 years, water was consumed in the greatest amount (g/day and servings/day*) followed by diet beverages and sugar sweetened beverages for boys; for girls, intake was highest for water, followed by diet beverages and plain milk. This beverage intake pattern was similar across sex for children ages 6 to 12 years of age. Plant-based beverage consumption was low in all children. Surprisingly, coffee and tea beverages accounted for 7% of the beverages consumed by children ages 2 to 5 years of age, and 9% of beverages consumed by those 6 to 12 years old.

When looking at servings consumed, children ages 2 to 5 years and 6 to 12 years old were consuming less than 1 serving per day of plain milk and less than half a serving per day of fruit juice. Males 2 to 5 years old consumed over 1 serving a day for each diet and sugar sweetened beverages. Girls aged 2 to 5 years consumed about 1 serving a day for diet beverages, which was more than that reported for plain milk (0.82 servings/day) and sugar sweetened beverages (0.71 servings per day).

Table 9. Mean usual intake across beverage categories for youth ages 13-18y; and adults19y+, Ontario

| Beverage Category | 13-18 years males | | | 13-18 years females | | | 19+ years males | | | 19+ years females | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | g/d | % | Svgs /d* | g/d | % | Svgs /d* | g/d | % | Svgs /d* | g/d | % | Svgs /d* |
| Plain Water | 589 | 35.5 | 2.35 | 625 | 41.8 | 2.50 | 582 | 33.0 | 2.32 | 615 | 38.2 | 2.46 |
| Diet Beverages | 311 | 18.7 | 1.24 | 279 | 18.6 | 1.11 | 339 | 19.2 | 1.35 | 302 | 18.7 | 1.21 |
| Sugar Sweetened Beverages | 233 | 14.0 | 0.90 | 154 | 10.3 | 0.59 | 156 | 8.8 | 0.60 | 99 | 6.1 | 0.38 |
| Coffee and Tea | 200 | 12.0 | 0.80 | 172 | 11.5 | 0.69 | 454 | 25.7 | 1.81 | 402 | 25.0 | 1.61 |
| Plain milk | 201 | 12.1 | 0.78 | 183 | 12.2 | 0.71 | 145 | 8.2 | 0.56 | 131 | 8.1 | 0.51 |
| Fruit Juice | 106 | 6.3 | 0.40 | 71 | 4.7 | 0.28 | 76 | 4.3 | 0.29 | 49 | 3.0 | 0.19 |
| Plant-based beverages | 8.0 | 0.4 | 0.03 | 9.1 | 0.6 | 0.04 | 8.3 | 0.4 | 0.03 | 9.2 | 0.5 | 0.04 |
| Total[1] | 1657 | | 6.5 | 1493 | | 5.9 | 1760 | | 6.96 | 1607 | | 6.3 |

*Servings based on 1 cup/250 ml; water 250.4g, milk 257.8g, soy beverage 256.8g, juice 264.2g, diet carbonated drink 250.3g; sweetened carbonated drink 259.3g; coffee/tea plain 250.3g

[1]"Total beverages" does not account for all beverage consumption, as some beverages were not included in these analyses (e.g. alcohol and protein shakes)

Among youth 13 to 18 years of age (Table 9), water was consumed in the highest amount (g/d and servings/d*), followed by diet beverages and sugar sweetened beverages for males; among females, water was consumed in the highest amount followed by diet beverages and plain milk. Among adults over 19 years of age, water was the highest consumed beverage followed by coffee/tea and diet beverages, and this pattern was similar for both males and females. Among youth ages 13 to 18 years old, plain milk intakes were less than 1 serving per day and less than half a serving per day for adults 19 years and older. Plant-based beverage consumption was less than

1% for those ages 13 years and older. Fruit juice consumption was lowest in adults 19 years and older. Diet beverages accounted for more than 1 serving per day for youth 13 to 18 years and adults over the age of 19 years. Sugar sweetened beverage consumption was highest for males 13 to 18 years and lowest for females 19 years of age and older.

# Discussion

This report examined the beverage intake patterns in the Ontario population over the age of two to identify some recommendations that could be communicated to policy makers and consumers to improve eating and beverage behaviours.

In 2007, Canada's Food Guide recommended 500 ml (2 cups) of milk every day for adequate vitamin D, consuming vegetables and fruit more often than juice, and limiting foods and beverages high in calories, fat, sugar or salt.[26] The 2019 Canada's Food Guide, does not provide serving size recommendations and categorizes milk and dairy products with other protein foods, making it difficult to examine prevalence based on guidance.[27] Canada's Food Guide recommends water as the preferred beverage of choice and replacing sugary drinks with water, unsweetened milk, fortified soy beverage or fruit.[27]

Recent research on the beverage intakes of Canadians between 2004 and 2015 have shown shifts toward higher intakes of water[4 6] and lower intakes of fruit juice and milk in 2015 compared to 2004.[4 5] Changes in water, soft drink and fruit consumption were attributed to a lower proportion of the population consuming these beverages, while declines in milk and fruit juice intake were attributed to lower quantities of these beverages being consumed.[4] These shifts have implications for the nutrient intakes of Ontarians.

## Beverage Intake Patterns Ontario and National

In this study, we examined beverage intakes across different ages and sex groups. In all population groups, water was consumed in the greatest amount followed on average by diet beverages. For male children ages 2 to 12 years, sugar sweetened beverages were consumed in the third highest amount. For female children ages 2 to 12 years, plain milk consumption was higher than sugar-sweetened beverage intake. After unsweetened plain milk, coffee and tea, and fruit juice were consumed in lower amounts. For males 13 to 18 years, sugar sweetened beverages were the third highest amount consumed while plain milk was third for females, similar to results reported for younger children. For adults 19 years and older, coffee and tea were consumed in the third highest amount, while plain milk and sugar sweetened beverages were consumed in lower but similar amounts for males; milk was higher for females and lower for sweetened beverages for females 19 years and over. Plant-based alternatives were consumed in the lowest amount for all population groups.

Similar to the results found in the present study, water was consumed in the highest amounts for Ontario (21.4%) and national (23.4%) families in another report by Nutrition Connections, based on Ipsos Five syndicated data for the 12 months ending in December 2019 (NC-Ipsos).[14]The NC-Ipsos report found that fruit beverages and dairy beverages were reported to be higher in Ontario families compared to Canada. Ontario families reported consuming more fruit beverages (3.2% of drinking occurrences versus 2.6%), dairy beverages (3.2% versus 2.4%), and other beverages (1.8% versus 1.4%) and less caffeinated beverages (6.0% versus 7.6%) compared to the total national families surveyed, however, the statistical significance of difference was not determined.[14]

When looking at age differences in children, the NC-Ipsos report (2020)[14] found children ages 2 to 5 years reporting a higher percentage of beverage intakes from water (24.5%) compared to children 6 to 12 (22.3%) and children 13 to 17 (16.9%). Children ages 2 to 5 years also reported higher intakes of dairy beverages (7.8%) compared to children ages 6 to 12 (4.6%) and children 13 to 17 (5.0%). Intake of fruit beverages, carbonated and caffeinated beverages was reported highest for children 13 to 17 years.[14]

Most Ontario families (63.4%) reported drinking 2% milk, while some indicated they drank 1% milk (12.2%) or 3.25% milk (9.7%). Notably, Ontario families reported drinking more flavoured milks (e.g., chocolate) than other Canadian families. Consumption of milk alternatives including plant-based beverages was relatively low, with only 0.2% of Ontario families reporting they consumed these beverages in the NC-Ipsos study. [14]

## Beverage Intake Patterns and Nutrient Concerns

### Milk and Plant-based Beverages

The 2019 Canada's Food Guide includes plain milk in the protein group and unsweetened milk and alternatives are suggested; however, lower milk intakes have been associated with lower intake of nutrients including calcium and vitamin D (Garriguet, 2019).[4] When looking at the CCHS 2015 nutrition survey data, milk servings have decreased compared to 2004 (Garriguet, 2019; Tugault-Lafleur and Black, 2019).[4] [5] This shift could be a concern from a population health perspective, if fluid milk is not replaced with other foods or beverages that provide vitamin D and calcium. [4] [5]

A previous report by Nutrition Connections and the University of Toronto (NC-UofT) examined nutrient intakes based on the CCHS 2015 nutrition survey and found the

Ontario population including children and adults had mean intakes of vitamin D below recommended levels, and females over 9 years of age, and males over 71 years of age had a mean daily intake of calcium below recommended levels; results were similar to national. [3] [28] However, it can not be assumed that the population is deficient in these nutrients.

Plant-based beverages do not have the same nutrient profile as milk. Starting with protein levels, cow's milk provides 8 g/1 cup (250 mL) serving compared to soy (7g), oat (4g) and almond (1g) beverages. Most plant-based milk substitutes have been fortified with calcium and vitamin D to closely match that of milk which has 322 mg of calcium and 103 IU of vitamin D per 1 cup (250 mL) serving compared to soy (319 mg calcium; 87 IU Vit D), oat (300 mg calcium; 80 IU vit D), and almond (312 mg calcium; 85 IU vit D) beverages. Other beverages including cashew and coconut milk provide 0 grams of protein, 233 mg of calcium and 81 – 86 IU of vitamin D.[29] A recent review of one oat beverage product showed that Vitamin D provided only about 2 µg (10% of recommended daily value).[30]

While this present study and the previous NC-Ipsos report[14] both showed low intakes of plant-based beverages (0.4 to 0.6% of total mean usual beverage intakes), consumer interest in these beverages is apparent and has grown over the last few years, based on the wide array of products available in the Canadian food supply. A recent survey in 2021 by Sylvain Charlebois from the Agri-Food Analytics Lab at Dalhousie University[31] found that in Ontario, 38.2% of respondents did not use any milk or cream substitutes, while 34.5% reported using almond, 17.2% oat, and 10.1% soy substitutes. Use of milk and cream substitutes was higher in Ontario compared to BC, Atlantic and prairie provinces, and Quebec. Almond and oat milk were ahead of soy beverages as milk and cream substitutes in Ontario, BC and the prairies according to this same survey. In Quebec and the Atlantic provinces almond beverages were ahead of soy and oat beverages and milk and cream substitutes.[30]

**Fruit Juice**

It has been recommended by Canada's Food Guide and others that fruit juice intake be decreased, as it provides free sugars and excess calories in the diet.[27] [32] Tugault-Lafleur and Black (2019) found that fruit juice consumption decreased from 2004 to 2015.[5] However, fruit juice is a source of vitamin C and decreases in juice intakes can explain some decrease in vitamin C observed in adults, which was 20% lower in 2015 compared

to 2004 according to Garriguet (2019).[4] However, the Canadian population has not been found to have inadequate intakes of vitamin C (Ahmed et al, 2021).[25]

Garriguet (2019) showed that most of the juice consumed in Canada was fruit rather than vegetable juice.[4] In this study, vegetable juices were not included with fruit juice as vegetable juice consumption was too low on its own to be accurately estimated using the NCI methodology. Our main rationale for grouping certain beverage categories into "diet beverages", including vegetable juice, was their caloric contribution. Vitamin water was included in the diet beverages category for the same reason. Additionally, vegetable juice was not considered to be a significant source of added or free sugars. For example, the total sugars found in orange juice is 19.52 g/250 ml and apple juice 25.21g/250 ml compared to tomato juice which has only 6.62g/250 ml. (Canada Nutrient File reference numbers: orange juice 1725; apple 1752; tomato 2464).[33]

**Diet Beverages**

This study found that diet beverage intakes were second only to water in terms of amounts consumed. The diet beverage category included low-calorie and artificially sweetened drinks, such as diet soft-drinks, vegetable juice and flavoured or artificially sweetened water including vitamin water. Most of these beverages provide a source of hydration but aside from vegetable juice or vitamin water, few nutrients. Vegetable juice is a source of added sodium. Vitamin waters typically contain water-soluble B and C vitamins, which the Canadian population is not deficient in[25], however some may also contain added sugar.

The concern with high intakes of diet beverages is that they can replace healthier options such as plain water, or unsweetened milk or fortified alternatives, especially in the diet of children and youth.

In the 2015 CCHS**,** diet soft drinks intake alone was reported to be 95 g/day *E* (*E use with caution)* for children ages 1 to 8; 278 g/day for children ages 9 to 13; and increased to 279 g/day and 418 g/day for female and male youth ages 14 to 18 years of age respectively, according to Garriguet (2019).[4] For adults 19 and older, the average intake of diet soft drinks was 485 g/day.[4]

Some research has pointed to some concerns with non-nutritive artificial sweeteners such as saccharin, aspartame, and acesulfame potassium.[34] The impact of artificial sweeteners on children's and adults' health has been debated; however, they have some value in helping people with obesity manage their sugar intakes.[33] [35] Regardless, it is in

the best interest of children to reduce consumption of diet beverages, particularly soft drinks, as they don't provide a source of nutrients and could be replacing more nutritious beverage choices.

**Sugar Sweetened Beverages**

This study found that average consumption of sugar sweetened beverages, was highest for males in the youngest age group, 2 to 5 years old (288g) and this continued to be a pattern with young males aged 6 to 12 (253g) and 13-18 (233g). Young females, 2-5 years old also consumed the highest amount of sugar sweetened beverages (184g) compared to other female age groups, with adult females consuming the lowest amount (99g). This demonstrates the need for more policy actions and strategies to reach parents about the need to reduce sugary drink intakes in children. Excess intakes of sugars have been associated with overweight, cardiovascular disease, diabetes and metabolic syndrome and there is some evidence that sugars from beverages are more harmful than sugars from solid food. [36] [37] [38] [39] Additionally, sugary beverages may reduce consumption of or displace more nutritious foods or beverages in the diet of children.[40]

Langlois et al., (2019) determined that sugary beverages accounted for 21.8% of average total sugars consumption in 2015 for children ages 2 to 8 years, which was significantly lower than the 32.8% in 2005. [8] For children 9 to 18 years of age these numbers were 29.8% and 39.2% respectively. [8] Among those ages 19 and over, 23.6% of total sugars came from sugary beverages in 2015 compared with 30% in 2004.[8] Langlois et al., (2019) translated average intakes into 5 tsp (22.1 grams) of sugars from sugary beverages in 2015 for children 2 to 8 years old, 8 tsp (34.4 grams) for older children 9 to 18 years of age, and 5 tsp (20.0 grams) for adults 19 and older.[8]

In the previous NC-UofT report (2021)[3] on nutrient intakes in the Ontario population, the overall average intake of sugar for the population in Ontario over two years of age was 91 grams, equivalent to about 22 tsp of sugar a day. Energy from mean total sugar contributed 20% to total energy intake in Ontario.[3]

In a study by Liu et al. (2020), also based on CCHS 2015, desserts/sweets and beverages were the two food groups that contributed the most to added, free and total sugar intake in the Canadian diet.[9] Fruit juice and other beverages contributed 17.9% of total sugar intakes in the Canadian diet in 2015.[9] While fruit juice has a low added sugar content it is

high in free sugars, as are fruit drinks and sweetened soft drinks and carbonated beverages (WHO, 2015).[41]

The WHO recommends reducing the intake of free sugars to less than 10% of total energy intake for both adults and children.[40] Free sugars include those added to foods as well as the sugars that are naturally present in honey, syrups and fruit juices (WHO, 2015).[40] Consuming high intakes of free sugars found in sugar sweetened beverages is linked to increased risk of excess weight gain, type 2 diabetes and heart disease (Jones et al, 2019).[6] In 2015, only 33.8% of the population were following the WHO recommendation to keep free sugars intake to under 10% of total energy intake; only 5.4% of the population was adhering to the more stringent recommendation to keep total energy intake from free sugars to under 5% (Liu et al, 2020).[9]

Despite the increase in consumption of plain water and decreases in sugary drink consumption observed in 2015 compared to 2004, sugary drinks were found to continue to contribute substantially to energy intake. [6] In 2015, sugar sweetened beverages were in the leading source of energy intakes from beverages (36% of calories), while juice accounted for 10% of beverage calories in Canada. [6]

**Coffee and Tea**

For some individuals too much caffeine can cause side effects such as insomnia, headaches, irritability and nervousness.[42] In young people, caffeine is linked to sleep disturbances, increased sugar consumption, mental health problems, and possible concerns during active brain development.[43]

For the average adult, moderate intakes of caffeine at about 400 mg/day have been determined not to be associated with any adverse effects.[41] Recommended caffeine levels are 45 mg/day for children 4 to 6 years of age, 62.5 mg/day for children 7 to 9 years of age and 85 mg/day for 10 to 12 year olds.[41]

One cup of coffee (237 ml) provides about 135 mg of caffeine, while a cup of tea provides about 43 mg of caffeine. Cola-type caffeinate soft drinks provide 36 to 50 mg of caffeine per 355 mL can.[41]

In this study, we did not measure caffeine intakes, but we did find that children ages 2 to 5 years and 6 to 12 years were consuming about half a cup/half serving of coffee or tea per day, not counting any cola beverages, potentially putting some children at risk for

overconsuming caffeine. For those ages 13 to 18 years, intakes of coffee and tea were reported to be 0.69 to 0.80 servings per day for females and males, respectively, and 1.61 to 1.81 servings per day for females and males over 19 years of age, respectively.

**Fluid intakes and requirements**

An adequate intake of fluids for individuals varies according to age, gender and activity levels. For example, children 1-3 and 4-8 years of age require 4 to 5 cups (0.9L to 1.2L) per day of total beverages including water. For children aged 9-13 years of age an adequate intake is 7 cups (1.6L) to 8 cups (1.8L) per day, for females and males respectively. Females and males 14-18 years of age require 8 cups (1.8L) to 11 cups (2.6L) per day as total beverages including water, respectively. For adults 19 to 50 years, an adequate intake is 9 cups (2.2L) to 13 cups (3.0L) per day of fluids for females and males, respectively (IOM, DRIs).[44] The present study shows that fluid intakes for those 13 years of age and older are not reaching fluid intake guidelines, however beverages including alcohol and protein shakes were not included in total intakes so fluid intakes may be underestimated.

## Strategies to improve healthy hydration and reduce sugary beverage consumption in children in Ontario

A recent effort to increase water and reduce sugary beverage intakes was undertaken by the Ontario Ministry of Health's Healthy Kids Community Challenge (HKCC)[45] through the "Water does Wonders" campaign in 2016. This initiative involved 45 communities across Ontario implementing different themed campaigns over four years to improve the physical activity and eating behaviours of families. The goal of the "Water does Wonders" campaign was to encourage the consumption of more water and decrease intakes of sugary beverages. While some evaluations were conducted to measure the media exposure of this campaign[46] and community impact[47] there have been no reports to assess the impact of this intervention at the provincial level for behaviour change with respect to sugary beverage consumption in the population. Anderson et al., 2021[48] examined sugary beverage intake among children zero to 12 years of age in Toronto and compared those living in a neighborhood with the HKCC program to control neighborhoods not participating in the HKCC. Results showed no evidence of change in total sugar containing beverage intake in HKCC neighbourhoods compared to children living in non-HKCC neighbourhoods. However, a limitation of this study was that awareness and/or participation of the study children or their parents in the HKCC

campaign activities was not measured.[46] Different HKCC communities utilized various strategies to promote increasing water and reducing sugary beverage consumption in youth and families such as social media, theme days, special events, distribution of water bottles, increasing water stations/water jets inside and outside of community and school facilities, promoting the Blue Water program to increase water bottle refills at restaurants, while others tried to lobby municipalities to reduce sales of sugar sweetened beverages in recreation and other community settings (NC, 2018).[49] The Nutrition Resource Centre (now NC-OPHA) was one of four resource centres supporting local HKCC program managers in implementing their water campaign strategies. The biggest challenge reported was getting community decision makers onboard to change the physical environment to reduce the marketing and sale of sugary beverages.[48]

Many resources have been developed to support public health and other community advocates to improve access to healthier foods and reduce access to sugary drinks.[50] [51] [52] In the US an expert panel of key national health and nutrition organizations produced a consensus statement regarding healthy beverage consumption in early childhood.[53] In Ontario we are promoting healthy beverage consumption in line with Canada's Food Guide[27] and have several resources promoting healthy beverage intakes including: Feeding your Baby[54], Student Nutrition Program Nutrition Guidelines[55] and Healthy Eating Toolkit.[56] However, in order to have a greater impact influencing eating and beverage habits of the population more systematic large-scale efforts and population-based strategies and policies are required.[57]

# Strengths and Limitations

The analyses conducted in this report have many strengths. The use of the most recent CCHS 2015 data permits national and provincial analyses, allowing for the examination of detailed population-level dietary and nutritional trends and for comparisons between Ontario and Canada. With the use of the NCI method, the long-term dietary intake of Ontarians and Canadians can be estimated and compared, offering more accurate insight into provincial and national-level dietary habits than if only a single day of 24-hour dietary recall was used. There were also methodological considerations in the analyses to account for limitations in using survey data: dietary misreporters were identified in the dataset using Statistics Canada-approved cut-offs[21] self-reported height and weight were "corrected" to approximate measured height and weight using a Statistics Canada correction factor[58], and confounders which may affect dietary intake (including energy misreporting status) were adjusted for in all NCI models.

Despite these strengths in methodological design, as with all research studies, limitations exist. CCHS 2015 is cross-sectional, and therefore represents dietary information from only one "snapshot" in time. Additionally, comparisons between Ontario and Canada, and between age-sex groups, were made by comparing mean estimates and 95% confidence intervals; in the absence of Bonferroni corrections, significant findings should be interpreted with caution. There are limitations to using 24-hour dietary recall data, such as systematic biases in energy reporting. However, CCHS 2015 remains the best source for comprehensive nutritional data, and steps to examine long-term intake, such as using the NCI method, were taken. Finally, while there may be some misclassification in assigning dietary misreporting status to individuals based on limited days of dietary recall data, previous research has shown that it is appropriate to assign misreporting cut-offs to individuals in CCHS 2015.[21]

Alcohol was not included in the analysis and yet studies show that about 50% of adults in Canada consumed alcohol in the past seven days, consistent with other high-income countries such as Mexico and the United Kingdom.[59] Alcohol contributes fluid but also excess calories to the diet. In 2015, the mean reported consumption of all beverages was 1806 ml (275 kcal) per capita, per day. While water contributed to the highest intake in volume, SSBs contributed the most to energy intake (99 kcal), followed by alcohol (71 kcal) per day (Jones, et al., 2019).[6] Future studies on beverage intakes in Ontario should include alcoholic beverages. Additionally, fluid intakes may be underreported as protein shakes were also not included in this study.

# Policy Actions Recommended

A number of policy actions are recommended to improve beverage intakes in the population in order to promote and protect the health of children, youth and the population in general:

- Continue promotion and education on the use of food labels, nutrition and menu labelling to enable consumers to make healthy food choices, including decisions about healthy beverage choices.[60 61 62 63 64]
- Promote guidelines and standards for beverages served in child care and schools including increasing access to water and restricting the serving of sugar sweetened beverages.[65 66]
- Reduce the marketing of unhealthy food and beverages to children.[53 60 61 62]
- Ban the marketing and sale of sugar sweetened beverages in schools and student nutrition programs.[60 61 67 68]
- Restrict the marketing and sale of sugar sweetened beverages in recreation centres frequented by children.[50 51 69]
- Promote standards for children's restaurant meals, such as default beverages to be offered.[52]
- Provide government sanctioned healthy eating campaigns targeted to children, youth and parents and the general public to improve eating behaviour and beverage choices.[61 62]
- Increase efforts to promote Canada's Food Guide and Canada's Dietary Guidelines to all population groups to make healthy beverage choices such as increasing water consumption and decreasing intakes of beverages high in sugar, salt and fat.[27]
- Include food literacy as a mandatory component of school curriculum at every grade level, including in the training of childcare providers and educators.[61 62 70]

# Conclusions

Beverage intakes contribute significantly to hydration, and energy intakes for both adults and children. Beverages are also important sources of some key nutrients including calcium and vitamins C and D. This study examined the Ontario population and found that water was consumed in the highest amount followed by diet beverages. Children ages two to five and under 13, particularly males, were consuming higher amount of sugar sweetened beverages compared to adults. Efforts to continue promoting water and plain milk or alternatives over diet and sugary beverages is important to ensure fluid and nutrient needs are being met. Continuing to monitor the intake of sugar sweetened beverages, especially for children, is important as these beverages provide extra calories and sugar and tend to be less nutritive, and their consumption may displace more nutritious choices.  Further, policies are needed to increase water and reduce the consumption of sugary beverages.

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