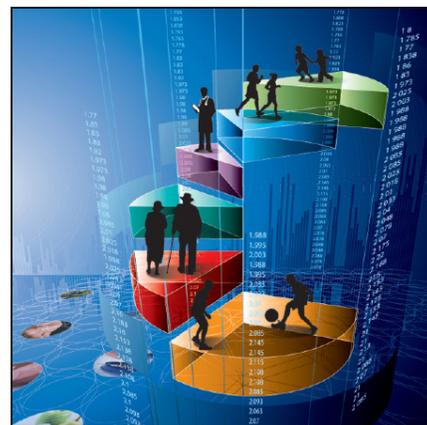


Health Reports

Change in vegetable and fruit consumption in Canada between 2004 and 2015

by Jane Y. Polsky and Didier Garriguet

Release date: June 24, 2020



Statistics
Canada

Statistique
Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

Email at STATCAN.infostats-infostats.STATCAN@canada.ca

Telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following numbers:

- Statistical Information Service 1-800-263-1136
- National telecommunications device for the hearing impaired 1-800-363-7629
- Fax line 1-514-283-9350

Depository Services Program

- Inquiries line 1-800-635-7943
- Fax line 1-800-565-7757

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "Contact us" > "[Standards of service to the public](#)."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Published by authority of the Minister responsible for Statistics Canada

© Her Majesty the Queen in Right of Canada as represented by the Minister of Industry, 2020

All rights reserved. Use of this publication is governed by the Statistics Canada [Open Licence Agreement](#).

An [HTML version](#) is also available.

Cette publication est aussi disponible en français.

Change in vegetable and fruit consumption in Canada between 2004 and 2015

by Jane Y. Polsky and Didier Garriguet

Abstract

Background: Eating plenty of vegetables and fruits on a daily basis is the foundation of a healthy diet. This study investigated patterns in Canadians' vegetable and fruit consumption in 2015 and compared these with 2004 data.

Data and methods: The 2015 Canadian Community Health Survey (CCHS) – Nutrition and the 2004 CCHS – Nutrition (Cycle 2.2) provided nationally representative 24-hour dietary recall data on Canadians' vegetable and fruit intakes. The frequency of consumption and the average quantity of daily intake for total vegetables, fruits and subgroups were calculated overall and by age and sex group for each survey year. The National Cancer Institute's methodology was used to assess the distribution of usual total vegetable and fruit intake and how it relates to recommendations in the 2007 Canada's Food Guide.

Results: Overall, Canadians reported consuming fewer total servings of vegetables and fruits in 2015 (4.5 average daily servings) than in 2004 (5.3 average daily servings). Lower total fruit intakes were explained by significantly lower intakes of fruit juice across nearly all age and sex groups, resulting in a decline of 0.3 average total daily fruit servings in the overall population. Lower vegetable consumption was largely driven by lower intakes of potatoes and, to a lesser extent, lettuce. Intakes of whole fruits and other vegetables remained largely unchanged. In both years, the majority of Canadians did not usually consume the number of total vegetable and fruit servings recommended for their age and sex group in the 2007 Canada's Food Guide.

Interpretation: Canadians reported consuming fewer vegetables and fruits in 2015 compared with 2004. This was largely driven by substantially lower consumption of fruit juice and, to a lesser extent, potatoes. These findings can serve as valuable baseline data to assess any changes in patterns of vegetable and fruit consumption in Canada.

Keywords: Canadian Community Health Survey, nutrition, dietary intake, fruit, vegetables

DOI: <https://www.doi.org/10.25318/82-003-x202000400001-eng>

Eating a variety of vegetables and fruits on a daily basis is the foundation of a healthy diet and helps to protect against a number of chronic diseases, including cardiovascular disease and type 2 diabetes.¹⁻⁴ In the most recently issued national dietary guidelines, the 2019 Canada's Food Guide (CFG), vegetables and fruits lead the list of nutritious foods that should be consumed regularly, along with whole grains and protein foods.^{1,5} The 2019 CFG also recommends eating “plenty of vegetables and fruits,” and advises Canadians to “try making half of your plate vegetables and fruits” and to “replace juice with water.”⁵ These recommendations are generally consistent with those outlined in the previous 2007 edition of the CFG, which also stressed the importance of consuming a variety of vegetables and fruits every day for optimal diet and health, and recommended consuming fruit more often than juice.⁶ Unlike the 2019 CFG, the 2007 CFG offered specific guidance about the types and amounts of vegetables and fruits to consume. This included guidance to “eat at least one dark green and one orange vegetable each day,” and age- and sex-specific numbers of recommended daily vegetable and fruit servings.⁶

Previous analyses of nationally representative data showed that Canadians' vegetable and fruit intakes are consistently low, and that the majority of Canadians do not meet national recommendations.⁷⁻¹¹ For example, between 2007 and 2014, the average frequency of fruit and vegetable consumption among Canadians aged 12 or older decreased from 5.0 times a day in 2007 to 4.7 times a day in 2014.⁹ Analyses based on 24-hour dietary recall data revealed that in 2004, only 26% of Canadians aged 2 years or older consumed the recommended number of total vegetable and fruit servings, and juice was a substantial contributor to overall vegetable and fruit intake.¹⁰

Given the importance of vegetable and fruit consumption for achieving a healthy diet and promoting good health, it is important to understand Canadians' recent patterns of vegetable and fruit intake and how these have changed since 2004. This study used the most recent national-level data available on Canadians' dietary intakes to describe the quantity and composition of Canadians' vegetable and fruit intake in 2015 and to compare these with estimates from 2004. A secondary objective of this study was to assess the distribution of usual vegetable and fruit consumption and how it relates to recommendations in the 2007 CFG, which was the food guide in effect in 2015.

Data and methods

Data sources and analytic sample

Data for this study came from two nationally representative cross-sectional surveys conducted by Statistics Canada: the 2004 Canadian Community Health Survey (CCHS) – Nutrition (Cycle 2.2) and the 2015 CCHS – Nutrition. The target populations for each survey were Canadian household residents of any age (2004) and those aged 1 or older (2015) living in the 10 Canadian provinces.¹²⁻¹³ Both surveys excluded full-time members of the Canadian Forces and individuals who lived on reserves or in other Aboriginal settlements, in some remote areas, or in institutions.

Each survey contained a 24-hour dietary recall component that asked respondents to recall everything they ate and drank in the past 24 hours, from midnight to midnight, including detailed food descriptions and amounts consumed. The United States Department of Agriculture Automated Multiple Pass Method,

What is already known about this subject?

- Consuming plenty of vegetables and fruits is the foundation of a healthy diet and helps to lower the risk of a number of chronic diseases, such as cardiovascular disease and type 2 diabetes.
- Analyses based on 2004 national-level dietary data showed that Canadians' vegetable and fruit consumption was lower than what was recommended by Canada's Food Guide.

What does this study add?

- On average, Canadians reported consuming fewer total daily servings of vegetables and fruits in 2015 compared with 2004.
- Canadians reported consuming fewer total servings of fruit in 2015, which was explained by significantly lower intakes of fruit juice in nearly all age and sex groups. The average daily intake of whole fruits remained largely unchanged.
- Lower vegetable consumption was largely explained by lower intakes of potatoes and, to a lesser extent, lettuce.
- In both years, the majority of Canadians did not usually consume the number of daily servings of vegetables and fruits recommended by the 2007 Canada's Food Guide.

adapted for the Canadian setting, was used in both surveys to help respondents maximize their recall of foods and drinks consumed.¹²⁻¹³ A proxy respondent provided dietary data for children younger than age 6. Children aged 6 to 11 were interviewed with proxy assistance, and respondents aged 12 and older provided their own information.

A total of 35,107 and 20,487 respondents in 2004 and 2015, respectively, took part in the first 24-hour dietary recall. About 30% of respondents (10,786 and 7,608 in 2004 and 2015, respectively) were selected to participate in a second 24-hour dietary recall 3 to 10 days after the initial interview. This allowed for the estimation of a person's day-to-day diet changes and usual

intakes.¹²⁻¹³ Data were mainly collected in person for the first recall and via telephone for the second recall. Response rates were 76.5% for the first recall and 72.8% for the second recall in 2004; in 2015, analogous response rates were 61.6% and 68.6%, respectively.

This analysis was restricted to Canadians aged 2 years or older with valid data and non-zero food and drink intake on the recall day. The final analytic sample sizes were 33,960 for 2004 and 20,111 for 2015.

Classification of vegetable and fruit servings

For each cycle, survey data on basic foods and foods in recipes were linked with the corresponding CFG file to extract information on the number of vegetable and fruit servings consumed (serving size determined by Health Canada, based on weight standardized to grams), and on each food item's 2007 CFG food subgroup classification and tier assignment (described below). The CFG food subgroups were based on Health Canada's 2014 Surveillance Tool,¹⁴ which classifies vegetables and fruits into the following subgroups, based on the 2007 CFG: fruit other than juice; fruit juice; dark green vegetables or deep yellow or orange vegetables (combined into a single subgroup because of low intake levels); potatoes (i.e., white potatoes prepared in various ways: raw or cooked, fried or roasted, and potato chips); and other vegetables (e.g., onions, tomatoes, celery, cucumbers, lettuce). A sixth subgroup, vegetable juices and cocktails, was not presented separately because of sparse data, but was included in all estimates for total vegetable and fruit intake. A careful examination of the classification of individual vegetables and fruits into CFG subgroups was conducted for each year in order to minimize the impact on intake estimates of any differences in coding or classification practices between survey years. This resulted in a number of amendments to the 2004 classification of vegetables in the "dark green" and "other" subgroups, where classification differed from the 2015 cycle (discrepancies confirmed with Health Canada).

The 2014 Surveillance Tool also assigned all vegetable and fruit servings to one of four tiers based on how closely

they aligned with the 2007 CFG, and based on set thresholds for total fat, saturated fat, sodium and sugar content.¹⁴ Servings in tiers 1 to 3 (called "Food Guide Servings") were deemed as most closely aligned or partially aligned with CFG recommendations, and tier 4 servings were not considered to be aligned.¹⁴ For this analysis, a single error in tier assignment was identified and corrected, in consultation with Health Canada: all servings assigned to the 2015 Nutrition Survey System food code 502747 (French-fried potatoes) were reassigned from tier 3 to tier 4.

The vegetable and fruit servings assigned to all four tiers were used for the primary study objective to estimate the overall quantity and composition of Canadians' vegetable and fruit intake in 2015, and to compare these with 2004 estimates. Servings from all four tiers were included to properly describe which vegetables and fruits, regardless of their nutritional quality, Canadians actually consumed. Another reason for including all servings in the comparison of estimates across cycles was that a number of minor changes were introduced to coding practices (e.g., amalgamation of certain food codes, such as potato chips), which could influence the comparability of estimates between cycles. For example, because most potato chips were assigned to tier 4 in 2004, but to tier 3 in 2015, analyses limited to servings in tiers 1 to 3 would affect the comparability of estimates of total potato consumption between cycles.

For the secondary study objective to assess the distribution of Canadians' usual vegetable and fruit intake and how it relates to the 2007 CFG recommendations, the analysis was restricted to vegetable and fruit servings assigned to tiers 1 to 3 (i.e., the "Food Guide Servings"). This was done to assess specifically the consumption of vegetables and fruits considered to be in line or partially in line with national dietary guidelines.¹⁴

Vegetable and fruit intake

Descriptive statistics were used to calculate the percentage of the Canadian population that consumed vegetables and fruits the day before the interview, and the average quantity consumed (i.e., the

mean number of servings from all four tiers among consumers only and among consumers and non-consumers combined). Only data from the first recall were used for these analyses because they represent average values, and average daily intakes equal average usual intakes (defined below in “Statistical analysis”).¹⁵ Estimates were generated overall and for 14 Dietary Reference Intake (DRI) age and sex groups defined by the United States National Academy of Medicine (formerly the Institute of Medicine).

Sensitivity analysis

Because of evidence that misreporting (i.e., overestimating or underestimating dietary intakes) changed between the 2004 and 2015 CCHS – Nutrition, as a sensitivity analysis, the proportion of vegetable and fruit consumers and the average quantity consumed were also calculated by limiting analyses to plausible energy reporters, using a previously published methodology.¹⁶

Top sources of vegetable and fruit intake

To estimate top intake sources, all vegetable and fruit servings in the CFG file were further categorized according to the more granular Bureau of Nutritional Sciences (BNS) classification system used in both surveys. Selected modifications were made to the BNS scheme to amalgamate certain food items and disaggregate others. For example, servings of “lettuces and leafy greens” (BNS food group 36H) were combined with servings of lettuce and greens consumed as part of “salads” (BNS food group 220C) into a single “lettuce” group. Also, cucumbers and blueberries were disaggregated from “other” vegetable or fruit groups. The top 10 sources of vegetables and fruits were based on intakes reported in the first 24-hour recall and were ranked according to the average intake quantity (i.e., number of servings) in the overall population.

Statistical analysis

The distribution of the usual intake of total vegetable and fruit servings (tiers 1 to 3 only) in each survey year and

how that relates to intake recommendations in the 2007 CFG were estimated using the univariate National Cancer Institute (NCI) method.^{15,17,18} The NCI method allows the estimation of usual (i.e., habitual or typical) food intake by estimating within-person variability (i.e., variability resulting from differences in a given person’s day-to-day intake, using data from both recalls) and between-person variability in dietary intakes (i.e., differences in average dietary intakes between individuals), and removing the former from the overall variance.^{17,18} The univariate NCI method was used to estimate the distribution of the usual total vegetable and fruit intake in the overall population and for each DRI group. One-part (“amount only”) models were used because nearly all Canadians consumed some vegetables or fruits daily in both survey years. For each model, both survey years were pooled to provide more stable estimates of the variance components. All models controlled for consumption day (weekday or weekend), sequence of recall (first or second) and survey year. Estimates for each survey year were presented separately.

Chi-square tests were used to test for any differences in the proportion of Canadians consuming vegetables and fruits, and t-tests were used to test for differences in the average amounts consumed and usual intakes between 2004

and 2015. All analyses were conducted in SAS version 9.3 or the SAS-callable SUDAAN version 11.0.1, and applied survey sampling weights to account for the complex sampling design and unequal probability of selection. Bootstrap weights provided with each survey year were used to calculate robust standard errors and coefficients of variation. Statistical significance was flagged at three levels: “*” for $p < 0.05$, “**” for $p < 0.001$ and “***” for $p < 0.0001$.

Results

While the majority of Canadians consumed some vegetables on the recall day (94.0% in 2004 and 93.3% in 2015, overall), the average number of total daily vegetable servings declined among consumers in all age and sex groups, except in children younger than age 9 (Table 1). This decline was primarily driven by lower intakes of potatoes (on average, 0.33 fewer daily servings reported overall in 2015 compared with 2004, with significant declines in most age and sex groups) and, to a lesser degree, “other” vegetables. There was little change in the average quantity of dark green, deep yellow or orange vegetables consumed. Analyses of average vegetable intake based on all respondents showed similar results (Table 2).

Table 1
Intake of vegetables among consumers, household population aged 2 or older, Canada excluding territories, 2004 and 2015

Sex and age group (years)	Total vegetables		Dark green, deep yellow or orange vegetables		Potatoes		Other vegetables	
	2004	2015	2004	2015	2004	2015	2004	2015
	percentage of consumers							
Male and female 2 years and older	94.0	93.3	61.6	59.9	46.8	41.1***	80.0	80.2
Male and female 2 to 3 years	90.7	86.3	62.5	58.8	44.2	34.0*	71.6	73.1
Male and female 4 to 8 years	92.0	92.4	57.0	58.3	46.8	42.7	72.7	75.9
Male 9 to 13 years	91.6	90.7	52.1	49.3	50.4	43.3*	72.5	75.2
Female 9 to 13 years	93.1	92.1	52.4	49.7	50.3	40.8*	73.5	81.6*
Male 14 to 18 years	93.3	93.2	48.7	50.1	53.6	41.0**	78.0	79.2
Female 14 to 18 years	92.3	91.3	50.3	53.3	46.4	40.4	77.9	75.4
Male 19 to 30 years	93.4	94.0	58.4	59.6	49.3	38.6*	82.4	84.0
Female 19 to 30 years	93.0	94.0	56.2	57.6	41.6	40.1	80.4	79.9
Male 31 to 50 years	94.0	93.4	58.0	57.2	47.2	38.9*	81.0	80.1
Female 31 to 50 years	95.6	93.7	66.8	63.2	43.2	34.9*	83.7	83.5
Male 51 to 70 years	94.3	93.3	67.1	60.5*	47.1	45.6	81.5	80.0
Female 51 to 70 years	95.0	94.8	70.4	66.0*	44.6	43.7	81.8	80.4
Male 71 years and older	94.6	92.8	68.9	62.2*	51.9	49.2	77.7	78.1
Female 71 years and older	95.0	94.4	69.5	63.5*	55.2	47.6*	79.8	80.7

Table 3 shows a significant shift toward lower intakes of fruit juice in 2015 compared with 2004—both in terms of a lower percentage of fruit juice consumers (35.0% in 2004 compared with 26.1% in 2015, in the overall population) and in terms of the average quantity consumed by consumers (2.62 servings in 2004 compared with 2.32 servings in 2015, overall). This decline was most pronounced among young children, adolescent girls and adults younger than age 31. Among the youngest children studied (aged 2 to 3 years), both the percentage of fruit juice consumers and the average amount consumed were significantly lower in 2015 than in 2004, whereas among older children (aged 4 to 13), lower juice intake was mostly explained by fewer servings consumed, on average, by consumers. Significantly fewer Canadians aged 51 to 70 drank fruit juice on the recall day in 2015 compared with 2004 (e.g., among females, 32.8% in 2004 compared with 17.2% in 2015), but the average amount consumed remained stable at just under two daily servings.

At the same time, the proportion of Canadians consuming whole fruits (i.e., fruits other than juice) increased slightly (from 61.6% in 2004 to 66.0% in 2015, overall), but with little change in the average amount consumed (Table 3). Among consumers only, the average intake of whole fruits remained at approximately two daily servings in every age and sex group, except for a slight increase among the youngest children. Table 4 shows similar results for consumers and non-consumers combined. For total vegetables and fruits, there was a significant decrease in the quantity consumed by the overall population, from 5.32 average daily servings in 2004 to 4.48 servings in 2015. This decline was most pronounced among adolescent girls, younger males aged 19 to 30 and males aged 51 to 70, among whom average intakes decreased by more than one daily serving.

Figures 1 and 2 present the top 10 sources of vegetable and fruit intake in the overall population, based on average

Table 1
Intake of vegetables among consumers, household population aged 2 or older, Canada excluding territories, 2004 and 2015

Sex and age group (years)	Total vegetables		Dark green, deep yellow or orange vegetables		Potatoes		Other vegetables	
	2004	2015	2004	2015	2004	2015	2004	2015
	average number of servings among consumers [†]							
Male and female 2 years and older	3.29	2.74***	1.31	1.18**	1.75	1.42***	1.73	1.52***
Male and female 2 to 3 years	1.47	1.43	0.59	0.63	0.84	0.72**	0.79	0.82
Male and female 4 to 8 years	1.92	1.75	0.74	0.73	1.22	0.80***	1.00	1.10
Male 9 to 13 years	2.60	2.00***	0.94	0.83	1.79	1.27***	1.30	1.09*
Female 9 to 13 years	2.32	1.98*	0.96	0.79*	1.39	1.13***	1.27	1.16
Male 14 to 18 years	3.17	2.57***	1.19	1.05	2.24	1.87***	1.45	1.35
Female 14 to 18 years	2.71	2.12***	1.15	1.01	1.74	1.08***	1.35	1.24
Male 19 to 30 years	3.70	2.73***	1.38	1.16	2.13	1.61***	1.84	1.41**
Female 19 to 30 years	3.02	2.51*	1.23	1.23	1.46	1.20	1.80	1.45*
Male 31 to 50 years	3.82	3.01***	1.50	1.37	2.24	1.61***	1.94	1.68*
Female 31 to 50 years	3.36	2.89**	1.42	1.32	1.45	1.24***	1.85	1.67
Male 51 to 70 years	3.92	3.19***	1.53	1.27*	2.04	1.90	1.93	1.60**
Female 51 to 70 years	3.60	2.98***	1.41	1.22*	1.58	1.37	1.99	1.71*
Male 71 years and older	3.41	3.00*	1.32	1.15	1.87	1.55*	1.63	1.58
Female 71 years and older	2.99	2.55*	1.17	0.93**	1.37	1.25*	1.52	1.44

* significantly different from 2004 ($p < 0.05$)

** significantly different from 2004 ($p < 0.001$)

*** significantly different from 2004 ($p < 0.0001$)

[†] Average number of servings, based on the first 24-hour recall, among respondents who consumed a given vegetable subgroup on the recall day.

Source: Statistics Canada, Canadian Community Health Survey – Nutrition, 2004 and 2015.

Table 2
Intake of vegetables among all respondents, household population aged 2 or older, Canada excluding territories, 2004 and 2015

Sex and age group (years)	Total vegetables		Dark green, deep yellow or orange vegetables		Potatoes		Other vegetables	
	2004	2015	2004	2015	2004	2015	2004	2015
	average number of servings [†]							
Male and female 2 years and older	3.09	2.55***	0.81	0.70***	0.82	0.59***	1.38	1.22***
Male and female 2 to 3 years	1.33	1.24	0.37	0.37	0.37	0.25**	0.56	0.60
Male and female 4 to 8 years	1.77	1.62	0.42	0.42	0.57	0.34***	0.73	0.83
Male 9 to 13 years	2.38	1.81***	0.49	0.41	0.90	0.55***	0.95	0.82
Female 9 to 13 years	2.16	1.82*	0.50	0.39*	0.70	0.46***	0.94	0.95
Male 14 to 18 years	2.96	2.40**	0.58	0.53	1.20	0.76***	1.13	1.07
Female 14 to 18 years	2.50	1.93***	0.58	0.54	0.81	0.43***	1.05	0.94
Male 19 to 30 years	3.45	2.57***	0.81	0.69	1.05	0.62***	1.52	1.18*
Female 19 to 30 years	2.81	2.36*	0.69	0.71	0.61	0.48	1.45	1.16*
Male 31 to 50 years	3.59	2.81***	0.87	0.78	1.05	0.62***	1.57	1.35*
Female 31 to 50 years	3.21	2.70**	0.95	0.83	0.62	0.43***	1.54	1.40
Male 51 to 70 years	3.70	2.97***	1.02	0.77**	0.96	0.87	1.57	1.28**
Female 51 to 70 years	3.41	2.82***	0.99	0.81*	0.70	0.60	1.63	1.38*
Male 71 years and older	3.23	2.78*	0.91	0.72*	0.97	0.76*	1.27	1.23
Female 71 years and older	2.84	2.40*	0.81	0.59***	0.75	0.59*	1.21	1.16

* significantly different from 2004 ($p < 0.05$)

** significantly different from 2004 ($p < 0.001$)

*** significantly different from 2004 ($p < 0.0001$)

[†] Average number of servings, based on the first 24-hour recall, among all respondents (i.e., consumers and non-consumers combined).

Source: Statistics Canada, Canadian Community Health Survey – Nutrition, 2004 and 2015.

daily servings (ranked according to the top 10 in 2015). Potatoes and lettuce were the leading sources of vegetable intake in both 2004 and 2015, and the ranking order for the top five sources of vegetable intake remained unchanged between cycles (Figure 1). Collectively, potatoes (i.e., combined servings of raw and cooked potatoes, fried and roasted potatoes, and potato chips) were the most commonly consumed vegetable in both years, but their average intake decreased by nearly a quarter of a serving (from 0.82 to 0.59 daily servings). The combined decline in potato and lettuce intakes (0.38 fewer average daily servings, overall, in 2015 compared with 2004) accounted for a large share of the half-serving decrease in the average intake of total vegetables (Table 2).

Fruit juice remained the leading source of fruit intake in 2015, but declined by an average of 0.31 daily servings since 2004 (Figure 2). Bananas, apples, citrus fruits and melons rounded out the top five sources of fruit intake in both cycles, with minimal shifting in their ranking position and minor changes in the amounts consumed.

Table 5 shows the distributions of usual intake of total vegetables and fruits in 2004 and 2015. In 2004, overall, over half of Canadians (55.4%) usually consumed no more than five total servings of vegetables and fruits in a typical day. In 2015, this estimate (67.0%) was significantly higher, indicating lower overall intake levels. In both survey years, the majority of Canadians did not usually consume the number of combined vegetable and fruit servings recommended for their age and sex group in the 2007 CFG, ranging from approximately 54% to 61% of young children aged 2 to 3 to approximately 87% to 95% of adolescents and adults younger than age 50. For example, 88.5% of adolescent boys in 2004 and 90.3% in 2015 typically consumed fewer than the eight daily servings of vegetables and fruits recommended for their age and sex group. In terms of differences in the usual intake distribution between survey years, significantly more males aged 19 to 50 and

Table 3
Intake of fruits and total vegetables and fruits among consumers, household population aged 2 or older, Canada excluding territories, 2004 and 2015

Sex and age group (years)	Total fruits		Fruits other than juice		Fruit juice		Total vegetables and fruits	
	2004	2015	2004	2015	2004	2015	2004	2015
	percentage of consumers							
Male and female 2 years and older	72.6	73.4	61.6	66.0***	35.0	26.1***	97.9	97.3*
Male and female 2 to 3 years	90.9	93.8	80.1	88.2**	64.7	45.5***	98.3	98.5
Male and female 4 to 8 years	83.3	88.7**	69.1	79.2***	52.7	49.4	98.5	99.0
Male 9 to 13 years	74.1	76.6	60.1	68.1*	42.6	38.7	97.5	96.3
Female 9 to 13 years	78.4	77.9	66.3	69.7	43.6	39.2	98.0	96.1
Male 14 to 18 years	64.3	74.2***	46.9	58.0**	39.5	38.2	97.1	98.2
Female 14 to 18 years	68.4	69.6	49.4	60.4**	40.6	26.0***	96.3	97.2
Male 19 to 30 years	60.0	57.8	45.7	47.8	33.9	27.2	97.6	96.7
Female 19 to 30 years	70.3	75.8	59.6	64.9	33.9	25.7*	97.1	98.7*
Male 31 to 50 years	64.4	68.3	53.1	62.5**	29.1	22.8*	97.2	97.1
Female 31 to 50 years	71.6	72.9	61.8	66.4	28.3	21.1**	98.5	96.2*
Male 51 to 70 years	72.6	69.7	63.5	63.0	31.9	22.2***	97.9	96.7
Female 51 to 70 years	80.5	75.0*	73.5	70.1	32.8	17.2***	98.6	97.7
Male 71 years and older	83.1	79.4	74.7	72.7	35.7	25.9**	98.3	98.1
Female 71 years and older	86.9	79.8*	80.5	72.3*	39.1	29.6**	98.8	97.9
	average number of servings among consumers [†]							
Male and female 2 years and older	3.07	2.63***	2.13	2.00*	2.62	2.32***	5.44	4.61***
Male and female 2 to 3 years	3.23	2.78*	1.72	2.02*	2.40	1.81***	4.33	3.90*
Male and female 4 to 8 years	3.15	2.91	1.85	1.90	2.55	2.18**	4.46	4.24
Male 9 to 13 years	3.35	3.10	1.97	2.05	3.05	2.52*	4.99	4.35*
Female 9 to 13 years	3.25	2.98	2.14	2.01	2.57	2.34	4.80	4.31*
Male 14 to 18 years	3.83	3.41	2.12	2.16	3.71	3.35	5.58	5.01*
Female 14 to 18 years	3.33	2.57***	2.06	1.94	3.12	2.37***	4.96	3.83***
Male 19 to 30 years	3.76	3.05*	2.02	1.97	3.95	3.04*	5.85	4.48***
Female 19 to 30 years	3.25	2.49**	2.10	1.96	3.05	2.39**	5.25	4.30**
Male 31 to 50 years	3.20	2.78*	2.33	2.06	2.83	2.69	5.82	4.85***
Female 31 to 50 years	2.85	2.52*	2.28	2.03	2.24	2.31	5.33	4.72*
Male 51 to 70 years	3.21	2.59*	2.50	2.17	2.32	1.98*	6.16	4.94***
Female 51 to 70 years	2.52	2.30*	1.94	2.00	1.85	1.91	5.52	4.66***
Male 71 years and older	2.54	2.37	2.03	1.87	1.67	2.01	5.43	4.75*
Female 71 years and older	2.46	2.16*	1.84	1.69	1.67	1.70	5.03	4.22***

* significantly different from 2004 (p < 0.05)

** significantly different from 2004 (p < 0.001)

*** significantly different from 2004 (p < 0.0001)

[†] Average number of servings, based on the first 24-hour recall, among respondents who consumed a given fruit or vegetable subgroup on the recall day.

Source: Statistics Canada, Canadian Community Health Survey – Nutrition, 2004 and 2015.

adults aged 51 or older failed to consume the recommended number of vegetable and fruit servings in 2015 compared with 2004. Usual intakes of total vegetables and fruits were generally lower in 2015 than in 2004 among adolescent girls, younger adult females, males aged 19 to 50, and particularly among adults older than age 50.

Sensitivity analysis

Trends in the frequency and average quantity of vegetable and fruit consumption were materially unchanged when analyses were restricted to plausible reporters (results not shown).

Discussion

This study used dietary data from two large, nationally representative samples to explore changes in the quantity and composition of Canadians' intakes of vegetables and fruits over the 11-year period between 2004 and 2015, and to examine the distribution of usual vegetable and fruit intake and how it relates to the 2007 CFG. In the population as a whole, consumption of total vegetables and fruits decreased by 0.8 daily servings, on average. The decline was most pronounced in adolescent girls and adults, and persisted when analyses were

restricted to plausible reporters. Lower levels of total vegetable intake were partially explained by lower average intakes of potatoes and, to a lesser extent, lettuce. However, these two vegetables remained the leading sources of total vegetable intake for Canadians in both years. For total fruit consumption, there was a significant shift toward lower intakes of fruit juice in nearly every age and sex group. Depending on the age and sex group, this change was due to a decline in the number of fruit juice consumers and/or lower quantities (i.e., fewer servings) of fruit juice consumed. Despite the overall decline, fruit juice remained the leading source of total fruit intake, and Canadians' average daily intake of whole fruits remained largely unchanged.

The substantial decline in fruit juice consumption (particularly in young children, adolescent girls, younger adults and adults aged 51 to 70) is consistent with recommendations in both the 2007 and 2019 CFG to limit fruit juice intake.^{5,6}

Table 4**Intake of fruits and total vegetables and fruits among all respondents, household population aged 2 or older, Canada excluding territories, 2004 and 2015**

	Total fruits		Fruits other than juice		Fruit juice		Total vegetables and fruits	
	2004	2015	2004	2015	2004	2015	2004	2015
Sex and age group (years)	average number of servings [†]							
Male and female 2 years and older	2.23	1.93***	1.31	1.32	0.92	0.61***	5.32	4.48***
Male and female 2 to 3 years	2.93	2.61*	1.38	1.78**	1.55	0.82***	4.26	3.84*
Male and female 4 to 8 years	2.63	2.58	1.28	1.50*	1.35	1.08**	4.39	4.20
Male 9 to 13 years	2.48	2.37	1.18	1.40	1.30	0.97*	4.87	4.18**
Female 9 to 13 years	2.54	2.32	1.42	1.40	1.12	0.92*	4.70	4.15*
Male 14 to 18 years	2.46	2.53	0.99	1.25	1.47	1.28	5.42	4.93
Female 14 to 18 years	2.28	1.79**	1.02	1.17	1.26	0.62***	4.78	3.72***
Male 19 to 30 years	2.26	1.77*	0.92	0.94	1.34	0.83 [‡]	5.71	4.33***
Female 19 to 30 years	2.29	1.88*	1.25	1.27	1.03	0.61**	5.09	4.25**
Male 31 to 50 years	2.06	1.90	1.24	1.28	0.82	0.61*	5.65	4.71***
Female 31 to 50 years	2.04	1.84	1.41	1.35	0.64	0.49*	5.25	4.54**
Male 51 to 70 years	2.33	1.80**	1.59	1.37	0.74	0.44***	6.03	4.78***
Female 51 to 70 years	2.03	1.73*	1.43	1.40	0.60	0.33***	5.44	4.55***
Male 71 years and older	2.11	1.88	1.52	1.36	0.60	0.52	5.34	4.66*
Female 71 years and older	2.14	1.73***	1.48	1.22**	0.65	0.50*	4.97	4.13***

[‡] use with caution

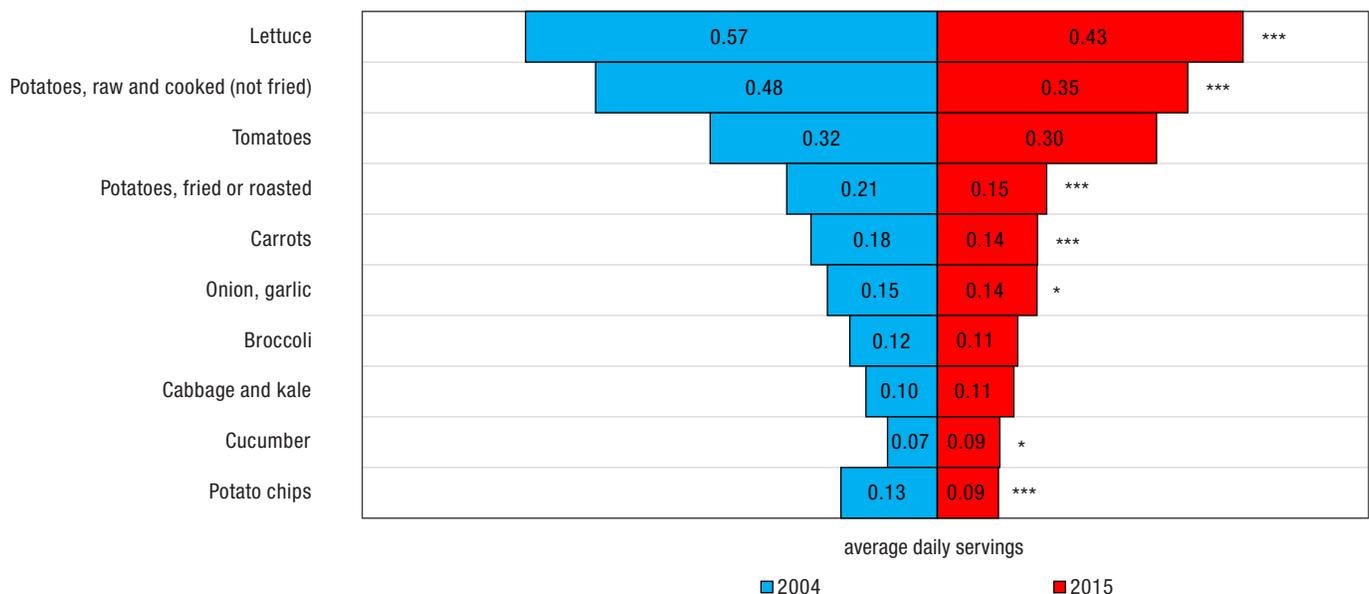
* significantly different from 2004 ($p < 0.05$)

** significantly different from 2004 ($p < 0.001$)

*** significantly different from 2004 ($p < 0.0001$)

[†] Average number of servings, based on the first 24-hour recall, among all respondents (i.e., consumers and non-consumers combined).

Source: Statistics Canada, Canadian Community Health Survey – Nutrition, 2004 and 2015.

Figure 1**Top 10 sources of vegetable intake, household population aged 2 or older, Canada excluding territories, 2004 and 2015**

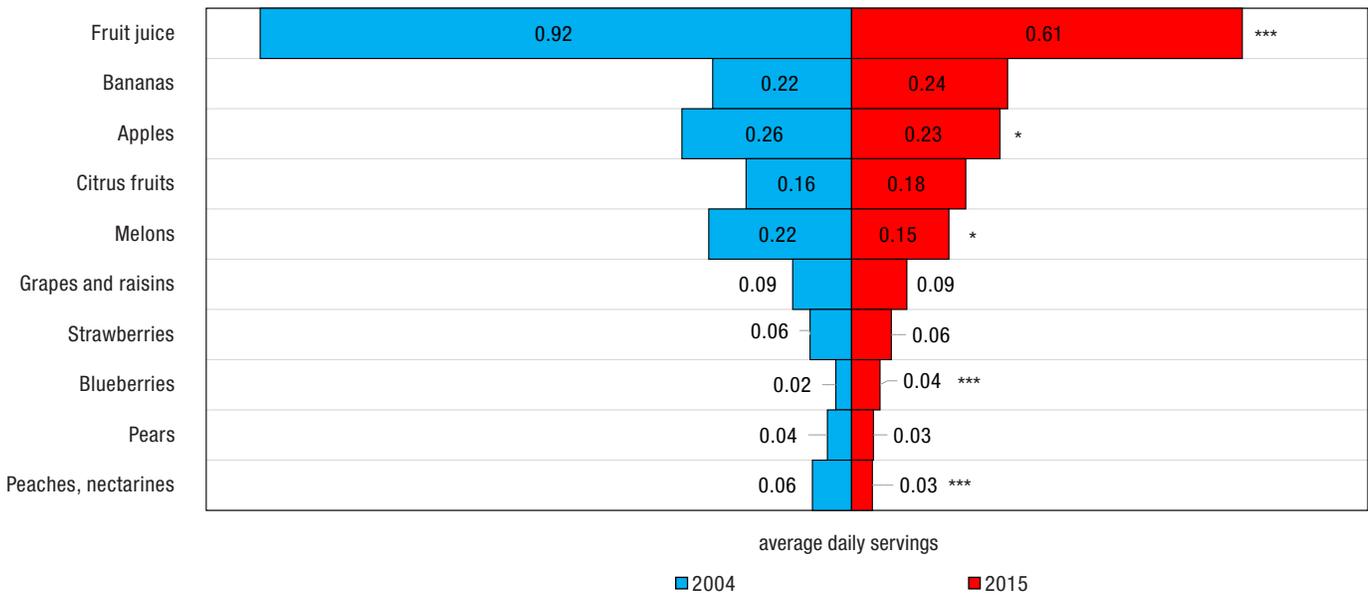
* significantly different from 2004 ($p < 0.05$)

*** significantly different from 2004 ($p < 0.0001$)

Notes: Foods are ranked according to top 10 in 2015. Estimates (average number of servings in the overall population) are based on intakes reported in the first 24-hour recall. Bureau of Nutritional Sciences (BNS) codes were used to classify the vegetable subgroups as follows: lettuce—BNS codes 36H or 220C; potatoes, raw and cooked (not fried)—BNS codes 39A or 220A; tomatoes—BNS codes 36N, 220E or 220F; potatoes, fried or roasted—BNS codes 38B or 220B; carrots—BNS code 36E; onion, garlic—BNS codes 36J or 220F; broccoli—BNS codes 36B or 220F; cabbage and kale—BNS code 36C; cucumber—BNS codes 36P or 220E; and potato chips—BNS code 38A.

Source: Statistics Canada, Canadian Community Health Survey – Nutrition, 2004 and 2015.

Figure 2
Top 10 sources of fruit intake, household population aged 2 or older, Canada excluding territories, 2004 and 2015



* significantly different from 2004 ($p < 0.05$)

*** significantly different from 2004 ($p < 0.0001$)

Notes: Foods are ranked according to top 10 in 2015. Estimates (average number of servings in the overall population) are based on intakes reported in the first 24-hour recall. Bureau of Nutritional Sciences (BNS) codes were used to classify the fruit subgroups as follows: fruit juice—BNS codes 45A, 231E or 231F; bananas—BNS codes 40C, 40L, 42B, 220F or 225A; apples—BNS codes 40B or 225A; citrus fruits—BNS code 40A; melons—BNS code 40F; grapes and raisins—BNS codes 40E or 225A; strawberries—BNS codes 40K or 225A; blueberries—BNS codes 40L or 225A; pears—BNS code 40H; and peaches, nectarines—BNS codes 40G or 225A.

Source: Statistics Canada, Canadian Community Health Survey – Nutrition, 2004 and 2015.

Analyses based on the CCHS annual component similarly showed that the frequency of daily fruit juice consumption in Canada declined between 2007 and 2014 and, consistent with this study’s findings, was not accompanied by a higher intake of whole fruits.⁹ Lower fruit juice consumption is also consistent with documented declines in the consumption of other beverages in Canada, including milk, soft drinks and fruit drinks.¹⁹⁻²¹ Lower intakes of fruit juice and sweetened beverages may reflect a change in the population’s eating habits in response to growing concerns about the free sugar and energy content of these beverages.^{19,22,23}

This analysis also documented a small decline since 2004 in the average daily intake of potatoes in all forms (i.e., raw, cooked, baked, fried and roasted, and potato chips) in nearly every age and sex group. A recent analysis based on the same dietary data revealed similar trends, even when analyses were restricted to plausible energy reporters and adjusted

for a number of covariates, including total energy intake.¹¹ Because fried potatoes (e.g., French fries) and potato chips are typically consumed as processed foods that contain high amounts of sodium and saturated fat, reduced intake of these foods is consistent with 2019 CFG guidance to “limit highly processed foods and drinks because they are not a part of a healthy eating pattern.”⁵ It is worth noting, however, that lower intakes of potatoes were not accompanied by any observable increase in the consumption of other vegetables, such as dark green or deep yellow or orange vegetables (the 2007 CFG recommended daily consumption of these types of vegetables).⁶

In terms of evaluating the distribution of usual vegetable and fruit intake and how it relates to the 2007 CFG recommendations (which were still in effect in 2015), this analysis found that in both 2004 and 2015, the majority of Canadians did not usually consume the recommended number of total daily vegetable and fruit servings. This finding is in line

with previous reports documenting consistently low intakes of vegetables and fruits in Canada during the previous decade.⁷⁻¹¹

Consistent with previous analyses of data from the 2004 CCHS – Nutrition,^{8,10} this study showed that younger children were most likely to consume the recommended number of vegetable and fruit servings, and this pattern persisted in 2015. Adolescents and adults younger than age 51 in both survey years and adults older than age 50 in 2015 had the widest gap between reported and recommended intakes, with approximately 87% to 95% of people failing to consume the recommended number of vegetable and fruit servings in a typical day. The persistently low intake of vegetables and fruits represents a concerning trend for public health.²⁴

This study has limitations that are inherent to analyses of nutrition surveys, including misreporting and, particularly, underreporting of self-reported food and drink intakes. Indeed, a 2018

Table 5

Usual intake distribution of total vegetable and fruit servings, by age and sex, household population aged 2 or older, Canada excluding territories, 2004 and 2015[†]

Sex, age group (years) and survey cycle	Number	Usual number of daily vegetable and fruit servings								
		2	3	4	5	6	7	8	9	10
		Probability								
	number	percent								
Male and female 2 years and older										
2004	33,960	5.4	18.3	36.6	55.4	71.0	82.4	89.9	94.4	97.0
2015	20,111	9.5**	27.4***	48.5***	67.0***	80.5***	89.1***	94.2***	97.0***	98.6**
Male and female 2 to 3 years										
2004	1,498	11.2 ^E	31.1	54.1	73.2	86.1	93.3	97.0	98.8	99.5
2015	952	15.3	37.8	61.0	78.8	89.9	95.4	98.1	99.3	99.8
Male and female 4 to 8 years										
2004	3,346	8.8 ^E	28.0	52.0	72.2	85.9	93.5	97.2	98.9	99.6
2015	1,233	8.8 ^E	28.3	52.5	72.9	86.2	93.5	97.3	98.9	99.6
Male 9 to 13 years										
2004	2,149	8.8 ^E	26.2	47.4	66.1	79.8	88.7	94.0	96.9	98.4
2015	1,047	12.4 ^E	33.0	55.5	73.1*	84.9	92.0	96.1	98.1	99.1
Female 9 to 13 years										
2004	2,043	F	20.0 ^E	43.8	67.1	83.3	92.4	96.9	98.9	99.6
2015	969	F	28.7 ^E	55.2*	76.5	89.6	95.9	98.4	99.5	99.9
Male 14 to 18 years										
2004	2,397	7.5 ^E	22.0	39.7	56.9	71.0	81.5	88.5	93.1	96.0
2015	960	9.3 ^E	25.1	43.2	60.6	74.2	83.9	90.3	94.4	96.7
Female 14 to 18 years										
2004	2,368	10.3 ^E	28.8	49.8	68.2	81.2	89.6	94.5	97.3	98.6
2015	1,035	16.4 ^E	39.0*	61.5*	77.6*	88.0*	93.8	97.0	98.6	99.4
Male 19 to 30 years										
2004	1,897	6.8 ^E	19.8 ^E	36.7	53.8	68.2	79.2	87.0	92.1	95.3
2015	882	13.6 ^E	31.5*	51.0*	67.5*	79.9*	88.2*	93.2*	96.1	98.0
Female 19 to 30 years										
2004	2,082	F	18.9 ^E	40.0	61.1	77.5	88.0	94.1	97.2	98.8
2015	1,019	F	27.6 ^E	52.2*	71.9*	85.5	93.1	96.9	98.8	99.5
Male 31 to 50 years										
2004	2,750	F	15.5 ^E	32.5	50.8	66.8	79.2	87.5	92.8	96.0
2015	2,077	F	24.2 ^E	44.6*	63.1*	77.6*	87.0*	92.9*	96.2	98.1
Female 31 to 50 years										
2004	2,927	F	F	25.9 ^E	52.8	75.7	89.4	96.0	98.7	99.7
2015	2,469	F	F	42.3	69.4*	87.2	95.5	98.6	99.6	99.9
Male 51 to 70 years										
2004	2,725	6.2 ^E	16.7	30.5	45.6	59.5	70.9	80.0	86.7	91.5
2015	2,246	12.9*	29.2***	46.5***	62.1***	74.5***	83.6***	89.7**	93.7*	96.4*
Female 51 to 70 years										
2004	3,408	F	12.7 ^E	29.9	49.8	67.7	81.1	89.9	94.9	97.6
2015	2,420	6.7 ^E	23.0*	44.9***	65.5***	80.6***	90.0**	95.3*	97.9*	99.1
Male 71 years and older										
2004	1,601	F	13.8 ^E	30.8	50.0	67.0	80.2	89.1	94.2	97.1
2015	1,246	7.5 ^E	23.5*	44.1*	64.1*	79.1*	88.9*	94.4	97.3	98.8
Female 71 years and older										
2004	2,769	5.7 ^E	18.6	37.1	56.3	72.3	83.9	91.4	95.5	97.8
2015	1,556	13.7**	33.6***	55.5***	73.6***	85.7***	92.8***	96.6*	98.5*	99.4*

^E use with caution

F too unreliable to be published

* significantly different from 2004 ($p < 0.05$)** significantly different from 2004 ($p < 0.001$)*** significantly different from 2004 ($p < 0.0001$)[†] Estimates are probabilities of consuming fewer than the usual number of daily vegetable and fruit servings, calculated using the National Cancer Institute method and adjusted for weekday or weekend of record, sequence of recall, and survey cycle.**Notes:** These analyses are based on Food Guide servings (tiers 1 to 3) of vegetables and fruits, which are in line with the 2007 Canada's Food Guide recommendations. Shaded cells mark the percentile corresponding to the average number of servings recommended in the 2007 Canada's Food Guide for each age and sex group. (Health Canada. Eating Well with Canada's Food Guide 2007. 2007. Available at: <https://www.canada.ca/en/health-canada/services/canada-food-guide/about/history-food-guide/eating-well-with-canada-food-guide-2007.html>).**Source:** Statistics Canada, Canadian Community Health Survey – Nutrition, 2004 and 2015.

study showed that while the number of plausible reporters remained unchanged, the number of underreporters in the Canadian population was significantly higher in 2015 compared with 2004.¹⁶ However, results of sensitivity analyses to examine average daily total intakes of vegetables and fruits and subgroups restricted to plausible energy reporters (data not shown) were highly consistent with the main results that were based on the full sample. A recent analysis similarly concluded that between 2004 and 2015, declines in the average daily intake of various food groups, including vegetables and fruits, were not explained by changing patterns of underreporting or overreporting in Canada.¹¹

To increase respondents' accuracy in estimating portion size, changes were made to the food model booklet used in the 2015 CCHS – Nutrition. Standard amounts shown to respondents in 2015 were generally smaller than in 2004, particularly for bowls, glasses and mugs.¹³ This change may have affected the comparability of reported intakes of some foods and drinks, and particularly fruit juice. A previous analysis of CCHS – Nutrition data found that while total beverage intake was indeed lower in 2015 than in 2004, this pattern did not extend to all types of beverages (e.g., the average quantity of water consumed

was higher in 2015 compared with 2004).¹⁹ No standard approach currently exists to estimate or correct any underestimation or overestimation introduced by changes to standard amounts in the 2015 food model booklet. Changes to the food model booklet are unlikely to affect differences in intake caused by changes in the proportion of consumers since the food model booklet should not affect the reporting of whether a given food or drink was consumed. Finally, an assessment of how vegetable and fruit intakes align with recommendations in the revised 2019 CFG was not possible because quantifiable metrics to measure adherence were not available at the time of this study. Additionally, the 2019 CFG recommendations would have been unknown to respondents to the 2004 and 2015 CCHS – Nutrition surveys. Future analyses can assess adherence to 2019 CFG recommendations, following the release of quantifiable metrics by Health Canada.

This study has a number of notable strengths, including the use of two large, nationally representative samples of Canadians, and two different survey years with similar methodology and sampling designs. Both surveys used a validated 24-hour dietary recall method to collect information about food and drink intakes, and both surveys allowed

for the examination of the quantity and composition of Canadians' vegetable and fruit intakes. To ensure that observed differences between surveys did not result from changes in coding practices, the classification of individual vegetables and fruits into CFG subgroups and tiers was carefully inspected and amended, where appropriate. Finally, this study's use of the NCI method allowed for adjustment for within-person variation in food intake. In turn, this allowed for estimation of the distribution of usual vegetable and fruit intake and comparison with CFG recommendations.

Conclusions

Overall, Canadians reported lower vegetable and fruit intakes in 2015 compared with 2004 because of notable declines in the consumption of fruit juice and, to a lesser extent, potatoes. These declines were not accompanied by increased intakes of whole fruits or other vegetables. This study's findings also demonstrate a significant gap between reported intakes and intakes recommended in the 2007 CFG.⁶ Results of this study can serve as valuable baseline data to assess the impact of efforts to improve population-level diet quality in Canada, including the 2019 CFG.

References

1. Health Canada. *Canada's Dietary Guidelines for Health Professionals and Policy Makers* (Health Canada, Catalogue H164-231/2019E-PDF) Ottawa: Health Canada, 2019.
2. Herforth A, Arimond M, Alvarez-Sanchez C, et al. A global review of food-based dietary guidelines. *Advances in Nutrition* 2019; 10(4): 590-65 (epub ahead of print).
3. Health Canada. *Summary of Health Canada's Assessment of a Health Claim About Vegetables and Fruit and Heart Disease* (Health Canada, Catalogue H164-202/2016E-PDF) Ottawa: Health Canada, 2016.
4. Li M, Fan Y, Zhang X, et al. Fruit and vegetable intake and risk of type 2 diabetes mellitus: meta-analysis of prospective cohort studies. *BMJ Open* 2014; 4(11). e005497.
5. Government of Canada. *Canada's Food Guide*. 2019. Available at: www.canada.ca/FoodGuide.
6. Health Canada. *Eating Well with Canada's Food Guide 2007*. 2007. Available at: <https://www.canada.ca/en/health-canada/services/canada-food-guide/about/history-food-guide/eating-well-with-canada-food-guide-2007.html>.
7. Garriguet D. Canadians' eating habits. *Health Reports* 2007; 18(2): 17-32.
8. Health Canada. *Evidence Review for Dietary Guidance: Technical Report 2015*. (Health Canada Catalogue H164-192/2016E-PDF) Ottawa: Health Canada, 2016.
9. Colapinto CK, Graham J, St-Pierre S. Trends and correlates of frequency of fruit and vegetable consumption, 2007 to 2014. *Health Reports* 2018; 29(1): 9-14.
10. Black JL, Billette J-M. Do Canadians meet Canada's Food Guide's recommendations for fruits and vegetables? *Applied Physiology, Nutrition, and Metabolism* 2013; 38: 234-42.
11. Tugault-Lafleur CN, Black JL. Differences in the quantity and types of foods and beverages consumed by Canadians between 2004 and 2015. *Nutrients* 2019; 11(3): E526.
12. Statistics Canada. *Canadian Community Health Survey (CCHS) Cycle 2.2 (2004) Nutrition – General Health (including Vitamin & Mineral Supplements) & 24-Hour Dietary Recall Components User Guide*. 2008. Available at: http://www23.statcan.gc.ca/imdb-bmdi/document/5049_D24_T9_V1-eng.pdf.
13. Statistics Canada. *2015 Canadian Community Health Survey (CCHS) – Nutrition, User Guide*. August 2017.
14. Health Canada. *The Development and Use of a Surveillance Tool: The Classification of Foods in the Canadian Nutrient File According to Eating Well with Canada's Food Guide* (Health Canada, Catalogue H164-158/2-2014E-PDF) Ottawa: Health Canada, 2014.
15. National Cancer Institute. 2015. *Dietary Assessment Primer*. Available at: <https://dietassessmentprimer.cancer.gov>.
16. Garriguet D. Accounting for misreporting when comparing energy intake across time in Canada. *Health Reports* 2018; 29(5): 3-12.
17. Tooze JA, Kipnis V, Buckman DW, et al. A mixed-effects model approach for estimating the distribution of usual intake of nutrients: the NCI method. *Statistics in Medicine* 2010; 29(27): 2857-68.
18. Tooze JA, Midthune D, Dodd KW, et al. A new statistical method for estimating the usual intake of episodically consumed foods with application to their distribution. *Journal of the American Dietetic Association* 2006; 106(10): 1575-87.
19. Garriguet D. Changes in beverage consumption in Canada. *Health Reports* 2019; 30(7): 20-30.
20. Czoli CD, Jones AC, Hammond D. Trends in sugary drinks in Canada, 2004 to 2015: a comparison of market sales and dietary intake data. *Public Health Nutrition* 2019; 4: 1-6 (epub ahead of print).
21. Jones AC, Kirkpatrick SI, Hammond D. Beverage consumption and energy intake among Canadians: analyses of 2004 and 2015 national dietary intake data. *Nutrition Journal* 2019; 18(1): 60.
22. World Health Organization. *Guideline: Sugars Intake for Adults and Children*. Geneva: World Health Organization, 2015.
23. Heyman MB, Abrams SA. Section on Gastroenterology, Hepatology, and Nutrition; Committee on Nutrition. Fruit juice in infants, children and adolescents: current recommendations. *Pediatrics* 2017; 139(6). pii: e20170967.
24. Ekwaru JP, Ohinmaa A, Loehr S, et al. The economic burden of inadequate consumption of vegetables and fruit in Canada. *Public Health Nutrition* 2017; 20(3): 515-23.