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Trends and correlates of frequency of fruit and vegetable consumption, 2007 to 2014

by Cynthia K. Colapinto, John Graham and Sylvie St-Pierre

Abstract

Background: Eating fruit and vegetables is recommended as part of a healthy diet. This study describes trends in the frequency of fruit and vegetable consumption in Canada, the contribution of fruit juice to these trends, and correlates of the frequency of fruit and vegetable consumption.

Data and methods: The data are from the annual Canadian Community Health Survey for the 2007-to-2014 period and pertain to the household population aged 12 or older. Weighted frequencies and cross-tabulations were used to estimate the average frequency of fruit and vegetable consumption by socio-demographic characteristics and body mass index, age-standardized to the 2014 Canadian population. Multivariate logistic regressions were used to examine correlates of frequency of fruit and vegetable intake in 2014.

Results: In 2014, Canadians reported consuming fruit and vegetables an average of 4.7 times a day, a slight, but significant, decrease from 5.0 times a day in 2007. The decrease over time was no longer significant when fruit juice was excluded (dropping to an average of 4.1 times a day in both years). Canadians drank less juice in 2014 than in 2007, a decline that was apparent across all age, sex and household income quintiles, all regions, and all weight categories. In 2014, Canadians who reported consuming fruit and vegetables 5 or more times a day tended to be female, in younger age groups, in the highest household income quintile, and neither overweight nor obese.

Interpretation: Between 2007 and 2014, Canadians' reported frequency of fruit and vegetable consumption was consistently low. Correlates of fruit and vegetable consumption can be used to target nutrition policy and education efforts to improve intake.

Keywords: Diet, dietary habits, eating, food intake, health behaviour, nutrition

Fruit and vegetable consumption is recommended as part of a healthy diet.¹ Fruit and vegetables are a source of vitamins and minerals, including folate, vitamin A, vitamin C, and carotenoids.² They also provide fibre, which is important for digestive health. Diets that include fruit and vegetables have been linked to a lower risk of some chronic conditions, including cardiovascular disease, type 2 diabetes, and colorectal cancer.³⁻⁵ High consumption of fruit and vegetables suggests better diet quality.⁶

For people aged 12 or older, the 2007 *Food Guide* recommended 6 to 10 servings of fruit and vegetables a day.⁷ However, results of the 2004 Canadian Community Health Survey (CCHS), which used a 24-hour recall to collect nutrition data, showed that more than 50% of Canadians aged 12 or older consumed fewer than the recommended number of servings for their age and sex group.⁸ According to the 2014 CCHS—Annual component, the *frequency* of fruit and vegetable consumption, which is a validated indicator of diet quality,⁶ was low, with fewer than 45% reporting at least 5 times a day.⁹

Unlike discrete time-points, linear trends in the frequency of fruit and vegetable intake allow for an understanding of change over time. Based on annual data from the CCHS, the present analysis describes trends in the frequency of fruit and vegetable intake among Canadians aged 12 or older from 2007 to 2014. The contribution of 100% pure fruit juice to these trends, and how fruit and vegetable intake differed by socio-demographic characteristics and body mass index (BMI) are also explored.

Data and methods

The CCHS—Annual component¹⁰ is a cross-sectional survey that collects information about health status, health care utilization, and health determinants. The survey covers the population aged 12 or older in the 10 provinces and 3 territories. It excludes: residents of reserves and other Aboriginal settlements in the provinces; full-time members of the Canadian Forces; the institutionalized population; children aged 12 to 17 in foster care; and residents of the Quebec health regions of Région du Nunavik and Région des Terres-Cries-de-la-Baie-James. Together, these exclusions represent less than 3% of the Canadian population aged 12 or older. In the north, the CCHS covers 92% of the targeted population in the Yukon and 96% in the Northwest Territories. In Nunavut, starting in 2013, coverage was extended to represent 92% of the targeted population; previously, coverage was 71%, as the survey included only the 10 largest communities.

Estimates for this study are based on consecutive years of CCHS data from 2007 to 2014. About 65,000 respondents were interviewed each year. The analyses pertain to respondents who answered questions about frequency of fruit and vegetable intake (approximately 60,000 per year).

Frequency of fruit and vegetable consumption

“Fruit and Vegetable Consumption” was a core module on the CCHS questionnaire from 2007 to 2014. The module consisted

of six questions adapted from the fruit and vegetable module of the Behavioral Risk Factor Surveillance System of the Centers for Disease Control in the U.S.,¹¹ which captures self-reported frequency of intake as the number of times per day, week, month or year, rather than the amount (number of servings) consumed. The derived variable (DV) for total frequency of fruit and vegetable intake per day was used, which combined questions on the following foods and drinks, whether consumed at meals or snacks, at home or away: 1) 100% pure fruit juice such as orange, grapefruit or tomato; 2) fruit, not including juice; 3) green

salad; 4) potatoes, not including french fries, fried potatoes, or potato chips; 5) carrots; and 6) “other vegetables.” The “other vegetables” response was considered in the DV as the number of times per day, week, month or year, although the question was phrased as the number of “servings.”

Frequency of fruit juice consumption

Because nutrition recommendations advocate eating fruit and vegetables rather than drinking juice, the DV for the frequency of fruit and vegetable intake, excluding juice, was used. The question on how many times per day respondents drank 100% pure fruit juice was used to examine the frequency of juice intake separately.

Covariates

Age was classified into three groups: children and adolescents (12 to 18), adults (19 to 50), and older adults (51 or older).

Sex was a self-reported dichotomous variable indicating male or female.

Household income deciles were produced for the 10 provinces. They account for rural/urban location and household size consistent with pre-tax low-income cut-offs relative to a 1992 base year.¹² The deciles were collapsed into quintiles. Because income information was not available for the territories, income estimates were not produced for these jurisdictions.

Region was categorized as: Atlantic (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, and New Brunswick), Quebec, Ontario, Prairies (Manitoba, Saskatchewan, and Alberta), British Columbia, and territories (Yukon, Northwest Territories, and Nunavut).

Body mass index (BMI) was based on self-reported height and weight and calculated by dividing weight in kilograms by height in metres squared (kg/m²). In accordance with Health Canada guidelines, adults were classified as: neither overweight nor obese (BMI less

than 25), overweight (BMI 25 to less than 30) or obese (BMI 30 or more).¹³ For respondents aged 12 to 17, age- and sex-specific cut-points defined by the World Health Organization were used to classify BMI.¹⁴ Analyses that used BMI excluded female respondents aged 15 or older who were pregnant or who did not answer the CCHS pregnancy question.

Statistical analyses

Linear regression assessed average annual changes during the 2007-to-2014 period in: 1) total frequency of fruit and vegetable intake; 2) frequency of fruit and vegetable intake excluding fruit juice; and 3) frequency of fruit juice intake. Rates were adjusted to the age structure of the Canadian population aged 12 or older as of July 1, 2014 to yield more valid comparisons of aggregate frequency of fruit and vegetable consumption rates over time and between populations.

With weighted frequencies and cross-tabulations, the average number of times per day fruit and vegetables were consumed was estimated by socio-demographic characteristics and BMI. Correlates of the frequency of consumption were examined with multivariate logistic regression, using a dichotomous outcome variable of less than 5 times per day versus 5 or more times per day, which is considered a proxy for better diet quality.⁶ Multi-collinearity was assessed using PROC REG and a variance inflation factor of 4 as a cut-off point for variable selection to ensure that the variables were not strongly correlated with others in the logistic regression models. Because income information was not available for the territories, region was excluded from the multiple logistic regression analyses.

Analyses were performed with SAS 9.3. Point estimates were generated with PROC SURVEYLOGISTIC, and bootstrap replicate weights were applied using BOOTVAR V3.1 for variance estimation (95% confidence intervals) and significance testing to account for the survey's complex sampling design.¹⁵⁻¹⁷

What is already known on this subject?

- The frequency of fruit and vegetable intake is an indicator of diet quality.
- Higher fruit and vegetable consumption is related to a reduced risk of nutrition-related chronic diseases.
- Annual cross-sectional data show low fruit and vegetable intake in Canada.

What does this study add?

- This study describes trends in the frequency of fruit and vegetable consumption among a nationally representative sample of Canadians aged 12 or older, by socio-demographic characteristics and BMI.
- Between 2007 and 2014, the frequency of fruit and vegetable consumption was consistently low.
- Those who reported consuming fruit and vegetables at least 5 times a day tended to be female, younger, in the highest household income quintile, and neither overweight nor obese.

Results

Slight decrease in frequency between 2007 and 2014

Canadians' average frequency of fruit and vegetable consumption (including juice) was 4.7 times a day in 2014, down from 5.0 times in 2007—a small, but significant, decrease (annual average decline of 0.05 times a day) (Table 1, Figure 1).

This trend was apparent across age groups, with annual decreases in consumption frequency of 0.07 times a day at ages 12 to 18; 0.04 times a day at ages 19 to 50; and 0.05 times a day at age 51 or older. Among both males and females, the annual decrease was 0.05 times a day.

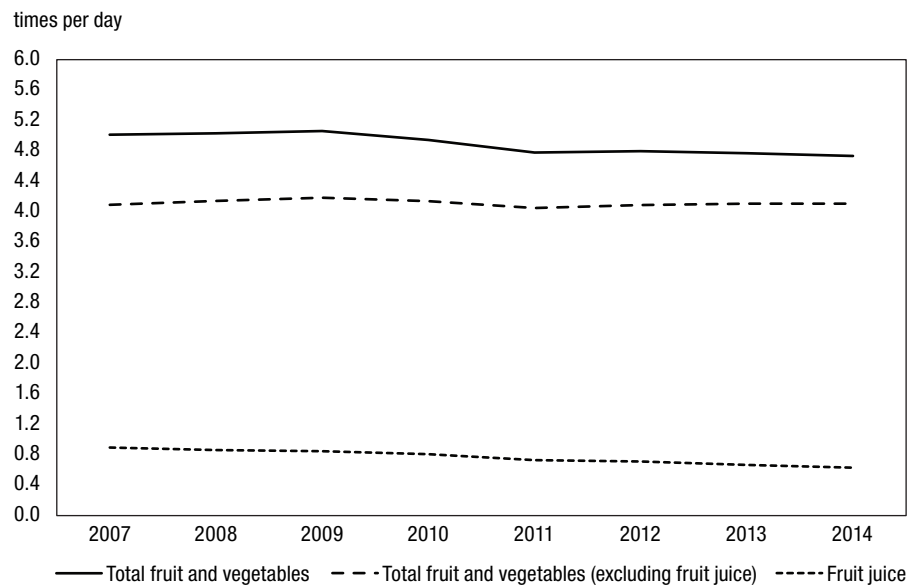
By household income, the largest annual drop in the frequency of consumption (0.06 times a day) was among the lowest income quintile, and the smallest (0.03 times a day) was among the highest. Annual decreases were observed across regions (except for the territories)—0.07 times a day in Quebec; 0.05 times a day in the Atlantic provinces and Ontario; and 0.04 times a day in British Columbia and the Prairies. Annual decreases were 0.04 times a day among people in the neither overweight nor obese BMI category, and 0.05 times a day in both the overweight and obese categories.

No significant decline when fruit juice excluded

To a considerable extent, these decreases reflected a slight decline in the frequency of fruit juice consumption from an average of 0.9 times a day in 2007 to 0.6 times a day in 2014, a slight but significant annual decline of 0.04 times a day (Figure 1).

When fruit juice was excluded from fruit and vegetable intake, the average frequency of consumption did not change between 2007 and 2014 (4.1 times a day in both years) (Figure 1, Table 1). As well, the trend no longer indicated significant decreases by age (except age 51 or older—an annual decline of 0.02 times a day), sex, BMI (except those who were obese—0.01 times a day), household

Figure 1
Average frequency of fruit and vegetable consumption, by food grouping, household population 12 and older, Canada, 2007 to 2014



Note: Age-standardized to July 1, 2014 Canadian population.

Source: Canadian Community Health Survey—Annual Component, 2007 to 2014.

income, or region (except Quebec—0.02 times a day). Slight increases were recorded for the highest income quintile (0.02 times a day) and the territories (0.05 times a day).

Excluding fruit juice, males' average frequency of fruit and vegetable consumption was lower than females' in both 2007 and 2014 (3.6 versus 4.5 times a day). As well, gradients observed in 2007 persisted in 2014, with frequency of consumption being lower with decreasing household income and rising BMI. In both 2007 and 2014, the frequency of consumption was lowest in the Atlantic provinces and the territories, and highest in Quebec.

Correlates of intake frequency in 2014

Results of logistic regression analyses show that, even when age, household income and BMI were taken into account, in 2014, females were significantly more likely than males to report consuming fruit and vegetables 5 or more times a day (OR 1.7, 95% CI: 1.6 to 1.8) (Table 2). The odds of reporting at least 5 times a day were significantly

lower for adults aged 19 to 50 (OR 0.5, 95% CI: 0.5 to 0.6) or 51 or older (OR 0.5; 95% CI: 0.5 to 0.6) than for 12- to 18-year-olds.

Compared with people in the lowest household income quintile, those in the highest had significantly greater odds of reporting at least 5 times a day (OR 1.2; 95% CI: 1.1 to 1.4), and those in the low-middle income quintile had significantly lower odds (OR 0.9, 95% CI: 0.8 to 1.0).

People who were overweight (OR 0.9, 95% CI: 0.8 to 1.0) or obese (OR 0.7, 95% CI: 0.6 to 0.8) were less likely than those who were neither overweight nor obese to report at least 5 times a day.

When fruit juice was excluded, many of the same relationships were observed. For instance, females' odds of reporting 5 or more times a day continued to exceed those of males (OR 1.8, 95% CI: 1.7 to 1.9).

Similarly, older age groups still had significantly lower odds (ages 19 to 50 OR 0.4, 95% CI: 0.4 to 0.5; age 51 or older OR 0.4, 95% CI: 0.4 to 0.5) of reporting at least 5 times a day, compared with children and adolescents.

Table 1
Average frequency of fruit and vegetable consumption, including and excluding fruit juice, by sex, age group, household income, region and body mass index (BMI), household population aged 12 or older, Canada, 2007 and 2014

	2007			2014			p-value [†]	Annual change (univariate linear regression analysis)
	Average times/day	95% confidence interval from	to	Average times/day	95% confidence interval from	to		
Including fruit juice								
Average (overall)	5.0	5.0	5.0	4.7	4.7	4.8	<.0001	-0.05
Sex								
Male [‡]	4.6	4.6	4.7	4.4	4.3	4.4	<.0001	-0.05
Female	5.4*	5.3	5.4	5.1*	5.0	5.1	<.0001	-0.05
Age group								
12 to 18 [‡]	5.3	5.2	5.5	5.2	5.1	5.3	<.0001	-0.07
19 to 50	4.9*	4.9	5.0	4.7*	4.6	4.8	<.0001	-0.04
51 or older	5.0*	5.0	5.1	4.7*	4.6	4.7	<.0001	-0.05
Household income quintile (excluding territories)								
Lowest [‡]	4.8	4.7	4.9	4.5	4.4	4.6	<.0001	-0.06
Low-middle	5.0*	4.9	5.1	4.6	4.5	4.7	<.0001	-0.06
Middle	5.0*	4.9	5.1	4.8*	4.7	4.8	<.0001	-0.04
High-middle	5.1*	5.0	5.2	4.8*	4.7	4.9	<.0001	-0.04
Highest	5.2*	5.1	5.3	5.0*	4.9	5.1	<.0001	-0.03
Region								
Atlantic [‡]	4.5	4.4	4.6	4.2	4.1	4.3	<.0001	-0.05
Quebec	5.5*	5.4	5.6	5.2*	5.1	5.3	<.0001	-0.07
Ontario	4.9*	4.9	5.0	4.6*	4.5	4.7	<.0001	-0.05
Prairies	4.8*	4.7	4.8	4.5*	4.5	4.6	<.0001	-0.04
British Columbia	5.0*	4.9	5.1	4.7*	4.6	4.8	<.0001	-0.04
Territories	4.2	4.0	4.5	4.3	4.1	4.5	0.346	0.02
BMI								
Neither overweight nor obese [‡]	5.2	5.1	5.2	4.9	4.9	5.0	<.0001	-0.04
Overweight	4.9*	4.8	5.0	4.7*	4.6	4.7	<.0001	-0.05
Obese	4.7*	4.6	4.8	4.4*	4.3	4.5	<.0001	-0.05
Excluding fruit juice								
Average (overall)	4.1	4.1	4.1	4.1	4.1	4.1	0.096	-0.00
Sex								
Male [‡]	3.6	3.6	3.7	3.6	3.6	3.7	0.381	-0.00
Female	4.5*	4.5	4.6	4.5*	4.5	4.6	0.680	0.00
Age group								
12 to 18 [‡]	3.9	3.8	4.0	4.2	4.1	4.3	0.267	0.01
19 to 50	4.0	3.9	4.0	4.1	4.0	4.1	0.115	0.01
51 or older	4.3*	4.2	4.3	4.1	4.1	4.2	<.0001	-0.02
Household income quintile (excluding territories)								
Lowest [‡]	3.8	3.8	3.9	3.8	3.7	3.9	0.061	-0.01
Low-middle	4.0*	4.0	4.1	4.0*	3.9	4.0	0.071	-0.01
Middle	4.1*	4.0	4.2	4.1*	4.0	4.2	0.894	0.00
High-middle	4.2*	4.1	4.2	4.2*	4.1	4.3	0.435	0.01
Highest	4.3*	4.3	4.4	4.4*	4.4	4.5	0.015	0.02
Region								
Atlantic [‡]	3.6	3.5	3.7	3.5	3.5	3.6	0.856	-0.00
Quebec	4.4*	4.3	4.5	4.4*	4.3	4.5	0.006	-0.02
Ontario	4.0*	4.0	4.1	4.0*	4.0	4.1	0.421	0.00
Prairies	4.0*	3.9	4.0	4.0*	3.9	4.1	0.641	0.00
British Columbia	4.3*	4.2	4.3	4.3*	4.2	4.4	0.361	0.01
Territories	3.3*	3.1	3.5	3.6	3.4	3.8	0.001	0.05
BMI								
Neither overweight nor obese [‡]	4.2	4.1	4.2	4.3	4.2	4.3	0.128	0.01
Overweight	4.0*	3.9	4.1	4.0*	4.0	4.1	0.636	-0.00
Obese	3.9*	3.9	4.0	3.8*	3.7	3.9	0.047	-0.01

* significantly different from reference category (p < 0.05)

[†] p-value for average annual change from 2007 to 2014 estimated using linear regression

[‡] reference category

Note: Age-standardized to July 1, 2014 Canadian population.

Source: Canadian Community Health Survey—Annual Component, 2007 to 2014.

People in middle income quintiles were significantly less likely than those in the lowest to report 5 or more times a day (high-middle OR 0.8, 95% CI: 0.8 to 0.9; middle OR 0.8, 95% CI: 0.7 to 0.9; low-middle OR 0.7, 95% CI: 0.6 to 0.8).

Individuals who were overweight (OR 0.9, 95% CI: 0.8 to 0.9) or obese (OR 0.7, 95% CI: 0.6 to 0.8) had lower odds of reporting at least 5 times a day than did those who were neither overweight nor obese.

Discussion

In Canada, as in other countries,^{18,19} fruit and vegetable intake is lower than recommended.^{8,20,21} Nationally representative data from 2007 to 2014 indicate that Canadians' reported frequency of fruit and vegetable consumption was consistently low and decreased slightly (by an average of 0.05 times a day per year, or a total of 0.3 times a day over the period). This was largely attributable to slightly less frequent fruit juice consumption; when fruit juice was excluded from the calculations, the decrease was not significant.

The slight drop in how often Canadians drank fruit juice may reflect a change in eating habits, possibly due to concern that juice is a source of free sugars.²² However, additional research is required to understand factors influencing the amount of juice consumed.

Sex, age, household income, and BMI were correlates of the frequency of fruit and vegetable intake, whether fruit juice was included or not. People who reported consuming fruit and vegetables at least 5 times a day in 2014 tended to be female, children or adolescents, in the highest income quintile, and neither overweight nor obese.

The low frequency of fruit and vegetable intake at lower income levels may be associated with limited availability (the supply of food to a region or community) and limited access (the ability of an individual or household to acquire nutritious food).²³ Socio-demographic factors have been related to reduced nutrient intake.^{24,25} For example, a study based on data from the first 24-hour recall from the 2004 Canadian Community Health Survey—Nutrition found that

Table 2
Adjusted odds ratios relating frequency of fruit and vegetable intake of at least 5 times per day (including and excluding fruit juice) to sex, age group, household income and body mass index (BMI), household population aged 12 or older, Canada, 2014

	Including fruit juice			Excluding fruit juice		
	Adjusted odds ratio [†]	95% confidence interval		Adjusted odds ratio [†]	95% confidence interval	
		from	to		from	to
Sex						
Male [‡]	1.0	...	...	1.0	...	...
Female	1.7*	1.6	1.8	1.8*	1.7	1.9
Age group						
12 to 18 [‡]	1.0	...	...	1.0	...	...
19 to 50	0.5*	0.5	0.6	0.4*	0.4	0.5
51 or older	0.5*	0.5	0.6	0.4*	0.4	0.5
Household income quintile (excluding territories)						
Lowest [‡]	1.0	...	...	1.0	...	...
Low-middle	0.9*	0.8	1.0	0.7*	0.6	0.8
Middle	1.0	0.9	1.1	0.8*	0.7	0.9
High-middle	1.0	1.0	1.2	0.8*	0.8	0.9
Highest	1.2*	1.1	1.4	1.0	1.0	1.1
BMI						
Neither overweight nor obese [‡]	1.0	...	...	1.0	...	...
Overweight	0.9*	0.8	1.0	0.9*	0.8	0.9
Obese	0.7*	0.6	0.8	0.7*	0.6	0.8

... not applicable

* significantly different from reference category (p < 0.05)

[†] adjusted for other variables in model

[‡] reference category

Note: Because of rounding, some odds ratios with lower or upper confidence limit of 1.0 were statistically significant.

Source: Canadian Community Health Survey—Annual Component, 2014.

adolescents and adults in food-insecure households had poorer diets, including lower intake of fruit and vegetables.²⁵ Regional variations in consumption may reflect less availability in some areas.²³

Consistent with other research,²⁶⁻²⁸ lower frequency of consumption was associated with higher BMI. A U.S. study with more than 400,000 partici-

pants, which was based on data from the 2007 Behavior Risk Factors Surveillance System, reported an inverse association between fruit and vegetable intake and obesity.²⁶ However, evidence of an association between fruit and vegetable consumption and prevention of weight gain or reduction of obesity risk is limited.²⁹⁻³¹

Strengths and limitations

A major strength of this study is the large, nationally representative dataset with uniform questions that allow trend analysis. It is limited by reliance on the “frequency” of intake outcome variable—type of fruit or vegetables could not be examined, and portions could not be quantified. Because the data were self-reported, estimates of consumption frequency and of BMI may be subject to error. As well, although survey questions specifically indicated that intake of 100% fruit juice does not include fruit-flavoured drinks or fruit punch, respondents may not have distinguished “fruit juice” from “fruit drink,” which could over- or underestimate the frequency of juice intake. Because household income was not available for the territories, region was excluded from the multivariate regression models. Finally, the fruit and vegetable module of the CCHS changed in 2015; as a result, statistical comparisons cannot be made directly with earlier years.

Conclusion

The frequency of fruit and vegetable intake in Canada is consistently low. Correlates of fruit and vegetable consumption indicate target populations that could be considered when planning nutrition policy and education initiatives. ■

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