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Consumption of ultra-processed and minimally processed foods by eating location and occasion in Canada

by Jane Y. Polsky, Virginie Hamel, and Jean-Claude Moubarac

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ABSTRACT

Introduction

There is mounting evidence about the negative dietary, health, and environmental impacts associated with high consumption of ultra-processed food and drink products (UPF) and low consumption of unprocessed or minimally processed foods and drinks (MPF). Eating context, including eating location and occasion, can influence food intake. This cross-sectional study used the most recent available national-level data for Canada to describe how consumption of UPF and MPF varied according to eating location and occasion.

Data and methods

The 2015 Canadian Community Health Survey – Nutrition provided 24-hour dietary recall data for Canadians aged 2 and older residing in the 10 Canadian provinces (n=20,080). Food and drink items were categorized using the NOVA classification. Descriptive statistics were used to characterize UPF and MPF consumption, as a percentage of energy intake, across four common eating locations (home, institution, restaurant, and other) and eating occasions (breakfast, lunch, dinner, and snack), overall and by age group.

Results

In 2015, overall, Canadians consumed most of their total daily energy at home (70.1%), and dinner accounted for 33.1% of energy intake. Meals consumed at home and in institutions (e.g., school, work) generally provided lower proportions of energy from UPF and higher proportions of energy from MPF compared with restaurants and “other” locations, with some variation by eating occasion and age group. Dinner consumed at home had the most favourable profile in terms of type of processing (overall, 30.6% of energy from UPF and 53.9% from MPF relative to total at-home dinner energy content). UPF intake in restaurants, as a proportion of energy consumed in restaurants, was high for all age groups (over 50% of energy), particularly for children and adolescents (over 65% of energy).

Interpretation

Eating location and occasion matter in terms of UPF and MPF energy intakes. These findings can inform the design of policies and programs aiming to encourage and support healthy eating environments.

Keywords

Canadian Community Health Survey, nutrition surveys, dietary intake, ultra-processed food, NOVA.

AUTHORS

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What is already known on this subject?

- High consumption of ultra-processed food and drink products (UPF) and low consumption of unprocessed or minimally processed foods and drinks (MPF) are associated with negative effects on human and planetary health.
- Contextual characteristics of eating environments, including the location of food consumption and eating occasion (e.g., breakfast, lunch), can influence food choices.
- Little is known about the locations where and occasions when Canadians consume UPF and MPF.

What does this study add?

- In 2015, home was the most commonly reported eating location for breakfast and dinner among Canadians aged 2 and older. Lunch was eaten at home by about half of respondents.
- Meals consumed at home and in institutions (e.g., school, work) generally provided lower proportions of energy from UPF and higher proportions of energy from MPF compared with restaurants and “other” locations.
- Dinner consumed at home provided the most favourable profile in terms of UPF and MPF energy intake for all age groups.
- UPF intake in restaurants, as a proportion of total energy consumed in restaurants, was high for all age groups, particularly for children and adolescents.
- Eating location and eating occasion matter in terms of UPF and MPF intake and can inform the design of policies and programs aiming to support healthy eating environments.

Unhealthy diet is a leading risk factor for disease burden in Canada.¹ The food environment in high-income countries, including Canada, is saturated with ultra-processed food and drink products (UPF).² The most recent (2019) Canada’s food guide for the first time added a recommendation to limit the consumption of highly processed foods because they undermine healthy eating.³ There is mounting evidence that high consumption of UPF is associated with negative dietary and health impacts.^{4,5} A recent comprehensive umbrella review based on evidence from nearly 10 million participants concluded that greater consumption of UPF was associated with elevated risk of 32 health outcomes, particularly cardiometabolic outcomes (e.g., overweight and obesity, type 2 diabetes, cardiovascular disease), common mental disorders (e.g., anxiety and depression), and premature mortality.⁴ UPF are also associated with a range of negative environmental impacts, including plastic pollution and intensive agriculture.^{6,7}

UPF are industrially manufactured products containing few, if any, whole foods and encompass a range of ready-to-eat or ready-to-heat products, such as soft drinks, many breakfast cereals, instant noodles, packaged breads and buns, and frozen meals.⁸ UPF are distinct from unprocessed or minimally processed foods and drinks (MPF) and processed foods, including fresh, frozen, dried, canned, and traditionally preserved foods. In Canada, in 2015, UPF consumption was high, comprising nearly half of total daily energy intake, with little variation across sociodemographic subgroups.^{9,10}

Eating behaviours are complex and subject to myriad sociocultural and contextual influences. The immediate location of food consumption (e.g., home, restaurant, work cafeteria) shapes both the available food options and contextual factors (e.g., eating alone or with others), which collectively influence the type and amount of food consumed.¹¹ Places of food consumption are also intricately linked with different types of eating occasions (i.e., breakfast, lunch, and dinner as main meals, and snacks as smaller-sized meals) in terms of food choice, meal construction, and what people perceive as acceptable or appropriate foods to consume at various occasions.^{12,13}

There is limited information on where Canadians consume different types of meals and, to the authors’ knowledge, no previous examination of Canadians’ UPF and MPF intake according to eating location and occasion. A better understanding of how dietary intake characterized in terms of processing type varies across common places where Canadians consume meals and snacks can inform strategies to foster healthy eating environments. Therefore, the current study’s objective was to characterize the consumption of UPF and MPF according to eating location and occasion in Canada using the most recent available (2015) population-representative nutrition data.

Data and methods

Data source

Data for this study came from the 2015 Canadian Community Health Survey (CCHS) – Nutrition.¹⁴ The survey target population was Canadian household residents aged 1 and older living in the 10 Canadian provinces. Full-time members of the Canadian Forces and individuals who lived on reserves or in other Indigenous settlements, in some remote areas, or in institutions were excluded from the survey. The 2015 CCHS – Nutrition has a sample size of 20,487 respondents, with an overall survey response rate of 61.6%. All survey respondents completed a dietary recall of all foods and drinks consumed, including descriptions and amounts, in the 24 hours prior to the interview day. About 30% of respondents completed a second dietary recall 3 to 10 days after the initial interview. However, these data were not used because group means from a single dietary recall represent unbiased estimates at the population level.¹⁵

Data for the first recall were mainly collected in person by trained interviewers.¹⁴ The Automated Multiple-Pass Method adapted for Canada was used to help respondents maximize their dietary recall and to provide information about the time of food consumption, eating location, and eating occasion. For children younger than age 6, a parent or guardian provided information; for children aged 6 to 11, the interview was

conducted with the child, with help from a parent; respondents aged 12 years and older provided their own information.

Study sample

The current study sample was composed of respondents to the 2015 CCHS – Nutrition aged 2 years and older. After excluding respondents younger than age 2, breastfeeding infants and children, and those who did not consume any energy on the previous day, the final analytic sample was 20,080 people.

The following age groups were defined to reflect major life stages, similar to previous studies:^{9,16} young children aged 2 to 5 years, children aged 6 to 12, adolescents aged 13 to 18, younger adults aged 19 to 30, adults aged 31 to 64, and older adults aged 65 and older. Sex-stratified analyses were also conducted but did not reveal any meaningful differences across eating locations or occasions; sex-stratified analyses were therefore omitted to optimize category-specific sample sizes.

Location of food consumption

Respondents were asked about the **location** where each reported food and drink was consumed (not where the food was prepared or purchased). If the location was somewhere other than home, respondents selected 1 of 18 location options. For this study, locations were collapsed into four categories to reflect the most common eating locations in the sample and optimize category-specific sample sizes:

Table 1
Percentage of consumers and mean energy contribution (percentage of total daily energy) by eating location, eating occasion, and age group, household population aged 2 and older, Canada excluding the territories, 2015

	All ages		Young children aged 2 to 5			Children aged 6 to 12			Adolescents aged 13 to 18			Younger adults aged 19 to 30			Adults aged 31 to 64			Older adults aged 65 and older			
	95% confidence interval		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval						
	%	from	to	%	from	to	%	from	to	%	from	to	%	from	to	%	from	to			
Eating location																					
Home																					
Consumers	97.4	96.9	97.9	98.0	96.5	98.9	97.7	96.4	98.5	97.6	96.5	98.4	95.9	93.4	97.5	97.2	96.3	97.9	98.7	97.9	99.3
Total energy (kcal)	70.1	68.9	71.3	73.7	71.3	76.1	65.8	63.8	67.7	67.5	65.4	69.6	64.0	60.2	67.7	68.7	66.9	70.4	83.6	81.9	85.4
Restaurant																					
Consumers	21.7	20.4	23.0	8.7	6.8	11.1	12.8	10.8	15.2	20.8	18.0	24.0	26.9	22.6	31.6	23.1	21.3	25.1	21.2	18.9	23.7
Total energy (kcal)	9.3	8.4	10.1	2.8	2.1	3.6	4.9	3.8	6.0	8.2	6.8	9.7	13.1	10.0	16.2	9.6	8.4	10.8	8.6	7.3	9.8
Institution¹																					
Consumers	32.5	31.1	33.9	36.8	32.5	41.3	50.4	46.9	53.9	39.9	36.6	43.2	41.1	36.1	46.3	34.1	32.1	36.2	9.3	7.5	11.5
Total energy (kcal)	11.4	10.7	12.1	13.7	11.8	15.7	17.3	15.8	18.8	12.5	10.7	14.2	13.7	11.3	16.1	12.1	11.1	13.1	2.8	2.1	3.6
Other²																					
Consumers	32.6	31.2	34.0	35.1	30.7	39.9	39.7	36.5	43.0	36.6	33.5	39.8	35.0	30.7	39.5	33.9	31.8	36.1	21.4	19.3	23.7
Total energy (kcal)	9.2	8.5	9.9	9.8	8.0	11.5	12.1	10.3	13.8	11.8	10.1	13.4	9.2	7.4	10.9	9.6	8.5	10.8	4.9	4.0	5.9
Eating occasion																					
Breakfast																					
Consumers	91.2	90.4	92.0	99.1	98.1	99.6	97.3	96.3	98.0	87.7	85.4	89.7	83.2	79.1	86.6	91.0	89.8	92.0	94.9	93.3	96.2
Total energy (kcal)	19.8	19.3	20.2	19.2	18.4	20.0	18.8	18.0	19.6	18.1	17.2	19.0	19.1	17.2	20.9	19.5	18.9	20.1	22.9	22.0	23.7
Lunch																					
Consumers	85.9	84.9	86.8	95.2	92.9	96.8	93.7	91.9	95.1	84.1	81.7	86.3	81.3	77.4	84.6	85.3	83.8	86.6	85.8	83.7	87.6
Total energy (kcal)	24.4	23.9	24.9	23.8	22.8	24.9	24.2	23.4	25.1	23.6	22.5	24.6	24.4	22.6	26.2	24.7	23.9	25.5	24.1	23.1	25.1
Dinner																					
Consumers	95.8	95.2	96.4	97.7	96.2	98.6	97.8	96.6	98.6	95.1	93.5	96.3	92.9	89.3	95.3	95.9	95.0	96.6	96.7	95.7	97.5
Total energy (kcal)	33.1	32.6	33.6	26.6	25.4	27.9	29.9	28.9	31.0	32.2	30.9	33.4	32.4	30.6	34.2	34.0	33.2	34.8	34.7	33.7	35.7
Snack																					
Consumers	94.5	93.6	95.2	99.1	98.2	99.5	97.8	96.5	98.6	94.4	92.7	95.8	94.2	91.9	95.9	94.2	92.9	95.3	92.8	91.3	94.0
Total energy (kcal)	22.7	22.0	23.4	30.4	29.0	31.7	27.0	25.8	28.2	26.2	24.8	27.6	24.1	21.4	26.8	21.8	20.9	22.7	18.4	17.4	19.3

1. Institution includes school, work, child care centre, and adult or family care centre.

2. Other location includes someone else's home; grocery store, corner store, or other type of store; sports or entertainment venue; car or other vehicle; extended consumption; church, temple, or other religious site; and location not stated.

Notes: Kcal: kilocalories. Consumers are people who consumed any energy at a given eating location or eating occasion on the previous day. The percentage of total daily energy (kcal) was calculated for all respondents (consumers and non-consumers).

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

- home
- restaurant (includes all restaurant types, such as full-service and fast-food, and bar, tavern, or lounge)
- institution (school, including school cafeteria; work, including work cafeteria; child care centre; adult or family care centre)
- other location (someone else's home; grocery store, corner store, or other type of store; sports or entertainment venue; car or other vehicle; extended consumption; church, temple, or other religious site; location not stated).

Eating occasions

Respondents self-reported eating (meal) **occasions**, selecting from a list of options (e.g., breakfast, lunch). All foods and beverages reported at the same time were grouped as a single eating occasion. This study categorized four eating occasions, as follows:

- breakfast (includes brunch)
- lunch
- dinner (supper)
- snack (includes snack, drink, extended consumption, and “other” eating occasion).

Classification of food items according to type of processing

This study used the NOVA system to categorize all foods and drinks reported by respondents into four mutually exclusive groups according to the extent and purpose of processing:⁸ MPF, processed culinary ingredients, processed foods, and UPF. MPF include foods such as fresh, dry, and frozen fruits and vegetables; milk and plain yogurt; eggs; fresh and frozen meat and fish; pasta; and grains and legumes. Culinary ingredients include vegetable oils, butter and sugar. Processed foods include canned fruits, vegetables and legumes; salted, cured and canned meat or fish; and freshly made breads and cheeses. UPF include a range of ready-to-eat or ready-to-heat products such as soft drinks, many breakfast cereals, instant noodles, packaged breads and buns, and frozen meals.

Classification of all food and drinks according to NOVA followed a previously described protocol.⁹ Briefly, the classification followed a two-step process. In phase 1, all ingredients, basic foods, and recipes without nutritional information (e.g., some granola bars) were classified into one of four NOVA groups based on food item description provided in the Canadian Nutrient File, 2015. In phase 2, mixed dishes were searched to flag common UPF (e.g., burger, pizza, doughnut). If the flagged dish was consumed in a quick-service restaurant, then all its underlying ingredients were reclassified as UPF. If the flagged dish was consumed anywhere other than a quick-

service restaurant, then the ingredient-based phase 1 classification was maintained.

Consumption of foods and drinks from each of the four NOVA groups was defined as their relative energy contribution, i.e., the percentage of energy intake (in kilocalories).

Statistical analysis

Descriptive statistics were used to generate percentages, means, and their associated 95% confidence intervals (CIs). This included estimating the percentage of consumers at each specific eating location and occasion, the mean total energy consumed at each eating location and occasion, and the mean energy contributions of UPF and MPF as proportions of total location-specific and/or occasion-specific energy intake. Most analyses were restricted to “consumers,” i.e., respondents who had consumed any energy at a specific eating location and/or occasion examined. The exception was the percentages of total daily energy intake according to eating location and occasion, which were calculated for the whole sample (i.e., for consumers and non-consumers combined). As a conservative approach, comparisons between subgroups were made by the CI overlapping technique. All analyses applied survey weights to account for the complex sampling design and non-response. Replicate (bootstrap) weights provided by Statistics Canada were applied to generate robust standard errors. Data analyses were conducted in SAS 9.4 and SAS-callable SUDAAN 11.0.3.

Results

Among Canadians aged 2 and older, UPF contributed, on average, 45.7% (95% CI: 45.0% to 46.4%) and MPF contributed 39.4% (95% CI: 38.7% to 40.0%) of total daily energy intake. Processed culinary ingredients accounted for 7.1% (95% CI: 6.9% to 7.3%) and processed foods accounted for 7.7% (95% CI: 7.5% to 8.1%) of total daily energy intake.

Consumers and energy intake by eating location and occasion

Nearly all respondents (97.4% overall and over 95% across all age groups) reported having consumed some energy at home on the previous day (Table 1). Home was also where respondents consumed, on average, the largest share (70.1%) of their total daily energy intake. Approximately one in three respondents had consumed some energy in an institution (32.5% overall) or an “other” location (32.6%). The percentage of consumers and total energy consumed at different locations varied somewhat by age group, particularly for restaurants and institutions. For example, 8.7% of young children aged 2 to 5 years had consumed some energy in a restaurant on the previous day, and these foods represented 2.8% of their total daily energy intake. By contrast, 26.9% of young adults had consumed energy in a restaurant, and this represented 13.1% of their total daily energy intake. For eating occasions, lunch was somewhat less commonly consumed (by 85.9% of respondents overall) than

other eating occasions (over 90% of consumers for breakfast, dinner, and snacks). Dinner contributed, on average, the highest share of total daily energy (33.1%) overall, and breakfast contributed the least (19.5%). The energy contribution of snacks was inversely related to age, with children and youth consuming more energy from snacks than adults (e.g., 30.4% of total daily energy from snacks among children aged 2 to 5 versus 18.4% of energy among adults aged 65 and older).

Energy intake from NOVA groups according to eating location and occasion

The contribution of NOVA groups to the total energy content consumed at each location for the overall sample is shown in Chart 1-a, and analogous estimates for eating occasions are shown in Chart 1-b. UPF contributed, on average, over 50% of the total energy consumed in restaurants and “other” eating locations, while MPF represented about 30% of total energy consumed in these locations (Chart 1-a). The mean shares of UPF and MPF were more comparable when meals were consumed at home (42.9% of total at-home energy from UPF and 42.1% from MPF). Estimates for UPF and MPF stratified by age group are shown in Appendix Table 1. These results show few differences according to NOVA and age group when meals were consumed at home and in “other” locations, and more notable differences for restaurants and institutions. For meals consumed in restaurants, children and adolescents derived, on average, over 65% of the energy consumed at these locations from UPF, whereas younger adults aged 19 to 30 derived 53.6% of energy from UPF. When school-aged children aged 6 to 12 and adolescents ate or drank something in an institution, UPF represented a significantly higher proportion of energy content consumed at this location (about 60%) compared with all other age groups (less than 50%) (95% CIs do not overlap).

For eating occasions overall, more than half of total energy consumed at breakfast (53.6%) and snacks (54.2%) came from UPF (Chart 1-b). Dinner provided, on average, the lowest share of energy from UPF (34.0%) and the highest share from MPF (50.9%). Age-stratified results show little variation according to UPF and MPF intake for breakfast and dinner (Appendix Table 2). For lunch, children and adolescents generally consumed more energy from UPF (over 50%) as a percentage of total lunch energy compared with adults. Snacks provided over 60% of energy from UPF for children aged 6 to 12 and adolescents versus approximately 50% for all other age groups.

Meal consumers by eating location

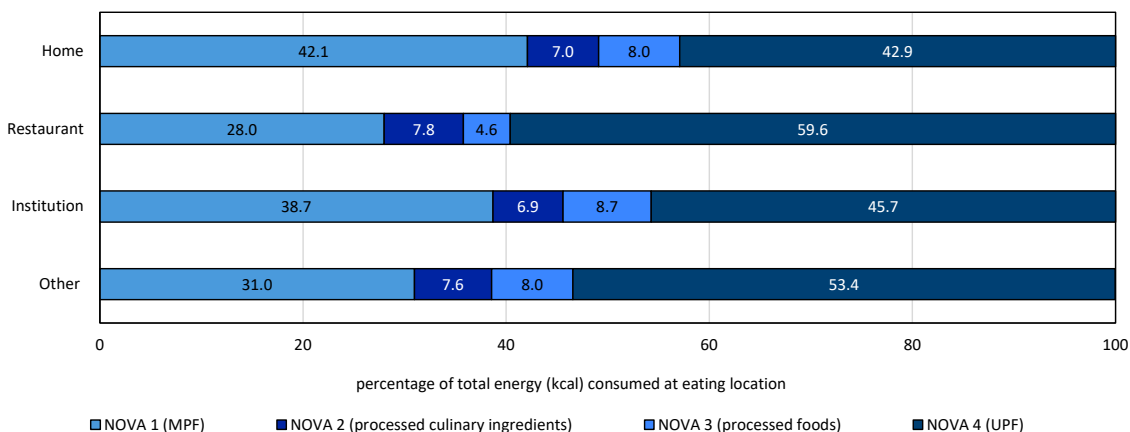
Chart 2 presents the overall percentage of main meal consumers by eating location. Most respondents (over 83%) reported having consumed breakfast and dinner at home, while over one-third of lunch consumers ate this meal in either an institution or a restaurant.

Multiple snacking occasions across the day at one or more locations were possible per person (data not shown). Among those who had consumed any non-zero energy snack on the previous day, 80.0% had snacked at home, 5.3% in a restaurant, 23.7% in an institution, and 21.5% in an “other” location.

Intake of UPF and MPF in specific eating location and occasion settings

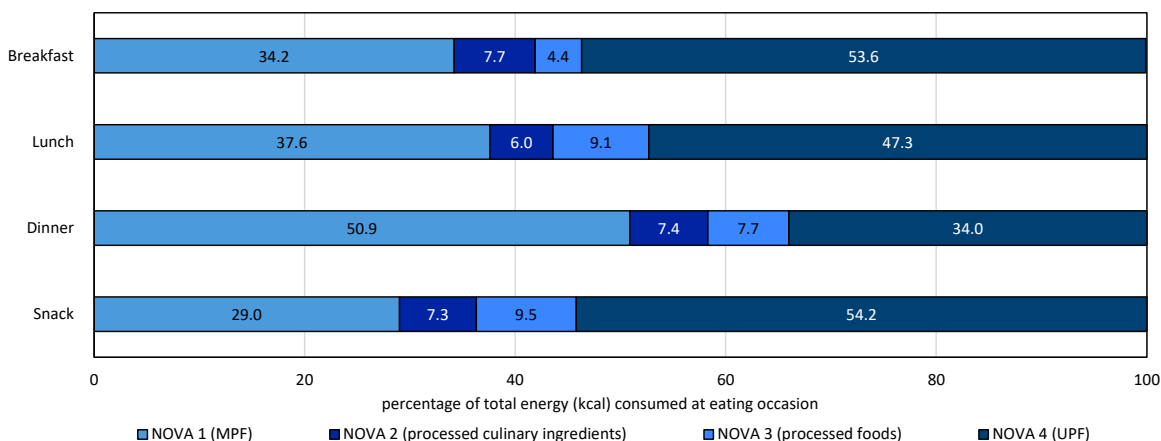
For consumers of a given meal occasion in a specific location, Chart 3 shows the consumption of UPF and MPF as mean shares of the total energy consumed at each eating occasion and location setting. For breakfast consumers, there was little variation in the shares of energy from UPF and MPF across eating locations. For lunch consumers, those who ate at home derived notably less energy from UPF (42.2%) and more energy

Chart 1-a
Mean energy contribution (percentage of kcal) of NOVA groups by eating location, household population aged 2 and older, Canada excluding the territories, 2015



Notes: Kcal: kilocalories; MPF: unprocessed or minimally processed foods and drinks; UPF: ultra-processed food and drink products. The percentage of energy (kcal) was estimated for consumers of any energy at a given eating location. Institution includes school, work, child care centre, and adult or family care centre. Other location includes someone else’s home; grocery store, corner store, or other type of store; sports or entertainment venue; car or other vehicle; extended consumption; church, temple, or other religious site; and location not stated.
Source: Statistics Canada, 2015 Canadian Community Health Survey – Nutrition.

Chat 1-b
Mean energy contribution (percentage of kcal) of NOVA groups by eating occasion, household population aged 2 and older, Canada excluding the territories, 2015



Notes: Kcal: kilocalories; MPF: unprocessed or minimally processed foods and drinks; UPF: ultra-processed food and drink products. The percentage of energy (kcal) was estimated for consumers of any energy at a given eating occasion.
Source: Statistics Canada, 2015 Canadian Community Health Survey – Nutrition.

from MPF (40.8%) than those who had consumed lunch in a restaurant (66.5% of energy from UPF and 23.5% from MPF) or an “other” location (54.0% of energy from UPF and 33.4% from MPF) (95% CIs do not overlap). Dinner consumers derived a notably low share of energy from UPF (30.6%) and a high share from MPF (53.9%) when they ate this meal at home. These patterns were consistent across age groups (data not shown).

Discussion

This descriptive study used the most recent available (2015) nationally representative nutrition data to characterize common places where Canadians consumed different types of meals (breakfast, lunch, dinner, snacks), and how consumption of UPF and MPF, measured in terms of their relative energy contributions, varied according to these eating locations and occasions. Home was the most commonly reported eating location for breakfast and dinner, while lunch was eaten at home by about half of respondents. Dinner provided the highest share (one-third) of total daily energy intake in the overall population. Meals consumed at home and in institutions (e.g., school, work) generally provided lower proportions of energy from UPF and higher energy proportions from MPF compared with restaurants and “other” locations, although with some variation by eating occasion and age group. Dinner consumed at home provided the most favourable profile in terms of UPF and MPF intake for all age groups. UPF intake in restaurants, as a proportion of total energy consumed in restaurants, was high for all age groups, particularly for children and adolescents. These findings suggest that contextual characteristics of eating environments (i.e., eating location and occasion) matter in terms of UPF and MPF intake. These findings can inform the design of policies and programs aiming to encourage and support healthy eating.

Home was the location where Canadians consumed most of their daily energy in 2015, and this was little changed since the previous national-level nutrition survey conducted in 2004.¹⁶ Home also provided, on average, the lowest proportion of total daily energy from UPF and the highest proportion from MPF compared with restaurants, institutions and “other” locations. These findings are generally consistent with previous evidence that eating away from home versus at home is associated with lower diet quality, higher total energy intake, and higher UPF intake.¹⁷⁻¹⁹ Consuming more meals at home can mean cooking more frequently, which has been associated with higher overall diet quality,²⁰ lower intake of UPF, and higher intake of MPF in the United States and United Kingdom.^{21,22} The 2019 Canada’s food guide proposes cooking as a strategy to support healthy eating habits and reduce reliance on highly processed foods.³

While this study lacked data on cooking and food preparation practices, it did observe variation in the processing profiles (i.e., relative energy contributions from UPF and MPF) of different at-home meal occasions that typically involve varying levels of food preparation. For example, UPF represented over half of the energy consumed at breakfast, both at home and in other eating locations examined. Breakfast tends to be a simple meal that requires little preparation, particularly when pressed for time, with commonly consumed foods being breakfast cereals and packaged breads.^{23,24} This study’s findings suggest that breakfast meals, whether consumed at home or out of home, can have similarly unfavourable processing profiles. By contrast, dinner consumed at home represented the most favourable processing profile relative to other meal occasions. The evening meal is typically the most substantial and structured meal of the day, lasting longer and involving more preparation than other meals.²³ In studies of foods consumed at various eating occasions across the day in Australian, Norwegian and U.S. samples, dinner was the largest contributor of vegetable and meat, poultry, or fish intake.²⁵⁻²⁷ Additionally, dinner

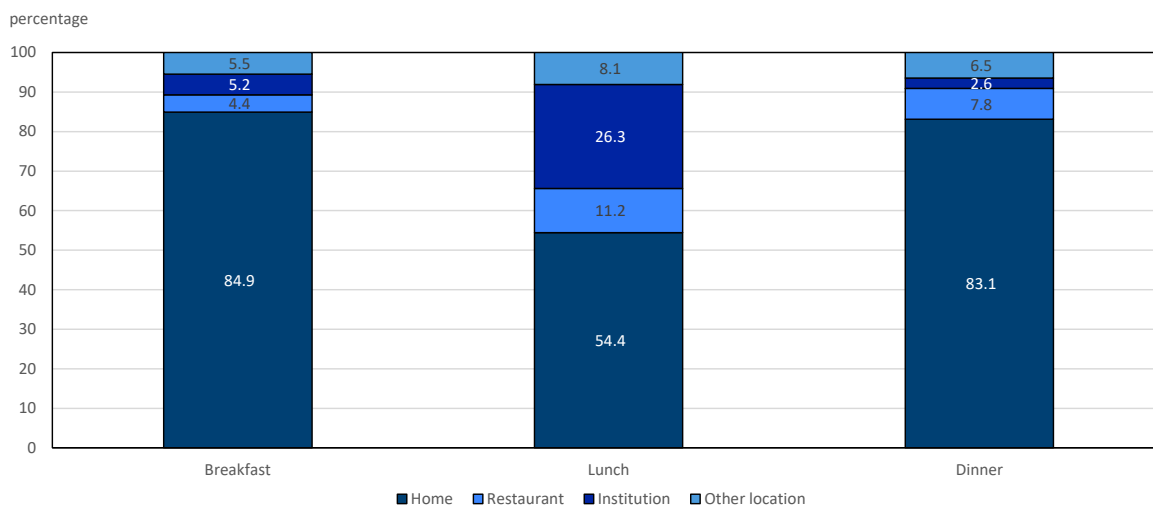
preparation often involves multiple household members (e.g., children helping to prepare food or set the table), and dinner is the meal most often eaten as a family.²⁸⁻³⁰ In Canada, more frequent engagement of young people in family meal preparation has been associated with higher consumption of fruits and vegetables and lower consumption of meals prepared away from home.^{28,29} Collectively, these findings point to the importance of the dinner meal in terms of its nutritional and processing profile. This information may be relevant to public health nutrition programs and messaging in Canada related to bolstering the dinner meal and improving the dietary quality of other meal occasions, such as breakfast.

When considering energy intake from UPF across all meals consumed at home, this study documented relatively high consumption (greater than 40% of at-home energy intake). Previous reports from the United Kingdom and United States similarly noted high levels of UPF consumption at home, even among individuals in households where meals were cooked regularly.^{21,22,31} This is not surprising given the ubiquity of UPF in the food supply,² the fact that ready-to-eat and ready-to-heat foods can be purchased outside and eaten at home, and the varying public perceptions of what constitutes “cooking” (e.g., cooking from basic or whole ingredients versus including ultra-processed ingredients and convenience foods).^{32,33} A recent Canadian study of young people aged 16 to 30 years estimated that more than one-quarter of all meals prepared at home over the course of a week were ready-to-eat or boxed foods (e.g., microwave, frozen, or packaged meals), but it did not distinguish between different meal occasions.³⁴ Findings of this study add to previous research by showing that in Canada, the energy share of UPF consumed at home was higher at breakfast and snacking occasions, rather than dinner or lunch.

Institutions such as daycare centres, school, and work were the second most common eating location after home. Children, adolescents, and working-age adults typically spend a large part of their weekdays at school or work and, as expected, consumed a greater share of their total daily energy in institutions than retirement-age adults aged 65 and older. After meals consumed at home, meals consumed in institutions, on average, provided the second-lowest share of energy intake from UPF and the second-highest energy share from MPF among the four locations examined. These findings are consistent with multiple European studies of adults that similarly found the nutritional quality of foods consumed at work and at home to be generally comparable.^{31,35,36} Bringing packed food from home to eat at work, which is a common practice among many adults, may contribute to the observed comparability, because the composition of packed food is likely to be similar to that of food consumed at home.³⁵

The current study observed age variation for meals (mainly lunches and snacks) consumed in institutions: for school-aged children and adolescents, UPF contributed a higher share of energy and MPF contributed a lower share of total energy consumed at these locations than for young children and adults. In the absence of a national school food program in Canada, school-aged children have relied largely on home-packed lunches or foods purchased off campus as the main sources of food consumed at school.³⁷ Findings of this study echo previous Canadian evidence that the nutritional quality of foods consumed by children and adolescents during school hours is suboptimal.^{37,38} As Canada prepares to develop its first national school food program,³⁹ these findings can inform the program’s development by expanding the understanding of Canadian children’s energy intake in institutions according to type of processing.

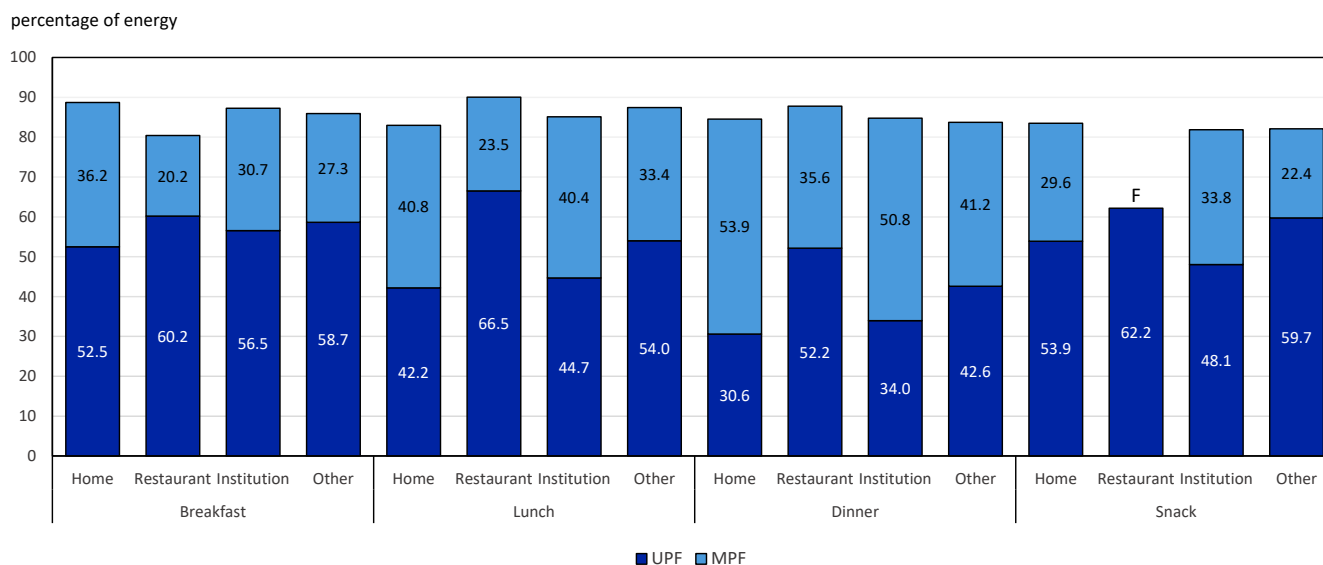
Chart 2
Percentage of meal consumers by location, household population aged 2 and older, Canada excluding the territories, 2015



Notes: Institution includes school, work, child care centre, and adult or family care centre. Other location includes someone else's home; grocery store, corner store, or other type of store; sports or entertainment venue; car or other vehicle; extended consumption; church, temple, or other religious site; and location not stated.

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

Chart 3
Mean energy contribution (percentage of kcal) of UPF and MPF by eating occasion and location, household population aged 2 and older, Canada excluding the territories, 2015



F too unreliable to be published

Notes: UPF: ultra-processed food and drink products; MPF: unprocessed or minimally processed foods and drinks; kcal: kilocalories. Institution includes school, work, child care centre, and adult or family care centre. Other location includes someone else's home; grocery store, corner store, or other type of store; sports or entertainment venue; car or other vehicle; extended consumption; church, temple, or other religious site; and location not stated. Analyses were restricted to consumers of any energy at a given eating occasion and location setting. Mean energy contributions of UPF and MPF were estimated relative to total energy consumed at a specific occasion and location setting.

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

Meals consumed in restaurants and “other” locations, including convenience stores, grocery stores, and sports and entertainment venues, consistently provided relatively high shares of energy from UPF and low shares from MPF. Additionally, foods prepared in restaurants, and particularly fast-food establishments, are typically nutrient poor and energy dense,⁴⁰⁻⁴² and their regular consumption has been consistently associated with lower diet quality, high energy intakes, and adverse cardiometabolic outcomes.^{17,43-45} The present study found that while UPF intake in restaurants, as a proportion of total energy consumed in restaurants, was high for all age groups (over 50%), it was particularly high for children and adolescents (over 65%). This is consistent with evidence that children’s transition into late childhood and adolescence is linked with deterioration of diet quality, including reduced intakes of MPF, such as fruits and vegetables, and higher intakes of energy-dense, nutrient-poor foods, such as fast food.^{46,47} A previous analysis of the 2015 CCHS – Nutrition showed that when Canadians ate out in a restaurant, for children and adolescents, it was more likely to be a quick-service restaurant (e.g., fast-food or pizza), while for adults, it was more likely to be a full-service (sit-down) restaurant.⁴⁸ Quick-service establishments typically offer substantially more UPF (e.g., soft drinks, ultra-processed hamburgers and fries) than full-service restaurants,³¹ and regular consumption of foods from quick-service establishments versus other restaurant types has been differentially associated with weight gain and adverse metabolic outcomes.^{44,45,49} Collectively, this evidence points to

the need for continued efforts to improve the healthfulness of foods and drinks offered in restaurants and other away-from-home settings, particularly those frequented by children and youth.

This study has several limitations. In the 2015 CCHS – Nutrition, “eating location” referred to the place where the food was consumed and not where the food was purchased or prepared. This means that some foods consumed at home, in institutions, or in “other” locations were obtained from sources other than the place of consumption (e.g., restaurant takeout meals consumed at home or work). Most meals consumed in restaurants were presumably directly purchased from these venues, and this is expected to attenuate differences between restaurants and other locations examined. Further, during classification of foods and drinks according to NOVA, some misclassification was likely introduced because of a lack of available details about product brands, types of food processing, and places of food preparation. Additionally, this study used data from a single 24-hour dietary recall, which does not capture all intra-person variability and thus may not represent the usual dietary intake of individuals. However, group means from a single dietary recall represent unbiased estimates at the population level.¹⁵

Results of this study are based on data from 2015. Although these represent the most recent available population-representative nutrition data for Canada, they may not reflect the current situation. However, rather than focusing on

prevalence estimates, this study examined patterns of UPF and MPF intake according to eating location and occasion, which retain relevance. More updated data on what Canadians are eating and drinking at various locations and occasions would provide valuable information for researchers, public health professionals, and policy makers. This is particularly relevant considering the current food environment that facilitates access to foods prepared away from home via meal delivery applications and the rising costs of food and other essentials since 2021.^{50,51} Future studies, including assessments of food intake according to type of processing, should examine meal location, occasion, and source (i.e., place of purchase and method of preparation) to gain a more comprehensive understanding of population dietary patterns and the multiple contextual influences on eating behaviours.

Conclusions

This descriptive national-level study characterizes the common locations where Canadians consumed various meals throughout the day and how energy intake from UPF and MPF varied across these contextual settings. Findings reveal that both eating location and occasion matter for levels of UPF and MPF intake. Results of this study reinforce the unfavourable role of restaurants in terms of UPF and MPF intake, particularly for children and youth, and highlight the favourable role of dinner consumed at home. These findings highlight the importance of contextual characteristics of eating environments for dietary intake, which can inform the design of policies and programs aiming to reduce UPF intake and promote the intake of MPF and, more broadly, inform strategies to foster healthy eating environments.

Appendix Table 1

Mean energy contribution (percentage of kcal) of UPF and MPF by age group and eating location, household population aged 2 and older, Canada excluding the territories, 2015

Age group (years) / Eating location	UPF			MPF		
	Mean (% kcal)	95% confidence interval		Mean (% kcal)	95% confidence interval	
		from	to		from	to
Young children aged 2 to 5						
Home	45.5	43.4	47.5	43.5	41.6	45.4
Restaurant	75.7	67.6	83.7	18.4 [£]	10.7	26.1
Institution	48.0	43.3	52.8	39.7	36.1	43.3
Other	59.2	54.0	64.5	30.0	26.0	34.0
Children aged 6 to 12						
Home	48.7	47.3	50.1	39.5	38.2	40.7
Restaurant	65.9	60.7	71.1	24.0	19.3	28.6
Institution	60.4	58.2	62.5	28.4	26.7	30.1
Other	61.0	57.4	64.5	25.7	23.4	28.1
Adolescents aged 13 to 18						
Home	46.8	45.3	48.2	40.0	38.6	41.4
Restaurant	71.1	66.6	75.7	18.4	15.0	21.8
Institution	60.2	56.7	63.8	29.0	25.9	32.1
Other	60.5	56.6	64.3	26.4	23.3	29.5
Younger adults aged 19 to 30						
Home	42.6	40.2	44.9	42.9	40.8	45.1
Restaurant	53.6	45.7	61.4	33.5	25.4	41.6
Institution	46.2	41.9	50.6	37.8	33.9	41.6
Other	54.1	47.9	60.3	31.2	25.9	36.5
Adults aged 31 to 64						
Home	40.8	39.6	42.0	43.0	41.9	44.2
Restaurant	60.9	57.2	64.5	27.0	24.4	29.7
Institution	40.0	37.5	42.5	42.8	39.9	45.6
Other	51.2	47.6	54.8	32.7	29.3	36.1
Older adults aged 65 and older						
Home	44.2	43.1	45.3	40.7	39.6	41.8
Restaurant	55.1	49.5	60.8	29.8	25.6	34.1
Institution	43.7	38.2	49.2	37.6	32.8	42.5
Other	46.1	40.4	51.8	32.0	28.4	35.6

[£]use with caution

Notes: Kcal: kilocalories; UPF: ultra-processed food and drink products; MPF: unprocessed or minimally processed foods and drinks. The percentage of energy (kcal) was estimated for consumers of any energy at a given location. Institution includes school, work, child care centre, and adult/family care centre. Other location includes someone else's home; grocery store, corner store, or other type of store; sports or entertainment venue; car or other vehicle; extended consumption; church, temple, or other religious site; and location not stated.

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

Appendix Table 2
Mean energy contribution (percentage of kcal) of UPF and MPF by age group and eating occasion, household population aged 2 and older, Canada excluding the territories, 2015

Age group (years) / Eating occasion	UPF			MPF		
	Mean (% kcal)	95% confidence interval		Mean (% kcal)	95% confidence interval	
		from	to		from	to
Young children aged 2 to 5						
Breakfast	53.8	50.7	56.9	39.3	36.5	42.0
Lunch	51.9	48.5	55.4	35.8	32.6	39.0
Dinner	35.4	32.2	38.7	52.5	49.6	55.5
Snack	52.3	49.6	55.0	36.0	33.7	38.3
Children aged 6 to 12						
Breakfast	57.5	55.3	59.6	34.6	32.8	36.4
Lunch	56.0	53.9	58.2	31.4	29.5	33.3
Dinner	36.8	34.8	38.7	48.8	46.9	50.6
Snack	65.3	63.1	67.4	23.8	22.1	25.4
Adolescents aged 13 to 18						
Breakfast	57.8	55.7	59.9	32.5	30.7	34.2
Lunch	55.6	52.6	58.6	32.0	29.5	34.4
Dinner	36.0	33.8	38.1	48.7	46.7	50.8
Snack	64.7	62.4	67.1	23.4	21.6	25.2
Younger adults aged 19 to 30						
Breakfast	53.8	49.9	57.7	33.4	29.7	37.1
Lunch	44.3	40.5	48.2	40.6	37.2	44.0
Dinner	34.6	31.5	37.7	51.0	48.0	54.0
Snack	55.0	50.9	59.2	29.4	24.9	33.9
Adults aged 31 to 64						
Breakfast	52.5	50.8	54.1	34.1	32.6	35.7
Lunch	44.9	43.0	46.8	39.2	37.4	41.1
Dinner	33.1	31.5	34.6	51.6	50.2	53.1
Snack	50.8	48.7	52.9	30.1	28.3	31.9
Older adults aged 65 and older						
Breakfast	53.5	51.6	55.5	34.7	32.9	36.6
Lunch	48.8	46.6	51.1	35.5	33.5	37.5
Dinner	33.8	32.2	35.3	49.9	48.3	51.5
Snack	51.7	49.4	54.0	29.7	27.7	31.6

Notes: Kcal: kilocalories; UPF: ultra-processed food and drink products; MPF: unprocessed or minimally processed foods and drinks. The percentage of energy (kcal) was estimated for consumers of any energy at a given eating occasion.

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

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