Is the 2019 Canada's Food Guide Snapshot nutritionally adequate?

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<td>Novelty bullets: points that summarize the key findings in the work:</td>
<td>Canadians who consume foods as depicted in the Food Guide Snapshot are likely to fall below calcium and vitamin D requirements</td>
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Is the 2019 Canada’s Food Guide Snapshot nutritionally adequate?

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Abstract: This analysis assessed the nutrient content of foods depicted in Canada’s Food Guide Snapshot. Nutrient contents per 2000 kcal were initially assessed by comparison to Daily Values (DVs). For essential nutrients provided in amounts <DVs, the probability of inadequacy was determined. DVs were met for “nutrients to limit”, dietary fibre, and most essential nutrients. However, the probability of calcium and vitamin D inadequacy for reference individuals in most age/sex groups exceeded 50% and ranged up to >90%.

Novelty Bullet

- Canadians who consume foods as depicted in the Food Guide Snapshot are likely to fall below dietary requirements for calcium and vitamin D.

Key words: Food Guide, nutrient adequacy, dietary requirements, calcium, vitamin D, Canada
Introduction

According to Health Canada’s document *History of Canada’s Food Guides from 1942 to 2007,* “food guides are basic education tools that are designed to help people follow a healthy diet” (Health Canada 2007). A fundamental aspect of a healthy diet is obtaining required amounts of essential nutrients. This was addressed in previous Food Guides by considering national dietary reference standards in place at the time; these standards were “part of the science that underpinned food guide recommendations” (Health Canada 2007). In 2007, the Dietary Reference Intakes (DRIs), developed in partnership by Health Canada and the United States’ Institute of Medicine (Institute of Medicine 2006), were used to assess the nutrient adequacy of *Eating Well with Canada’s Food Guide* (Katamay et al. 2007). This was done using a process based on recommendations for use of DRIs in dietary assessment (Institute of Medicine 2000).

Although the basic purpose of the Food Guide has not changed over time, the Food Guide has evolved to reflect progress in the science linking diet and health, and to address other considerations about food and eating. Among other modifications over time, the number of food groups represented has changed (Health Canada 2007). Guides released from 1944 to 1961 included five food groups (milk products, fruit, vegetables, grain products, and meats/alternatives). Fruits and vegetables were merged to a single group in 1977, and the Guide had four food groups until 2019. The current Guide ([https://food-guide.canada.ca/en/](https://food-guide.canada.ca/en/)) includes three groups of foods: vegetables and fruit, protein foods, and whole grains. The 2019 Food Guide also differs from other recent guides as it does not specify amounts that should be consumed from each food group; instead, relative proportions are shown (50% vegetables/fruit, 25% whole grains, 25% protein foods).

To date, information on the 2019 Food Guide provided on Health Canada’s website
(https://food-guide.canada.ca/en/) does not indicate how (or if) nutrient adequacy of the Guide was assessed, to determine whether it meets known requirements for essential nutrients. The only quantitative information provided to consumers is a photo, referred to as the Food Guide Snapshot, which depicts a plate of vegetables/fruits, protein foods and whole grains. Given that the Food Guide is intended to help consumers follow a healthy diet, it is reasonable to expect that the Snapshot would portray a variety of recommended foods that, if consumed over time in amounts sufficient to meet energy requirements, would also meet nutrient requirements. The analysis described below was conducted to determine whether this would occur.

**Methods**

**Nutrient content of Snapshot foods**

Although all foods shown in the Food Guide Snapshot are not intended to be consumed in a single meal or on a single day (i.e., neither an individual meal nor a day’s total intake would include all of the items shown in the Snapshot), it seems reasonable to speculate that the intent of the Snapshot is to convey examples of a variety of recommended foods that an individual could consume over a period of time. Accordingly, average nutrient intake over time of individuals following the suggested intake pattern would be approximated by the nutrient content of the foods shown, if consumed in amounts to meet daily energy needs.

The ASA24-Canada-2018 program (National Cancer Institute 2019), which incorporates the 2015 Canadian Nutrient File, was used to determine the nutrient content of foods shown in the Snapshot. (See Supplementary Table S1 for a list of foods included in the analysis.) The amount of each food was determined by counting when possible (e.g., number of carrot slices), or by visual estimates of volume. When selecting foods to enter
into the analysis, those without added salt were chosen, as this is recommended by the Guide. Because the potatoes and yams/sweet potatoes shown in the Snapshot appear to have been roasted, 1 tsp of unsaturated oil was added to the analysis.

**Initial comparison of nutrient content of Snapshot foods to Daily Values**

Canadian Daily Values (DV) have been established for nutrients, and are used in the Nutrition Facts Panel of food labels (Health Canada 2016). DVs for essential nutrients are based on the highest Recommended Dietary Allowance (RDA) or Adequate Intake (AI) for any of the DRI age/sex groups (excluding pregnant or lactating women). Since both the RDA and AI are thought to meet requirements of almost all healthy individuals (Institute of Medicine 2006), intake of essential nutrients at or above the DV would ensure dietary nutrient adequacy for almost all Canadians. Thus, nutrient content of foods shown in the Snapshot were initially compared to DVs for individuals aged 4 years and above (Health Canada 2016), by normalizing nutrient amounts to 2000 kcal, as this is the energy value used to derive several DVs (e.g., the DV for fibre is 28 g, based on the AI of 14 g/1000 kcal). As analyzed, the Snapshot foods contained 941 kcal, so nutrient amounts were multiplied by 2.13 (2000/941) to obtain values to compare to the DVs.

**Estimating probability of inadequacy for essential nutrients that did not meet DVs**

For essential nutrients provided in amounts below the DV, estimates were made of the approximate probability that intake would be inadequate (fail to meet requirements) for reference individuals in each of the DRI age/sex groups, assuming foods shown in the Snapshot were consumed in the proportions shown, and in amounts to meet energy needs. There were several steps in this process:

1) Energy requirements for DRI age/sex groups were estimated using equations provided from the Institute of Medicine (2005). For children aged 4-8 years, and for boys and
girls separately for those aged 9-13 and 14-18 years, estimated energy requirements of reference individuals at the midpoint of the age range were used, assuming a ‘low active’ physical activity level. For adults, energy requirements were estimated for ‘low active’ individuals at the midpoint of each DRI age range, assuming average height and a Body Mass Index (BMI) of 22.5 kg/m$^2$ (the approximate median of those in the normal BMI range).

2) The amount of the nutrient provided by Snapshot foods in amounts equal to the estimated energy requirement for each age/sex group was calculated.

3a) For nutrients with an Estimated Average Requirement (EAR), the probability that the nutrient amounts calculated in step 2 are inadequate was estimated by determining where they fall in the distribution of requirements (Institute of Medicine 2000). Intake at or above the RDA, an intake recommended for individuals, is 2 standard deviations (SD) above the EAR. It is thus estimated to meet requirements of “almost all” (>97.5%) healthy individuals in an age/sex group. The EAR, by definition, is inadequate for 50%, and intake that is >2 SD below the EAR would be inadequate for almost everyone (>97.5%). The probability of inadequacy at usual intakes between the RDA and 2SD below the EAR can be estimated by determining the number of SD by which intake is above or below the EAR for the age/sex group, and consulting a table of the cumulative frequency distribution of the standard normal curve. For example, for a nutrient with an EAR of 100 units and a SD of 10 units, usual intake of 90 units (-1.0 SD) would have a probability of inadequacy of ~84% (only ~16% of individuals would meet requirements), whereas usual intake of 110 units (+1.0 SD) would have a probability of inadequacy of ~16% (and meet requirements of ~84%).

3b) For nutrients with an AI, the nutrient amount was assumed to be adequate if it met or exceeded the AI.
Results

Nutrient content of Food Guide Snapshot foods compared to Daily Values

Figure 1 shows the nutrient amounts per 2000 kcal of the Snapshot foods expressed as a percentage of the DVs for individuals aged 4 years and above. Amounts of most nutrients compared favourably to DVs: “nutrients to limit” (saturated fat, cholesterol, sodium, and sugars) were provided in amounts below the DV, and most essential nutrients were provided in amounts that met or exceeded the DV, suggesting that the dietary pattern depicted in the Snapshot would meet or exceed requirements for these nutrients of “almost all” healthy individuals. However, amounts of calcium and vitamin D were well below their DVs, at 50% and 42% respectively, and potassium was 95% of the DV.

Estimated probability of inadequacy of Snapshot foods for calcium, vitamin D and potassium

Table 1 displays the estimated probability of inadequate calcium and vitamin D intakes for reference individuals by DRI age/sex group. For children, teens, and older adults (men >70 yr, women >50 yr), the probability of calcium inadequacy exceeded 97.5%: thus, almost all reference individuals would have inadequate intakes if they consumed foods shown in the Snapshot in amounts that met their energy requirements. The only groups in which the probability of inadequacy was below 50% were adult men aged 19-50, who have relatively lower calcium requirements and higher energy requirements than other age/sex groups. For vitamin D, the estimated probability of inadequacy was also substantial, ranging from 26% to 93% for reference individuals in DRI age/sex groups. In contrast, potassium intakes exceeded 100% of the AI for all DRI age/sex groups (range 144% to 203%). (See Supplementary Table S2.)

Discussion
The results of this analysis indicate that consuming a variety of foods from three food groupings (vegetables/fruit, whole grains and protein foods), as depicted in the Food Guide Snapshot, would meet Canadian’s dietary requirements for most nutrients. Particularly notable are the amounts of fibre and potassium, which are underconsumed by most Canadians (Health Canada 2012). Furthermore, the foods depicted in the Snapshot are low in “nutrients to limit”, such as saturated fat, sodium and sugars. However, a variety of foods from these three groupings – and by inference, the dietary pattern recommended by the Food Guide – was wholly inadequate in terms of meeting requirements for calcium and vitamin D.

It should be noted that the estimated probabilities of calcium and vitamin D inadequacy are based on a number of assumptions, including the specific amounts of foods shown in the Snapshot, which are recognized to be imprecise. However, this is likely to have had only a minor impact on the findings of this analysis. Moreover, even modestly higher amounts of calcium and vitamin D would do little to alter the conclusion that consumption of foods shown in the Snapshot leads to a high probability of inadequacy in reference individuals of all ages and both sexes, and by extrapolation, to a large majority of Canadians. For example, the gap between the amount of calcium provided by Snapshot foods and the RDA was >400 mg/d for the majority of age/sex groups, and >600 mg/d for males aged 9-13 yr, and for females aged 9-18 yr and >50 yr). Meeting a gap of 600 mg would require the addition of about 500 ml of fluid milk. Another key assumption is that energy needs are met by consuming only the foods shown in the Snapshot. It is likely that most individuals, even those who try to follow Food Guide recommendations, would include at least small amounts of other items such as added fats, added sugars, and foods with lower nutrient density than those depicted in the Snapshot. Assuming they do not exceed their energy needs (i.e., that these other items displace energy provided by Snapshot foods,
rather than being consumed in addition to them), calcium and vitamin D intakes could be lower, and thus the probability of inadequacy higher.

It is also important to recognize that the EAR for vitamin D is based on an absence of exposure to ultraviolet light (Institute of Medicine 2006). Available data suggest that for many Canadians, sunlight makes an important contribution to vitamin D status, as the proportions with low serum 25-OH-D levels are considerably lower than would be predicted based on dietary vitamin D intake (Vatanparast et al. 2010; Whiting et al. 2011). Nevertheless, vitamin D has been identified as a nutrient of concern for Canadians: 11% of whites and 33% of nonwhites had winter serum levels <40 nmol/L (Whiting et al. 2011). In an effort to address this, Health Canada recently proposed amendments to the Food and Drugs Act to increase the fortification levels of vitamin D in fluid milk and margarine (Government of Canada 2018). However, given the tiny amounts of milk products depicted in the Snapshot, and recommendations to use oils as spreads for bread and in cooking (Health Canada 2019), the effectiveness of this initiative may be limited.

**Conclusion**

The 2019 Canada Food Guide dietary pattern, as portrayed in the Snapshot, appears to be inconsistent with achieving one of the fundamental aspects of a healthy diet; namely, providing required amounts of essential nutrients. The calcium and vitamin D contents of foods shown in the Snapshot have a high probability of being inadequate for reference individuals in almost all DRI age/sex groups. Additional guidance is needed regarding a dietary pattern that provides adequate amounts of these nutrients, both for consumers as well as for registered dietitians using the Food Guide to plan menus for groups (e.g, school meals, hospitals, residential care facilities).
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Conflict of Interest

The author has no conflict of interest to report.

References


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Table 1. Estimated probability of inadequate calcium and vitamin D intakes from foods shown in Canada’s Food Guide Snapshot at median energy requirements

<table>
<thead>
<tr>
<th>Age/sex group</th>
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<th>Calcium</th>
<th>Vitamin D</th>
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<tr>
<td></td>
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<td>EAR; SD (mg)</td>
<td>Snapshot foods (mg)</td>
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<tr>
<td>Children 4-8 yr</td>
<td>1493</td>
<td>800; 100</td>
<td>481</td>
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<tr>
<td>Males 9-13 yr</td>
<td>1985</td>
<td>1100; 100</td>
<td>639</td>
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<tr>
<td>14-18 yr</td>
<td>2736</td>
<td>1100; 100</td>
<td>881</td>
</tr>
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<td>19-30 yr</td>
<td>2730</td>
<td>800; 100</td>
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<td>Females 9-13 yr</td>
<td>1813</td>
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<td>1000; 100</td>
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1. Energy requirements were estimated using Institute of Medicine equations for low-active individuals at the midpoint of the age range. For those <19 yr, median height and weight were used. For those ≥19 yr, estimates were for adults of reference height and BMI 22.5 kg/m².
2. Intake at the Estimated Average Requirement (EAR) meets requirements of 50% of an age/sex group. The SD is not shown for vitamin D for those aged >70 yr as requirements were considered more variable in this age group.
3. Snapshot foods were estimated to provide 644 mg calcium and 8.5 µg vitamin D per 2000 kcal. These values were used to calculate calcium and vitamin D provided by the Snapshot foods at median energy requirements of age/sex groups.
4. Intakes >2SD below the EAR are expressed as having a >97.5% probability of inadequacy; others probabilities were estimated using the cumulative frequency distributions of the standard normal curve. https://www.mathsisfun.com/data/standard-normal-distribution-table.html
5. Note that Dietary Reference Intakes for vitamin D are based on amounts required in the absence of exposure to sunlight. Accordingly, the proportions with inadequate vitamin D status (versus intakes) will be overestimated, given normal sunlight exposure.
**Figure Captions**

**Figure 1.** Comparison of nutrient content of foods in Canada’s Food Guide Snapshot (expressed per 2000 kcal) to Daily Values (DV). Saturated fat, cholesterol, sugars and sodium are considered “nutrients to limit”; accordingly, daily intakes below 100% of the DV are recommended. For other nutrients, intakes ≥100% of the DV would meet requirements of almost all Canadians.