

Drivers and Deterrents of Canadians Adopting Canada's New Food Guide and Using Plant-based Foods

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RESEARCH

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ABSTRACT

Recent global and national initiatives have placed greater emphasis on recommending foods that are healthier and more sustainable. However, the current attitudes underlying Canadian consumers' food choices, and the sociodemographic factors that drive or deter these choices are not well known. The aim of this study was to learn more about Canadian attitudes towards and perceptions of plant-based foods and the 2019 Canada's Food Guide (CFG). In an online survey, 1042 participants rated their attitudes towards plant-based foods and the new CFG. The impact of sociodemographic factors and the influence of environmental knowledge on participants' dietary choices were also assessed. Overall, (57.6%) participants were familiar with the 2019 CFG, which was influenced by their gender, age, income, and their level of education. Taste was identified as a barrier to consuming bean dishes in older

participants whereas 68.9% of participants consuming beans identified taste and ease of preparation as attractive features. Canadian consumers vary in the amount of plant-based foods consumed and some were conflicted in their willingness to purchase plant-based products. Environmental gains, taste, price, and convenience influenced food choices. Analyses of drivers and deterrents to change may inform strategies to increase consumer adoption of the new CFG and the use of more plant-based foods.

Keywords: Canada's Food Guide, Food choice, Plant-based, Sustainable, and Strategies.

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CAD	Canadian dollars
CF	Carbon Footprint
CFG	Canada's Food Guide
Gov	Government
LSD	Least Significant Difference
NA	Not applicable
P-B	Plant-based
SD	Standard deviation
Wk	Week

INTRODUCTION

In many developed countries, the food industry must confront challenges that threaten sustainable food production and the responsible management of natural



resources [1]. Multifaceted approaches with interventions from multi-sector stakeholders have been recommended as a strategy to mobilize meaningful change [2]. Initiatives such as the United Nations' global calls to actions, that emphasize the health and planetary advantages of the production and consumption of lower-emission foods, are important steps in strengthening food security, food sovereignty, and sustainability [3]. Moreover, food-based dietary guidelines that promote consumer education and support healthy eating decisions have the potential to also improve food security [4]. Indeed, some North American countries have already revised their national dietary guidelines to include more plant foods such as pulses, fruits and vegetables which are linked to better outcomes for human and planetary health [4]. In the United States, the current dietary guidelines for Americans recommend that people needing 2000 calories per day should include 2 cups of fruit, and 2.5 cups of vegetables in their daily diets [5]. In Canada, the most recent version (2019) of the Food Guide recommends 7-8 servings of fruits and vegetables for adult females (19-50 y), and 8-10 servings of fruits and vegetables for adult males of the same age group [6].

In the revised Canada's Food Guide (CFG) foods were grouped into three categories: (a) fruits and vegetables, (b), whole-grain foods, and (c) protein foods. One of the most prominent changes was the removal of the 'meat and alternatives' and 'milk and alternative' categories, and the addition of the 'protein foods' category. The revised 'protein foods' category contained an increased emphasis on plant-based proteins such as pulses, seeds, and nuts, and a decreased focus on traditionally consumed meats, like beef and pork which are linked to increased risk of chronic disease, animal welfare concerns, and unsustainable food production practices [1, 7]. These changes in the CFG were met with mixed reviews in different sectors. For example, dairy producers were concerned that the emphasis on plant-proteins would be detrimental for their industry. Conversely, health professionals applauded the use of health and nutritional science for evidence-based recommendations, and less reliance on industry-led information [8].

Although there is now growing evidence to support the use of plant-based foods and proteins as sustainable solutions to meet nutrition and health demands with a fraction of the environmental burden, purchasing sustainable foods can be a complex decision for some consumers [9]. Canadian consumers have deep cultural roots towards traditional diets, often privileging meat products [10]. However, compared to studies of ten years ago, Canadians appear to be consuming more plant foods such as pulses, particularly younger Canadians [11]. The willingness of participants to pay more for more sustainable foods can be a potential hindrance that negatively impacts their intent to purchase these products. Hoek and colleagues found that a lower food price, whether through subsidies, helped increase consumer purchase and consumption [11]. The cost of food has long been established as a barrier to making healthy and sustainable food choices [12]. Sajdakowska et al. [13] conducted face-to-face interviews in 2004 and 2011 and observed that the purchasing decisions of Polish consumers were more influenced by price and ease of cooking. In another study, Reipurth et al. [14] used an online survey, to evaluate a sample of Danish consumers' attitudes towards adopting more plant-based foods. The authors reported that although Danish consumers were aware of the recommendations about sustainable food consumption, negative attitudes related to taste and the perceived nutritional need for meat as a source of protein were identified as barriers to increased consumption of these products. Hoek et al. [11] also noted that Australians' attitudes to more sustainable products depended on their familiarity with, and how much they liked the healthier alternatives. Similar to the Polish study, the price of these foods was also an important factor that impacted Australian's food purchasing decisions.

Previous scholarship has also linked sociodemographic factors such as income, education, and age to consumers' willingness to purchase plant-based foods and their perceptions of these foods [14, 15]. Public discourse, national guidelines, and nutrition counselling all have influence in dietary selection. A recent study of



Canadian dietitians reveals their willingness to recommend plant-based foods in nutrition counselling and the value of promoting the national guidelines as a most recognizable diet-related educational tool in Canada [16]. Furthermore, Szejda, Bushnell, and Asher [17] argue that to-date, research on plant-based foods has focused on identifying acceptance rates, barriers, and benefits of these foods. A 2018 survey in Canada also highlighted that some Canadians (51.3%) intend to lower their meat intake [10]. However, it is less well-known how the general Canadian population can be described based on their sociodemographic characteristics and food choices. Accordingly, the aim of the present study is to better understand Canadian consumers' attitudes, perceptions, and practices regarding plant-based food choices particularly pulses or bean dishes and to determine whether those food choices reflect the recommendations in the new CFG. The impact of sociodemographic factors on participants' dietary choices, and their knowledge and perception of the environmental impacts of their food choices also are assessed.

MATERIALS AND METHODS

Recruitment of Participants

To access consumer attitudes and habits towards integrating plant-based food choices, invitations to participate were distributed to households across all Canadian regions and socio-economic groups and in both English and French via the Qualtrics research system. Qualtrics is an online survey platform with a subscription service that guarantees delivery of surveys to a representative sample of households in Canada. Recruitment was randomized from the database of Qualtrics households prepared to participate in surveys. Respondents were randomly chosen in two stages: first at the household level, and second at the individual level. Each household was assigned a number, and random numbers of different households were selected to participate. Participation in the study was limited to those with access to the internet and computer technology and know-how. Individuals willing to participate accessed the survey

anonymously through a URL provided in the recruitment advertisement. To obtain an effective measuring tool, a test-retest was conducted with an initial set of households using outreach via Qualtrics. Responses were sought from 10-15 respondents to test the survey. The reliability between tests was good, with a Pearson correlation of 0.9. After taking the test the second time, the "test respondents" were asked to indicate any terms or questions that needed clarification. After obtaining this input, revisions were made to increase clarity of the questions before launching the survey. Questions were translated into French and the meaning and tone for all questions was adjusted where needed. A total of twenty-three questions were included in the survey.

Determination of Sample Size

The sample size was estimated using an online calculator from Creative Research Systems (<https://www.surveysystem.com/sscalc.htm>) [18]. A confidence level and interval of 95% and 5%, respectively, and a population count of 37.59 million were used in the calculation. Our aims were to achieve geographical and socioeconomic scattering of consumers' characteristics and thereby obtain a representative sample of Canadians. For validity, eligible respondents had to have lived in Canada for twelve months and be at least eighteen years old. Similar approaches have been used in other consumer choice and food consumption studies [11, 19].

Survey Design and Data Collection

A cross-sectional survey was designed to obtain data on Canadian consumer attitudes towards adopting plant-based food choices, specifically pulses. Participants were asked questions relating to their: (1) attitudes towards pulses, plant-based foods, and Canada's food guide; (2) dietary choices and food planning; (3) pulse preparation and consumption; and (4) awareness of the environmental impact of certain food choices (Table 2). Each question was scaled on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 =

strongly agree), and respondents could rate their level of agreement.

However, question 11 did not follow the Likert scale model (Table 2). For this question participants were asked to rate how often they prepared pulse dishes, and the choices consisted of six items (“Yes, regularly”, “Yes, the majority of time”, “I try to most of the time”, “No, I do not prepare dishes with beans or pulses, for example, chickpeas, lentils, peas, etc. at least twice a week”). Participants were also asked to provide their demographic data and to indicate their current diet. Dietary types include an array of animal based and vegetarian diets. Vegetarian diets are those that exclude, in varying degrees, dairy and eggs, animal products and fish. Lacto-ovo vegetarian (exclude animal and fish products, while eggs and dairy products are included in their diet); pescatarian; vegan; flexitarian (vegetarians who occasionally eat meat and fish); or any religious or cultural diet. Finally, at the end, participants were invited to use open-ended style to record any additional comments regarding their dietary choices: (1) As a consumer I consider myself a vegetarian, Lacto-ovo vegetarian, pescatarian, vegan, flexitarian, religious or cultural preferences or no dietary preferences; (2) Is there anything you would like to add regarding dietary choices? The responses from the open-ended questions were reviewed and coded according to the themes that emerge from the data.

Statistical Analyses

Differences in the sociodemographic variables age, location, education, and income were assessed according to responses to each question. One-way analysis of variance (ANOVA) was used to identify levels of statistical significance. Post hoc multiple comparisons (Fisher’s LSD Test) were performed to identify which pairs of means were different. These analyses were performed using SPSS version 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). In addition, independent t-tests were used to determine whether men and women differed in their responses to each question in the survey. T-tests were performed using GraphPad Prism

version 8.4.1 for MacOS, La Jolla California USA, (www.graphpad.com). For all analyses, the statistical significance level was set at $p < 0.05$. Interactions effects were examined using simple regression models as outlined by Chung et al. (2017) [20] with some modifications. Although in some cases the scores were not normally distributed. The use of ANOVA is still appropriate due to the large sample size [21].

RESULTS

Demographic Data

A total of 1042 participants completed the survey in the present study with 53% women compared to 47% men. Fifty three percent of the participants were between 26-55 years old, and ~37% were aged >55 years. Conversely, only 9% of the participants were < 26 years (Table 1). Almost 44% of the participants earned incomes <50k, whereas ~52% earned incomes between 50-100k. However, those earning >100k represented the smallest group of participants (4.6%). Over half (56%) of the participants had a college or university level of education, whereas 28.9% had a secondary level or high school education. The numbers of participants who reported having a registered trade (7.1%) or an advanced university degree (7.9%) were similar. Most of the respondents (62.2%) lived in urban cores or suburban areas in Ontario and Quebec, with fewer participants from the Maritime Provinces (8.3%) and the Western part of the country (28.6%) (Table 1). The data obtained from the respondents also are compared to the data obtained from the 2016 Canada Census [22]. Compared to the Canada Census data [22], several biases were observed among the study participants. There was an under-representation of those who earned <\$35k, those >74 years old, and those who had some high school education. Conversely, there was an over-representation of study participants who earn >\$75k, those <26 years old, and those with an advanced university degree.

Responses from the open-ended questions also revealed the dietary habits of the participants (Figure 1). Among the respondents, 66.4% reported no specific dietary

habits or preference. The second highest percentage (14.7%) reported by participants was those who identified as flexitarians. Flexitarians are known to follow a vegetarian diet, but they also include some meat and fish [23]. Vegetarians accounted for 3.3% of the participants, whereas Lacto-ovo vegetarians (vegetarians who eat dairy) accounted for 1.1% of the study population. Consumers with specific religious or cultural dietary habits accounted for 2.6% of the study population, whereas another 10.1% selected the option labelled 'other'.

Canadians' Purchasing Habits and Adherence to the 2019 Canada Food Guide

Over half of the participants (57.6%) noted that they were familiar with the 2019 Canadian Food Guide, whereas 27.9% of participants neither agreed nor disagreed with the statement, and the rest disagreed (14.5%) (Table 2). The mean Likert scores suggests that overall, women participants were more familiar (3.6) than men (3.4) with the recommendations of the food guide (Table 2). Younger participants were no more familiar with the CFG compared to older participants ($p > 0.05$) (Table 3). However, a significant difference was observed in familiarity with the CFG between participants with lower incomes versus those who earned $>100k$. Similarly, participants with advanced university education were more familiar with the recommendations of the CFG compared to participants with some secondary level education. Most participants (63.3%) in the present study also agreed that the 2019 CFG was based on scientific evidence related to nutrition and health. More than half of the respondents (51.1%) agreed that they were familiar with plant-based foods such as pulses (dried seed of leguminous plants). However, perceptions towards plant-based foods differed significantly based on age ($P = 0.04$), income ($P = 0.01$), and level of education, ($P = 0.02$). Participants who earned $>100k$ and those with higher levels of education were more familiar with plant-based foods. Younger participants also appeared to be more familiar with plant-based foods (Table 3). Table 3 also highlights findings on food purchasing and consuming practices. Younger people were more familiar with the CFG and included beans

in their diets more than those older than 56 but slightly less than those 26-55 years of age. Willingness to pay did not seem to align with age but does appear to increase with levels of education and did not increase consistently with income.

Food Planning and Dietary Choices of Canadians

Overall, 82.6% of the participants reported that they always planned and prepared meals for themselves at least four days a week. In addition, most people indicated that they had many ideas for meals to make, and that they enjoyed making meals for themselves (67.6%) or family members (75.4%). Although many of these participants (78.7%) indicated that they purchased most of the food for their families, their dietary choices did not reflect adherence to the recommendations from the new CFG as indicated by their mean Likert scores of 3.1 ± 0.9 (Table 2). Participants with advanced University education registered mean scores of 4.0 ± 1.0 on a 5-point Likert scale, for ideas for meals and sources of recipes versus 3.6 ± 1.0 for those with some High School education (Table 3). It is noteworthy that women also had a more active role in food planning and managing their dietary choices, with registered mean scores of 4.4 ± 0.9 ($P < 0.05$) vs. 3.9 ± 1.1 for men (Table 2).

Table 3 shows the average responses for participants' familiarity with the new CFG, their purchasing practices related to including plant foods such as pulses in their weekly diet, and their willingness to pay more for plant-based foods. The impact of three sociodemographic factors on these responses age, annual income, and level of education are also highlighted. This analysis shows the willingness to adapt habits and the possible influence of external drivers, such as price or perceived affordability, of the products within participants' chosen dietary patterns.

Canadians' Purchasing, Preparation, and Consumption Decisions Regarding Plant-based Products such as Beans

The most pronounced reason selected for preparing meals with beans was the satisfaction and taste. Indeed, 79.2% of participants agreed that beans were

satisfying and tasty (Table 3). Participants 56-74 years old had the highest Likert scores for beans (4.0 ± 0.7), followed by those in the 41-55 age group (3.9 ± 0.8) (Table 3). The youngest demographic, <26 years old, consumed significantly ($P < 0.05$) less beans (3.4 ± 0.9) than those 56-74 (4.0 ± 0.7), 41-55 (3.9 ± 0.8), and 26-40 years old (3.8 ± 0.8) (Table 3). However, participants >74 years old were less likely (mean score 2.8 ± 1.3 , $P < 0.05$) to consume bean dishes due to tastiness when compared to the other age groups (Table 3). Participants who more frequently selected and prepared pulses in their meals represent a slightly higher education level (college or above) at 68% compared to 64% of the broader sample. When preparing plant-based foods such as beans, most of the participants (52.7%) preferred to use canned or processed beans. In addition, ease of preparation and convenience were also of great significance to 68.9% of participants (Table 2). On the other hand, the use of dry beans was not the preference for 25.9% of the participants, as they either strongly disagreed or disagreed with the question indicating that they did not like to or did not typically use these foods.

Canadians' Knowledge of and Interest in New Food Products and how this Impacts their Intention to Consume Plant-based Products

Data from the present study show that age and income were two key factors that limited the participants' willingness to purchase plant-based foods despite the environmental benefits of these products (Table 3). Overall, Canadians 26 years old or younger were more willing to spend more on these products (mean scores of $3.43(1.0)$ and $3.1(1.1)$, respectively) than individuals in any other age group investigated (Table 3). Participants who earned between \$50k - \$75k or higher, were more likely to purchase foods that had a positive impact on the environment. The level of education did not impact the willingness to purchase these products. On the other hand, in answering questions related to their willingness to pay more for plant-based food products, 31% of respondents purchased these products sometimes as indicated by their 'neither agree nor

disagree' responses (Table 2). In addition, many of the respondents were also familiar with the environmental (67.8%) and health benefits (68.5%) associated with the consumption of plant-based foods (Table 2). However, most participants (76.5%) agreed that because animal-based products require more land, water, and other resources than plant-based products, that the latter should be cheaper (mean scores, 3.9 ± 0.9) on a 5-point Likert scale (Table 2).

DISCUSSION

Consumers make their dietary choices based on internal and external influencers. Internal factors may include consumer attitudes towards food products or processes, anticipated health benefits, affordability, how they interpret social consequences of their choices, and the degree to which they may feel in control of their behaviour and the outcomes [19]. External factors, cited by Clark and Bogdan [25], may contribute to dietary behaviours. They make note of price, convenience, quality, and brand familiarity. The current study concurred with Clark and Bogdan [25] and Vainio et al. (2016) [26] regarding the influence of price and convenience. Brand and quality were not included in this inquiry. Compared to studies of ten years ago, Canadians appear to be consuming more plant foods such as pulses, particularly Canadians of younger generations [10]. More frequently these younger cohorts appear to be selecting bean or plant-based products or prepared or canned beans (Table 3). Further findings from Clark and Bogdan [25] found that interest in trying new plant-alternative foods were motivated by affordability (47%), availability (39%), meeting dietary needs (37%), ease of preparation (34%), and health concerns (29%).

Our findings reveal that for most Canadians, age and income were more likely to drive how they planned their meals and managed their dietary choices whereas, level of education had no significant impact ($P > 0.05$) on these activities (Table 3). Participants also seemed conflicted in their willingness to purchase plant-based products that were more expensive, even if they were better for the environment (33.1% disagreed; 35.9% agreed,

and 31% neither agreed nor disagreed). One participant added, "There is no way in the world that plant-based foods should be more expensive than meat." In contrast, in a similar Danish study that examined consumers' attitudes towards eating plant-based foods, participants ranked the attitude 'it is good for the environment to eat more plant-based food' with the highest level of agreement 4.0 ± 0.91 vs. a score of 2.69 ± 1.07 for the attitude 'it is expensive to eat a more plant-based diet' [27]. Hartmann and Siegrist [28] stated that participants' lack of awareness about different types of plant-based diets, health, and sustainability existed in older populations, however no significant differences in these age groups were found in the present study. This may be because older participants are more willing to accept nutrition education and guidelines from healthcare professionals as more are becoming health conscious as they age [28].

The unwillingness of participants to pay more for more sustainable foods suggests that although Canadians may be aware of recommendations that promote sustainable food consumption, cost maybe a potential hinderance that negatively impacts their intent to purchase plant-based products. Hoek and colleagues found that a lower food price, whether through subsidies or lower price, helped increase consumer purchase and consumption [11]. The cost of food has long been established as a barrier to making healthy and sustainable food choices [12]. A participant shared this view by adding, "It is difficult to follow the Canada Health Plan when all dietary choices are based on a very limited income." Another response was, "Cost has a lot to do with why I don't eat healthier. Simply can't afford it." However, whether it is cost or other factors driving the inclusion of pulses in the weekly diet is debated by some researchers. While pulses are cheaper than animal-based proteins, those attempting to transition to daily or weekly pulse consumption do not consider cost to be a primary motivator for this change [29]. However, Vainio et al. [29] also noted that consumers who had a history of pulse consumption considered the low-priced pulses to be the driver. With a growing availability of a variety of plant-based foods, consumers find great variation in price on

foods such as dry beans compared to value-added bean dishes or compared to processed meat alternatives. Higher costs associated with new plant-based products may be linked to the unwillingness to incorporate plant-based foods in the diet as found in the present study (Table2).

Another possible explanation for the seemingly indecisive responses for intent to purchase plant-based products could be related to the fact that most of the participants (66.2%) indicated that they had no dietary preferences (Figure 1). This is an interesting result since 53% of the participants in the present study were women. A similar study with 42.2% male and 57.8% female University participants, reported significantly higher mean intention among females (2.66 ± 1.75) vs. males (2.02 ± 1.38) to adopt plant-based diets (28). Indeed, Rothgerber (30) proposed that vegetarianism is most often associated with women and feminine behavior whereas more men equate meat eating with 'masculine traits' of strength and virility. What, then, does this mean for the widespread adoption of plant-based diets in the Canadian landscape? Love and Sulikowski (31), and Bird (32) proposed that in traditional ecological contexts men generally hunted large game whereas women tended to cook the game or gathered plant-based foods. Greenebaum and Dexter (33), however, showed that many vegan men do not aim to fit into the mainstream, choosing instead to redefine and reconstruct a form of hybrid masculinity. Clearly, the gendered landscape of food consumption is a complex notion that extends beyond this study. Gender, along with other factors, like education and income, can present as challenges to the uptake of diets based on plant-based foods.

Responses also varied greatly as to whether dietary choices reflect the recommendations from the new CFG. Most of the participants (45.2%), neither agreed or disagreed, and only 31% agreed or strongly agreed while 24% disagreed or strongly disagreed.

However, the mixed Canadian response to the CFG is not unique since similar objections to national guidelines on diet have been reported in a British survey in which 42% of the participants indicated disinterest in following guidelines as they felt Government should not provide

advice on what the population should eat or drink [34]. Furthermore, Ruan et al. [19] reported that most Canadians still consume red meat and other animal-based products multiple times per week despite the 2019 Canada's Food Guide recommendations. In the current study, 15.5% indicated they were flexitarians, individuals who follow mostly plant-based diets but eat meat in moderation. As vegetarians accounted for 3.3% of the participants, lacto-ovo vegetarians 1.1%, vegans at 1.8%, and those choosing diets according to religious practice 2.6%, this suggests that it is a minority of 8.8% that demonstrates the closest adherence to CFG in this study. Those indicating 'other' as dietary choice also may be a group prepared to make some changes. Consequently, if more adherence to the CFG is desired, more assistance from governments, for greater affordability and accessibility of healthy food, seems to be a sensible recommendation as underscored by participants. Two such notations were "diminuer le prix des vegetaux" (meaning: reduce the price of vegetables) and "make healthier food less expensive so people can actually afford to eat better". Thus, it appears that consumers' attitudes to national guidance on healthy eating do not exist in a vacuum but may be impacted by other factors including economic, social, and cultural aspects. These factors also influence dietary patterns and may help or hinder intentions to purchase plant-based foods [35].

To better characterize some of the drivers and deterrents that guide Canadians' purchasing decisions and consumption patterns we reviewed the comments that were stated at the end of the survey. Some remarks include, "I still enjoy and believe that old fashioned meat is still good for me"; "[I'm] not convinced that the production of plant-based products actually reduces the carbon footprint" and "Sorry I am meat eater Irish, steak and potatoes." Importantly, 66.2% of the participants reported in the survey that they had no dietary preference, whereas 71.5% were aware of the environmental benefits of plant-based products and selecting for better health also were mentioned. "I'm always looking into food that will improve my mental health." Another added, "I like to eat more fibre" and another wrote, "I think that a plant-based diet is the

best choice going forward." However, when asked to indicate their willingness to purchase these foods, it became clear that some respondents remained unsettled about whether the costs of incorporating more plant-based diet in their food choices outweighed the benefits (Table 2). Tobler et al. [36] further emphasize that changing consumer behaviour is by no means linear and can be impacted by several drivers including sensory appeal, environmental benefit, convenience, and price. For example, one respondent noted, "I have not tried beyond meat alternatives but do want to at some point." Another wrote, "[p]eople can't always eat the healthy choices they wish to." Shepherd [37] also reasoned that food choice is as much a social and cultural act as it is an individual one. While not discussed in this paper, the political role in healthy diets needs to be further underscored.

Correlations are well established between individual diets, household habits, disease, obesity and food environments and the Government policies that support the availability of unhealthy foods [38]. Furthermore, Atkins and Michie [39] purport that motivation to change behaviour is a reflective process in which intentions or plans should overcome the automatic processes including our wants and impulses. Lea et al. [15] describe it this way, "the benefits of change need to outweigh the barriers of behavioural change". One respondent summed up this notion by adding, "I tend to try to eat a balanced diet that isn't too restrictive while also being considerably more healthy than not."

This study is limited by the questions posed and those not included. For example, in Section-3, questions were raised specifically about beans; yet for some, beans have some undesirable properties. Maybe the responses would have been different if chickpeas were mentioned instead. Other themes could have been explored such as gaining insights on sources of information, trust in the products and the features and benefits of each product. The sampling procedure used in the present may also limit generalization of the results. For example, most of the participants were from Atlantic Canada, whereas participants from Quebec and the Prairie Provinces were under-representation in the sample pool (Table 1). Using a

geographically random selection procedure would have provided a more representative sample of Canadian participants. Other limitations may be related to self-reporting errors and participants' social desirability biases, which is the tendency to present oneself in a way that is perceived to be more socially acceptable [40]. Berge and Labonté (2020) [41] emphasize that the latter may lead to overestimation of socially desirable attributes which reduces heterogeneity in the overall responses obtained. These biases may have occurred because the study was administered online. The use of self-administered questionnaires has been suggested as one strategy that may limit the occurrence of these biases. Future research on this topic may consider using this approach [41]. Nevertheless, this was an exploratory study, and we have provided new evidence to support a fundamental understanding of Canadians' attitudes, perceptions and intended actions towards plant-based food products. We have shown that while many Canadians are familiar with the 2019 CFG, the adoption of the guidelines was low. Potential areas of focus for future research include addressing the limitations identified and evaluating the impact of messaging on consumers' willingness to adopt more plant-based foods.

CONCLUSION

This study reveals some helpful strategies for moving the field forward. As noted, consumers' attitudes to healthy eating through national guidance are not formed in isolation, so care is needed to develop economic, social, and cultural supports to aid in accelerating dietary shifts. There are numerous demographic factors which influence consumers' willingness to adhere to nutrition guidelines, including adapting to a plant-based diet. Plant foods, including pulses, hold the potential to substantially reorient food patterns, shift diets and culinary priorities to foster more equity, health, and environmental benefits. Purchase decisions are propelled by a broad range of motivations (emotions, perceptions, values, social norms, routines, convenience, and familiarity), and the challenges for public health practitioners, food industry and researchers are to

adequately address these different issues. This study shows that consumers vary in the amounts of plant-based foods consumed and their reasons for this. Some seek health and environmental gains while others may be influenced by taste, price, and convenience. Consideration of motivations and attention to barriers are needed to aid in increasing the adoption of plant foods. Helping consumers to increase their knowledge of food preparation can help with advancing dietary shifts. The gendered landscape of food consumption also needs attention as consumers are invited to re-work, redefine, and reconstruct their relationships with and identity around food.

Consumers who are striving to reduce their meat consumption are a potential population to offer guidance on increasing their plant-based consumption. This population, along with vegans, vegetarians, and other plant-based consumers, appear to exhibit a degree of willingness to change dietary behaviour and try new foods and unfamiliar tastes. Consumers may need more access to information and exposure to plant foods, along with incentives to increase their appetite for and consumption of plant-based foods, particularly pulse-based products. Ethical or health-based appeals for shifts in diets based on rational persuasion may be too narrow in the context of today's consumer society as there is no clear boundary between "responsible" citizens and "irresponsible" consumers.

Beyond a focus on individual or household consumption, more attention is needed for public education and political and cultural supports to illuminate economic, environmental and health benefits driving the calls for greater plant-based dietary patterns. Governments could help to increase consumer willingness to purchase more sustainable foods by aiding with lower food prices, whether through subsidies to producers or incentives to consumers. Private and public interests are intertwined in the act of consumption as well as in consumers themselves.

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Conflict of Interest

Authors state no conflict of interest. No funding was obtained for this research.

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PEER REVIEW

Not commissioned. Externally peer reviewed.



FIGURES

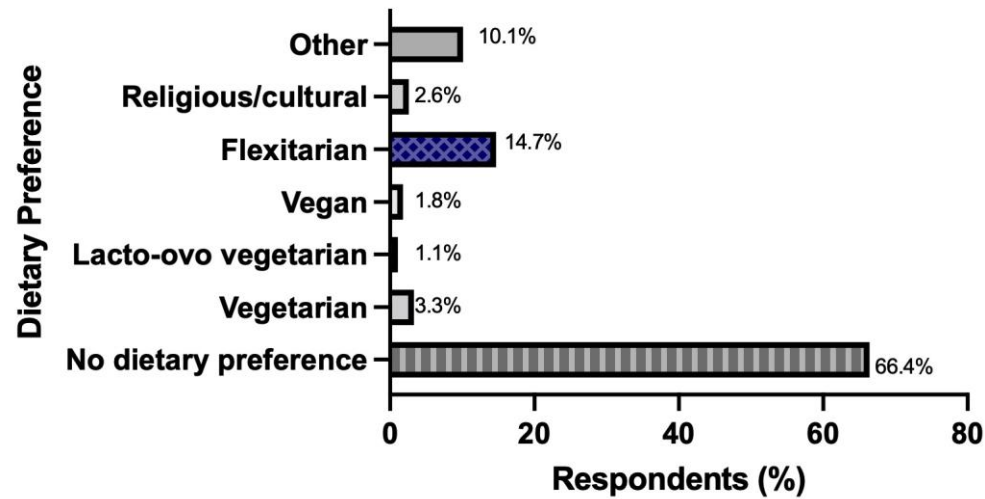


Figure 1. The dietary habits of the participants.



TABLES

Table 1. Sociodemographic characteristics of respondents. The number of respondents (n) who participated are indicated in brackets. The data obtained from the respondents were compared to data obtained from the 2016 Canada Census.

Current Survey Demographics	Survey Respondents (n)	Respondents (%)	2016 Canadian Population (%) [*]
Gender	(1040)	100	100
Men	488	47.0	48.6
Women	522	53.0	51.4
Age (years)	(1042)		
Before 1946 (>74)	38	3.65	9.04
1946 – 1964 (74-56)	354	33.9	41.7
1965 – 1979 (55-41)	275	26.4	26.3
1980 – 1994 (40-26)	281	27.0	24.5
After 1994 (< 26)	94	9.03	2.31
Income (\$CAD)	(1042)		
Under \$35k	51	27.6	42.7
\$35k-\$49,999k	250	16.0	18.3
\$50k - \$74,999k	74	22.6	18.9
\$75k - \$99,999k	302	15.1	9.93
\$10k - \$149,999k	282	14.2	6.72



Over \$15k	83	4.61	3.50
Education	(1042)		
Some high school	128	4.90	14.0
High school diploma	176	24.0	23.7
Apprenticeship or trade	385	7.11	10.8
College or non-university	263	29.0	22.4
University education	86	27.0	23.9
Advanced university Education	4	7.97	1.52
Location	(1042)		
Atlantic Canada	287	8.26	6.43
British Columbia	166	12.3	13.5
Northern Region	235	0.38	0.33
Ontario	157	37.0	38.8
Prairies	148	16.9	15.8
Quebec	49	25.2	22.5

* Source: Statistics Canada (19). CAD, Canadian dollars.



Table 2. Mean responses from consumer survey and the combined percent responses for respondents that agreed or strongly disagreed to the question asked. The impact of gender is also shown as the mean responses and the standard deviation (SD) values.

Short version of questions and statements	Total Mean Responses (\pm SD)	Agree + Strongly Agree (%)	Neither agree nor Disagree (%)	Disagree+ Strongly Disagree (%)	Men	Women
<i>Attitudes towards plant-based foods and, the CFG</i>						
1. I am familiar with the CFG	3.5 (0.9)	57.6	27.9	14.5	3.4 (0.9) ^a	3.6 (0.9) ^b
2. Evidence base of CFG	3.7 (0.8)	63.3	28.5	8.2	3.7 (0.8)	3.7 (0.9)
3. I include pulses in my weekly diet	3.3 (1.1)	51.1	22.8	26.1	3.3 (1.9)	3.3 (1.1)
4. Lower CF is reason to shift diet	3.7 (0.9)	67.8	22.2	10.0	3.7 (0.9) ^a	3.8 (0.9) ^b
5. Pulses, reason to ↓ meat in diet	3.8 (0.9)	68.5	20.4	11.0	3.7 (1.0)	3.8 (0.9)
<i>Dietary choices and food planning</i>						
6. I plan & make meals ~ 4 times/wk	4.2 (0.9)	82.6	9.9	7.3	4.0 (0.9) ^a	4.3 (0.9) ^b
7. Dietary choices reflect new CFG	3.1 (0.9)	30.8	45.2	24	3.1 (0.9)	3.1 (0.9)
8. Many ideas/resources for recipes	3.8 (1.0)	67.6	19.7	12.7	3.7 (0.9)	3.8 (1.0)
9. I enjoy making my meals	4.0 (0.9)	75.4	15.5	9.1	4.0 (0.9)	3.9 (1.0)
10. Purchase and plan most meals	4.2 (0.9)	78.7	12.5	8.8	3.9 (1.1) ^a	4.4 (0.9) ^b
<i>Pulse Preparation and Consumption</i>						
11. Do you make dishes with pulses?	2.9 (1.1)	67.6	14.1	na	2.2 (1.1)	2.2(1.1)
12. I use dry beans for bean dishes	3.2 (1.1)	37.9	36.2	25.9	3.2 (1.1)	3.1 (1.1)



13. I use cooked beans for bean dishes	3.4 (0.9)	52.7	29.4	17.5	3.4 (0.9)	3.4 (1.0)
14. Bean dishes are convenient to make	3.7 (0.8)	68.9	25.0	6.1	3.4 (1.0)	3.7 (0.8)
15. Bean dishes are tasty & satisfying	3.9 (0.8)	79.2	18.0	5.8	3.9 (0.8)	3.9 (0.8)
16. I have purchase & enjoy P-B foods	3.1 (1.3)	46.8	15.8	37.4	3.1 (1.3)	3.2 (1.3)
17. I plan to purchase more P-B foods	3.4 (1.0)	51.8	30.1	18.2	3.4 (1.0)	3.5 (1.1)
<i>Awareness of the environmental impact of certain food choices</i>						
18. Willing to pay more for P-B foods	3.0 (1.1)	35.9	31.0	33.1	2.9 (1.2)	3.1 (1.1)
19. I prefer to buy P-B foods	2.6 (1.1)	25.9	34.6	39.5	2.8 (1.1) ^a	2.9 (1.1) ^b
20. Gov.'s role: P-B food in Institutions	3.7 (0.9)	66.5	22.8	10.7	3.7 (1.0) ^a	3.8 (0.9) ^b
21. P-B foods should cost less	3.9 (0.9)	76.5	16.6	6.9	3.9 (0.9)	4.0 (0.9)
22. Buy more P-B foods to ↓ meat in diet	2.7 (1.2)	27.2	26.1	46.6	2.6 (1.2) ^a	2.8 (1.2) ^b

¹NA = not applicable; CF = Carbon footprint; CFG = Canadian Food Guide; P-B = plant-based; Institutions (e.g., schools, hospitals).

²Mean responses from consumer survey and the combined percent responses for participants that agreed or strongly agreed or disagreed or strongly disagreed to the questions asked. The impact of gender is also shown as the mean responses and the standard deviation (SD) values.



³T-tests were used to determine differences in the responses between men and women. In each row, means with different letters indicate significant differences ($P < 0.05$)

⁴Qu. 11 to 17, n= 639 respondents; and Qu. 1 to 6 & Qu. 18 to 22, n = 1042 respondents.

Table 3. Sociodemographic factors influence on various respondents' practices.

Variables	Familiarity with CFG	Include pulses in diet	Willingness to pay more for plant-based foods	Bean dishes are tasty	Many ideas or resources for recipes
Age (years)					
>74	3.4 (0.9)	3.2 (0.9)	3.1 (1.0)	2.8 (1.3) ^a	3.6 (1.1)
56-74	3.6 (1.1)	3.1 (1.1) ^a	2.8 (1.1) ^a	4.0 (0.7) ^b	3.0 (0.9)
41-55	3.5 (0.9)	3.5(1.1) ^{b,c}	2.9 (1.1)	3.9 (0.8) ^b	3.7 (1.0)
26-40	3.5 (0.9)	3.5 (1.1) ^{b,c}	3.1(1.1) ^b	3.9 (0.8) ^b	3.8 (0.9)
<26	3.7 (0.9)	3.4 (1.0)	3.4 (1.0) ^b	3.4 (0.9) ^b	3.7 (2.0)
Education					
Some high school	3.3 (0.9) ^a	3.2 (1.1)	2.8 (1.1)	3.7 (1.1)	3.6 (1.0)
High school	3.4 (0.9)	3.1 (1.1)	2.9 (1.1)	3.8 (0.9)	3.9 (1.0)
Trade	3.5 (0.9)	3.1 (1.1)	2.9 (0.9)	3.8 (0.6)	3.8 (0.9)
College	3.5 (0.9)	3.3 (1.0)	2.9 (1.1)	3.9 (0.8)	3.7 (1.0)
University	3.6 (0.9)	3.5 (1.1)	3.1 (1.2)	4.0 (0.8)	3.8 (0.9)
Advanced	3.7 (0.9) ^b	3.5 (1.1)	3.2 (1.2)	3.9 (0.8)	4.0 (1.0)



university					
Income (\$CAD)					
<35k	3.3(0.9) ^a	3.1(1.1) ^a	2.8 (1.0) ^a	3.9 (0.9)	3.7 (1.0)
35-49k	3.4(0.9)	3.3(1.1)	2.9 (1.1)	3.9 (0.9)	3.7 (0.9)
50-74k	3.5(0.9)	3.3(.2)	3.2 (1.1)	3.9 (0.7)	3.7 (1.0)
75-99k	3.7(0.9)	3.4(1.0)	2.8 (1.2)	3.9 (0.8)	3.9 (0.9)
100-150k	3.7(0.9) ^b	3.5(1.1) ^b	3.3 (1.1) ^b	3.9 (0.8)	3.9 (0.9)
>150k	3.7(0.9) ^b	3.5(1.1) ^b	3.4 (1.1)	3.9 (0.8)	3.8 (1.0)

¹Data are expressed as means and standard deviation.

²Letters indicate results of ANOVA and Fisher's LSD post hoc test, means with different letters in the same column indicate significant differences.

