




Article

Taking Stock of Fruit and Vegetable Consumption in Canada: Trends and Challenges

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Abstract: *Purpose:* A diet rich in fruits and vegetables is vital for prolonged health and wellness. Yet, the consumption of fruits and vegetables remains low in some regions. *Methodology:* This exploratory quantitative study utilized a web-based survey instrument to probe the likelihood of consumption by Canadian consumers. Canadians who have lived in the country for 12 months or more and were 18 years of age or older were surveyed. Care was given to get a representative sample from all Canadian regions. *Findings:* Barriers to produce consumption include cost (39.5%), lack of knowledge and preparation skills (38.5%), and confusion surrounding health benefits (6.3%). There is further confusion surrounding the nutrition of frozen vs. fresh vegetables. Finally, respondents were concerned about pesticide residue on imported produce (63.4%). *Originality:* Although evidence that fruits and vegetables can mitigate disease and that promotion of fruit and vegetable consumption has been a key policy area for the Canadian government, consumers still fail to integrate sufficient fruits and vegetables into their diets. To our knowledge, this is the only study probing consumers on their fresh produce intake in the Canadian context. Public awareness and education about the regular consumption of fruits and vegetables and their nutritional value and health-promoting benefits can increase consumption in many Canadian regions and demographics.

Keywords: Canada; produce consumption; fruits; vegetables; dietary education

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1. Introduction

Fruits and vegetables (F&V) consumption has continuously been a priority for health professionals around the world, including in Canada. The year 2021 was declared by the United Nations as the International Year of F&V [1]. In Canada, a new “Canada Food Guide” was introduced in January 2019 [2]. It was a departure from the previous version, which only gave F&V minimal attention compared to other similar food guides around the world [3,4]. The new food guide recommends that F&V should comprise half an individual’s entire diet. For the first time, the focus on animal proteins was lessened in favor of more plant-based protein consumption [5].

Much research has been conducted on the health of individuals [6,7]. Potential reasons for poor nutritional choices are an inheritance of certain foods and tastes [8], an unbalanced nutrient profile, habits, routines, lack of knowledge and information [9], or economic constraints related to time or financial means [10]. These barriers are known and documented by the scientific community and vary in severity [11].

The Canadian diet is rich in protein [12,13]. Canadians have access to affordable animal protein products, including fish and seafood products [14]. According to a 2017 study, Canadians consumed an average of 4.38 servings of F&V per day [15]. For people aged 19–50, the former Canada Food Guide recommended 7 to 8 daily servings for women and 8 to 10 for men. The same study estimated that about 80% of women and 89% of

men in Canada consume inadequate amounts of produce. It has been argued that lower consumption of F&V leads to a higher prevalence of cardiovascular diseases and higher healthcare costs in Canada [16].

The economics of F&V production is not necessarily strong in Canada as most F&V consumed in the country is imported, especially in winter [17,18], due largely to Canada's harsh winters. People are often urged to consume products that originate from traditional Canadian sectors, such as dairy and several meat sectors [19,20]. Unlike other commodities, Canada's climate is not conducive to growing F&V all year round [21]. Imported F&V represent the bulk of grocery retailing during the winter months [22].

A diet low in fruits and vegetables is associated with chronic diet and metabolic diseases, such as cancer, obesity, heart disease, and diabetes [23]. In addition, poor diets are negatively associated with mental [24] and social [25] health that affects levels of education [26] and antisocial behavior [27]. Due to rising healthcare costs, the Canadian federal government has endorsed the importance of a diet rich in F&V. Canada's Food Guide recommends eating F&V, whole grains, and protein often to develop a healthy eating pattern and maintain health long-term [28]. It is also recommended to have a variety of F&V represent half of an individual's plate or diet [29].

Since the introduction of the new food guide, F&V consumption in Canada has been encouraged as the Food Guide is one of the most consulted documents released by the federal government, which makes it a highly influential and visible food policy tool [30]. The aim of this paper is to analyze how F&V fit in the lives of Canadians and how they are perceived generally. In this paper, our exploratory investigation looks at the consumption of F&V in Canada and the inherent perceived risks related to the consumption of produce in general.

2. Produce Consumption

Canadians have an interesting relationship with F&V. While Canada is an important producer of fresh vegetables, the country continues to import many products in high demand, such as lettuce, tomatoes, and peppers [31]. Leading suppliers of vegetables to Canada are the USA, Mexico, and China [32]. It is estimated that more than 60% of the F&V consumed in Canada is imported [22].

Broadly, Canadian consumers can have different motives for their food selection behaviors. Research indicates that sensory appeal, healthfulness, convenience, and price tend to be important factors influencing food choice [33,34]. Nutritional attributes of a food product also seem to have a major influence on consumers' perception of food options but may not necessarily translate into a purchase [35].

Seasonal and regional F&V may be perceived as fresher because they can be harvested when ripe and are not exposed to lengthy shipping conditions [33]. Evidence suggests that purchase points of F&V may influence how they perceive its inherent attributes [36]. Similarly, consumers perceive F&V purchased at a farmers' market differently from F&V purchased at a grocery store [37]. Some scholars point to the notion of "mental" and "physical" availability as determinants in purchasing fresh produce [38]. Research has shown that consumers tend to perceive locally produced food as of higher quality, particularly in terms of freshness and taste [39].

In this study, we also examined the influence of several food-related attitudes on eating seasonal fruits and vegetables. Past research indicated that consumers strongly associate sustainability with so-called naturalness [40,41]. For example, consumers concerned about the naturalness of food seem to be more willing to purchase organic food products. Consumers who buy organic food also seem to have a greater health consciousness and be willing to eat something if they are convinced it improves their health [42].

With benefits also come threats. In modern agriculture, the use of pesticides is unavoidable for pest control in crops, especially for F&V [43]. Consumers are generally concerned about unwanted residue on F&V, and this does make the category less attrac-

tive to some [44]. Food safety concerns have also triggered worry and anxiety among consumers, especially those with compromised immune systems [45].

In summary, this exploratory study investigated consumers' perceptions of their behavioral choices related to the consumption of F&V in a Canadian context. The principal aim of the study is to identify determinants of produce purchasing in Canada and understand what motivates Canadians to buy and eat produce. Canada is one of the largest countries in the world, with ten provinces and three territories. Consumption patterns and cultures do vary between regions. We looked at motives and factors that cause them to purchase and consume more or less F&V.

3. Methodology

A web-based survey instrument using Qualtrics was designed by the authors and reviewed by colleagues with expertise in survey design and in food consumption habits (Appendix A). The instrument design was largely influenced by specific issues our group wanted to explore, as it is an exploratory study. All questions were multiple-choice. All of the analysis was based on regressions and multivariates to understand the relationships between variables and determinants. In the first section, the instrument contained the following measures about where respondents buy produce, the volume of purchases relative to Canada's Food Guide requirements, and reasons why they do not eat more F&V. The following questions were posed: "Where do you buy most of your produce?"; "Do you eat the required number of fruits and vegetables, recommended by Canada's new Food Guide?"; and "What would be the reasons why you don't eat more fruits and vegetables?" In the second section, the instrument investigated attitudes and how respondents perceive F&V generally. Respondents were asked to compare fresh with processed or frozen. We also asked about local foods and organically grown F&V. In the third section, questions were tailored to assess where respondents were getting information about F&V. "What sources of information influence your fruit and vegetable purchases the most?" The objective was to see how Canada's Food Guide is relevant to their information search. In the last section, the survey looked at the threats and benefits of consuming F&V. Questions asked ranged from concerns about pesticide residues, to biologically active compounds (bioactives), to the health benefits of eating F&V, to reducing cancer and cardiovascular diseases.

The survey was shared online with a demographically representative sample of 10,006 Canadians, ages 18 and older, in the summer of 2021. These questions were part of a CARAVAN[®] omnibus survey conducted twice weekly by Caddle in Canada, a third-party data collection agency. The sample included individuals who volunteered to participate in online surveys and polls. Pre-survey weights were applied based on age, gender, geographic region, race, and education so that the sample would match Canadian population demographics. The sampling error cannot be calculated because participants self-selected for participation. Survey weights were used to adjust the sample to reflect national data from the Canadian Census based on age, gender, geographic region, race, and education. These weights were applied in all reported analyses.

4. Results

In total, 52% of the respondents were women, the average age of respondents was 42 years old, and 24% had university degrees. All regions were proportionally represented. Our sample design allowed us to capture Canada's demographic and economic fabric.

4.1. British Columbians and Ontarians Are Produce Lovers

The first series of questions was related to where Canadians buy F&V and how frequently. While a total of 86.6% of consumers primarily buy their F&V at a grocery store, 4.6% claimed they buy most of their produce at a farmers' market. Interestingly, 1.2% of Canadians grow all their F&V themselves. As for frequency, 43.1% of Canadians buy enough produce to meet the recommended amounts in Canada's Food Guide a few days a week, and 29.3% will buy the recommended amount every day. The highest rate of daily

purchases is in British Columbia at 31.4%, followed by Ontario at 31.0%. The lowest rate in the country is in Prince Edward Island at 11.6%, followed by Newfoundland and Labrador at 19.7% (see Figure 1).

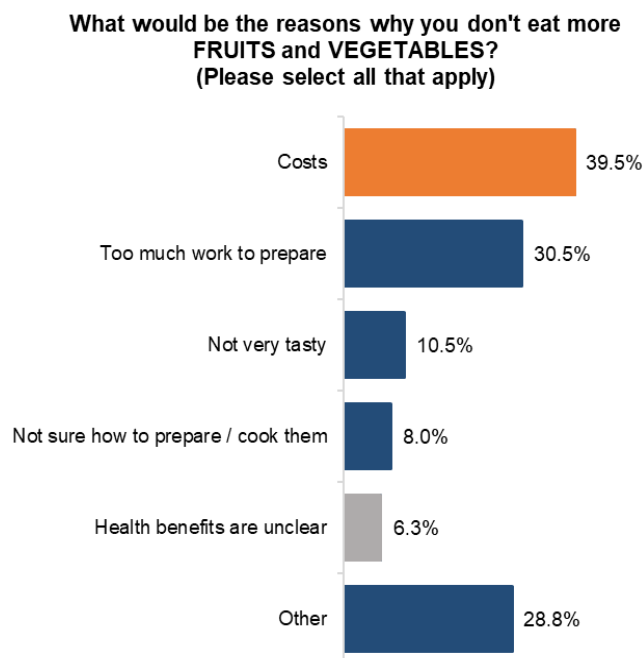


Figure 1. Reasons to buy produce.

The barriers to purchasing F&V are numerous. The number one reason Canadians do not buy F&V more often is the price. A total of 39.5% of Canadians believed the price to be the most significant barrier, followed by the fact that produce requires too much work to prepare, at 30.5%. Taste (10.5%), Not sure how to prepare them (8.1%), and Unclear health benefits (6.3%) are other popular reasons. Health benefits appeared to really motivate Canadians to buy produce. A total of 74.6% of Canadians have an important reason to buy produce.

4.2. Frozen/Fresh Dilemma and Local Focus

A total of 64.9% of Canadians will only buy fresh produce, and 18.7% prefer frozen produce—a significant difference. The majority of Canadians prefer fresh over frozen. As for local produce, 27.4% of Canadians claim to buy only local F&V. The highest number of consumers who will only buy local produce is on Prince Edward Island, at 39.5%, followed by both Quebec and Nova Scotia at 30.7%. Saskatchewan has the lowest number of consumers only buying local foods, at 17.5% (see Table 1).

Consumers will also use different information sources to influence their fruit and vegetable choices. The most common sources for Canadians are food and cooking websites at 39.0%. Nutritionists are at 25.3%, followed by Canada's Food Guide at 20.8%. Typically, celebrities and websites are quite popular among Canadians looking for information, but with F&V, authoritative sources such as nutritionists and our Food Guide appeared to be more popular than other options (see Figure 2).

Table 1. Purchasing habits for produce per province.

Provinces	Percentage of Consumers Only Buying Locally Grown Produce	Percentage of Consumers Eating Recommended Produce Amount Every Day, As Per CFG (Proper Proportion)
Prince Edward Island	39.5% (1)	11.6% (10)
British Columbia	27.9% (5)	31.4% (1)

Table 1. Cont.

Provinces	Percentage of Consumers Only Buying Locally Grown Produce	Percentage of Consumers Eating Recommended Produce Amount Every Day, As Per CFG (Proper Proportion)
Nova Scotia	30.7% (2)	25.7% (7)
Quebec	30.7% (2)	30.7% (3)
Ontario	29.2% (4)	31.0% (2)
Alberta	21.5% (7)	27.1% (5)
New Brunswick	22.6% (6)	21.3% (8)
Newfoundland and Labrador	20.4% (8)	19.7% (9)
Manitoba	20.1% (9)	29.6% (4)
Saskatchewan	17.5% (10)	27.1% (5)

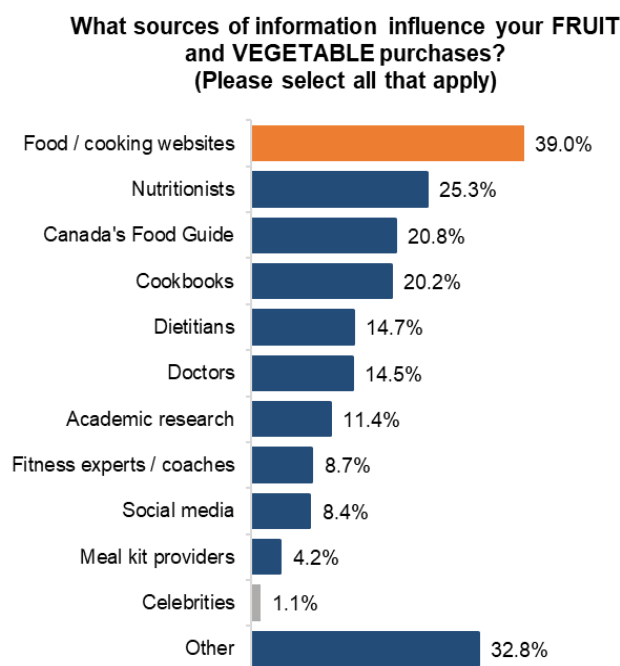


Figure 2. What information is used to buy produce.

4.3. Food Safety Concerns

During our investigation, some questions were asked about pesticide residue, which concerns many Canadians. While 63.4% were concerned about pesticide residue on produce in grocery stores, 60.6% were concerned about it at other retail locations, and 47.2% were concerned about it at farmers' markets.

4.4. Health Benefits

F&V are synonymous with healthy eating. The survey also included questions related to food bioactive compounds, cancer risks, and the gut microbiome. These results were interesting. Only 21.4% of Canadians thought about food bioactive properties when purchasing fruits or vegetables. As for cancer risks, 42.6% think about this when purchasing produce and 47.6% eat produce to reduce cancer risks. A total of 66.0% of Canadians see F&V as superfoods—foods that offer maximum nutritional benefits for minimal calories. They contain a high concentration of vitamins, minerals, and antioxidants, 66.8% eat produce to lose weight, and 71.3% eat F&V for their microbiome and gut health.

5. Discussion

Respondents may not be educated about the health virtues of F&V, especially cancer-preventing properties. Many F&V are excellent sources of dietary antioxidants and food

bioactives—a bioactive compound will have an effect on a living organism’s physiology and promote health and wellness—and can really support Canadians in their quest for a better quality of life [46]. However, our survey shows that respondents do not perceive the health-promoting bioactives of F&V and actions are required to educate the public about these beneficial, non-nutrient bioactives present in fresh produce. Canada has alarming death rates due to cancer and chronic disorders associated with overweight individuals and obesity [47]. The curricula of Canadian education—from primary school through medical college—should be revisited to incorporate knowledge of the impact of food on health and well-being.

Some regions in Canada are more inclined to buy and consume F&V than others. The survey results show that respondents from British Columbians and Ontarians are more inclined to eat F&V than those in other provinces. These two provinces contribute significantly to the production of F&V, and thus, the costs of buying the products there are less. For example, in 2020, British Columbia produced 111,438 tons of grapes, 161,346 tons of blueberries, and 424,888 tons of apples. In comparison, in the same year, Newfoundland and Labrador produced no grapes, 110 tons of blueberries, and 1 ton of apples [48]. This lack of production contributes directly to the pricing of F&V. Without the need for extensive transportation, F&V becomes less expensive. It should also be considered that British Columbia’s average income for those 18 years and up is CAD 50,500, and Newfoundland and Labrador’s average income for the same group is CAD 46,400 [49]. Further, there is an established literature on diets that has determined that income is a significant determinant in the consumption of fresh produce [50–53].

F&V consumption among Canadians is in decline. In 2017, 28.6% of Canadians reported that they consume F&V five or more times a day. In 2020, that number was down to 25.4% [54]. This may have to do with availability due to the COVID-19 pandemic. There is also evidence to suggest that the work-from-home transition led consumers to eat fewer fruits and vegetables as many sought comfort food [9].

In 2020, the total amount of processed fruit available to be consumed decreased by 8.3% from 2010, as did fresh vegetables, by 6.7% [55]. The availability of processed vegetables did increase when compared to 2010, but by a comparatively small increment, at 4.4%, as did fresh fruit at 2.9% [55]. There is a negative correlation between the price and supply of a commodity; that is, the price increases as the supply decreases [56–58]. Thus, we can infer from the slow increase in the availability of F&V that the decrease in prices is also slow.

As mentioned, food safety concerns were a subject of discussion. A large portion of respondents is concerned about pesticide residue on produce in grocery stores, while a much smaller portion is concerned about the same on produce at farmers’ markets. Farmer’s markets and local foods are generally viewed as being more healthful than their grocery store counterparts and, supporting this, a study by York University found that 53% of customers at a Toronto-area farmer’s market were there because of a self-identified interest in having a healthier diet [59]. In the case of our study, there may be a conflation of these two facts. Because farmer’s markets are deemed healthier by public opinion, individuals then make the assumption that their health-centric concern about pesticide residue will be less relevant in a farmer’s market setting. More research is needed in this area.

6. Strengths and Limitations

A key strength of this research is that it provides policy-relevant information focused on the specific reasons Canadians eat or do not eat F&V. In addition, it comes from a survey administered to a nationally representative sample. A key limitation is that, as with other surveys and most studies addressing perceptions of food consumption, the research relies on self-reporting. Respondents may misreport their perceptions and practices due to factors, including aspiration and a widespread unawareness of personal practices leading to different consumption behaviors. The survey also did not specifically consider First Nations and Indigenous populations, which make up about 4.7% of the Canadian population. A

separate and different food guide was introduced by Health Canada for First Nations, which would require a separate survey and different measurements.

An additional limitation was in the wording of the main outcome variable questions. Respondents were asked about their frequency of F&V consumption, but the question did not specifically ask which F&V are consumed and with what other food products. The focus of the survey was solely on F&V. Lastly, the findings may be affected by sources of error, including sampling bias, non-response bias, errors associated with the way the questions or response options were constructed, and errors in the post-survey weighting.

This study only considered perceptions. Future research can build on this study to determine how physical availability influences the buying behavior of F&V in Canada. There is also a need to understand the “mental availability” of various F&V for consumers; that is, how much consumers consider F&V products in buying situations all year round, not just during the growing season. Research into consumer goods categories has found that both mental and physical availability guide patterns of F&V buying behavior [60]. It would also be useful to conduct additional F&V user profile studies to include data on consumers’ socio-economic groups and race/ethnicity/health status to find out whether these factors influence buying behavior among consumers.

Finally, it is unknown how familiar respondents were with the guidelines outlined in Canada’s Food Guide released in 2019. While it is possible that respondents were completely unfamiliar with the new guidelines, or even the previous version published by Canada Health, data on whether Canadians consume the daily recommended intake is measured by Statistics Canada on a regular cycle, and it established that many do not reach this daily limit.

7. Conclusions

Canada has set a goal of encouraging Canadians to eat more F&V. Highlighting the country’s ongoing commitment, the federal government and several provinces have funded projects to produce more F&V domestically to get consumers to think about locally grown produce all year round. This research confirms the importance of federally coordinated efforts to encourage consumers to consume F&V, beyond the 2019 Food Guide, especially as the rates of F&V consumption continue to decline.

Furthermore, when considering this decline, this research confirms that these efforts and projects may be ineffective. This may suggest that the solution does not necessarily lie in informing Canadians of the need to consume more F&V but instead in making it easier for them to do so. Thus, further efforts to decrease the barriers to consumption of F&V, including food literacy, affordability, and safety concerns, and, by extension, efforts to increase production of the same are needed.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Dalhousie University.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The authors declare no conflict of interest.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. SURVEY: Do Canadians Eat Enough Fruits and Vegetables?

PIs: S. Charlebois and H.P.V. Rupasinghe

Background: It is well known that our diet is closely linked to chronic and metabolic diseases such as cancer, obesity, heart disease and diabetes. Due to the raising health care costs, Canadian federal Government have endorsed the importance of diet rich in fruits and vegetables (F&V). Canada's Food guide recommend to eat vegetables and fruits, whole grain foods and protein foods often to develop a healthy eating pattern and maintain health. It is recommended to have variety of vegetables and fruits representing the half of the plate or diet.

The goals of this survey is to understand:

Where do you buy most of your produce?

- (1) Grocery store/supermarket;
- (2) Convenience store;
- (3) Local farmers' market;
- (4) Online
- (5) Specialty store;
- (6) I grow my own, mostly;
- (7) I don't buy produce.

Do you eat the required amount of fruits and vegetables, recommended by Canada's new Food Guide?

- (1) Each day;
- (2) Every other day;
- (3) Once a week;
- (4) Rarely;
- (5) Never.

What would be the reasons why you don't eat more fruits and vegetables (you can select more than one)

- (1) Costs;
- (2) Health benefits are unclear;
- (3) Too much work to prepare;
- (4) Not very tasty;
- (5) Not sure how to prepare/cook them.

How do you feel about the following statement: I only buy fresh produce, and not processed.

Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I prefer frozen produce over fresh.

Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I only buy locally grown produce.

Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I only buy organic produce.

Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

What sources of information influence your fruit and vegetable purchases the most?

(You can select more than one)

- (1) Food/cooking websites;
- (2) Nutritionists;
- (3) Dietitians;
- (4) Doctors;
- (5) Academic research;
- (6) Fitness experts/coaches;
- (7) Cookbooks;
- (8) Canada's Food Guide;
- (9) Meal kit providers;
- (10) Celebrities;
- (11) Social media.

How do you feel about the following statement: I am concerned about pesticide residue on produce both at the grocery store.
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I am concerned about pesticide residue on produce both at the store.
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I am concerned about pesticide residue on produce both at a farmers' market.
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: When I buy produce, I think about the health benefits of eating fruits and vegetables.
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: When I buy produce, I think about the bioactives related to consuming fruits and vegetables.
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: When I buy produce, I think about how they can reduce cancer risks.
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I see fruits and vegetables as "superfoods".
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I consume fruits and vegetables for reducing my risk of having cancer
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: My primary to reason to eat fruits and vegetables to maintain health body weight
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

How do you feel about the following statement: I know fruits and vegetables can improve my gut microbiome or gut health.
 Strongly agree/agree/neither agree nor disagree/disagree/strongly disagree

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