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Revisiting fruit and vegetable determinants: Evidence from Latin America

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Introduction: In the past decade, the public health discussion regarding fruit and vegetable (FV) consumption has been dominated by economic and physical accessibility.

Methods: Using an online survey in four Latin American countries, we applied a set of tobit models to compare the determinants of desirable and current consumption of FV levels for satisfied and unsatisfied respondents.

Results: We found that, even when consuming less than five FV portions a day, most of the respondents were satisfied with their current FV consumption level. Satisfied respondents consumed significantly more FV than unsatisfied ones. In general, the desirable and current consumption of FV levels were associated with different sets of determinants, while years of education were relevant in both cases. Finally, in a hypothetical case where unsatisfied respondents would not face any physical or economic access restrictions, unsatisfied respondents would not reach the goal of five FV portions a day.

Discussion: Assuming that physical and economic access improved, this would automatically increase FV to reach the five-a-day recommendation may be inaccurate in some cases. We also need to take mental access into account. We may ask how to improve the desirable level of FVs and then how to close the gap between the current and desirable FV levels.

KEYWORDS

food access, fruits and vegetables, consumer behavior, food consumption, fruit, vegetable

1. Introduction

In the context of the Nutrition Decade, the United Nations General Assembly (2019) proclaimed 2021 the International Year of Fruits and Vegetables, an entity that instructs the Food and Agriculture Organization (FAO) of the United Nations as the agency responsible for the implementation of the year. Through this resolution, all Member States, organizations of the United Nations system, other international and regional organizations, and other relevant stakeholders, including civil society, the private sector, and academia, were invited to participate in the International Year, through different activities.

Fruit and vegetable (FV) consumption is a necessary, but not sufficient condition of a healthy diet. FVs consumption is associated with a lower prevalence of diet-related diseases (Aune et al., 2017; Wang et al., 2021), decreased risk of depression (Liu et al., 2016), and increased natural immunity (Hosseini et al., 2018). In the past decade, the public health discussion has been dominated by accessibility. Recognizing that it would depend on many determinants, physical (Larson et al., 2009) and economic (Lee et al., 2013) access to FVs have been historically pointed out as one of the reasons why low-income households consume less than the recommended amount of FVs. Physical access to FVs means that is expected that a household located close to healthy food stores, such as FVs selling points, would facilitate to purchase of healthy food (Silva et al., 2021b), while a household has economic access when it can afford FVs.

The Latin American region exports a large variety of fruit to the world (Long and Roberts, 2005). However, the FV consumption in the region is relatively low (Uauy et al., 2001; Kovalskys et al., 2019). Trying to explain this apparent contradiction, some authors have argued that companies are exporting fruits that can be consumed domestically. However, in an open-market economy, countries export product that holds competitive advantages (Carter and Zhong, 1991). While countries also benefit from importing other products, with competitive disadvantages, that would be more expensive if they were produced domestically. In the end, households have a wider variety to choose from as part of their food basket (Shim et al., 2001). For instance, Chile exports table grapes to Ecuador, while it imports bananas from Ecuador. Since Chile, mostly in the Central Valley, has Mediterranean weather, it cannot produce bananas. Banana is the most purchased and most consumed fruit in Chilean households. In this way, an open-market economy allows households to access a wider variety of products that are cheaper when they are produced domestically. In an open market, the production decision of companies and the consumption decision of households are taken separately.

Fruit export companies that face developing restrictions, such as export taxes, technological restrictions, and financial constraints, would make the industry less competitive and thus affect the overall fruit production (Whitfield, 2012). In Latin America, most of the fruit that is sold domestically are products that do not achieve export quality standards in terms of shape, size, or color (Balsevich et al., 2003). Second-quality fruit is sold domestically at cheaper prices than the exported fruit (Balsevich et al., 2003). Developing restrictions would create a disincentive to invest such as new varieties, irrigation systems, and expand production land, and this would lead to a contract, exports as well as fruit to the domestic market, supply (Scherr and Hazell, 1994). A contraction on the supply side, while keeping demand conditions, would likely be translated into higher domestic fruit prices. Therefore, although industry developing restrictions may seem attractive to increase domestic fruit availability in the short term, it is likely to make fruit more expensive and then less affordable for everyone in the long term.

Another possibility to increase FV consumption is to promote their consumption. A variety of health policies have been implemented in different countries to encourage the consumption of FVs. The WHO/FAO (2003) recommends eating, at least, five portions of FVs per person per day, each portion weighing 80 g. Local governments and related agencies have promoted the five-a-day recommendation to the population. The recommendation, in each case as part of a different media campaign, started being promoted in the late 1980s in the United States; then, it spreads to Australia, the United Kingdom, and many other countries (Carreño and Silva, 2019). In Latin America, the five-a-day recommendation started in 2003 in Mexico, in 2006 in Chile, and in 2007 in Colombia (Zacarías et al., 2020), while the starting date is not clear in the case of Ecuador.

The five-a-day campaign is likely the most well-known informational campaign to promote FV intake in the world (Carreño and Silva, 2019). The Global Alliance to Promote Fruit and Vegetable Consumption "5 a Day" is a non-profit organization that gathers 39 institutions from 32 countries with the purpose of promoting FV consumption, preventing non-communicable diseases, and enhancing global health. Nevertheless, no country has been able to reach such a level yet (Micha et al., 2015). Among nutritionists, there is agreement that five portions of FVs a day should be considered a minimum basis. In this article, we distinguish between the five-a-day recommendation from the five-a-day campaign. In our questionnaire, we asked respondents about the five-a-day recommendation. The five-a-day recommendation is the content that advises consuming at least five portions of FVs a day. Instead, the five-a-day campaign is the specific media selection to disseminate the five-a-day recommendation. We cannot talk about a single five-a-day campaign worldwide since each country has used a different set of media to promote the five-a-day recommendation (Rekhy and McConchie, 2014).

In Colombia, the Government puts in place initiatives from early childhood to programs for the elderly (Ortiz-Moncada et al., 2006). Then, the five-a-day recommendation has been promoted to a wider range of population segments. In Ecuador, the five-a-day recommendation has just stayed as a recommendation rather than a campaign. In Chile and Mexico, the five-a-day campaign has focused on education programs at elementary schools in low-income neighborhoods (González et al., 2020). In addition, in these countries, the five-a-day campaign has focused on social networks, such as Facebook and Twitter. Social networks can be a cost-effective way to reach young population segments (Grassi et al., 2016; Coates et al., 2019).

Substantial attention has been paid to the existence of areas with limited access to affordable healthy food, also known as "food deserts" (Beaulac et al., 2009; Allcott et al., 2018). The underlying assumption is that a household located in a food desert would have difficulties purchasing FVs. In this way, the lack of access to FVs would lead to unhealthy food and then to a higher prevalence of malnutrition-related diseases (Bridle-Fitzpatrick, 2015). In the same way, higher consumption is a factor that contributes to the transition toward healthier diets and would pose a cross-cutting benefit between public health and sustainable production (Mason-D'Croz et al., 2019). However, there is no agreement on the actual effect of food deserts on purchasing behavior and diet-related diseases (Larsen and Gilliland, 2009). While some research has found that food deserts are determinants in terms of the prevalence of obesity and diet-related diseases (Hendrickson et al., 2006; Morris et al., 2019), other research has found an ambiguous relationship (Schafft et al., 2009; Rodier et al., 2017; Allcott et al., 2018; Pitts et al., 2018). Ver Ploeg and Wilde (2018) concluded that households in the same neighborhood, and the same food environment, can have different food purchasing patterns.

Recognizing that physical and economic access is likely to play a relevant role in FV intake, especially in the very low-income population, the objective of this article is to analyze FV consumption level satisfaction as a proxy of mental access. We do not directly assess mental access in this study. Instead, we analyze data regarding current and desirable FV consumption levels and the level of satisfaction of the respondents with their current FV consumption level. We consider it illustrative that most of the people surveyed while consuming less than the public health recommendation level were satisfied with the FV consumption. For this purpose, we used data from an online survey of food purchases in four Latin American countries.

2. Background

Recently, mental access has been gaining attention (Ma et al., 2021). Ma et al. (2021) defined mental access based on having the knowledge to access FVs for consumption, dietary knowledge, or

food skills. Knowledge to access refers to being aware of where/how to find FVs. Dietary knowledge means having nutritional knowledge about the relevance of an adequate amount of FVs as part of a healthy diet and avoiding diet-related diseases (Rasmussen et al., 2006; Riediger et al., 2007). Finally, food skills refer to knowing how to prepare FVs (McGowan et al., 2017). Hartmann et al. (2013) found that cooking skills are positively associated with vegetable consumption in both genders, while it is positively associated with fruit consumption only in the case of women. Therefore, although dietary knowledge is different from food skills, we can define mental access as having the knowledge to access FVs, nutritional FVs knowledge, and food skills to prepare FVs.

Social marketing helps social change using contemporary commercial marketing theory and practice (Dann, 2010). In FV consumption, social marketing campaigns can provide information and raise awareness. Mental access, to some extent, can be similar to education level. It can be argued that an educated person is more aware of the relevance of consuming abundant FVs. However, mental access and education are not the same. Mental access, in a more holistic way, is to be willing to increase FV consumption when the consumption level is under the five-a-day recommendation. Fresh vegetables, and some fruits, are time-consuming to prepare, and in some cases, this requires culinary skills that not everyone is willing to develop. Fresh FVs, in most cases, are less convenient. For instance, fresh FVs can be difficult to select at the store, to carry on, to eat (to separate edible from not edible portions), and to store. Despite the convenience challenges, some people still may want to eat FVs because of their nutritional and health benefits. However, few surveys explicitly measure nutritional and health benefits knowledge; some examples can be found in the work done by Scalvedi et al. (2021) in Italy and Koch et al. (2021) in Germany. In this sense, using education as a determinant of FV consumption, education is likely to capture indirectly nutritional and health benefits knowledge. We argue that it is necessary to develop instruments to measure directly the dimensions that are included in mental access.

According to Barlow et al. (2016), people who choose unhealthy foods tend to have higher temporal discount rates, which means they focus more on immediate satisfaction. In contrast, people willing to consume more FVs would have lower temporal discount rates. People with a low discount rate care about future benefits in a similar way that this food presents benefits (Barlow et al., 2016). Since most of the health benefits, associated with high consumption of FVs, would be experienced in the long term, people with higher discount rates may not be as attracted to handle the inconvenience of FV consumption. Previous research has found that a high temporal discount rate is associated with obesity (Barlow et al., 2016), depressive disorders (Pulcu et al., 2014), and low-income conditions (Yang, 2016). However, it may be not straightforward to the actual causal path between FV consumption and discount rate. It may be the case that the discount rate leads to FV consumption, or *vice-versa*, or both are correlated and are the result of another determinant. For instance, Levens et al. (2019) analyzed temporal discount and healthy food choices as simultaneous outcomes, while Kao et al. (2019) studied the effect of temporal discount that leads to healthy food choices.

An illustrative example of mental access can be found in the study done by Silva et al. (2021a). In this study, the authors found that FV produce sellers, who should have been granted physical and economic access, do not consume more FVs than the rest of the population. Despite practicing more physical activity, FV produce sellers have a higher prevalence of being overweight than the rest of the population, and similar weight to people with the same educational level (Silva et al., 2021a). Consequently, educational level, rather than physical or economic access, can help explain body weight and body mass index.

Therefore, mental access may indicate whether low FV consumers actually pursue increasing their FVs consumption. Mental access challenges the previous belief that everyone wants to consume at least five portions of FVs a day. Someone with physical and economic access may not consume five FV portions a day because they may not feel like it. Following the study presented by Silva et al. (2021a), our article challenges the assumption that low FV consumers, who eat less than five portions a day, do not eat more FVs exclusively due to restrictive physical and economic access conditions. Of course, physical and economic access may be relevant in many cases; we just want to highlight to take also into account other determinants that are influencing the FV consumption level.

3. Methodology

We conducted an online survey. The survey was implemented using SoGo and distributed through Facebook from November to December 2021. Our study is non-experimental; therefore, we did not have a random treatment assignment or a control group. In the beginning, the respondents needed to agree with the informed consent form to be able to continue. After that, the respondents needed to confirm they were of legal age. In this way, the survey was distributed online to adults in Chile, Colombia, Ecuador, and Mexico. Each respondent had one opportunity to answer the survey; at the end, the data set corresponded to cross-sectional data.

In total, we received 1,987 surveys, of which 1,698 were completed surveys. As an incentive, the respondents who completed the survey had the chance to win a prize equivalent to US$100 in local currency. Since we did not have a random sample, we cannot argue that our estimation corresponds to a representative sample of the population. In this sense, we want to take our results with some caution. We pursue to show that current and desirable FV consumption levels may not differ, rather than estimate the FV consumption level with accuracy.

The survey included an FV consumption section, pesticide risk section, sociodemographic information section, and a food security section. The complete questionnaire is presented in Supplementary material. The questions regarding FV consumption estimation used visual aids from the *Encuesta Nacional de Salud* of Chile. Before its final field implementation, the survey questionnaire was tested using *focus groups* and a small sample. We also conducted interviews with experts who helped to improve the survey questionnaire. The data collection process was approved by the Ethical Review Board of the *Universidad Central de Chile*.

We are aware that FV consumption is the result of many factors and determinants. Our article analyzes the determinants of FV desirable consumption level (question Q23 in the questionnaire in the Supplementary material) and the potential gap compared to the current FV consumption level (question Q13 and question Q16 in the questionnaire in the Supplementary material). We modeled the desirable FV consumption as the dependent variable in a regression model. Since the gap between desirable and current FV consumption

levels can be zero, we needed to use a Tobit model to take into account the censored nature of the data.

As defined in the "Introduction" section, mental access has three dimensions (FV access knowledge, nutritional knowledge, and cooking skills), which we were not able to directly assess in the survey. Therefore, we do not have evidence to argue that lack of mental access is associated with low FV consumption. Nevertheless, it may be interesting to consider that most of the people surveyed were satisfied with the FV consumption level.

The Tobit model shows a linear relationship between amount variables when the dependent variable is left- or right-censored. Censoring happens when the variable cannot take values beyond a certain point. Following Wooldridge (2010), the Tobit model can be written as $y = max\ (0,\ X\beta + u)$, in which the error term is normally distributed and independent of x, $u|x \sim N\ (0,\ \sigma^2 I)$. In our case, y is FV consumption, dependent variable, which is left-censored at zero (people cannot consume a negative amount of FVs).

As explanatory variables, X, we used food shopper characteristics (age, gender, and education), household characteristics (urban vs. rural), and four variables associated with the five-a-day recommendation: achieve the recommendation, aware, meaning, and classification knowledge (as presented in Table 1). We asked whether the respondent had heard about the five-a-day recommendation. Then, we gave choices only to the people who were aware of the five-a-day recommendation, to find out whether they knew what it meant, such as five types of FVs, five portions, or five colors. Finally, we tested the people to find out whether they knew the type of elements included in the five-a-day recommendation. For instance, potatoes, corn, and sugar-sweetened juices are not included in the five-a-day recommendation.

4. Results

4.1. Descriptive statistics

Table 1 compares satisfied and unsatisfied FV respondents. In our sample, 70.1% of the respondents were satisfied with the current level of FV consumption. Moreover, among the satisfied ones, 43.3% achieve the five-a-day recommendation. In other words, most people are satisfied with the current FV consumption level, which is less than five portions a day. Among the unsatisfied ones, 31.3% achieved the five-a-day recommendation. The respondents who were aware of the five-a-day recommendation stated to consume 4.5 portions a day, while those unaware respondents stated to consume 4.1 portions a day. Based on descriptive statistics, we cannot argue causality; however, there seems to be an association between awareness of the five-a-day recommendation and FV consumption.

In general, unsatisfied respondents are younger, and more educated women. These results suggest that unsatisfied ones are people who may be more aware of the relevance of including FVs as part of a healthy diet. However, unsatisfied respondents have a desirable FV consumption level that is similar to the current FV consumption level of satisfied ones. Therefore, Table 1 shows that there is a need for improving the desirable FV consumption level to reach at least the five-a-day recommendation.

As presented in Table 1, we found that the current consumption of FV is 4.3 portions and the desirable consumption of FV is 6.2 portions. Since confidence intervals overlap, we cannot argue that they are statistically different. In other words, even being lower than the five-a-day recommendation level, there is no statistical difference between the current and the desirable FV consumption levels.

Regarding the five-a-day recommendation, most of the respondents indicate to be aware of the five-a-day recommendation. They correspond to 61.5%, which shows a the high penetration level of the recommendation. However, a small proportion of respondents know the correct meaning of the five-a-day recommendation. Particularly, 21.9% of respondents know that five-a-day means five portions, or servings, a day, and 17.9% of respondents are able to identify correctly the FVs that are recommended. For instance, potatoes are tubers, which are not recommended as part of the five-a-day recommendation. Therefore, Table 1 shows that the five-a-day recommendation has been disseminated widely; however, most of the respondents do not understand the message correctly.

COVID-19 has led to relevant effects on the supply and demand sides. In contrast, the consequences of sanitary restrictions due to COVID-19 may be different depending on factors such as age, gender, socioeconomic level, and location, which could aggravate existing inequalities (Bann et al., 2021). According to our survey, 26.1% of the population has maintained their FV consumption, and 30.9% of the respondents stated to have decreased their FV consumption after COVID-19, of which 84.0% is the result of economic access barriers. Then, 43.0% of the respondents stated to have increased their FV consumption after COVID-19, of which 77.0% is the result of health concerns.

Overall, our results show that 73.9% of the respondents have changed their FV consumption level after COVID-19. Among unsatisfied respondents, 63.2% of them stated to have decreased FV consumption after COVID-19. In contrast, among satisfied respondents, 53.3% of them stated to have increased FV consumption after COVID-19. Therefore, it seems that the current level of satisfaction with FV consumption is highly associated with consumption changes led by COVID-19.

4.2. Tobit results

Table 2 shows the results of a Tobit model to explain FV consumption, desirable FV consumption, and the difference between them, known as the consumption gap. Gender, education, and country of the respondent at least have a relevant role to explain FV consumption. Rather than focusing on specific determinants, it is worth noticing that most determinants are different in each Tobit model. Therefore, the determinants that explain current FV consumption are different from desirable FV consumption and from the gap between current and desirable levels.

We found consistently with previous research that education level and gender do play a significant role. On the education side, Silva et al. (2021a), using the Oaxaca-Blinder decomposition in two waves of a national data set in Chile, found that FV disparities can be better explained by a change in the effect of education of the household head rather than a change on his/her number of years of education. On the gender side, according to Wardle et al. (2004), weight control, rather than a stronger belief regarding healthy eating, explains that women are more likely than men to report avoiding high-fat foods, eating fruit and fiber, and limiting salt consumption. In Canada, Colapinto et al. (2018) found that women are more likely to eat FV

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TABLE 1 Descriptive statistics by fruit and vegetable consumption.

	Unsatisfied		Satisfied		Overall	
	Mean	SD	Mean	SD	Mean	SD
FV current consumption	4.01	(1.64)	4.48	(1.76)	4.34	(1.74)
FV desirable consumption	4.41	(1.56)	6.99	(0.15)	6.22	(1.46)
Foodshopper characteristics						
Age, years	47.73	(13.32)	51.55	(13.83)	50.40	(13.79)
Gender, 0 = man, 1 = woman	0.87	(0.34)	0.82	(0.39)	0.83	(0.37)
Body mass index categories, foodshopper						
Normal	0.37	(0.48)	0.40	(0.49)	0.39	(0.49)
Overweight	0.34	(0.48)	0.35	(0.48)	0.35	(0.48)
Obese	0.29	(0.45)	0.25	(0.43)	0.26	(0.44)
Education category, foodshopper						
No education	0.21	(0.41)	0.21	(0.41)	0.21	(0.41)
High school	0.47	(0.50)	0.39	(0.49)	0.41	(0.49)
College and more	0.32	(0.47)	0.40	(0.49)	0.38	(0.48)
Household characteristics						
Household size, number of members	3.88	(1.70)	3.67	(1.71)	3.73	(1.71)
Zone, 0 = rural, 1 = urban	0.79	(0.41)	0.82	(0.38)	0.81	(0.39)
Country						
Chile	0.25	(0.43)	0.27	(0.44)	0.26	(0.44)
Colombia	0.25	(0.43)	0.25	(0.43)	0.25	(0.43)
Ecuador	0.21	(0.41)	0.23	(0.42)	0.22	(0.42)
Mexico	0.30	(0.46)	0.25	(0.43)	0.27	(0.44)
Five-a-day recommendation						
Achieve recommendation, 0 = no, 1 = yes	0.31	(0.46)	0.43	(0.50)	0.40	(0.49)
Aware, 0 = not aware, 1 = aware	0.58	(0.49)	0.63	(0.48)	0.62	(0.49)
Meaning, 0 = incorrect, 1 = correct	0.19	(0.39)	0.23	(0.42)	0.22	(0.41)
Classification knowledge, 0 = incorrect, 1 = correct	0.21	(0.41)	0.16	(0.37)	0.18	(0.38)
FV consumption change after COVID-19						
Decreased	0.63	(0.48)	0.17	(0.38)	0.31	(0.46)
Maintained	0.18	(0.38)	0.30	(0.46)	0.26	(0.44)
Increased	0.19	(0.39)	0.53	(0.50)	0.43	(0.50)
Observations	508		1,190		1,698	

A fruit and vegetable portion corresponds to 80 g. In the case of mutually exclusive categorical variables, the mean can be interpreted as a percentage. For instance, 61.5% of the overall sample indicates that is aware of the five-a-day recommendation. However, in the case of continuous variables, such as current FV consumption, the mean is interpreted as the average.

more frequently than men and consume the recommended amount of FVs.

In Table 1, we show that most of the respondents were aware of the five-a-day recommendation, while they did not know the correct meaning. Table 2 shows that not knowing the correct meaning of the 5-day recommendation is not as relevant as not knowing being aware of the five-a-day recommendation. In other words, if someone does not know whether the recommendation is five portions or five types of FVs is not as relevant in terms of current and desirable consumption. Meanwhile, being aware of the five-a-day recommendation is associated with a higher level of current and desirable FV consumption. Finally, knowing the FVs that are included in the five-day recommendation is not associated with changes on the current or desirable FV consumption levels.

Therefore, we found that, even when consuming less than five FV portions a day, most of the respondents were satisfied with the current FV consumption level. Moreover, according to Table 1, satisfied respondents state to consume 0.5 portions more than unsatisfied ones. In general, the desirable and current consumption FV levels are associated with different sets of determinants, while

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TABLE 2 Tobit results.

Variables	Current FV consumption	Desirable FV consumption	Consumption gap
Age, years	−0.01	0.01	0.02
	(0.004)	(0.004)	(0.007)
Gender, 0 = man, 1 = woman	0.23	−0.07	−0.36
	(0.08)	(0.15)	(0.18)
High school	0.07	−0.13	−0.26
	(0.09)	(0.07)	(0.11)
College and more	0.24	0.22	−0.07
	(0.14)	(0.10)	(0.08)
Zone, 0 = rural, 1 = urban	0.29	0.04	−0.31
	(0.15)	(0.06)	(0.14)
Five-a-day awareness, 0 = not aware, 1 = aware	0.27	0.18	−0.16
	(0.13)	(0.10)	(0.05)
Five-a-day meaning, 0 = incorrect, 1 = correct	0.18	0.06	−0.14
	(0.08)	(0.11)	(0.13)
Five-a-day classification, 0 = incorrect, 1 = correct	0.05	−0.10	−0.20
	(0.11)	(0.14)	(0.23)
Var(e)	2.93	2.11	5.64
	(0.09)	(0.11)	(0.29)
Constant	3.69	5.89	2.06
	(0.18)	(0.17)	(0.39)
Observations	1,694	1,694	1,694

A fruit and vegetable portion correspond to 80 g. The estimation uses the country as a cluster variable.

years of education are relevant in both cases. Finally, in a hypothetical case where unsatisfied respondents would not face any physical or economic access restrictions, most of the unsatisfied respondents would not reach the goal of five FV portions a day.

5. Discussion

In Latin American countries, the FV consumption is low compared with developed countries. According to Miller et al. (2016), who compared 18 countries involving 143,000 participants, the average consumption was 3.8 portions of FVs (95% CI 3.7–3.9). The consumption varied based on income: 2.1 servings in low-income countries, 3.2 portions in lower-middle income countries, 4.3 portions in upper-middle income countries, and 5.4 portions in high-income countries. The FV consumption is close to 3.9 portions in Chile (Silva et al., 2021a), 2.0 portions in Colombia (Delgado et al., 2010), 2.0 in Ecuador (Freire et al., 2015), and 3.0 in Mexico (López González and Alarcón Osuna, 2018). It is likely that the higher consumption is due to the higher education level of the survey sample. For instance, in Chile, in the survey sample, 37.6% of the respondents held a college degree, while according to national surveys, it should be around 28.8% (INE, 2018).

As presented in Table 2, current and desirable FV consumption are led by different sets of determinants, which have relevant policy implications. In order to increase FV consumption, we may need to address two separate questions. First, we would need to increase the desirable FV consumption level, which can be done by improving the awareness of the five-a-day recommendation. Most people are satisfied with the FV consumption even when they do not achieve the five-a-day recommendation. Second, we would need to increase the current FV consumption level which at least can be done by improving the five-a-day awareness, while also explaining which is the actual meaning of the five-a-day recommendation.

In terms of household location, similar to the findings of Dean and Sharkey (2011), urban respondents state to consume 0.3 portions a day per person more than rural ones. This result, consistent with previous studies, can also seem contradictory, to some extent. In a rural setting, it is expected to have a food environment with more abundant FVs; however, rural respondents report eating fewer FVs than urban ones. This fact also suggests that FV consumption is not only a matter of physical and economic access.

Also, from the respondents that have decreased FV consumption, our study found that only 18.7% state that price is the main determinant for fruit consumption, and 14.9% for vegetable consumption. Ares et al. (2017) found that convenience was the most relevant barrier to healthy eating among mid-income households, while for low-income households, satiety—feeling full—was a key food consumption determinant. Arce et al. (2021) found that the acceptability of some FVs is reported to have a high influence on consumption. In this sense, price as an FV consumption barrier is likely to be hiding other determinants (Livingstone et al., 2020;

Hohoff et al., 2022; Young and Stewart, 2022). Of course, price is relevant in many consumption decisions; however, in some cases, it is likely to have overstated their actual effect on consumption.

COVID-19 has a heterogeneous effect on FV consumption (Picchioni et al., 2021). Our results show that 73.9% of respondents have changed their FV consumption level after COVID-19. Unsatisfied respondents have mainly decreased FV consumption. In contrast, satisfied respondents have mainly increased FV consumption after COVID-19. However, we do not have information to assess whether the respondents were unsatisfied before COVID-19, or they became unsatisfied after COVID-19. Therefore, COVID-19 had a heterogeneous and relevant effect on FVs in a large proportion of respondents, and this research topic keeps unfolding.

COVID-19 made some households increase their FV purchases looking for a way to boost their immune systems (Zupo et al., 2020; Jordan et al., 2021; Yedjou et al., 2021). However, other places have been experiencing FV supply restrictions. In Colombia, the high dependence of the nation on the importation of not only processed but also fresh products has been evidenced; there is a shortage of FVs in some cities (Vivas Carbó, 2020). In Mexico, after the COVID-19 pandemic, 18.7% of the population began to consume fewer fruits and 13.3% fewer vegetables (Shamah-Levy et al., 2021).

6. Conclusion

Our results show that 61.5% of respondents were aware of the five-a-day recommendation, which shows that the message has been widely disseminated. The fact that most of the respondents also were satisfied with their current FV consumption level, even not reaching the five-a-day recommendation, can be taken as an opportunity to redesign informational messages to promote FV consumption. We may need to have a clearer, simple message based on nutritional evidence.

Substantial evidence has been developed to measure physical and economic access. Now, it would be interesting to work on mental access indicators beyond years of schooling. In this article, we use the level of satisfaction as a proxy for mental access. However, there is a need to further develop indicators to assess each one of the mental access dimensions presented by Ma et al. (2021): knowledge of FV access, nutritional knowledge, and food skills. The understanding of these dimensions in a population segment can help tailor messages according to the specific objective to increase current and desirable consumption FV levels.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material. The dataset will be made available from the corresponding author upon request.

Ethics statement

The studies involving human participants were reviewed and approved by Universidad Central de Chile—Ethics Board. The patients/participants provided their written informed consent to participate in this study.

Author contributions

AS supervised the data collection and analysis and wrote the manuscript. AA contributed in data analysis and literature review. SD-A contributed in data collection. AD revised the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer DG declared a shared affiliation with the authors AD, AA, and AS to the handling editor at the time of review.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2022.1001509/full#supplementary-material

References

Allcott, H., Diamond, R., Dubé, J.-P. H., Handbury, J., Rahkovsky, I., and Schnell, M. (2018). *The geography of poverty and nutrition: food deserts and food choices across the United States* (No. w24094). National Bureau of Economic Research. doi: 10.2139/ssrn.3095779

Arce, S., Gugole Ottaviano, F., and Sosa, M. (2021). Sensory acceptability, consumption frequency, and factors associated with consumption of fruits and vegetables among low and medium income consumers in argentina. *J. Sens. Stud.* 36, e12632. doi: 10.1111/joss.12632

Ares, G., Machín, L., Girona, A., Curutchet, M. R., and Giménez, A. (2017). Comparison of motives underlying food choice and barriers to healthy eating among low medium income consumers in uruguay. *Cad. Saude Publica* 33, e00213315. doi: 10.1590/0102-311x00213315

Aune, D., Giovannucci, E., Boffetta, P., Fadnes, L. T., Keum, N., Norat, T., et al. (2017). Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality-a systematic review and dose-response meta-analysis of prospective studies. *Int. J. Epidemiol.* 46, 1029–1056. doi: 10.1093/ije/dyw319

Balsevich, F., Berdegué, J. A., Flores, L., Mainville, D., and Reardon, T. (2003). Supermarkets and produce quality and safety standards in Latin America. *Am. J. Agric. Econ.* 85, 1147–1154. doi: 10.1111/j.0092-5853.2003.00521.x

Bann, D., Villadsen, A., Maddock, J., Hughes, A., Ploubidis, G. B., Silverwood, R., et al. (2021). Changes in the behavioural determinants of health during the COVID-19 pandemic: gender, socioeconomic and ethnic inequalities in five British cohort studies. *J. Epidemiol. Commun. Health* 75, 1136–1142. doi: 10.1136/jech-2020-215664

Barlow, P., Reeves, A., McKee, M., Galea, G., and Stuckler, D. (2016). Unhealthy diets, obesity and time discounting: a systematic literature review and network analysis. *Obesity Rev.* 17, 810–819. doi: 10.1111/obr.12431

Beaulac, J., Kristjansson, E. and Cummins, S. (2009). Peer reviewed: a systematic review of food deserts, 1966–2007. *Prev. Chronic Dis.* 6, A105.

Bridle-Fitzpatrick, S. (2015). Food deserts or food swamps? A mixed-methods study of local food environments in a Mexican city. *Soc. Sci. Med.* 142, 202–213. doi: 10.1016/j.socscimed.2015.08.010

Carreño, P., and Silva, A. (2019). Fruit and vegetable expenditure disparities: evidence from Chile. *Br. Food J.* 121, 1203–1219. doi: 10.1108/BFJ-06-2018-0365

Carter, C. A., and Zhong, F.-N. (1991). Will market prices enhance chinese agriculture? A test of regional comparative advantage. *Western J. Agric. Econ.* 1991, 417–426.

Coates, A. E., Hardman, C. A., Halford, J. C., Christiansen, P., and Boyland, E. J. (2019). Food and beverage cues featured in youtube videos of social media influencers popular with children: an exploratory study. *Front. Psychol.* 10, 2142. doi: 10.3389/fpsyg.2019.02142

Colapinto, C. K., Graham, J., and St-Pierre, S. (2018). Trends and correlates of frequency of fruit and vegetable consumption, 2007 to 2014. *Health Rep.* 29, 9–14. Available online at: https://www150.statcan.gc.ca/n1/pub/82-003-x/2018001/article/54901-eng.htm

Dann, S. (2010). Redefining social marketing with contemporary commercial marketing definitions. *J. Bus. Res.* 63, 147–153. doi: 10.1016/j.jbusres.2009.02.013

Dean, W. R., and Sharkey, J. R. (2011). Rural and urban differences in the associations between characteristics of the community food environment and fruit and vegetable intake. *J. Nutr. Educ. Behav.* 43, 426–433. doi: 10.1016/j.jneb.2010.07.001

Delgado, E. M. G., Barbosa, N. L., Gómez, G. E. P., Cadena, J. T. F., and Navarro, A. L. (2010). Factores asociados al consumo de frutas y verduras en Bucaramanga, Colombia. *Arch. Latinoam. Nutr.* 60, 247–253. Available online at: http://ve.scielo.org/scielo.php?pid=S0004-06222010000300006&script=sci_arttext

Freire, W., Ramírez-Luzuriaga, M., and Belmont, P. (2015). Tomo I: Encuesta Nacional de Salud y Nutrición de la población ecuatoriana de cero a 59 años, ENSANUT-ECU 2012. *Rev. Latinoam. Pol. Acción Publ.* 2, 1. doi: 10.17141/mundosplurales.1.2015.1914

González, C. G., Domper, A., Fonseca, L., Lera, L., Correa, P., Zacarías, I., et al. (2020). Aplicación y efectividad de un modelo educativo en hábitos saludables con entrega de fruta y programa de actividad física en escolares. *Rev. Chilena Nutr.* 47, 991–999. doi: 10.4067/S0717-75182020000600991

Grassi, E., Evans, A., Ranjit, N., Dalla Pria, S., and Messina, L. (2016). Using a mixed-methods approach to measure impact of a school-based nutrition and media education intervention study on fruit and vegetable intake of italian children. *Public Health Nutr.* 19, 1952–1963. doi: 10.1017/S1368980015003729

Hartmann, C., Dohle, S., and Siegrist, M. (2013). Importance of cooking skills for balanced food choices. *Appetite* 65, 125–131. doi: 10.1016/j.appet.2013.01.016

Hendrickson, D., Smith, C., and Eikenberry, N. (2006). Fruit and vegetable access in four low-income food deserts communities in Minnesota. *Agric. Human Values* 23, 371–383. doi: 10.1007/s10460-006-9002-8

Hohoff, E., Zahn, H., Weder, S., Fischer, M., La¨ngler, A., Michalsen, A., et al. (2022). Food costs of children and adolescents consuming vegetarian, vegan or omnivore diets: results of the cross-sectional VeChi Youth Study. *Nutrients* 14, 4010. doi: 10.3390/nu14194010

Hosseini, B., Berthon, B. S., Saedisomeolia, A., Starkey, M. R., Collison, A., Wark, P. A., et al. (2018). Effects of fruit and vegetable consumption on inflammatory biomarkers and immune cell populations: a systematic literature review and meta-analysis. *Am. J. Clin. Nutr.* 108, 136–155. doi: 10.1093/ajcn/nqy082

INE (2018). *Sintesis de resultados Censo 2017*. Santiago: Instituto Nacional de Estadísticas.

Jordan, I., Keding, G. B., Stosius, L., Hawrysz, I., Janiszewska, K., and Heil, E. A. (2021). Changes in vegetable consumption in times of COVID-19-first findings from an international civil science project. *Front. Nutr.* 540, 686786. doi: 10.3389/fnut.2021.686786

Kao, C.-C., Wu, W.-H., and Chiou, W.-B. (2019). Exposure to nature may induce lower discounting and lead to healthier dietary choices. *J. Environ. Psychol.* 65, 101333. doi: 10.1016/j.jenvp.2019.101333

Koch, F., Hoffmann, I., and Claupein, E. (2021). Types of nutrition knowledge, their socio-demographic determinants and their association with food consumption: Results of the NEMONIT study. *Front. Nutr.* 8, 630014. doi: 10.3389/fnut.2021.630014

Kovalskys, I., Rigotti, A., Koletzko, B., Fisberg, M., Go'mez, G., Herrera-Cuenca, M., et al. (2019). Latin American consumption of major food groups: results from the ELANS study. *PLoS ONE* 14, e0225101. doi: 10.1371/journal.pone.0225101

Larsen, K., and Gilliland, J. (2009). A farmers' market in a food desert: evaluating impacts on the price and availability of healthy food. *Health Place* 15, 1158–1162. doi: 10.1016/j.healthplace.2009.06.007

Larson, N. I., Story, M. T., and Nelson, M. C. (2009). Neighborhood environments: disparities in access to healthy foods in the US. *Am. J. Prev. Med.* 36, 74–81. doi: 10.1016/j.amepre.2008.09.025

Lee, A., Mhurchu, C. N., Sacks, G., Swinburn, B., Snowdon, W., Vandevijvere, S., et al. (2013). Monitoring the price and affordability of foods and diets globally. *Obes. Rev.* 14, 82–95. doi: 10.1111/obr.12078

Levens, S. M., Sagui-Henson, S. J., Padro, M., Martin, L. E., Trucco, E. M., Cooperman, N. A., et al. (2019). The effects of positive affect and episodic future thinking on temporal discounting and healthy food demand and choice among overweight and obese individuals: protocol for a pilot 2 × 2 factorial randomized controlled study. *JMIR Res. Protoc.* 8, e12265. doi: 10.2196/12265

Liu, X., Yan, Y., Li, F., and Zhang, D. (2016). Fruit and vegetable consumption and the risk of depression: a meta-analysis. *Nutrition* 32, 296–302. doi: 10.1016/j.nut.2015.09.009

Livingstone, K. M., Burton, M., Brown, A. K., and McNaughton, S. A. (2020). Exploring barriers to meeting recommendations for fruit and vegetable intake among adults in regional areas: a mixed-methods analysis of variations across socio-demographics. *Appetite* 153, 104750. doi: 10.1016/j.appet.2020.104750

Long, N., and Roberts, B. (2005). "Changing rural scenarios and research agendas in Latin America in the new century," in *New Directions in the Sociology of Global Development (Research in Rural Sociology and Development*, Vol. 11), eds F. H. Buttel and P. McMichael (Bingley: Emerald Group Publishing Limited), 57–90. doi: 10.1016/S1057-1922(05)11003-8

López González, F., and Alarcón Osuna, M. A. (2018). Cambio generacional del consumo de frutas y verduras en México a través de un análisis de edad-periodo-cohorte 1994–2014. *Pobl. Salud. Mesoam.* 15, 23–37. doi: 10.15517/psm.v15i2.28458

Ma, Y., McRae, C., Wu, Y.-H., and Dube„ L. (2021). Exploring pathways of socioeconomic inequity in vegetable expenditure among consumers participating in a grocery loyalty program in Quebec, Canada, 2015–2017. *Front. Public Health* 9, 634372. doi: 10.3389/fpubh.2021.634372

Mason-D'Croz, D., Bogard, J. R., Sulser, T. B., Cenacchi, N., Dunston, S., Herrero, M., et al. (2019). Gaps between fruit and vegetable production, demand, and recommended consumption at global and national levels: an integrated modelling study. *Lancet Planet. Health* 3, e318–e329. doi: 10.1016/S2542-5196(19)30095-6

McGowan, L., Caraher, M., Raats, M., Lavelle, F., Hollywood, L., McDowell, D., et al. (2017). Domestic cooking and food skills: a review. *Crit. Rev. Food Sci. Nutr.* 57, 2412–2431. doi: 10.1080/10408398.2015.1072495

Micha, R., Khatibzadeh, S., Shi, P., Andrews, K. G., Engell, R. E., and Mozaffarian, D. (2015). Global, regional and national consumption of major food groups in 1990 and 2010: a systematic analysis including 266 country-specific nutrition surveys worldwide. *BMJ Open* 5, e008705. doi: 10.1136/bmjopen-2015-008705

Miller, V., Yusuf, S., Chow, C. K., Dehghan, M., Corsi, D. J., Lock, K., et al. (2016). Availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels: findings from the prospective urban rural epidemiology (pure) study. *Lancet Global Health* 4, e695–e703. doi: 10.1016/S2214-109X(16)30186-3

Morris, A. A., McAllister, P., Grant, A., Geng, S., Kelli, H. M., Kalogeropoulos, A., et al. (2019). Relation of living in a "food desert" to recurrent hospitalizations in patients with heart failure. *Am. J. Cardiol.* 123, 291–296. doi: 10.1016/j.amjcard.2018.10.004

Ortiz-Moncada, R., Ruiz-Cantero, M. T., and Alvarez-Dardet, C. (2006). Ana'lisis de la pol'itica de nutricio'n en Colombia. *Rev. Salud Publ.* 8, 1–13. doi: 10.1590/S0124-00642006000100001

Picchioni, F., Goulao, L. F., and Roberfroid, D. (2021). The impact of COVID-19 on diet quality, food security and nutrition in low and middle income countries: a systematic review of the evidence. *Clin. Nutr.* 2021, S0261–5614(21)00395-2. doi: 10.1016/j.clnu.2021.08.015

Pitts, S. B. J., Wu, Q., McGuirt, J. T., Sharpe, P. A., and Rafferty, A. P. (2018). Impact on dietary choices after discount supermarket opens in low-income community. *J. Nutr. Educ. Behav.* 50, 729–735. doi: 10.1016/j.jneb.2018.03.002

Pulcu, E., Trotter, P., Thomas, E., McFarquhar, M., Juha'sz, G., Sahakian, B., et al. (2014). Temporal discounting in major depressive disorder. *Psychol. Med.* 44, 1825–1834. doi: 10.1017/S0033291713002584

Rasmussen, M., Krølner, R., Klepp, K.-I., Lytle, L., Brug, J., Bere, E., et al. (2006). Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: Quantitative studies. *Int. J. Behav. Nutr. Phys. Activity* 3, 1–19. doi: 10.1186/1479-5868-3-22

Rekhy, R., and McConchie, R. (2014). Promoting consumption of fruit and vegetables for better health. have campaigns delivered on the goals? *Appetite* 79, 113–123. doi: 10.1016/j.appet.2014.04.012

Riediger, N. D., Shooshtari, S., and Moghadasian, M. H. (2007). The influence of sociodemographic factors on patterns of fruit and vegetable consumption in canadian adolescents. *J. Am. Diet. Assoc.* 107, 1511–1518. doi: 10.1016/j.jada.2007.06.015

Rodier, F., Durif, F., and Ertz, M. (2017). Food deserts: is it only about a limited access?. *Br. Food J.* 119, 1495–1510. doi: 10.1108/BFJ-09-2016-0407

Scalvedi, M. L., Gennaro, L., Saba, A., and Rossi, L. (2021). Relationship between nutrition knowledge and dietary intake: an assessment among a sample of Italian adults. *Front. Nutr.* 8, 714493. doi: 10.3389/fnut.2021.714493

Schafft, K. A., Jensen, E. B., and Hinrichs, C. C. (2009). Food deserts and overweight schoolchildren: evidence from Pennsylvania. *Rural Sociol.* 74, 153–177. doi: 10.1111/j.1549-0831.2009.tb00387.x

Scherr, S. J., and Hazell, P. B. (1994). *Sustainable Agricultural Development Strategies in Fragile Lands* (No. 581-2016-39510). Technical Report.

Shamah-Levy, T., Romero-Martínez, M., Barrientos-Gutierrez, T., Cuevas-Nasu, L., Bautista-Arredondo, S., Colchero, M., et al. (2021). *Encuesta Nacional de Salud y Nutricio'n 2020 sobre COVID-19. Resultados Nacionales*. Cuernavaca: Instituto Nacional de Salud Pu'blica. doi: 10.21149/12580

Shim, S., Gehrt, K., and Lotz, S. (2001). Export implications for the japanese fruit market: fruit-specific lifestyle segments. *Int. J. Retail Distrib. Manag.* 29, 298–314. doi: 10.1108/09590550110393983

Silva, A., Jano, P., and Von Hausen, N. (2021a). Obesity under full fresh fruit and vegetable access conditions. *PLoS ONE* 16, e0249333. doi: 10.1371/journal.pone.0249333

Silva, A., Magana-Lemus, D., and Godoy, D. (2021b). The effect of education on fruit and vegetable purchase disparities in Chile. *Br. Food J.* 123, 2756–2769. doi: 10.1108/BFJ-12-2020-1184

Uauy, R., Albala, C., and Kain, J. (2001). Obesity trends in Latin America: transiting from under-to overweight. *J. Nutr.* 131, 893S—899S. doi: 10.1093/jn/131.3.893S

United Nations General Assembly (2019). *Resolution Adopted by the General Assembly on 19 December 2019*. International Year of Fruits and Vegetables, 2021 A/RES/74/244.

Ver Ploeg, M., and Wilde, P. E. (2018). How do food retail choices vary within and between food retail environments? *Food Policy* 79, 300–308. doi: 10.1016/j.foodpol.2018.03.005

Vivas Carbó, R. A. (2020). *Patrones de consumo en la alimentacio'n de los individuos de altos ingresos de Bogotá, ante la pandemia COVID-19*. Bogotá: CESA.

Wang, D. D., Li, Y., Bhupathiraju, S. N., Rosner, B. A., Sun, Q., Giovannucci, E. L., et al. (2021). Fruit and vegetable intake and mortality: results from 2 prospective cohort studies of us men and women and a meta-analysis of 26 cohort studies. *Circulation* 143, 1642–1654. doi: 10.1161/CIRCULATIONAHA.120.048996

Wardle, J., Haase, A. M., Steptoe, A., Nillapun, M., Jonwutiwes, K., and Bellisie, F. (2004). Gender differences in food choice: the contribution of health beliefs and dieting. *Ann. Behav. Med.* 27, 107–116. doi: 10.1207/s15324796abm2702_5

Whitfield, L. (2012). Developing technological capabilities in agro-industry: Ghana's experience with fresh pineapple exports. *J. Dev. Stud.* 48, 308–21. doi: 10.1080/00220388.2011.635198

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press.

WHO/FAO. (2003). *Diet, Nutrition and the Prevention of Chronic Diseases (Report)*. Geneva: World Health Organization.

Yang, S. (2016). Effect of poverty on intertemporal choice and psychological explanations. *Psychology* 7, 1296–1306. doi: 10.4236/psych.2016.710131

Yedjou, C. G., Alo, R. A., Liu, J., Enow, J., Ngnepiepa, P., Long, R., et al. (2021). Chemo-preventive effect of vegetables and fruits consumption on the COVID-19 pandemic. *J. Nutr. Food Sci.* 4, 029.

Young, S. K., and Stewart, H. (2022). US fruit and vegetable affordability on the thrifty food plan depends on purchasing power and safety net supports. *Int. J. Environ. Res. Public Health* 19, 2772. doi: 10.3390/ijerph19052772

Zacarías, I., González, C. G., Domper, A., Barrios, L., Moñino, M., and Vio, F. (2020). "5 a Day programs: A global perspective country case studies, 5 a Day Corporation Chile," in *AIAM5—Global Alliance for the Promotion of the Consumption of Fruits and Vegetables and the Ministry of Agriculture*, Government of Chile.

Zupo, R., Castellana, F., Sardone, R., Sila, A., Giagulli, V. A., Triggiani, V., et al. (2020). Preliminary trajectories in dietary behaviors during the COVID-19 pandemic: a public health call to action to face obesity. *Int. J. Environ. Res. Public Health* 17, 7073. doi: 10.3390/ijerph17197073