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Food insecurity and its determinants in a vulnerable area of Santiago, Chile

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This study aims to identify the determinants associated to food insecurity in a group of households composed of schoolchildren and their mothers/caregivers, who lived in a low-to-medium community development index area of the city of Santiago, Chile with a high presence of migrant population. The non-probabilistic and convenience sample was made up of 646 people, who answered a series of surveys with the aim of characterizing this group in sociodemographic terms (sex, age, number of inhabitants in the household, place of food purchase, conditional or non-conditional state transfer program beneficiary status, persons in charge of purchasing food for the household, mothers/caregivers education level and basic knowledge of food and nutrition). To assess moderate-to-severe food insecurity and severe food insecurity, the Food Insecurity Experience Scale-FIES was applied between September and October 2021. Logistic regression analysis were used to carry out multivariate analyses, with the use of stepwise back-and-forward strategies for the selected variables and defining $p < 0.05$. These models were adjusted per number of inhabitants in the household. The results indicate that 25.4% of households presented moderate-to-severe food insecurity, and 6.4% severe food insecurity experience. The variables that presented significant odds of risk to food insecurity were being a migrant, low maternal education level, low performance on basic knowledge in nutrition and when the father was responsible for food purchases. Several public policies have been implemented in Chile during the most recent decades aimed at increasing access to healthier foods and the implementation of healthier food environments. Despite this, there are still social and economic health determinants that contribute to the risk of odds insecurity for the most vulnerable groups in the country, thus putting at risk the fulfillment of the human right to adequate food at risk.

KEYWORDS

food insecurity, Chile, migrant, maternal education, public policies, food and nutrition, Food Insecurity Experience Scale

Introduction

During the most recent decades, Chile has stood out among Latin American countries for a sustained growth in its economy, and a decrease in poverty and indigence indicators [Economic Commission for Latin America and the Caribbean (ECLAC), 2022]. The country has achieved great advances to ensure a better health and quality of life for the population. This includes the eradication of primary children undernutrition, the drastic reduction in infant mortality and excellent access to basic sanitation conditions practically throughout the country, giving Chile a Human Development Index that is considered “very high” (0.851 in 2020) [United Nations Development Programme (UNDP), 2020]. Simultaneously, and in line with the epidemiological transition that occurred in the country, overnutrition increased, as well as chronic diseases. Chile is currently one of the countries in the world with the highest prevalence of obesity in children and adults [Organization for Economic Co-operation and Development (OECD), 2019].

As is the case for several other Latin American countries, Chile is a large producer and exporter of agricultural and fishery products of great nutritional value, which have a great influence on its economy (Lebdoui, 2019). In contrast, sustained studies and national surveys in recent decades have been warning about the poor quality of the population’s diet, mainly in vulnerable groups that have a low socioeconomic status (Vega-Salas et al., 2021). These groups have a low level of compliance with the Dietary Guidelines for fruits, vegetables, fish, legumes, dairy products, and water along with an excessive consumption of ultra-processed foods. In addition, these groups present a higher prevalence of diseases associated mainly with risk factors related to poor diet and sedentary lifestyle, such as obesity, metabolic diseases and cardiovascular risk (Ministry of Health, 2014). Foods with a high nutritional value produced and exported by Chile have low domestic consumption and the reasons are mainly related to physical and economic barriers to accessing them throughout the country. Natural foods (vegetables, fruits, fish) that are considered healthy are expensive (Verdugo et al., 2016).

Also, data for food insecurity in the country was scarce until 2017, when the Food Insecurity Experience Scale (FIES) by the Food and Agriculture Organization of the United Nations (FAO) was used for the first time in a national survey (Ministry of Social Development, 2017). The scale identifies experiences/perceptions and behaviors of the respondent or the household related to food, specifically when they experience difficulty accessing food due to limitations of physical and/or financial resources. The results classify the individual or the household in a state of moderate-severe insecurity (they do not have money to buy healthy food, they are uncertain about their ability to obtain food and possibly they were left without food due to lack of money), severe food insecurity (no

accessed food, went a whole day without eating several times a day) or food secure (does not have difficulties accessing food) [Food and Agricultural Organization (FAO), 2022a]. Using this scale, which consists of questions related to the perception of people’s physical and economic access to adequate food, 13.1% of households present moderate-to-severe food insecurity and 3.4% present severe food insecurity. These percentage increase considerably when analyzed by income decile (with a difference of 25.3 percentage points between the 1st and 10th deciles), or by other factors such as family structure and the presence of children or persons with disabilities in the household (Ministry of Social Development, 2017).

In 2020, at the end of the first year of the COVID-19 pandemic, the results of a new national survey using the FIES scale showed that the indicators related to moderate-to-severe food insecurity and severe food insecurity worsened during this period. This was observed mainly in those households with the presence of dependent populations, such as children, adolescents, and the elderly (Giacoman et al., 2021). In addition, a study using online surveys carried out by Araneda et al. (2021), which considered 2,767 Chilean households at the beginning of the COVID-19 pandemic, indicated that more than 60.0% of families were concerned about not having enough money to buy food, highlighting the high perception of food insecurity in households.

Factors such as gender, level of education and knowledge level of food and nutrition are determinants of food insecurity. For instance, in a high-income community in Australia, gender was observed to affect the association between the level of education, food, nutrition knowledge and food insecurity. Knowledge about food and nutrition were inversely associated with food insecurity among men, but not among women (Gallegos et al., 2022).

Different studies point to the worsening of food insecurity in several countries because of the COVID-19 pandemic (Dondi et al., 2020; Elshahory et al., 2020; Niles et al., 2020). This impact is greater for the most vulnerable groups, including the migrant population (Smith and Wesselbaum, 2020). Recent data from the World Bank indicates an increase in food inflation for various countries, which implies an increase in the price of the retail market, thus worsening the status of food insecurity in households (World Bank and Food Safety Update, 2022). This requires that governments identify the most vulnerable groups, to take more focused measures that reduce short- and long-term effects of food insecurity, in addition to identifying the most critical factors affect this risk.

The objective of this work was to identify the determinants associated to food insecurity in the household in a group of mothers/caregivers of schoolchildren from a Southern area of the city of Santiago, Chile, which is characterized by a concentration of communes with a low-to-medium communal development index and a high presence of migrant population.

Materials and methods

Design, setting and subjects

This observational cross-sectional study is part of a research project named “Development, scaling up and validation of an integrated system of interventions in schoolchildren in nutrition, physical activity and community environment” (FONDEFIT18I0016). This project seeks to build an integrated intervention model for healthy school environments, through increasing hours of physical activity, promoting the availability of healthier foods within and around the school environment and school community participation. Seven public schools from six low-income municipalities of Santiago, Chile (El Bosque, La Granja, San Ramón, Lo Espejo, San Joaquín, and Pedro Aguirre Cerda) were invited to participate and compose the setting for the research. More information about this project has been previously published (Bolados et al., 2021; Suárez-Reyes et al., 2021).

A non-probabilistic convenience sample was analyzed, which included 646 mothers/caregivers of students from second to fourth grade of primary education during 2019–2021, who were enrolled in public schools of the aforementioned municipalities. The non-response rate for some of the variables only reached 0.6%. This protocol was approved by the Ethics Committee of the University of Santiago de Chile (record number 187/2019). Data collection was carried out between September and October 2021 and the selection criteria were (a) oversee the direct care of the student enrolled in the project during 2019–2020; (b) have command of the Spanish language or be accompanied by a translator (in the case of Creole-speaking migrants); and (c) agreed to participate in the study.

Instruments and data collection

Three different strategies were used to apply the surveys. The first strategy was online and consisted of sending an electronic form through REDCap (3.5%). A telephone interviewer supported the survey responses when necessary. The second strategy consisted of applying the survey by telephone (66.5%). The third strategy was the application of the survey in person (30.0%). The mothers/caregivers of the schoolchildren who were beneficiaries of the School Feeding Program (PAE) were interviewed at the time of receiving the benefit. During the COVID-19 pandemic, these families received a box of food from the school. When mothers/caregivers did not have a good understanding of the Spanish language, because Creole was their native language, the support of a translator was requested. The surveys were conducted by trained and standardized nutrition and/or physical activity professionals. All information was recorded in an electronic form to create databases, using the

REDCap platform (<https://www.project-redcap.org/>) licensed by Universidad del Desarrollo.

The sociodemographic variables were determined by using information of the person responsible for the student (age, sex, relationship, nationality) and characteristics of the household (number of inhabitants, changes in the work activity of the head of household in the previous 12 months, person responsible for the purchase of food, and place of purchase of fruits and vegetables). They were also asked if there were any beneficiaries of state subsidies within the household: food boxes; the National Complementary Food Program (PNAC), which consists in delivering powder milk to children under 18 months and powder milk beverages to children between 18 and 36 months; the National Complementary Food Program for the Elderly (PACAM), which delivers powder milk drinks and powder cream soups to people over 70 years of age; any type of monetary subsidy; or PAE with breakfast and lunch delivery.

To determine the prevalence of the perception of moderate-severe food insecurity and severe food insecurity and the household probability of moderate-severe and severe food insecurity, the Food Insecurity Experience Scale (FIES) was used. This scale consists of 8 questions, which seek to record the experience of food insecurity and hunger related to the household in the last 12 months. The possible answers are *Yes*, *No*, *I don't know*, or *No answer*. These responses were transformed into a dichotomous format (0: Yes, I don't know/No answer; and 1: No) for later analysis, according to the proposed methodology for processing the FIES [Food and Agricultural Organization (FAO), 2022b].

To evaluate basic knowledge of nutrition and food, a validated survey was used that evaluates eating practices in Chilean families of schoolchildren. This survey consists of 8 questions related to items of the Chilean Food-based Dietary Guidelines and their relationship with health benefits (Lera et al., 2013). These questions are related to: (1) benefits of consuming fruits/vegetables and fibers/antioxidants, (2) having dinner vs. a fast meal, (3) consumption of legumes instead of meat; (4) consumption of dairy and calcium; (5) consumption of sugary drinks and water; (6) consumption of salt and sugar; (7) consumption of saturated fats; and (8) consumption of fish and omega-3. The answers follow a Likert-type scale model with 5 points, varying from “strongly disagree” to “strongly agree.”

Variables and data analysis

Sociodemographic characterization

All the following variables were transformed into dichotomous values (0 and 1) for subsequent logistic regression analysis. The risk factors were: being a migrant, being raised by a mother whose education level was lower than secondary education (incomplete primary and complete primary), not being a beneficiary of state subsidies during the period studied

(PAE, PNAC, PACAM, food boxes, monetary subsidy), either individually or combined, and regularly buying food and fruit/vegetables in supermarkets. Regarding the age variable of the person responsible for the student, being ≤ 36 years old (median age of the group studied) was considered a risk (value = 0).

Knowledge of food and nutrition

Due to the nature of the questionnaire (Lera et al., 2013), the answers were grouped into “correct” (value = 0) or “incorrect” (value = 1). The sum of the correct scores $\geq 75\%$ was considered adequate (value = 1), and a performance lower than 75% was considered inadequate (value = 0).

Food Insecurity Experience Scale

The scale processing methodology followed the guidelines indicated by FAO [Food and Agricultural Organization (FAO), 2022a], which are based on the use of the Rasch model and indicate whether the information collected by application of the FIES presents an acceptable quality. The application developed by FAO was used for this process [Food and Agricultural Organization (FAO), 2022b]. The missing values were within the acceptable range (10.0%), indicating that there were no difficulties in understanding the questions. Once the database was loaded in the application, the INFIT values (which identify items with low performance in the evaluated population) were between 0.7 and 1.2 (accepted values between 0.7 and 1.3). For the OUTFIT values (which identify cases with a high pattern of unexpected responses), only two items presented values ≥ 2 , which corresponds to 25% of the total number of items (acceptable up to 25% of the total). The reliability of the Rasch model obtained was 0.79 (acceptable value = 0.7). Evaluation of the overlap of items was analyzed using the residuals of the correlations and the values found ranged between -0.08 and 0.25 (acceptable values <0.4). Considering the results obtained, and accepting the model, the prevalence values of moderate-severe food insecurity and severe food insecurity were obtained for the group studied, in addition to the probabilities of moderate-severe food insecurity and severe food insecurity for each household. These values were used in the regression models to identify the variables most associated to food insecurity.

The household values for the probabilities of moderate-severe food insecurity and severe food insecurity were transformed into dichotomous variables (values 0 and 1). The cut-off point established as an increased risk for moderate-severe food insecurity was 75% of the distribution. For severe food insecurity values >0 were considered. Due to their low occurrence, values >0 were above 75% of the distribution.

Statistical analysis

Categorical variables were presented according to their absolute frequency and the bivariate analysis between moderate-severe food insecurity and severe food insecurity and the independent variables was analyzed using the chi-square test. The variables that met the established significance criteria ($p < 0.1$) entered the multivariate analyses. For this, logistic regression tests (LOGIT) were used to contrast the moderate-severe food insecurity and severe food insecurity variables with each independent variable selected in the previous stage. The procedure was subsequently repeated using stepwise backward and forward strategies for the selected variables, and for the final model the stepwise forward technique was used. Stata 16.0 software (College Station, TX, USA) was used for statistical analyses, using $p < 0.05$ as significant and calculating the 95% confidence intervals (95% CI).

Result

The sample consisted of 646 subjects, of which 642 answered the questions on the FIES scale for perception of food security. Fourteen percent of the group declared to be a migrant, coming mainly from Haiti and Colombia. In the households surveyed, there was an average of 5 people (CI 95%: 5.0–5.2). The average age of the respondents was 38.4 years (CI95%: 37.6–39.1) and more than 70% were mothers/stepmothers of the students (Table 1).

Preliminary analyses indicate that the prevalence of moderate-severe food insecurity in households was 25.4% and that of severe food insecurity was 6.4%. More than 80% of the mothers/caregivers did not reach secondary education and in those households that present moderate-severe food insecurity, this condition prevailed (χ^2 : 13.1; $p < 0.01$) as well as in those households that presented severe food insecurity (χ^2 : 10.0; $p = 0.04$). About 50% of the people responsible for the children underwent a change in their work activity within the 12 months prior to the interview, which coincides with the period of restrictions imposed by the COVID-19 pandemic in Chile. That condition was not associated with the perception of moderate-severe food insecurity (χ^2 : 13.7; $p = 0.032$) and or severe food insecurity (χ^2 : 13.67; $p = 0.034$).

Table 2 presents the items related to knowledge about food and nutrition according to the Chilean Food-based Dietary Guidelines and their association with household moderate-severe food insecurity and severe food insecurity. Only in one concept (item 5, consumption of water and sugary drinks) an acceptable performance presented a positive association with absence of severe food insecurity (χ^2 : 4.2; $p = 0.04$). On the other hand, a total value performance $>75.0\%$ in all questions was related to absence of food insecurity (χ^2 : 6.4; $p < 0.01$).

Table 3 shows that, when analyzing the questions of the FIES scale individually, the concern of not having enough money

TABLE 1 General characterization of the sample studied.

Characteristics	Overall	MSFI		SFI	
		No n (%)	Yes n (%)	No n (%)	Yes n (%)
Nationality					
Chilean	557 (86.2)	365 (71.0)	149 (29.0)	404 (79.2)	106 (20.8)
Migrant	89 (13.8)	37 (53.6)	32 (46.4)	46 (66.7)	23 (33.3)
Mother's education		$\chi^2: 13.1; p: 0.01$		$\chi^2: 10.0; p: 0.04$	
Incomplete primary education	145 (22.4)	82 (63.6)	47 (36.4)	95 (74.2)	33 (25.8)
Complete primary education	410 (63.6)	252 (68.1)	118 (31.9)	281 (76.4)	87 (23.6)
Incomplete secondary education	47 (7.3)	25 (80.6)	6 (19.3)	28 (90.3)	3 (9.7)
Complete secondary education	33 (5.1)	38 (88.4)	5 (11.6)	39 (92.9)	3 (7.1)
Higher education	10 (1.5)	5 (50.0)	5 (50.0)	7 (70.0)	3 (30.0)
Family relationship to student		$\chi^2: 6.11; p: 0.106$		$\chi^2: 4.22; p: 0.239$	
Mother/stepmother	489 (75.7)	304 (68.6)	139 (31.4)	347 (78.7)	94 (21.3)
Father/stepfather	74 (11.5)	47 (73.4)	17 (26.6)	50 (78.1)	14 (21.9)
Grandfather/grandmother	52 (8.0)	27 (57.5)	20 (42.5)	31 (65.9)	16 (34.0)
Other	31 (4.8)	24 (82.7)	5 (17.2)	22 (81.5)	5 (18.5)

MSFI, Moderate-Severe Food Insecurity; SFI, Severe Food Insecurity.

TABLE 2 Performance for the basic knowledge test on food and nutrition (percentage of correct answers $\geq 75.0\%$) according to perception of Moderate-Severe Food Insecurity (MSFI) or Severe Food Insecurity (SFI) in the household.

Contents	All n (%)	MSFI		SFI	
		No n (%)	Yes n (%)	No n (%)	Yes n (%)
1. Fruits and vegetables contain fibers and antioxidants that are good for your health.	633 (98.6)	396 (68.9)	179 (31.1)	444 (77.8)	127 (22.2)
2. It is better to have afternoon tea than to have dinner at night.	272 (42.4)	177 (72.5)	67 (27.5)	192 (79.0)	51 (20.1)
3. You can eat beans, chickpeas, lentils, or peas, instead of meat.	550 (85.8)	354 (69.8)	153 (30.2)	395 (78.5)	108 (21.5)
4. Dairy products such as milk, yogurt and cheese provide calcium for the health of bones and teeth.	605 (94.4)	384 (68.7)	175 (31.3)	430 (77.5)	125 (22.5)
5. It doesn't matter if you drink soft drinks, juices or water, the most important thing is to drink 6 to 8 glasses of any liquid a day to stay hydrated.	489 (76.2)	320 (70.6)	133 (29.4)	359 (79.6)	92 (20.4)*
6. It is good to eat little salt and sugar.	574 (89.41)	368 (69.7)	160 (30.3)	409 (78.0)	115 (21.9)
7. Saturated fats are healthy; you should prefer foods that contain them.	475 (74.1)	305 (70.3)	129 (29.7)	342 (79.3)	89 (20.6)
8. You need to eat fish 2 times a week for its content of proteins, minerals and omega 3 fatty acids.	617 (96.1)	389 (69.2)	173 (30.8)	437 (78.3)	121 (21.7)
Performance survey knowledge about food and nutrition $\geq 75\%$.	539 (84.2)	354 (70.8)	146 (29.20)**	390 (78.6)	106 (21.4)

MSFI, Moderate-Severe Food Insecurity; SFI, Severe Food Insecurity; * $p < 0.05$; ** $p < 0.01$.

to purchase food prevailed in the whole group (65.4%). The perception of moderate-severe food insecurity is shown as the most prevalent. Being a migrant was significantly associated with moderate-severe food insecurity ($p = 0.003$) and severe food insecurity ($p = 0.024$), as well as a maternal education that only reached complete and/or incomplete levels of primary education ($p = 0.010$ y $p = 0.007$, respectively) (Table 4).

In the multivariate analyses, both the stepwise backward and forward strategies resulted in the same final model, which

corroborates that there is no divergence between the procedures. In the group studied, being a migrant doubled the risk of experiencing moderate-severe food insecurity at home (OR: 2.2; $p = 0.004$; 95% CI: 1.3–3.8) as well as of severe food insecurity (OR: 2.2; $p = 0.006$; IC95%: 1.2–3.8). In turn, mothers/caregivers who managed to complete basic education are more likely to have households with a lower risk of severe food insecurity (OR: 0.3; $p = 0.004$; IC 95%: 0.1–0.7). Both a performance above 75% in the tests on basic knowledge on food and nutrition (OR:0.6;

TABLE 3 Distribution of the affirmative answers (yes) to the questions on the FIES scale according to the perception of Moderate-Severe Food Insecurity (MSFI) or Severe Food Insecurity (SFI) in the household.

FIES scale questions	All <i>n</i> (%)	MSFI <i>n</i> (%)	SFI <i>n</i> (%)
1. You were worried you would not have enough food to eat?	420 (65.4)	172 (44.6)	121 (31.6)
2. You were unable to eat healthy and nutritious food?	291 (45.3)	170 (63.4)	124 (46.8)
3. You ate only a few kinds of foods?	296 (45.1)	171 (64.0)	124 (46.6)
4. You had to skip a meal?	127 (19.8)	110 (94.8)	103 (88.8)
5. You ate less than you thought you should?	218 (34.0)	170 (85.4)	126 (63.6)
6. Your household ran out of food?	94 (14.6)	79 (91.9)	73 (84.8)
7. You were hungry but did not eat?	107 (16.7)	96 (98.0)	91 (92.9)
8. You went without eating for a whole day?	32 (5.0)	31 (100.0)	29 (93.5)

MSFI, Moderate-Severe Food Insecurity; SFI, Severe Food Insecurity.

TABLE 4 Associations between the perception of household food insecurity and characteristics of the sample studied, according to perception of Moderate-Severe Food Insecurity (MSFI) and Severe Food Insecurity (SFI) in the household.

Attribute	MSFI			SFI		
	No <i>n</i> (%)	Yes <i>n</i> (%)	<i>p</i>	No <i>n</i> (%)	Yes <i>n</i> (%)	<i>p</i>
Being a migrant	37 (53.6)	32 (46.4)	0.003	46 (66.7)	23 (33.3)	0.024
Incomplete/complete primary maternal education	334 (66.9)	165 (33.1)	0.010	376 (75.8)	120 (24.2)	0.007
Knowledge about nutrition (beverages and water)	320 (70.6)	133 (29.4)	0.100	359 (79.6)	92 (20.4)	0.041
Performance knowledge about food and nutrition >75%	46 (56.8)	35 (43.2)	0.012	58 (71.6)	23 (28.4)	0.159
Purchase of food made by the father	127 (73.0)	47 (27.0)	0.170	147 (85.0)	26 (15.0)	0.006

$p = 0.048$), as lower-than-median maternal age (OR: 1.5; $p = 0.003$) turned out to be risk factors for moderate-severe food insecurity, as well as the cases where the father was responsible for the household food purchases, which increased the risk of severe food insecurity (OR: 0.5; $p = 0.006$). The models were adjusted by number of inhabitants in the household (Table 5).

Discussion

In 2017, Chile began the systematic measurement of the level of food insecurity in households, through national surveys. The results indicated that the prevalence of moderate-severe food insecurity was 13.6% and, of severe food insecurity was 3.4% in the country, which increased to 25.3 and 7.4%, respectively in the first income quintile (Ministry of Social Development, 2017). Our study provides similar results, with moderate-severe food insecurity prevalence of 25.4 and 6.4% for severe food insecurity in the group studied, although the factors related to the increased risk of food insecurity differ. At the national level, households with the presence of children, older adults, and with more than 5 members presented a higher risk of food insecurity. In the group studied, being a migrant and having maternal education that did not reach secondary level (incomplete primary and complete primary school) prevailed as factors of greater risk. The results of our analyses highlight the strong association between

social determinants of health and the risk of food insecurity in the country.

A recent national study with used telephone surveys conducted in June 2020 and repeated in July 2021 in more than 5,000 households, showed that the perception of moderate-severe food insecurity decreased from 17.4 to 7.6% in the period. Of the households surveyed, 41.8% decreased the perception of moderate-severe food insecurity (Ministry of Social Development, 2021).

In recent decades, Chile has implemented a series of policies and programs focused on improving the health conditions of the population, mainly by the installation of healthier food environments (Rodriguez et al., 2021). Several regulations obtained great international recognition, such as the application of frontal warning labels (FOP) on packaged foods that are high in critical nutrients, as well as advertising regulations (Ministry of Health, 2013, 2015) and the increase in taxes on sugary drinks (Treasury, 2014). Evaluation of these regulations has shown a decrease in the content of critical nutrients in packaged foods and the use of FOP for food selection (Quintiliano-Scarpelli et al., 2020, 2021), in addition to a lower consumption of sugary drinks (Cuadrado et al., 2020).

Although these measures have contributed to better food environments in the country, they are strongly influenced by the socioeconomic gradient. This relationship was verified by evaluating the food environments in school aged children, in

TABLE 5 Association between characterization variables of the group studied and the risk of presenting Moderate-Severe Food Insecurity (MSFI) and Severe Food Insecurity (SFI) in the household.

Variables	MSFI			SFI		
	OR*	<i>p</i>	95%CI	OR*	<i>p</i>	95%CI
Nationality	2.21	0.004	1.29–3.75	2.19	0.006	1.24–3.85
Maternal education level	0.45	0.009	0.24–0.81	0.33	0.004	0.16–0.70
Performance knowledge about food and nutrition >75%	0.61	0.048	0.36–0.99	-	-	-
Mother's age	1.49	0.003	1.02–2.18	-	-	-
Purchase of food made by the father	-	-	-	0.51	0.006	0.31–0.82

*Models adjusted per number of inhabitants in the household.

the southern area of Santiago, Chile. Schools located in areas with a higher community vulnerability index presented a lower offer of healthier foods 100 m around these establishments (Pinheiro et al., 2022). These results highlight the strong influence of the socioeconomic determinants of food insecurity. In addition to the household vulnerability, children are inserted in school spaces that do not favor the rupture of this model.

Evaluation of the individual determinants of food insecurity in Europe shows that women are affected by very specific factors such as education, poverty and residence area, whereas the stronger mitigating factor for food insecurity is education. The authors conclude that people with a higher education degree have a decreased risk of food insecurity, which is independent of gender (Grimaccia and Naccarato, 2020). These results agree with the conclusions of our study, where a lower education of mothers/female caregivers increases the risk of both moderate-severe food insecurity and severe food insecurity.

In our study, being a migrant was also a risk factor for both moderate-severe food insecurity and severe food insecurity, which coincide with other research carried out in Chile. Maury-Sintjago et al. (2019) studied the risk of food insecurity in a group of migrant population of Haitian origin residing in southern Chile. Their results indicate that the presence of children in the household, difficulties in understanding of Spanish, lack of access to basic services (electricity, water, sewerage, etc.) and not having legal residence are associated with a higher risk of food insecurity. Other migrant groups residing in Chile have a higher risk associated with the access to healthier foods, such as migrants from Colombia who have a lower overall diet quality compared to the Chilean diet (Hun et al., 2021).

Another finding of this research indicates that, in the group studied, having basic knowledge on topics related to food and nutrition is not related to a lower risk of moderate-severe food insecurity or food insecurity, contrary to the observations made by Dollahite et al. (2003) and Eicher-Miller et al. (2009), where interventions aimed at providing nutritional education to vulnerable families were able to reduce the impact of food insecurity risk.

Facing the latent problem of food insecurity in Chile requires inclusive public policies that consider the socioeconomic determinants of health. Being a beneficiary of government programs of conditional or non-conditional transfer of food and/or financial resources was not associated with a lower risk of food insecurity in our study. In Brazil, the use of a conditional financial transfer program in a vulnerable municipality managed to reduce the prevalence of food insecurity by about 17.0% and the authors conclude that this increase on food security is more related to the benefit itself than to an improvement in family income over time (Palmeira et al., 2020).

Access to healthier food in sufficient quantity and quality for a full life, in Chile, is permeated by different factors that are not only related to physical access to food through state benefits. Deep structural measures must be considered in order to find a possible solution to this problem.

Great efforts must be made to reverse school dropout, which has a national level prevalence rate that increases according to the age range of the students, increasing from 1.7% for the group between 5 and 13 years to 3.9% for the group between 14 and 17 years in 2019. This percentage is projected to grow during the COVID-19 pandemic (Ministry of Education, 2020). This effort to retain students in the school system, in addition to reducing the risk of food insecurity in their homes, can be accessed via the School Feeding Program (PAE), which should be universal in Chile, and consider the vulnerability of the school and not of the student's family as a criterion for admission. The current criterion makes it possible for students who are beneficiaries of PAE and others who are not, to coexist in the same school.

Measures related to bringing healthier foods closer to less favored populations should first consider a better distribution of the points of sale of these foods, such as expanding the presence of fruit and vegetable markets in urban spaces. In February 2022, the largest increase in commodity prices (meat, dairy products, cereals, vegetable oils, sugar) was observed, according to the Food Price Index of the United Nations Agency for Food and Agriculture (FAO) [Food and Agricultural Organization (FAO), 2022c]. Therefore, healthy products that are the basis of the diet of most families, such as meat, dairy products, and cereals,

are more expensive, which can further aggravate the state of food insecurity.

Recent analyses carried out by our research group have shown that, in Chile, Brazil and Ecuador, during the 2019–2021 period, the least processed food groups had a greater variation in consumer prices than what was observed for processed and ultra-processed products (data not yet published). Therefore, unhealthy products are more financially accessible to the population than those considered healthy. This data leads to the idea of an increase of taxes on unhealthy foods as a strategy to reduce their consumption. It has been widely discussed to restrict their access and in the case of Chile, it was implemented on sugar-sweetened beverages in 2014, increasing taxes from 13 to 18% on sugary beverages with a sugar content above or equal to 6.25 g/100 ml, while taxes were decreased from 13 to 10% on beverages with a content of sugar <6.25 g/100 ml (Treasury, 2014; Rodriguez et al., 2021). This must be reviewed considering the new global scenario, from the perspective of food insecurity. This measure should be accompanied by a reduction in the tax on healthy foods that are recommended by the Chilean Food-based Dietary Guidelines (fruits, vegetables, dairy products, fish, legumes) (Olivares et al., 2013, 2015).

One of the limitations of this study is related to the fact that the instrument used to measure the state of food security in households, despite being internationally validated and widely used in the literature, considers the subject's perception. To delve into analyses, it is important to consider other factors and their relationships, which could be addressed by qualitative research methodology. Another limitation of the study is that the application period of the survey was between the months of September and October 2021, the final period of the mobility restriction due to the COVID-19 pandemic in Chile. This factor could have increased the perceptions of food insecurity detected by the FIES scale.

The human right to adequate food has been ratified by several countries and includes among other concepts adequate availability and accessibility. However, as the United Nations Office of the High Commissioner for Human Rights emphasizes “The right to food is not the same as the right to be fed” and “The denial of the right to food is NOT the result of the lack of food in the world” (Office of the United Nations High Commissioner for Human Rights, 2010). Under this premise, it is imperative that public policies both in Chile and in Latin America are aimed at guaranteeing these rights, mainly for those groups that are most vulnerable according to their socioeconomic status, and also for the migrant population.

Data availability statement

The datasets presented in this article are not readily available because the project is in the phase of finalization and writing of

reports for the financing fund. Requests to access the datasets should be directed to ACP, apinheiro@udd.cl.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the University of Santiago de Chile (record number 187/2019). The patients/participants provided their written informed consent to participate in this study.

Author contributions

ACP and MM: conceptualization. ACP, MM, and JA-F: methodology. ACP, RO, and DQ-S: formal analysis and data curation. ACP and DQ-S: software and resources. ACP, DQ-S, MS-R, and TP: investigation, supervision, and project administration. ACP: writing—original draft preparation. ACP, DQ-S, MM, JA-F, TP, MS-R, and RO: writing—review and editing. ACP, DQ-S, and MM: visualization. ACP and TP: funding acquisition. 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.

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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.2022.924921/full#supplementary-material>

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