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Social determinants of food insecurity experienced by Ecuadorian women during the COVID-19 pandemic of Summer 2020: an online survey at the individual level

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Abstract

The COVID-19 pandemic has amplified concerns about food insecurity, prompting its investigation. An online pilot survey anonymously gathered responses from a non-probabilistic sample of 2058 Ecuadorian women. The Food and Agriculture Organization's Food Insecurity Experience Scale was used to measure moderate or severe food insecurity (MSFI). Data quality was assessed using the Rasch item response theory model; this is a single-parameter logistic model that considers food insecurity severity as a latent trait. The analysis produced MSFI prevalence rates with 90% confidence level margins of error (90%MoE). The highest MSFI was found in women: lacking resources for personal expenses (29.53%, 90%MoE = 3.21) compared to those who had them (12.47, 90%MoE = 1.40); who live in the Amazon region (21.37, 90%MoE = 4.24) versus those living in Highlands (17.66%, 90%MoE = 1.77) or in Coast (13.44%, 90%MoE = 2.40); with three or more children (20.97%, 90%MoE = 4.71) against those without children (12.63%, 90%MoE = 3.57); who experienced income reduction during confinement (18.31%, 90%MoE = 2) compared to those who did not (15.71%, 90%MoE = 1.85); and who are rural (18.13%, 90%MoE = 2.83) versus urban residents (16.63%, 90%MoE = 1.55). This study highlights that the most vulnerable Ecuadorian women experienced the highest food insecurity levels during lockdown, emphasizing the need to consider the intersection between income and sociodemographic factors and their impact on women's food insecurity in future research and policymaking.

Key words: food security, COVID-19, Food Insecurity Experience Scale, women, Sustainable Development Goal 2.1.2

Introduction

Ending hunger and all forms of malnutrition and achieving food security by 2030 is the global wake-up call of the second Sustainable Development Goal (SGD-2) (United Nations [UN] 2019; Food and Agriculture Organization [FAO] 2022). However, in the 2021 report about the State of Food Security and Nutrition in the World, several agencies of the UN system (FAO, the International Fund for Agricultural Development, the United Nations Children's Fund, the World Food Programme, and the World Health Organization) reported that more than 2 million people in 2019 experienced moderate or severe forms of food insecurity (MSFI), thus declaring an unprecedented setback in meeting SGD-2 (FAO et al. 2021*a*).

Like other unobservable or latent traits, food insecurity cannot be measured directly. However, it can be estimated (FAO 2016*a*, *b*). For this purpose, several food experience-based scales have been proposed (Salvador Castell et al. 2015). Examples of these scales are the Latin American and Caribbean Food Security Scale (FAO 2012) or the Household Food Insecurity Access Scale (Food and Nutrition Technical Assistance III Project 2020), developed by the United States Agency for International Development (USAID) and its partners, including governmental and non-governmental organizations and academic institutions. However, the current recommendation focuses on using the Food Insecurity Experience Scale (FIES), considered the first MSFI measurement system based on experience with comparable results (FAO et al. 2019). The "prevalence of moderate or severe food insecurity of the population based on the FIES" is the indicator 2.1.2 of the SDG-2 (FAO et al. 2019). Since 2019, FAO has reported its official MSFI statistics based on the FIES. The increase in MSFI in Latin America and the Caribbean was more pronounced than in other regions, reaching 41% in 2020 (FAO et al. 2021*b*).

It has been noted that official data on this indicator may differ considerably depending on the institution or the year of reporting. In this way, in Ecuador, the FAO reported 32.7% of the MSFI in 2018–2020 (FAO et al. 2021*a*), while the National Institute of Statistics and Censuses of Ecuador (INEC) estimated a range of values for the MSFI between 14.65% and 17.83% in 2017 (Moreno et al. 2018). This MSFI range resulted from its estimation across various scenarios. Displaying results in diverse scenarios aims to assess the impact on prevalences by defining different groups of items, some of which were considered not comparable with the FAO's global FIES during the estimation process. This suggests a methodological dilemma concerning the use of this indicator, which may stem from various sources. Thus, variations among institutions obtaining the measurement could lead to different data collection methodologies or discrepancies in defining and measuring the indicator. In this sense, it has been suggested that the methodology for calculating MSFI prevalence according to international standards proposed by FAO may be somewhat arbitrary (Moreno et al. 2018). Additionally, factors such as data quality, sample coverage, sampling methods, and reporting practices can influence the observed differences in the indicator across various reports and data sources. However, the MSFI estimate is just a methodological detail compared to achieving SGD-2, as COVID-19 and the measures implemented to contain it have substantially increased economic stress, unemployment, or the number of working hours, and also contributed to the decline in household income (Erokhin and Gao 2020; World Health Organization [WHO] 2022). All this may have had repercussions on the state of food security of the population (*Comunidad de Estados Latinoamericanos y Caribeños*; FAO et al. 2015; FAO 2020).

In fact, global post-pandemic forecasts suggest that 265 million people worldwide will suffer from severe food insecurity, which is double the number compared to 2019 (Famine Early Warning Systems Network [FEWS NET] 2020). In this regard, a study conducted in Chile compared the levels of food security prevalence before and during the COVID-19 pandemic, observing a significant increase in MSFI from 30% in 2017 to 49% in 2020 (Giacoman et al. 2021). Similarly, a study conducted in Argentina in 2021 found a prevalence of MSFI of 47.29% (Pantaleón et al. 2021); in this country, MSFI grew from 19.2% (2014–2016) to 35.8% (2017–2019) and severe food insecurity grew from 5.8% (2014–2019) to 12.9% (2017–2019), showing a progressive increase in this indicator in recent years (FAO et al. 2020).

It has been estimated that, in 2020, women suffered 10% more from MSFI than men, compared to 6% in 2019 (FAO et al. 2021*b*). The evidence shows that MSFI is a historical and structural problem present in women (Jung et al. 2017), with an emphasis on female-headed households (Negesse et al. 2020), black women, and women with less education (Schall et al. 2022). It is known that women receive lower wages, have fewer savings possibilities, work in more insecure jobs, or live in poverty more often than men (UN 2020; Bapolisi et al. 2021). Hence, economic aspects and various social determinants, including gender, are related to MSFI (Jung et al. 2017; Negesse et al. 2020). Research conducted during the pandemic coincides with and reinforces the pattern of high prevalence of MSFI among women in countries like Brazil (Schall et al. 2022) and the United States (Belsey-Priebe et al. 2021). These studies highlight how women and households supported by females were the most affected by hunger and MSFI. Regarding Latin America, a study conducted in the early phases of COVID-19 found a high prevalence of MSFI in the region, as well as associations linking MSFI with female gender and residential area (Benites-Zapata et al. 2021).

However, other characteristics should also be considered. For example, the analysis of the geographical areas where women reside has indicated a greater risk of MSFI in rural areas compared to urban areas, according to global statistics (FAO et al. 2021*a*). Nonetheless, these findings might offer a generalized perspective and may not accurately depict the situation in each country. Thus, for instance, in 2021, a higher prevalence of MSFI was observed in urban areas compared to rural areas in Pakistan (Ghulam et al. 2021).

The discouraging statistics showing the increase of MSFI in Latin America and Ecuador require permanent monitoring and the implementation of timely actions. It is worth noting that in the case of Ecuador, MSFI increased by 12 percentage points between the periods 2014–2016 and 2018–2020 (FAO et al. 2021*b*). However, statistics often focus on the entire population, without distinguishing between men and women and rarely highlighting the specific needs of women or the persistent and disproportionate gender gap, which pushes them further into unemployment and poverty (Diab-El-Harake et al. 2022).

There are harmful consequences for women's health associated with MSFI, such as increased anxiety and depression (Trudell et al. 2021), overweight and obesity (Hernández et al. 2017), and cardiovascular diseases (Salinas-Roca et al. 2022). The problems of the high prevalence of MSFI in women also transcend the household, as they are associated with lower food variety and quality (Larson et al. 2019), and have negative consequences for maternal, fetal, and child health (Cunningham et al. 2015). Due to the elevated prevalence of MSFI in Ecuador, provisions for food sovereignty are explicitly outlined in several articles of its Constitution, namely 13, 15, 280, 281, and 413 (National Assembly of the Republic of Ecuador 2008). In response, the Government of Ecuador enacted the Organic Law of Food Sovereignty (2010), which mentions the State's responsibility to encourage the consumption of healthy and nutritious food in Article 3, and the Organic Law of Rural Lands and Ancestral Territories (2018), aimed to address the needs of Ecuadorian Indigenous populations. Also, programs were developed to improve the nutritional situation of the population, including: the Integral Micronutrient Program focusing on pregnant women, infants, and children under 60 months (Ministry of Public Health of Ecuador 2011); the National Agricultural Strategy for Rural Women (Ministry of Agriculture and Livestock of Ecuador 2020), and the Intersectoral Food and Nutrition Plan-PIANE 2018–2025 (Ministry of Public Health of Ecuador 2018). Additionally, in 2019, the Ministry of Agriculture and Livestock (2020) formulated a strategy to bolster food security in Ecuador. This initiative was implemented through the National Agricultural Strategy for Rural Women, engaging 1300 women in its formulation. The MSFI also influences Ecuador's social pro-

Box 1. Items of the Food Insecurity Experience Scale.

During the last 30 days, was there a time when (yes/no):	
Item	Standard label
Q1. You were worried you would not have enough food to eat because of a lack of money or other resources?	Worried
Q2. You were unable to eat healthy and nutritious food because of a lack of money or other resources?	Healthy
Q3. You ate only a few kinds of foods because of a lack of money or other resources?	Fewfood
Q4. You had to skip a meal because there was not enough money or other resources to get food?	Skipped
Q5. You ate less than you thought you should because of a lack of money or other resources?	Ateless
Q6. Your household ran out of food because of a lack of money or other resources?	Runout
Q7. You were hungry but did not eat because there was not enough money or other resources for food?	Hungry
Q8. You went without eating for a whole day because of a lack of money or other resources?	Whlday

grams. Thus, during the period of data collection for this study (in the year 2020), the National Plan for Good Living 2017–2021 was in force. This Plan prioritized the development of productive and environmental capacities to attain food sovereignty and enhance rural living standards under Objective 6. The Plan also mentioned the imperative to narrow women's income gaps, eradicate all forms of violence, and promote women's empowerment (National Secretariat of Planning and Development 2013).

Within the framework of SGD-2 monitoring, the objective of this pilot study is to analyze the differences in MSFI experienced by Ecuadorian women during the COVID-19 confinement, according to their sociodemographic and economic characteristics.

Methods

Sampling design and data

A cross-sectional study was conducted, in which an online questionnaire was applied to a sample of Ecuadorian women. A convenience sampling procedure, where participation was voluntary and self-selected, was used (Matthias et al. 2021). The inclusion criteria for participation were being a woman (self-identified), a resident of Ecuador, and aged 18 and over. This resulted in a non-probabilistic sample of 2200 Ecuadorian women who responded to the anonymous online questionnaire between July and August 2020. During the data collection period—and the 30-day reference period for responses—pandemic lockdown in Ecuador was mandatory, except for some professional collectives, including health professionals (Presidencia de la República del Ecuador 2020). The only exclusion criteria in this phase of data collection were a negative response to the conditions included in the informed consent. As 12 women responded negatively to them, the sample was reduced to 2188 women.

The online questionnaire collected data on sociodemographic variables (age, region, area of residence, occupation, level of education, marital status, and the number of children) and economic variables (reduced income during confinement and availability of money for personal expenses).

In addition, data on food insecurity were obtained through the module for individuals of the FIES. This module comprises eight questions or items with dichotomous responses (Yes/No) focused on experiences associated with difficulties accessing food (Box 1).

No cultural or linguistic adaptation of the instrument was made. However, the version for the Ecuadorian population provided by the FAO (2017*a*) was used. The reference period considered was 30 days before conducting the survey. Based on the guidelines for the use of the FIES, the "Don't know" option was included, and the online questionnaire was configured so that none of the responses to the FIES items were mandatory (FAO 2016*a*, 2017*b*).

The questionnaire was created in Google Docs Editors and disseminated through the official and social networks (Instagram, Facebook, Twitter, and WhatsApp) of the *Escuela Superior Politécnica de Chimborazo*. Before conducting the survey, thirty female volunteers were pretested and answered the questionnaire from their electronic devices (smartphones, tablets, or computers). In addition, the respondents were asked about their understanding of the questions and the adequacy of the response options. Consequently, the survey was modified, incorporating the option "Consensual union" in marital status.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was reviewed and approved by the Human Research Ethics Committee of Hospital Carlos Andrade Marín (HCAM) of Quito (Ecuador), N°. IESS-HCAM-CEISH-2020-1206-0 F. Informed consent was presented in the initial part of the online questionnaire and indicated the estimated time to complete the survey (7 min), the study's purpose, and the participant's right to answer voluntarily and confidentially. The participants only had access to the questionnaire once they had accepted to participate. Otherwise, the screen showed the acknowledgment interface, and the process ended.

Validation of the Rasch model

The FIES methodology (FAO 2018), based on item response theory (IRT), was used to measure MSFI in the surveyed pop-

Table 1. Statistical validations and item parameters ($N = 2058$[a]).

	First validation[b]				Second validation[c]			
Item	Item parameter	Standard deviation	Infit	Outfit	Item parameter	Standard deviation	Infit	Outfit
Worried	−10.499	0.228	1.008	1.173	−9.795	0.320	1.000	0.385
Healthy	−7.294	0.162	0.515	1.610	−5.983	0.273	1.021	0.914
Fewfood	−4.722	0.190	0.798	1041.807	–	–	–	–
Skipped	−1.276	0.293	0.286	41.907	–	–	–	–
Ateless	1.955	0.335	0.693	2.564	−0.909	0.417	1.031	0.609
Runout	5.336	0.402	0.656	0.102	3.055	0.537	1.131	0.229
Hungry	7.351	0.431	0.412	0.017	5.634	0.563	0.616	0.023
Whlday	9.148	0.539	0.958	0.021	7.998	0.739	0.985	0.018

Note: Values in logistic scale; the item parameter is understood in relation to the rest of the parameters, not admitting an absolute interpretation; the value 0 is therefore arbitrary.
[a]Incomplete cases and cases with an unusual response pattern have been removed.
[b]Number of cases complete non-extreme = 1208.
[c]Fewfood and Skipped items have been removed; number of cases complete non-extreme = 1196.

ulation. The IRT is a statistical procedure for measuring latent variables by analyzing survey data. The IRT model of the FIES is the Rasch model (FAO 2016*b*)—or one-parameter logistic model (Rasch 1960; Nord 2014)—which considers the severity of food insecurity as a measurable latent trait (FAO 2016*b*). The Rasch model is based on four assumptions: (1) only the dimension of access to food security is represented by the results of the response; (2) the more severe the food insecurity, the greater the probability that a respondent answers affirmatively to the following item; (3) a respondent's answers to the eight items of the FIES are correlated, as they are conditioned by the severity of the respondent's food insecurity, and (4) all questions are related to the latent trait of food insecurity and differ only in the level of severity (Cafiero et al. 2014). The Rasch model assumes that the severity level of food insecurity of the respondents and of the items is on the same one-dimensional scale (Cafiero et al. 2018).

The application of the FIES methodology started with the preparation of the initial sample of 2188 women. The eight items of the FIES were coded according to the respondents' responses: 0 = No and 1 = Yes (Ballard et al. 2013). The 80 incomplete cases with no response or a "Don't know" response to any of the items were excluded from the analysis, resulting in a reduction of the sample to 2108 women. Subsequently, response patterns were analyzed. In this sense, according to the assumptions of the Rasch model, a respondent who answers "no" to an item is expected to also answer "no" to the more severe items, and a respondent who answers "yes" to an item is expected to also answer "yes" to the less severe items. The 50 cases that deviated from this usual response pattern were eliminated (FAO 2018), resulting in the final 2058 women respondents (hereinafter referred to as the surveyed population).

In the second phase, the statistical validation of the Rasch model was conducted to verify the quality of the data and to check whether they could be used to calculate a coherent and comparable measure of MSFI in the surveyed population (FAO 2018). The evaluation of the consistency of the data with the assumptions of the Rasch model was carried out using the chi-square item-fit statistics (infit and outfit) (Nord 2014), the correlation matrix of the items, and the Rasch reliability.

Under the Rasch model, the expected value of the item-fit statistics is 1.0. Thus, an item is considered suitable for analysis if its fit statistics are between 0.8 and 1.2 (Ballard et al. 2013). However, in practice, those items whose fits are between 0.5 and 1.5 can be regarded as "productive for measurement" (Wright and Linacre 1994). When the fit of an item is greater than 2, it alters the measurement power of the scale (Linacre 2017). When the data does not fit the Rasch model, items with poor performance can be discarded (Cafiero et al. 2014). A high outfit shows that the answers to an item follow an unusual pattern concerning the rest of the items, and a high infit shows that the relationship between an item and the latent trait is weak (Nikolaus et al. 2019). In this sense, it is convenient to pay attention to the items with a high fit in the first instance, since their elimination will cause the rest of the items to readjust, placing their fit statistics within the productive range for the measurement (Linacre 2017).

After the first validation of the model was conducted, the items that did not fit it were eliminated: Skipped, with the minimum infit (less than 0.5), and Fewfood, with the maximum outfit (greater than 2). The fit statistics of the second validation indicated that the remaining six items were suitable for analysis. The number of complete nonextreme cases with all their affirmative or negative responses (total score 0 or 8) in the second validation was 1196. As this number was greater than 1000, the results were considered reliable (Nord 2014) (Table 1).

The correlation matrix was obtained to allow the identification of items that represent the same or closely related food insecurity conditions. All the elements of the correlation matrix had values of less than 0.4; therefore, there was no redundancy between the items (FAO 2018).

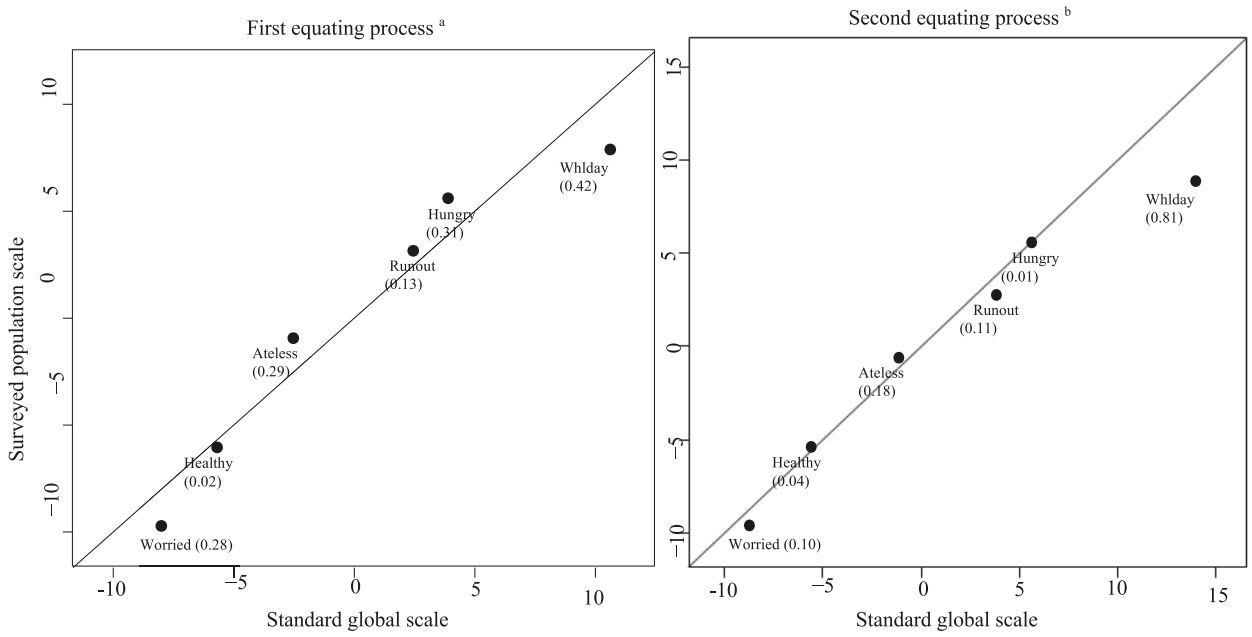
The Rasch reliability or proportion of data variability explained by the model is considered acceptable when it is greater than 0.7 for a number of items equal to 8 (Fisher 1962; FAO 2018). A value of 0.81 was obtained for a 6-item scale, showing high discriminatory power.

Table 2. Respondent parameters and probability of moderate or severe food insecurity by raw score ($N = 2058$[a]).

Raw score	Respondent parameter	Standard deviation	Probability of moderate or severe food insecurity
0	−9.876	1.927	0.000
1	−7.893	2.102	0.006
2	−3.445	2.680	0.381
3	1.027	2.110	0.959
4	4.290	1.649	1.000
5	6.876	1.621	1.000
6	8.338	1.927	1.000

Note: Parameter estimation after removing Fewfood and Skipped items; values of respondent parameters and standard deviation in logistic scale.
[a]Incomplete cases and cases with an unusual response pattern have been removed.

Fig. 1. Equating plots. Absolute difference between the standard items of the surveyed population and the standard global scales in brackets. [a]All items are common items; [b]Whlday is a unique item.



Food insecurity scale of the surveyed population

The food insecurity scale of the surveyed population was obtained by calculating the items and respondent parameters, as well as their corresponding standard errors. These parameters indicate the severity of food insecurity among the FIES items and respondents: the lower the parameter's value, the lower the level of severity on the scale (FAO 2016*a*).

The values of the item parameters enabled the ordering of the items in increasing food insecurity severity from Worried (−9.795) to Whlday (7.998) (Table 1).

The values of the parameters of the respondents indicated that the greatest difference in the severity of food insecurity (in absolute terms) was among the respondents whose raw scores or the number of affirmative answers to the items were 2 and 3 (difference equal to 4.472), compared to the minor difference between scores 5 and 6 (difference equal to 1.462) (Table 2). The probability of experiencing MSFI was equal to 1 for respondents with a raw score of 4 or more.

The procedure for the equalization or calibration of the food insecurity scale with the FIES global reference scale was carried out by readjusting the parameters to those of the global reference scale (FAO 2016*a*). The difference in absolute value between the corresponding items of both scales was less than 0.35 in all cases ("common items"), except in Whlday—with two affirmative answers and a difference equal to 0.42—for which it was considered as "unique item" (FAO 2016*a*) (Fig. 1). Whlday item represents being without eating for a whole day because of a lack of money or other resources during the past 30 days. The correlation between the common items was 99%.

Statistical analysis

A descriptive analysis was performed according to the sociodemographic and economic characteristics of the women in the surveyed population ($N = 2058$), calculating absolute frequencies and percentages.

Regarding data on food insecurity, the raw scores of the surveyed population in the eight items of the FIES were ob-

Table 3. Sociodemographic and economic characteristics of the surveyed population ($N = 2058$[a]).

Characteristic	Absolute frequency (%)
Region	
Ecuadorian Highlands	1256 (61.0)
Pacific Cost	548 (26.7)
Amazon region	254 (12.3)
Area of residence	
Urban	1556 (75.6)
Rural	502 (24.4)
Occupation	
Public/private employee	1652 (80.3)
Housekeeper/student	406 (19.7)
Educational attainment	
Primary/secondary	1227 (59.6)
University studies	831 (40.4)
Marital status	
Married/consensual union	1456 (70.7)
single/divorced/widowed	602 (29.3)
Number of children	
0	237 (11.5)
1–2 children	1620 (78.6)
More than 3 children	203 (9.9)
Reduction of income during confinement	
No	1042 (50.6)
Yes	1016 (49.4)
Having money for personal expenses	
Yes	1512 (73.5)
No	546 (26.5)

[a]Incomplete cases and cases with an unusual response pattern have been removed.

tained, along with their corresponding percentages. The raw scores were used to study the differences in MSFI experienced by the respondents according to the subpopulations, which were determined by each sociodemographic and economic characteristic. The raw scores are a suitable ordinal measure of food insecurity (Ghulam et al. 2021). For this analysis, a dichotomous variable was defined, with "Food security" (0–3 points) and "Moderate or severe food insecurity" (4–8 points) as the two categories (FAO 2016*a*). The chi-square homogeneity test for categorical variables and its continuity correction in 2×2 tables was applied. Logistic regression was used to estimate the risk of experiencing MSFI according to sociodemographic and economic characteristics. Odds ratios and their 95% confidence intervals were calculated.

The aforementioned equating process allowed obtaining comparable MSFI prevalence rates (expressed as percentages) and their margin of error (MoE)—with a 90% confidence level—both for the surveyed population and for the subpopulations determined by sociodemographic and economic characteristics.

The analysis was performed using the R software, the RM.Weights package (Cafiero et al. 2018), and the FIES online App (FAO 2019).

Results

In relation to sociodemographic and economic characteristics, the responses were collected from the surveyed population of 2058 women between 18 and 68 years, with an average age of 23 years. Among them, 61.0% of women indicated residence in the Andean highland region, and 75.6% reported living in an urban area. Additionally, 80.3% indicated working in the public or private sector, while nearly half (40.4%) disclosed having pursued university studies. Moreover, 70.7% stated being married or in consensual union, and 75.8% reported having one or two children. Finally, 73.5% indicated having economic resources for their expenses, while approximately half (50.6%) reported experiencing a reduction in income during the confinement period (Table 3).

Regarding characteristics related to food insecurity, a notable proportion of surveyed women (41.2%) stated feeling concerned about having healthy food (Worried). Additionally, 25.9% expressed being unable to afford healthy and nutritious food due to a lack of resources (Healthy). Moreover, 16.1% indicated having consumed limited food varieties due to financial constraints (Fewfood), while 9.5% mentioned skipping one of their three daily meals due to inadequate resources to acquire food (Skipped). Responses below 5% were

Table 4. Response to the items of the Food Insecurity Experience Scale in the surveyed population ($N = 2058$[a]).

Item	Number of affirmative answers (%)
Worried	1188 (41.2)
Healthy	748 (25.9)
Fewfood	466 (16.1)
Skipped	275 (9.5)
Ateless	139 (4.8)
Runout	44 (1.5)
Hungry	22 (0.8)
Whlday	4 (0.1)

Note: Worried: worried about not having enough food to eat due to a lack of money or other resources. Healthy: never being able to eat healthy and nutritious food due to a lack of money or other resources. Fewfood: having eaten little variety of food at some point due to a lack of money or other resources. Skipped: Skipping breakfast, lunch, or dinner because there wasn't enough money or other resources to get food. Ateless: having eaten less than you thought you should because of a lack of money or other resources. Runout: having been left home without food due to lack of money or other resources. Hungry: have ever felt hungry and not eaten because there was not enough money or other resources to get food. Whlday: having stopped eating for a whole day due to lack of money or other resources.
[a]Incomplete cases and cases with an usual response pattern have been removed.

recorded for questions concerning eating less than what was deemed adequate (Ateless) and going without food due to financial constraints (Runout). Percentages were below 1% for the Hungry question—0.8% of women reported experiencing hunger due to not eating—and Whlday—0.1% of female respondents reported going an entire day without eating (Table 4).

Significant differences were detected between the percentages of surveyed women who experienced MSFI according to whether they lived in the Amazon region (17.7%), the Ecuadorian Highlands (15.1%), or the Pacific Coast (10.4%) regions ($p < 0.01$) (Table 5). In this sense, the risk of experiencing MSFI is higher for women residing on the Pacific Coast compared to those in the Ecuadorian Highlands (OR = 0.65, 95% CI 0.48–0.90, $p = 0.01$). The percentage of women who experienced MSFI was also significantly higher among women who were married or in consensual union (15.3%) than among those who were single, divorced or widowed (11.5%) ($p < 0.05$). Accordingly, being single, divorced, or widowed serves as a protective factor against experiencing MSFI (OR = 0.72, 95% CI 0.54–0.95, $p = 0.02$).

In relation to the economic characteristics of the sample, there were significant differences between the subpopulations of the two categories considered. Thus, the percentage of women who experienced MSFI was higher among women whose income dropped during confinement (16%) than among those whose income did not drop (12.4%) ($p < 0.05$). Also, the percentage of women who experienced MSFI among women who did not have money for personal expenses during confinement (32.4%) was higher than among those who reported having resources for personal expenses (7.6%) ($p < 0.001$). In line with previous findings, the risk of experiencing MSFI was higher among women who encountered a reduction in income during confinement (OR = 1.35, 95% CI 1.05–1.73, $p = 0.02$) and particularly for those with no income for personal expenses (OR = 5.83, 4.49–7.57, $p < 0.001$).

Prevalence rates of MSFI for the surveyed population and for the subpopulations according to sociodemographic and economic characteristics

The MSFI prevalence rate for the surveyed population was 16.99% (90% MoE = 2.59) (Table 6).

The values of the MSFI prevalence rates for each subpopulation (Table 6) were consistent with the percentages of respondents who experienced MSFI calculated from the raw scores (Table 5): the higher the percentage of female respondents who experienced MSFI in a subpopulation, the higher the value of the prevalence rate in said subpopulation, and vice versa.

The MSFI prevalence rate for the subpopulation of women with public or private employment (17.01, 90% MoE = 1.52), as well as that for the subpopulation constituted by housewives and students (16.93, 90% MoE = 3.06), were similar to the prevalence rate for the surveyed population. The MSFI prevalence rate for the surveyed women living in rural areas (18.13, 90% MoE = 2.83) was higher than the prevalence rate for all surveyed women, as was that for women who suffered a reduction in their income during confinement (18.31, 90% MoE = 2) and, particularly, for those who did not have resources for their personal expenses (29.53, 90% MoE = 3.21).

Despite having larger margins of error due to the smaller size of the subpopulations (Table 1), the MSFI prevalence rate for women living in the Amazon region (21.37, 90% MoE = 4.24) and for women with three or more children (20.97, 90% MoE = 4.71) surpassed the prevalence rate for the surveyed population. Similarly, the prevalence rate of MSFI for women in the Ecuadorian Highland region (17.66, 90% MoE = 1.77), for women with primary/secondary education levels (17.26, 90% MoE = 1.77), for women who are married or in consensual union (17.36, 90% MoE = 1.63), and for women with 1 or 2 children (17.13, 90% MoE = 1.54) were slightly higher than the prevalence rate for the total women surveyed. In contrast, the MSFI prevalence rates for women residing in the Pacific Coast region (13.44, 90% MoE = 2.40), for women without children (12.63, 90% MoE = 3.57), for those who did not experience a decrease in their income (15.71, 90% MoE = 1.85), and for those who had resources for their personal expenses during confinement (12.47, 90% MoE = 1.40) were lower than the MSFI prevalence rate for the surveyed population. Likewise, the MSFI prevalence rates for women living in urban areas (16.63, 90% MoE = 1.55), for women with university studies (16.61, 90% MoE = 2.12), and for those who stated that they were single, divorced, or widowed (16.12, 90% MoE = 2.47) were slightly lower than those for the total women surveyed.

Discussion

This research provides evidence on the differences in MSFI among specific subpopulations of women in Ecuador in relation to the decrease in income during the COVID-19 con-

Table 5. Differences in moderate or severe food insecurity experienced by respondents among subpopulations determined by sociodemographic and economic characteristics ($N = 2058$[a]).

Characteristic	Food security[b], *n* (%)	Moderate or severe food insecurity[c], *n* (%)	OR (*p*-value[d])	95% CI
Region**				
Ecuadorian Highlands	1067 (85.0)	189 (15.1)		
Pacific Cost	491 (89.6)	57 (10.4)	0.65 (0.01)	0.49-0.90
Amazon region	208 (81.9)	46 (18.1)	1.25 (0.22)[e]	0.88-1.78
Area of residence				
Urban	1340 (86.1)	216 (13.9)		
Rural	426 (84.9)	76 (15.1)	1.11 (0.48)	0.83-1.47
Occupation				
Public/private employee	1417 (85.8)	235 (14.2)		
Housekeeper/student	349 (86.0)	57 (14.0)	0.98 (0.92)	0.72-1.35
Educational attainment				
Primary/secondary	1047 (85.3)	180 (14.7)		
University studies	719 (86.5)	112 (13.5)	0.90 (0.42)	0.70-1.16
Marital Status*				
Married/consensual union	1233 (84.7)	223 (15.3)		
Single/divorced/widow	533 (88.5)	69 (11.5)	0.72 (0.02)	0.54-0.95
Number of children				
0	213 (90.6)	22 (9.4)		
1–2 children	1382 (85.3)	238 (14.7)	1.67 (0.03)	1.05-2.64
More than 3 children	171 (84.2)	30 (15.8)	1.81 (0.04) [f]	1.02-3.23
Reduction of income during confinement*				
No	913 (87.6)	129 (12.4)		
Yes	853 (84.0)	163 (16.0)	1.35 (0.02)	1.05-1.73
Having money for personal expenses***				
Yes	1397 (92.4)	115 (7.6)		
No	369 (67.6)	177 (32.4)	5.83 (<0.001)	4.49-7.57

Note: n = absolute frequency; OR, odds ratio; CI, confidence interval; *p-value from the χ^2 test of homogeneity <0.05; **p-value from the χ^2 test of homogeneity <0.01; ***p-value from the χ^2 test of homogeneity <0.001. The first category is the reference category for odds ratios interpretation.
[a]Incomplete cases and cases with an unusual response pattern have been removed.
[b]Raw score from 0 to 3 points.
[c]Raw score from 4 to 8 points.
[d]p-Value <0.05 indicates statistical significance.
[e]Model p-value < 0.01.
[f]Model p-value = 0.08.

finement. This underscores the importance of studying vulnerable groups as a contribution to the formulation of more inclusive policies. In addition, it adds to increasing knowledge about other determinants of inequality in food insecurity among Ecuadorian women, whose intersection should be considered in future research. In this sense, the particularly severe situation faced by married women in rural areas and those in the Amazon region who lack financial resources for personal expenses highlights the relevance of empowering women (FAO 2017*a*).

At the onset of the COVID-19 pandemic, the Government of Ecuador managed the health crisis through a total of 58 health emergency declarations and orders. These measures included: the organization and strengthening of public and private health services with health infrastructure regulations; the diagnosis (rapid tests and PCR tests) and treatment of COVID-19-infected patients (including a toll-free telephone line); training and provision of financial incentives for health professionals; and the provision of supplies and coordination with other entities and institutions, such as fire brigades and provincial governments (International Labor Organization 2021). The National Emergency Operations Committee was established to manage risks and take and execute actions related to COVID-19. This national measure has been criticized for lacking citizen participation in decision-making (Torres and López-Cevallos 2021). Additionally, other immediate consequences of confinement on women, such as the increase in domestic violence (Wake and Kandula 2022), have also been shown to be associated with MSFI (Huq et al. 2021). The entire situation stemming from the pandemic resulted in an economic downturn related to the interruption of commerce, tourist activities, and the closure of companies (León and Erazo 2021). The already unequal economic status of women is expected to further deteriorate following the pandemic worldwide (UN 2020; Bapolisi et al. 2021).

Table 6. Prevalence of moderate or severe food insecurity for the surveyed population and for subpopulations determined by sociodemographic and income characteristics ($N = 2058$).

	Prevalence of moderate or severe food insecurity (%)	Margin of error[a]
Surveyed population	16.99	1.62
Region		
Ecuadorian Highlands	17.66	1.77
Pacific Cost	13.44	2.40
Amazon region	21.37	4.24
Area of residence		
Urban	16.63	1.55
Rural	18.13	2.83
Occupation		
Public/private employee	17.01	1.52
Housekeeper/student	16.93	3.06
Educational attainment		
Primary/secondary	17.26	1.77
University studies	16.61	2.12
Marital Status		
Married/consensual union	17.36	1.63
Single/divorced/widow	16.12	2.47
Number of children of the woman		
0	12.63	3.57
1–2 children	17.13	1.54
More than 3 children	20.97	4.71
Reduction of income during confinement		
No	15.71	1.85
Yes	18.31	2.00
Women have money for personal expenses		
Yes	12.47	1.40
No	29.53	3.21

[a]Calculated at the 90% confidence level.

It is important to mention that, in 2020, the UN announced that 84% of single-parent households were formed by women (UN-Women 2020) and that, according to the National Institute of Statistics and Censuses of Ecuador, 69.2% of households in Ecuador could not afford the monthly cost of the Basic Family Basket (Programa Mundial de Alimentos 2021). In addition, people's problems in meeting their nutritional requirements in Ecuador are related to the poorest income decile and to low protein consumption (FAO et al. 2020). However, there is a scarcity of data on food insecurity in Ecuador disaggregated by sex or by other vulnerable groups—both in official data and in previous studies, which makes it difficult to quantify the problem of food insecurity among women. Based on our research, women experiencing income reduction and those lacking personal funds during the pandemic exhibited higher MSFI prevalence rates than their counterparts who did not experience income reduction or had financial resources for their expenses, respectively. These differences were found to be statistically significant. Thus, hunger and acute and chronic malnutrition will continue to be a problem and a burden on the economies of many countries (FAO et al. 2020). However, as mentioned in previous research (Pool and Dooris 2021), low income alone does not explain the prevalence of MSFI. That is why, despite the limitations of our data, we conducted an analysis on the recognition that gender equality could be a necessary and innovative concept and practice to improve MSFI, even more than income. Furthermore, the empowerment of women could have an important impact on the social determinants of health (Ruiz-Cantero et al. 2019) and on the nutritional status of populations (Sugawara and Nikaido 2014; Cunningham et al. 2015), regardless of the economic situation of the household and the demographic characteristics of the population (Engle 1993). In this sense, women can play an interesting role in the eradication of MSFI because of their participation in food production, in agriculture (Ene-Obong et al. 2017), and in obtaining resources for their families (Sarki et al. 2016), as well as because of their role in child and family well-being, through care in dietary diversity and feeding practices (Larson et al. 2019). Proof of this was the important role that Ecuadorian rural women played in agriculture and marketing baskets with agricultural products for the population during the pandemic within the framework of the National Agricultural Strategy for Rural Women (Ministry of Agriculture and Livestock of Ecuador 2020). However, our findings show higher values of MSFI prevalence in rural women, which denotes a

divergence between their contributions to the population's food security and the challenges of proposing strategies to mitigate MSFI exclusively in them.

The condition of being a woman must also be accompanied by an analysis of its intersection with other social and maternal-infant dimensions. Thus, in our study, we found differences in the prevalence of MSFI among women from more vulnerable groups compared to more empowered women. A higher prevalence of MSFI was observed in women from the Amazon region compared to the Ecuadorian Highlands and the Pacific Coast regions. In this regard, the FAO, in its 2020 Report, conducted an analysis of the poor economic situation of the Amazon region, which could limit a healthy diet for its inhabitants (FAO et al. 2020). We also observed that women in this study experienced a higher prevalence of MSFI in households with more than three children or adolescents. This result is consistent with a study conducted in Chile, where a higher number of children is shown as a risk factor for MSFI (Giacoman et al. 2021). In 2020, the average number of children per woman in Ecuador was three (INEC 2021). This could be an aspect of interest for public policies and their adaptation to this context. In addition, in our study, we found that being married may be a risk factor for a higher prevalence of MSFI, as marriage and the presence of young children could explain the low participation of women in the labor force (UN-Women 2020).

However, a study conducted in Chile showed that, during the pandemic, female-headed households had fewer MSFI problems than male-headed households (Giacoman et al. 2021). It has been observed that women tend to manage the resources better than men (Larson et al. 2019) and, when they are the main contributors to household income, the risk of MSFI is substantially lower than when this role is assumed by the male partner or spouse (Schmeer et al. 2015).

Finally, we found a high percentage of women who were concerned about not having access to healthy foods. The global trend in food security refers to the growing uncertainty that a healthy, balanced, and diverse dietary pattern is becoming increasingly costly. This is related to the high prevalence of undernourishment (12.4%) reported by the FAO for Ecuador in the period 2018–2020 (Alle et al. 2021; FAO 2022). Food insecurity is therefore not only synonymous with hidden hunger and acute and chronic malnutrition (FAO et al. 2021*a*). Food insecurity can also have consequences for other aspects of people's health and well-being, for example, by causing negative psychosocial effects (Ballard et al. 2014). The experience, fear, uncertainty, or anxiety of not having healthy food constitutes a serious problem in itself, as it indicates a violation of a human right, that is, having adequate food (FAO 2018). In this regard, the impact of social norms that restrict the participation of married women in earning their own income should also be analyzed.

Limitations and strengths of the study

The main limitations of this study are, on the one hand, the use of non-probabilistic sampling—which prevents the generalization of our results to the population—and, on the other hand, the use of an online survey as a data collection technique—which could bias the information obtained; furthermore, online surveys face the challenge related to participant selection, given the difficulty in reaching certain demographic groups or engaging participants. This can result in a lack of representation of certain age groups, residential areas, or educational level groups. However, we show empirical evidence of the MSFI problem in a group of Ecuadorian women. Our study shows a MSFI prevalence rate of about 17% in a sample of Ecuadorian women as a pilot contribution to the monitoring of the SDG-2, with interesting differences by population subgroups. These data are similar to the figures shown by the National Institute of Statistics and Censuses of Ecuador (Moreno et al. 2018). However, it should be noted that these figures were obtained before the pandemic situation, and the FAO has warned that these figures may be even higher nowadays (FAO et al. 2021*b*).

It should also be noted that the application of the specific FIES module for the pandemic situation (FAO 2020) was not possible, since our survey was conducted before this module was available. In any case, it would be advisable to incorporate the FIES into national surveys (preferably periodic ones). This would allow not only to obtain MSFI prevalence rates that could be inferred for the entire population, but also to analyze its evolution over time.

With a view to including the FIES module in future surveys, it would be necessary to study (prior to its application) whether there are problems of interpretation of the items that presented a high outfit and, if necessary, to reformulate them (in the case of this study, Skipped and Fewfood). In this sense, cognitive tests could be used to verify the level of understanding of the questions, both in their structure and in their order. These tests could be applied to population groups shaped according to the cultural and regional variability of the country. Cognitive tests use a qualitative method that focuses on the reasoning behind the respondents' answers and have been shown to improve understanding of questions on surveys (Willis and Artino 2013).

Regarding the application of the FIES instrument, a 12-month reference period—with a previous linguistic and cultural adaptation—is recommended (FAO 2018). This would allow a better understanding of the questions in the FIES. In this sense, as suggested by the FAO, the order of the questions in the survey should be, first, demographic or general questions, second, the FIES items, and, finally, those relating to economic characteristics.

To ensure a certain degree of success, future studies similar to this descriptive study of socioeconomic and geographic dimensions associated with food insecurity will be enriched with an intersectional analysis of these dimensions. Women's food insufficiency is related to vulnerability factors such as intersectional identities and disparities (Moen et al. 2020). These include low income, resource management (Belsey-Priebe et al. 2021), rural area of residence (Benítez-Zapata et al. 2021; VanVolkenburg et al. 2022), marital status (having a partner or not), and household composition (having children or not) (Silva et al. 2023). These were some of the sociodemographic characteristics of this study that were related to MSFI. Other disparities that have been analyzed in previous studies, such as women as heads of household (Negesse et al. 2020),

low education (Grimaccia and Naccarato 2020), skin color (Afro-descendants) (Santos et al. 2023), and household composition that includes older adults (Silva et al. 2023), highlight the relevance of the intersectional perspective. This perspective can contribute to identifying elements that perpetuate exacerbated health inequalities when combined with other disparities and specific conditions of vulnerability.

The term intersectionality refers to the critical idea that race, class, gender, sexuality, ethnicity, nationality, ability, and age do not operate as unitary and mutually exclusive entities. Instead, they are interrelated phenomena that are reciprocally constructed (Crenshaw 2013)). Understanding the historical aspects of gender discrimination could help ensure that discrimination against women is not seen as an isolated problem; therefore, addressing the issues of MSFI in women must consider their own particularities (Crenshaw 2013; Peek et al. 2020). Health risks related to food insecurity, concern for future generations, and the burden of gender responsibility, including gendered responsibilities for domestic and care-giving roles (Izquierdo 2003), as well as gendered cultural expectations about food stewardship, may contribute to food anxiety among women. Within the medium- and long-term strategies considered to attain women's food security, emphasizing education is particularly valuable. Studies have demonstrated education's role in mitigating the effects of MSFI (Grimaccia and Naccarato 2020), analyzed within interconnected factors like income and motherhood, which significantly influence access to education. To this end, the Ecuadorian State has the Organic Law of Intercultural Education (2011), which, among other objectives, aims to promote policies, programs, and resources directed towards women who have lacked access to education or are educationally disadvantaged.

In Ecuador, similar to other ethnically diverse countries, Indigenous women's knowledge might have a positive correlation with dietary diversity, enjoyment of food, cultural practices, and nutrition (Kuhnlein 2017). Nevertheless, Indigenous nationalities in Ecuador have endured centuries of discrimination, with inequalities being more pronounced among women. Moreover, the various ethnic groups in the country face sexist behavior that undermines their autonomy. Interventions aimed at reducing MSFI should involve empowering women, minimizing occupational segregation, and enhancing resource redistribution (Silva et al. 2023; Nchanji et al. 2023), while incorporating cultural aspects that encompass an understanding of the agricultural and peasant worldview.

We conclude that, in the group of Ecuadorian women who formed part of this study, there were inequalities in food insecurity during the decline in income associated with the 2020 confinement. These inequalities were based on their sociodemographic and economic characteristics. The most severe situations of food insecurity stem from being married, living in rural areas or in the Amazon region, and having no money for personal expenses. Given the need for urgent interventions, we encourage further research to be conducted to enable state policymakers to identify the intersections between women's economic and sociodemographic characteristics and their impact on food insecurity. This will enable monitoring the results of programs and interventions with real-time data, which will ensure the functioning of food systems and strengthen effective social safety nets to safeguard food security, as well as women's empowerment in society.

To achieve SDG-2, Ecuador needs to implement a series of public policies and strategies. These strategies should focus on enhancing and strengthening the efficiency and diversity of productive systems to contribute to the variety of the Ecuadorian diet (Availability). Additionally, it is crucial to strengthen sustainable policies that support family and peasant economies, such as the National Agricultural Strategy for Rural Women, to mitigate the inflation affecting Ecuador's population (Access). Furthermore, actions must also be planned to counteract the consequences of natural phenomena and anthropogenic actions, such as deforestation and forest fires (Stability). The implementation of food and nutrition education programs is also essential (Use) (Aulestia-Guerrero and Capa-Mora 2020; Community of Latin American and Caribbean States 2020).

Acknowledgment

The authors thank Denise Sara Key, reviewer of scientific articles in English.

Article information

Editor

Candace Nykiforuk

History dates

Received: 20 January 2023
Accepted: 1 February 2024
Version of record online: 18 July 2024

Copyright

Data availability

Database will be shared upon receiving reasonable request. Please contact the corresponding author through this email: tannia.carpio@espoch.edu.ec.

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Competing interests

The authors declared that they have no conflict of interest.

Funding information

The authors declare no specific funding for this work.

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