

Food Insecurity in the Community: A Cross-Sectional Study in the Portuguese and Immigrant Population of Amadora

Ana Raimundo Costa^a Ana Hernando^b Joana Sousa^{b,c}

^aAmadora/Sintra Local Health Unit, Lisbon, Portugal; ^bNutrition Laboratory, Faculty of Medicine, University of Lisbon, Lisbon, Portugal; ^cEnvironmental Health Institute, Faculty of Medicine, University of Lisbon, Lisbon, Portugal

Keywords

Food insecurity · Health status · Community · Nationality

Abstract

Introduction: Food insecurity, defined as limited or uncertain access to adequate food, is recognized as a public health problem linked to poor eating habits, chronic diseases, and social inequalities. This study aims to characterize and compare food insecurity status among immigrant and Portuguese populations receiving primary healthcare in Amadora. **Methods:** A cross-sectional study was conducted based on interviews with individuals aged 18 and above, living in Amadora for at least 1 year. Sociodemographic and health status variables were collected, and food insecurity was assessed using a Portuguese-adapted version of the US Department of Agriculture Household Food Security Survey Module. Data analysis included binary logistic regression to explore the predictive capacity of variables, with food insecurity as the outcome. **Results:** The estimated prevalence of household food insecurity was 29.7%, with 10.5% classified as severely food insecure. Single individuals (OR: 3.090; CI: 1.353–7.059), those with basic education (OR: 3.296; CI: 1.175–9.247); immigrants (OR: 4.358; CI: 2.206–8.611), households with three or more members (OR: 2.686; CI: 1.019–7.079), and incomes below EUR 1,100 (OR: 7.359; CI:

2.613–20.726) were more likely to belong to food insecure households. When Portuguese households were analyzed, low income (OR: 8.730; CI: 2.607–29.232) and smoking habits (OR: 3.375; CI: 1.345–8.469) were found to be potential determinants of food insecurity. As for immigrant households, being single (OR: 6.002; CI: 1.404–25.659), having a household with three or more members (OR: 13.953; CI: 2.119–91.887), and low income (OR: 7.110; CI: 1.257–40.226) increased the risk of food insecurity. **Conclusion:** The results of this study show that food insecurity is significantly associated with sociodemographic and health factors, with differences between Portuguese and immigrant populations. Awareness of this problem and the need for monitoring should therefore be raised to prioritize community interventions.

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Insegurança alimentar na comunidade: um estudo transversal na população portuguesa e imigrante da Amadora

Palavras Chave

Insegurança alimentar · Estado de saúde · Comunidade · Nacionalidade

Resumo

Introdução: A insegurança alimentar é definida como o acesso limitado ou incerto a alimentos adequados e reconhecida como um problema de saúde pública associado a maus hábitos alimentares, doenças crônicas e desigualdades sociais. O objetivo deste estudo é caracterizar e comparar a insegurança alimentar entre a população portuguesa e imigrante dos cuidados de saúde primários da Amadora. **Metodologia:** Estudo transversal baseado numa entrevista a utentes adultos residentes na Amadora há pelo menos 1 ano, através de um questionário sociodemográfico e de saúde e à versão adaptada para a população portuguesa do *USDA Household Food Security Survey Module* para avaliar a insegurança alimentar. Recorreu-se à regressão logística binária para investigar a capacidade preditiva das variáveis, considerando como evento a presença de insegurança alimentar. **Resultados:** A prevalência estimada de insegurança alimentar para os agregados familiares foi de 29.7%, dos quais 10.5% insegurança alimentar grave. Os inquiridos solteiros (OR: 3.090; IC: 1.353–7.059), com ensino básico (OR: 3.296; IC: 1.175–9.247), imigrantes (OR: 4.358; IC: 2.206–8.611), com 3 ou mais elementos no agregado (OR: 2.686; IC: 1.019–7.079) e rendimentos abaixo de EUR 1,100 (OR: 7.359; IC: 2.613–20.726) tiveram maior probabilidade de pertencer a agregados em insegurança alimentar. Quando analisados os agregados portugueses, verificou-se que os rendimentos baixos (OR: 8.730; IC: 2.607–29.232) e os hábitos tabágicos do inquirido (OR: 3.375; IC: 1.345–8.469) são possíveis determinantes de insegurança alimentar. Nos agregados imigrantes, ser solteiro (OR: 6.002; IC: 1.404–25.659), ter um agregado com 3 ou mais elementos (OR: 13.953; IC: 2.119–91.887) e rendimentos baixos (OR: 7.110; IC: 1.257–40.226) aumentam o risco de insegurança alimentar. **Conclusão:** Estes resultados demonstram que a insegurança alimentar está significativamente associada a fatores sociodemográficos e de saúde, apresentando diferenças em relação à nacionalidade, pelo que deve haver uma sensibilização para esta problemática e para a necessidade de monitorização, de forma a priorizar intervenções na comunidade.

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Introduction

Food insecurity (FI) is associated with poor health outcomes, higher risk of chronic diseases, and inadequate disease management, with a clear relationship between the severity of FI and health status [1, 2]. In the presence

of chronic diseases, households often face significant financial burdens, forcing them to prioritize basic and essential needs such as food, heating, or housing. In turn, the extreme material deprivation associated with household FI, particularly severe FI, has been associated with compromised food intake and higher stress levels, reducing the ability to manage health problems, and increasing the need for health care [3–5].

Regardless of other social health determinants, household FI is a strong predictor of healthcare utilization and costs among working-age adults [1]. The healthcare community increasingly acknowledges the association between social needs of the population, such as FI and housing instability, and health outcomes and costs. Interventions addressing patients' social needs have been shown to produce improved health outcomes and reduced healthcare expenditures. Therefore, systematic FI screening in healthcare is imperative to meet the social needs of at-risk populations and enhance health outcomes [6–8].

The COVID-19 pandemic, coupled with economic downturns, has contributed to the increased prevalence of FI [9]. While 2021 marked a partial recovery from the impact felt, the emergence of the Ukraine war in February 2022, involving two of the world's major agricultural producers, caused shockwaves in the markets, further increasing uncertainty, and impeding job and income recovery. In many countries, the overall rise in inflation occurred in combination with a decrease in disposable income, prolonging the effects of the pandemic and exacerbating existing inequalities. These events placed an increased burden on the most vulnerable families [10, 11].

In 2020, 13.5% of the Portuguese population experienced material and social deprivation, with 18.4% at risk of poverty, and 16.4% reporting reduced family income [12]. In addition, the restrictions associated with the pandemic, such as lockdowns and remote work, have led to major changes in consumer behaviors, resulting in income loss and difficulties in affording money [13]. FI is identified as a complex and multidimensional phenomenon associated with inequalities in healthcare access and outcomes, especially affecting vulnerable groups such as those in disadvantaged socioeconomic categories (unemployed or in precarious employment conditions, with low education, or income levels) and the elderly population [14, 15, 16].

The resident population of Amadora municipality is persistently affected by significant fluctuations resulting from migratory flows, with immigrants accounting for 11.2% of the total population in 2016, with 99 different nationalities [17]. Compared to the national average of

6.7% immigrant population, Amadora stands out as one of the most culturally diverse municipalities in the country, with the majority originating from African countries, particularly Portuguese-speaking nations [17, 18].

Therefore, Amadora's health status is heavily influenced by demographic indicators, including an aging population, high population density, a large immigrant population, low family incomes, and high unemployment rates [18]. Given the national economic picture, the municipality's demographic characteristics, and the pivotal role of primary healthcare in assessing the food situation of the population, this study was carried out to evaluate and describe the FI status of the primary healthcare population in the municipality of Amadora.

Materials and Methods

A cross-sectional study was conducted, involving individuals aged 18 and above, living in Amadora for at least 1 year, and attending one of the 10 primary health care units in the municipality of Amadora between April and November 2023, who agreed to participate by giving their informed consent. Sample size was determined using Epi Info™, considering a target population of 179,165 individuals, an expected FI prevalence of 30% [19, 20], and a 95% confidence level (CI). Convenience sampling was used, stratified by health unit, to ensure proportional participation from all 10 units of the primary health center. Exclusion criteria included living in institutions and having any physical or cognitive impairment that impeded interview participation. Two intercultural mediators were included in the data collection team to facilitate communication with immigrant participants. They were previously trained in the conduction of the questionnaires and interviews, to minimize observation bias. The interviews took place in designated spaces (meeting or consultation rooms) and comprised two questionnaires. The first questionnaire consisted of closed-response items regarding gender, age, weight, height, nationality, marital status, education, occupation, household composition, and monthly income. Self-reported weight and height were used to calculate the participants' body mass index, classified according to the criteria of the World Health Organization [21]. Household composition referred to the number of people living in the same household, regardless of family relationships. Subjective classification of current health status and smoking habits were also gathered. The second questionnaire assessed FI using a Portuguese-adapted version

[22] of the US Department of Agriculture (USDA) Household Food Security Survey Module questionnaire [23, 24]. A score ranging from 0 to 18 was obtained according to the total number of affirmative answers. Each score was used to assign the respondent to one of four categories of FI (i.e., high food security, marginal food security/low FI, low food security/moderate FI, and very low food security/severe FI) (Table 1). Households with high and marginal food security were classified as "Food secure," while households with low and very low food security were classified as "Food insecure." The study protocol was reviewed and approved by the Ethics Committee for Health of ARSLVT.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 28.0, with a significance level of 0.05. Descriptive statistics were used to analyze sociodemographic and health status characteristics. The chi-square test of independence was used to verify the existence of an association between nationality and sociodemographic and health status variables. Spearman's correlation test was used to assess the correlation between FI level and ordinal variables. The predictive ability of FI for each of the independent variables under study was investigated using binary logistic regression, considering the presence of FI as the event. The selected method for introducing the variables was Stepwise Backward LR, to explore the most useful independent variables in predicting FI, eliminating superfluous ones [25, 26]. The results were presented as odds ratios (OR), adjusted ORs, and 95% CIs.

Results

Of the 352 individuals invited to participate, 323 agreed to participate, yielding a high adherence rate of 91.8%. The sample consisted of 71.5% women, with a mean age of 54.1 years (SD: 16.3 years, range: 18–93 years), and included 32% immigrants from 12 different nationalities. Overweight (pre-obesity and obesity) was prevalent in 76.1% of the sample. Nearly half (47.4%) of the participants were married or in common-law relationships, with households consisting of 3 or more members, and 33% had children under the age of 18. Regarding the level of education, 16.1% had completed higher education, while 5% had no schooling. Employment status varied, with 6% of Portuguese participants and 17.5% of immigrants being unemployed at the time of data collection ($p < 0.001$). Regarding monthly income, 35% of households had an income below EUR 1,100. Smoking habits were reported by 19% of Portuguese

Table 1. Food security scale

	Final score (number of affirmative answers)	
	households without children	households with children
High food security	0	0
Marginal food security/low FI	1–2	1–2
Low food security/moderate FI	3–5	3–7
Very low food security/severe FI	6–10	8–18
Adapted from: [24].		

participants compared to 4.9% of immigrants ($p = 0.012$). Almost 20% of the total sample considered their health as poor or very poor, with a higher prevalence among immigrants ($p = 0.007$). The results for sociodemographic and health status characteristics are presented in Table 2.

FI was present in 29.7% of households, with 19.2% experiencing moderate FI and 10.5% severe FI. Belonging to FI households was more commonly reported by women ($p < 0.001$), single individuals ($p < 0.001$), unemployed participants ($p < 0.001$), and immigrants ($p < 0.001$). FI level was also significantly correlated with self-reported health status ($r = 0.291$; $p < 0.001$), indicating that poorer individuals perceived health was associated with higher FI levels (Table 3). As shown in Table 4, in the general sample, single participants (OR: 3.090; 95% CI: 1.353–7.059), those with lower education (≤ 4 years of schooling; OR: 3.296; 95% CI: 1.175–9.247), immigrants (OR: 4.358; 95% CI: 2.206–8.611), households with 3 or more members (OR: 2.686; 95% CI: 1.019–7.079), and households with incomes below EUR 1,100 (OR: 7.359; 95% CI: 2.613–20.726) were more likely to belong to FI households. When evaluating nationalities separately, it was found that FI determinants for Portuguese participants were monthly household income and smoking habits: a household with an income below EUR 1,100 was 8.7 times more likely to be food insecure (OR: 8.730; 95% CI: 2.607–29.232), and participants with smoking habits were 3.4 times more likely to belong to food-insecure households (OR: 3.375; 95% CI: 1.345–8.469). As for immigrant participants, the determinants of FI were marital status (OR: 6.002; 95% CI: 1.404–25.659), household size (OR: 13.953; 95% CI: 2.119–91.887), and household income (OR: 7.110; 95% CI: 1.257–40.226), with single participants, households with 3 or more members, and incomes below EUR 1,100 being more likely to experience FI (Table 4).

Discussion

This study aimed to characterize the situation of FI in the Amadora community. The sample consisted of 323 participants and their respective households registered at Amadora's primary health care center. At the time of this study, the extent of this situation in the municipality of Amadora was unknown.

Sociodemographic Characteristics

As for gender, the sample consisted mostly of women (71.5%), exceeding the percentage reported by the 2021 Census (53.7%), possibly due to women's higher tendency to use health care services [25]. The prevalence of participants in both married or common-law marriages (47.4% vs. 47.1%) and households with two members (32.2% vs. 33.4%) are in line with the city's demographics [17]. Although the immigrant population prevalence was recorded at 13.8% in 2021 [26], 32% of the participants in this study were immigrants, possibly due to the greater use of healthcare services given their significant perception of poor and very poor health status. Education-wise, there was a higher illiteracy rate (5% vs. 2.4%), a higher rate of basic education (39.6% vs. 18.2%), and a lower prevalence of higher education (16.1% vs. 21.9%) compared to the city's 2021 data [17].

Prevalence of Food Insecurity

The results of this study revealed a FI prevalence of 29.7% among households registered at Amadora's primary healthcare center, of which 19.2% experienced moderate FI and 10.5% severe FI.

When examining the large nationwide studies carried out in Portugal over the last few years, a significant variability in the prevalence of FI is evident [19, 20, 26–28]. The first exploratory study on FI in the Portuguese population was conducted in 2003, revealing a prevalence of 8.1% [26].

Table 2. Sociodemographic and health related characteristics of Portuguese and immigrant participants

Variables	Total (n = 323)	Portuguese (n = 220)	Immigrants (n = 103)	p value*
Gender, n (%)				0.003
Female	231 (71.5)	146 (66.4)	85 (82.5)	
Male	92 (28.5)	74 (33.6)	18 (17.5)	
Age, n (%)				0.005
18–34 years	45 (13.9)	31 (14.1)	9 (8.7)	
35–64 years	183 (56.7)	113 (51.4)	52 (50.5)	
65 or more, years	95 (29.4)	76 (34.5)	42 (40.8)	
Mean±standard deviation	54.1±16.3	55.9±16.8	50.3±14.7	
Minimum – maximum	18–93	18–93	18–89	
BMI, kg/m ² , n (%)				0.742
Underweight	6 (1.9)	5 (2.3)	1 (0.9)	
Normal weight	71 (22)	50 (22.7)	21 (20.5)	
Pre-obesity	115 (35.6)	79 (35.9)	36 (34.9)	
Obesity	131 (40.5)	86 (39.1)	45 (43.7)	
Mean±standard deviation	29.7±5.6	29.6±5.4	30.1±6.1	
Minimum – maximum	14–47	17–41.8	14–47	
Marital status, n (%)				0.010
Single	91 (28.2)	52 (23.6)	39 (37.9)	
Divorced/widowed	79 (24.5)	62 (28.2)	17 (16.5)	
Married/common-law marriage	153 (47.4)	106 (48.2)	47 (46.6)	
Education, n (%)				0.445
No schooling	16 (5.0)	10 (4.5)	6 (5.8)	
Primary	128 (39.6)	83 (37.7)	45 (43.7)	
Secondary	127 (39.3)	93 (42.3)	34 (33.0)	
Higher	52 (16.1)	34 (15.5)	18 (17.5)	
Household, n (%)				0.003
1 element	66 (20.4)	50 (22.7)	16 (15.5)	
2 elements	104 (32.2)	80 (36.4)	24 (23.3)	
3 or more elements	153 (47.4)	90 (40.9)	63 (61.2)	
Household with children (under 18 years old), n (%)	107 (33.1)	63 (28.6)	44 (42.7)	0.012
Professional occupation, n (%)				<0.001
Paid worker	189 (58.5)	124 (56.4)	64 (62.1)	
Unemployed	31 (9.6)	13 (5.9)	18 (17.5)	
Other (student, retired, disabled)	103 (31.9)	83 (37.7)	29 (28.2)	
Household income, n (%)				0.542
Below EUR 1,100	113 (35.0)	77 (35.0)	36 (35.0)	
EUR 1,100 to EUR 2,000	115 (35.6)	82 (37.3)	33 (32.0)	
Above EUR 2,001	95 (29.4)	61 (27.7)	34 (33.0)	
Perceived health status, n (%)				0.007
Excellent	16 (5.0)	9 (4.1)	7 (6.8)	
Good	109 (33.7)	77 (35.0)	32 (31.1)	
Reasonable	134 (41.5)	99 (45.0)	33 (32.0)	
Poor	53 (16.4)	29 (13.2)	24 (23.3)	
Very poor	11 (3.4)	4 (1.8)	7 (6.8)	
Current smoking habits, n (%)	47 (14.5)	42 (19.1)	5 (4.9)	0.012

*p value for Pearson's χ^2 test.

Table 3. Distribution of sociodemographic characteristics by level of food security

Variables	High food security (n = 188)	Marginal food security (n = 39)	Moderate FI (n = 62)	Severe FI (n = 34)	p value*
Gender					<0.001
Female, n (%)	120 (63.8)	33 (84.6)	47 (75.8)	31 (91.2)	
Male, n (%)	68 (36.2)	6 (15.4)	15 (24.2)	3 (8.8)	
Age group					0.244
18–34 years, n (%)	27 (14.4)	7 (17.9)	8 (13.1)	3 (8.8)	
35–64 years, n (%)	108 (57.4)	26 (66.7)	31 (50.8)	18 (52.9)	
65 or more years, n (%)	53 (28.2)	6 (15.4)	23 (36.1)	13 (38.2)	
Body mass index (BMI)					0.550
Underweight, n (%)	3 (1.6)	1 (2.6)	0	2 (5.9)	
Normal weight, n (%)	44 (23.4)	8 (20.5)	10 (16.1)	9 (26.5)	
Pre-obesity, n (%)	59 (31.4)	19 (48.7)	24 (38.7)	13 (38.2)	
Obesity, n (%)	82 (43.6)	11 (28.2)	28 (45.2)	10 (29.4)	
Marital status					<0.001
Single, n (%)	37 (19.7)	10 (25.6)	26 (41.9)	18 (52.9)	
Divorced, n (%)	21 (11.2)	8 (20.5)	11 (17.7)	2 (5.9)	
Widowed, n (%)	21 (11.2)	4 (10.3)	6 (9.7)	6 (17.6)	
Married, n (%)	109 (57.9)	17 (45.6)	19 (30.6)	8 (23.5)	
Professional occupation					<0.001
Paid worker, n (%)	124 (65.9)	23 (58.9)	31 (50.0)	11 (32.4)	
Unemployed	8 (4.3)	4 (10.3)	7 (11.2)	12 (35.3)	
Other	56 (29.8)	12 (30.8)	24 (38.7)	11 (32.4)	
Education					0.434
No schooling, n (%)	10 (5.3)	0	4 (6.5)	2 (5.9)	
Primary, n (%)	73 (38.8)	12 (30.8)	31 (50.0)	12 (35.3)	
Secondary, n (%)	73 (38.8)	16 (41.0)	21 (33.9)	17 (50.0)	
Higher, n (%)	32 (17.0)	11 (28.2)	6 (9.7)	3 (8.8)	
Nationality					<0.001
Portuguese, n (%)	148 (78.7)	30 (76.9)	32 (51.6)	10 (29.4)	
Foreign, n (%)	40 (21.3)	9 (23.1)	30 (48.4)	24 (70.6)	
Cape Verde, n (%)	8 (4.2)	2 (5.1)	15 (24.2)	13 (38.2)	
Brazil, n (%)	20 (10.6)	3 (7.7)	4 (6.5)	3 (8.8)	
Sao Tome and Principe, n (%)	3 (1.6)	1 (2.6)	3 (4.8)	5 (14.7)	
Household composition					0.834
1 element, n (%)	35 (18.6)	7 (17.9)	14 (22.5)	10 (29.4)	
2 elements, n (%)	65 (34.6)	15 (38.5)	17 (27.4)	7 (20.6)	
3 or more elements, n (%)	88 (46.8)	17 (43.6)	31 (50.0)	17 (50.0)	
Household with children (under 18 years old), n (%)	62 (32.9)	10 (25.6)	20 (32.2)	15 (44.1)	0.413
Household income					0.834
Below EUR 1,100, n (%)	61 (32.4)	11 (28.2)	30 (48.4)	11 (32.4)	
EUR 1,101 to EUR 2,000, n (%)	71 (37.8)	16 (41.0)	18 (29.0)	10 (29.4)	
Above EUR 2,001, n (%)	56 (29.8)	12 (30.8)	14 (22.6)	13 (39.2)	
Perceived health status					<0.001 r = 0.291
Excellent, n (%)	11 (5.9)	2 (5.1)	2 (3.2)	1 (2.9)	
Good, n (%)	76 (40.4)	11 (28.2)	19 (30.6)	3 (8.8)	
Reasonable, n (%)	81 (43.1)	18 (46.2)	22 (35.5)	13 (39.2)	
Poor/very poor, n (%)	20 (10.6)	8 (20.5)	19 (30.6)	17 (50.0)	

*p value for Pearson's χ^2 test for categorical data (gender, marital status, professional occupation, nationality and household with children), Spearman's correlation test for ordinal data (age group, BMI, education, household composition and income and perceived health status).

In 2005–2006, the Fourth National Health Survey [27] estimated a FI prevalence of 16.5%, with 3.5% of the population facing severe FI. The *INFOFAMÍLIA* study [19], conducted between 2011 and 2014 among primary healthcare users, reported even higher numbers, suggesting that 48.7% of households were food insecure, of which 10.9% were experiencing severe conditions. Similarly, the *IAN-AF* study conducted between 2015 and 2016 [20], which assessed FI levels among the Portuguese population, found a FI prevalence of 10.1%, of which 2.6% was moderate or severe FI. At the same time, the Epidemiology of Chronic Diseases Cohort Study [27] reported that 19.3% of the adult Portuguese population faced FI, with 1.8% experiencing severe conditions. More recently, during the COVID-19 pandemic, the REACT-COVID study [28] reported that 29.1% of the population was at risk of FI. The reality of FI observed in Amadora can only be compared with the national scenario reported in the *IAN-AF* study, with its estimated prevalence of moderate and severe FI being more than ten times higher than the 2015–2016 results (29.7% vs. 2.6%). In both, the present study and the *IAN-AF* study, the full version of the Portuguese adapted scale from the USDA Household Food Security Survey Module, comprising 18 items and specific questions aimed at households with children under 18 years old, was used [22]. While differences in prevalence may be due to sociodemographic characteristics specific to the population of Amadora, factors such as the COVID-19 pandemic, the war in Ukraine, food and energy crisis, inflation, and increased debt, all contributing to prolonged economic fragility in the country, may also justify for the rise in FI prevalence compared to 2015–2016 [29].

Relation between Sociodemographic Characteristics and Food Insecurity

In line with existing literature, marital status [30, 31], level of education [30, 32, 33], nationality [14], household composition [31], and income [20, 32] are potential predictors of FI. Regarding nationality, immigrant participants and households have a higher prevalence of FI compared to those with Portuguese nationality (OR: 4.358; 95% CI: 2.206–8.611), with Cape Verde and Sao Tome and Principe being the nationalities that most contribute to this disparity. These findings are in line with international data, indicating a strong correlation between race/ethnicity and FI, with black households experiencing higher levels of FI compared to Caucasian ones [34]. At a national level, according to *IAN-AF* data, immigrant populations show a higher FI prevalence compared to the Portuguese population, particularly among non-European countries [14]. At a local level, data from Amadora may help explain this discrepancy, since, compared

to the rest of the immigrant population, people from Cape Verde and Sao Tome exhibit higher rates of unemployment and precarious housing [18]. Moreover, following the COVID-19 pandemic, FI among immigrant populations has been exacerbated, mainly due to job losses, reduced working hours, and low incomes, leading to a reduction in the purchase of nutritionally adequate foods, dietary changes, meal skipping, consumption of cheaper, lower quality food, and prioritization of children's nutrition [35].

Regarding education, participants with basic education were 3.3 times more likely to experience FI compared to those with higher education (OR: 3.296; 95% CI: 1.175–9.247). These results are in line with those observed by Álvares and Amaral [32], where schooling was the strongest independent factor associated with FI, with individuals lacking formal education being 8 times more likely to experience FI compared to those with a minimum of 10 years of schooling. Aguiar et al. [33] also assessed FI during the COVID-19 period and similarly found that schooling is a crucial social determinant not only of health but also of FI, with individuals with less than 12 years of schooling being 3 times more likely to experience FI. Both in the total sample and the nationality subgroups, income was the greatest determinant of FI, with households with monthly incomes below EUR 1,100 exhibiting ORs between 7 and 8, a trend supported by several studies [14, 30, 32, 33, 35], regardless of household composition. However, it should be noted that FI is not exclusive to low-income households, as it also affects other income classes, underscoring that income alone does not fully explain the situation of FI [36]. One possible explanation could be based on financial management skills, as households that show greater skills in this area are less likely to experience FI, even among those living with incomes below the poverty line [37]. Nutritional education for these households could be a possible strategy since studies indicate that food and nutrition education significantly improves the food security status of low-income families [38, 39]. Although gender has not been shown to be a good predictor of FI, it is associated with FI levels and is more prevalent among female participants, a trend that has also been reported by other authors [27, 31–33, 40]. This gender disparity can be explained by the fact that the sample had a higher representation of women compared to men (71.5% vs. 28.5%), possibly due to their increased use of health services [25]. Even though women contribute to food security at the household level through food acquisition, improved economic access through additional income, and time/food management skills, it has been shown that female-headed households are more likely to experience FI compared to male-headed households [41]. This gender disparity appears to be influenced by household composition rather than

Table 4. ORs, adjusted odds ratios, and respective CIs for the presence of FI and variables under study in Portuguese and immigrant households

Variables	Total sample		Portuguese households		Immigrant households	
	OR (95% CI)	adjusted OR (95% CI)	OR (95% CI)	adjusted OR (95% CI)	OR (95% CI)	adjusted OR (95% CI)
Gender						
Female	2.056 (1.147–3.683)	1.134 (0.522–2.465)	1.796 (0.829–3.893)	1.334 (0.499–3.568)	1.474 (0.530–4.101)	0.732 (0.143–3.753)
Male	1	1	1	1	1	1
Age group						
18–34 years old	1	1	1	1	1	1
35–64 years old	1.543 (0.715–3.333)	1.172 (0.437–3.141)	2.489 (0.697–8.889)	1.362 (0.324–5.716)	0.917 (0.290–2.893)	0.638 (0.128–3.173)
65 or more years old	1.538 (0.672–3.518)	0.523 (0.134–2.040)	2.333 (0.624–8.719)	0.598 (0.118–3.033)	2.333 (0.565–9.639)	1.799 (0.207–15.606)
Marital status						
Single	4.181 (2.329–7.503)	3.090 (1.353–7.059)	3.373 (1.421–8.009)	1.469 (0.400–5.393)	4.181 (2.329–7.503)	6.002 (1.404–25.659)
Divorced	2.092 (0.964–4.541)	1.696 (0.634–4.540)	3.662 (1.347–9.954)	1.337 (0.305–5.859)	2.092 (0.964–4.541)	0.702 (0.141–3.490)
Widowed	2.240 (1.002–5.006)	1.457 (0.443–4.794)	2.393 (0.841–6.805)	0.879 (0.183–4.218)	2.240 (1.002–5.006)	14.142 (0.000–3.450)
Married/ common-law marriage	1	1	1	1	1	1
Education						
No schooling	12.100 (3.304–44.313)	3.176 (0.660–15.275)	17.000 (1.993–145.000)	6.550 (0.600–71.469)	5.333 (0.968–29.393)	3.136 (0.302–32.553)
Primary	4.144 (1.806–9.509)	3.296 (1.175–9.247)	4.567 (1.293–16.136)	2.072 (0.503–8.540)	9.667 (2.414–38.713)	4.479 (0.862–23.283)
Secondary	1.094 (0.449–2.645)	0.818 (0.291–2.298)	1.360 (0.346–5.342)	0.695 (0.157–3.086)	0.800 (0.226–2.835)	0.491 (0.105–2.300)
Higher	1	1	1	1	1	1
Occupation						
Paid worker	1	1	1	1	1	1
Unemployed	6.277 (2.767–14.239)	1.919 (0.639–5.758)	1.860 (0.461–7.503)	0.690 (0.119–4.013)	15.273 (3.216–72.524)	5.137 (0.612–43.102)
Other (student, retired, disabled)	1.871 (1.096–3.192)	1.510 (0.657–3.471)	1.771 (0.879–3.570)	2.282 (0.620–8.403)	6.109 (1.976–18.891)	2.208 (0.353–13.821)
Nationality						
Portuguese	1	1	–	–	–	–
Foreign	4.721 (2.802–7.816)	4.358 (2.206–8.611)				

Table 4 (continued)

Variables	Total sample		Portuguese households		Immigrant households	
	OR (95% CI)	adjusted OR (95% CI)	OR (95% CI)	adjusted OR (95% CI)	OR (95% CI)	adjusted OR (95% CI)
Household						
1 element	1	1	1	1	1	1
2 elements	0.497 (0.251–0.983)	0.909 (0.353–2.337)	0.460 (0.197–1.073)	0.662 (0.234–1.875)	0.519 (0.145–1.849)	2.810 (0.403–19.585)
3 or +elements	0.800 (0.436–1.468)	2.686 (1.019–7.079)	0.424 (0.185–0.974)	0.762 (0.226–2.565)	1.008 (0.333–3.053)	13.953 (2.119–91.887)
Household with children (under 18 years)	1.183 (0.715–1.958)	1.334 (0.677–2.628)	0.734 (0.345–1.563)	0.747 (0.282–1.976)	1.682 (0.746–3.789)	2.784 (0.843–9.196)
Household income						
Below EUR 1,100	14.204 (6.293–32.061)	7.359 (2.613–20.726)	13.054 (4.254–40.056)	8.730 (2.607–29.232)	13.104 (3.684–46.614)	7.110 (1.257–40.226)
EUR 1,101 to EUR 2,000	2.719 (1.155–6.401)	2.520 (0.971–6.538)	2.396 (0.718–7.999)	1.912 (0.542–6.747)	2.762 (0.758–10.074)	2.647 (0.539–12.994)
Above EUR 2,001	1	1	1	1	1	1
Perceived health status						
Excellent	1	1	1	1	1	1
Good	1.034 (0.270–3.960)	2.085 (0.392–11.089)	1.059 (0.118–9.480)	2.109 (0.150–29.734)	1.500 (0.251–8.977)	1.359 (0.062–29.907)
Reasonable	1.532 (0.412–5.696)	3.553 (0.680–18.567)	1.877 (0.221–15.918)	3.968 (0.297–52.963)	2.353 (0.398–13.900)	2.568 (0.118–55.939)
Poor/very poor	5.571 (1.446–21.471)	5.271 (0.944–29.430)	4.952 (0.554–44.291)	5.469 (0.390–76.633)	8.571 (1.357–54.150)	5.160 (0.141–18.265)
Smoking habits	1.021 (0.519–2.009)	1.861 (0.780–4.439)	2.303 (1.071–4.953)	3.375 (1.345–8.469)	0.212 (0.230–1.968)	0.150 (0.011–2.089)
OR, odds ratio; CI, confidence interval.						

individual characteristics, with marital status potentially playing a role in cases of poor social relations, suggesting the significant role of having a partner [31]. Although no significant association between gender and marital status was observed in the study sample ($p = 0.160$), there was a weak but significant correlation between marital status and household composition, with most participants from households comprising of more than two individuals being married or in common-law marriage ($r = 0.236$; $p < 0.001$). Moreover, marital status was one of the predictors of FI, with single participants (86% of whom were women) being three times more likely to experience FI than those who were married or in common-law marriage (OR: 3.090; 95% CI: 1.353–7.059).

Relation between Health Status and Food Insecurity

In terms of perceived health status, 18% of the total sample considered their health as poor or very poor, a factor significantly correlated with FI levels since 50% of severely food insecure participants classified their health status as poor or very poor ($r = 0.291$; $p < 0.001$). Self-perceived health status is a valid and efficient measure of mental and physical health. It is comparable to other more complex instruments and can be used as a predictor of mortality, hospitalizations, and high use of outpatient services [42, 43]. Smoking was reported by 14.5% of the participants and was associated with nationality, with a higher prevalence of smokers (89%) in the Portuguese population ($p = 0.012$). Smoking was found to be a determinant of FI in this subgroup, with smokers being 3.4 times more likely to belong to a food-insecure household than nonsmokers (OR: 3.375; CI: 1.345–8.469).

Although 39.6% of food insecure participants were obese, no significant correlation was found between body mass index and FI ($p = 0.550$). This could be due to the high prevalence of obesity in the studied sample (40.5%), which exceeds the national figures of 22.3% observed in 2015–2016, and can be explained by the high rate of primary healthcare use among overweight individuals [44]. The coexistence of both FI and obesity is referred to as paradoxical since it seems contradictory: while FI results from a lack of economic means to access food, obesity results from excess energy compared to energy expenditure [45]. Hypotheses studied to explain this paradox include the consumption of high energy-dense and hyper-palatable foods in food-insecure populations, insufficient nutrition knowledge, limited resources, and lack of access to healthy, affordable foods [46, 47]. Since poverty is a key factor that contributes to FI and directly triggers the consumption of unbalanced diets, without essential nutrients, in low- and middle-income pop-

ulations, FI and poverty not only contribute to an increase in malnutrition, but also in the prevalence of obesity, with an increased risk of sarcopenic obesity [45, 46].

Conclusions

This study revealed a significant prevalence of FI within the community, estimated at 29.7%, of which 10.5% experiencing severe FI and 10.8% living in households with minors. FI status was found to be associated with gender, marital status, professional occupation, nationality, and perceived health status. Potential predictors of FI include being single, having basic education, being an immigrant, living in a household with three or more members, and having an income below EUR 1,100. Among immigrants, those in larger households, unmarried individuals, and those with lower incomes appear to be the most vulnerable groups, while among the Portuguese population, smokers and households with low incomes are at greater risk of FI. Consequently, it should be a priority to raise awareness of the FI as a persistent symptom of inequality, necessitating monitoring at both national and regional levels to identify needs and target community intervention.

Study Limitations

The study's cross-sectional design limits the ability to draw causal and temporal inferences about the association between the studied variables. Additionally, the non-random sampling method may not accurately reflect the true patterns of the population of Amadora. Also, self-reported data is subject to social desirability bias; as FI is a sensitive topic, participants may omit information about their reality, leading to an improper classification of their food security situation. Memory bias may also be present, as the assessment of FI refers to the 12 months prior to the study date. However, despite these methodological limitations, a validated instrument was used under similar conditions, and all data collection was carried out consistently by a properly trained team.

Implications for Practice

The findings of this study offer valuable insights into the sociodemographic and health status factors associated with FI among individuals living in Amadora, allowing us to understand which households are at higher risk. To the best of our knowledge, this is the first study to estimate FI prevalence in Amadora. Given that improving the quality of life and well-being is a priority in Amadora's Social and Health Development Plan for 2018–2025, particularly

focusing on promoting healthy lifestyles and addressing the high incidence of diseases associated with poverty factors in vulnerable groups, the results underscore the urgency of integrated community programs that include health and social action [18]. Enhancing food literacy is crucial, especially among identified vulnerable groups, while taking into account cultural aspects that influence food utilization, choice, and allocation within the households.

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Statement of Ethics

The protocol of the study was previously reviewed and approved by the Ethics Committee for Health of ARSLVT, with the Approval No. 1072/CES/2023. Written informed consent was obtained from all participants in the study.

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Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Ana Raimundo Costa and Joana Sousa designed the study. Ana Raimundo Costa collected and analyzed the data. Ana Raimundo Costa prepared the manuscript. Joana Sousa and Ana Hernando revised the manuscript.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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