

**Fatores associados com a insegurança alimentar na população portuguesa**  
**Factors associated with food insecurity in the Portuguese population**

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**Abbreviations**

BMI – *body mass index*

CI – *confidence interval*

IC – *intervalo de confiança*

OR – *odds ratio*

P – *percentile*



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## Resumo

**Introdução:** A insegurança alimentar caracteriza-se pela incapacidade em adquirir os alimentos necessários para satisfazer as necessidades diárias de forma socialmente aceitável. Em Portugal estão ainda por definir os fatores que se associam à insegurança alimentar e se são diferentes de acordo com a classe de índice de massa corporal.

**Objetivos:** Este estudo teve como objetivos investigar a coexistência de insegurança alimentar e excesso de peso, identificar os fatores associados à insegurança alimentar na população portuguesa e verificar se o índice de massa corporal medeia essas associações.

**Participantes e métodos:** Foi realizado um estudo transversal de dados obtidos no Quarto Inquérito Nacional de Saúde, efetuado em 2005/2006. Foram incluídos os indivíduos que afirmaram ser o representante da família e cujo grau de segurança alimentar foi possível determinar. A amostra foi de 3630 indivíduos.

**Resultados:** Dezassete por cento dos participantes estavam em insegurança alimentar e 3,7 % em insegurança alimentar grave. Dos indivíduos em insegurança alimentar, 60,6 % das mulheres e 52,8 % dos homens tinham excesso de peso. Alguns dos fatores associados à insegurança alimentar foram ser do sexo feminino, estar desempregado e ter hábitos tabágicos. Ser mais jovem, ter menor escolaridade, ter um baixo rendimento e classificar pior o próprio estado de saúde estiveram positivamente associados à insegurança alimentar. O principal fator associado à insegurança alimentar entre os indivíduos com baixo peso/índice de massa corporal normal foi a educação (OR = 0,08 IC 95 %: 0,04 –

0,19). Para os indivíduos com excesso de peso o principal fator associado à insegurança alimentar foi o rendimento (OR = 5,61 IC 95 %: 3,25 – 9,68).

**Conclusão:** Mais de metade dos indivíduos em insegurança alimentar tinham excesso de peso. Os fatores associados à presença de insegurança alimentar foram o género, a idade, a escolaridade, a ocupação, o rendimento, os hábitos tabágicos e a autoavaliação do estado de saúde. A magnitude das associações variou de acordo com a classe de índice de massa corporal.

**Palavras-chave:** insegurança alimentar, Portugal, fatores associados, índice de massa corporal, excesso de peso.

## **Abstract**

**Introduction:** Food insecurity exists when the ability to acquire foods to meet dietary needs in socially acceptable ways is not present. Little is known about the factors associated with food insecurity in Portugal, and whether this association is modified by body mass index (BMI).

**Objective:** To investigate the coexistence of food insecurity with overweight and to describe the factors associated with food insecurity in the Portuguese population. We further explored if they were mediated by BMI.

**Methods and participants:** This cross-sectional study used data of the fourth Portuguese National Health Survey, conducted between 2005 and 2006. It included the 3,630 respondents who claimed to be heads of the family and whose household food security status could be accessed.

**Results:** Seventeen per cent of the individuals were food insecure and 3.7 % had very low food security. Among the food insecure respondents 60.6 % of women and 52.8 % of men were found to be overweight. Female gender, occupation and smoking habits were associated with food insecurity. Those who were younger, had lower education, lower income, and rated their health worst had greater odds of food insecurity. Education was the main factor associated with food insecurity among the underweight/normal BMI respondents (OR = 0.08; 95 % CI 0.04, 0.19); for the overweight/obese, it was low income (OR = 5.61; 95 % CI 3.25, 9.68).

**Conclusions:** Over half the food insecure participants were overweight. Gender, age, education, occupation, household income, smoking habits and self-rated health status were associated with food insecurity in Portugal. The magnitude of these associations varied with body mass index.

**Key-words:** food insecurity, Portugal, associated factors, body mass index, overweight.

## **Introduction**



Food security exists when “all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. It is a broad concept that encompasses not only food being available, but also food accessibility and proper use, as well as the stability of these dimensions over time<sup>(1)</sup>.

Though food insecurity is more prevalent in non-developed countries where a greater part of the population lives in poverty, it has been documented in many developed countries<sup>(2)</sup>. Some nations evaluated their food insecurity at household level through national health surveys and its prevalence varied from 30.2 % in Brazil, 14.9 % in the United States to 7.7 % in Canada<sup>(3-5)</sup>. In Europe, only France, until now, has estimated their population food insecurity status reporting a prevalence of 12 %<sup>(6)</sup>.

Some studies have shown that age, low education level, marital status, low self-rated health status, body mass index (BMI), smoking habits and household composition, are related to food insecurity<sup>(5, 7-13)</sup>. A growing number of studies consistently showed that higher incomes are associated with greater food security but even households with incomes above the poverty line can experience food insecurity<sup>(3, 7, 8, 10, 12, 14)</sup>, especially under circumstances that affect the household budget, i.e. unemployment, child birth and loss of social benefits<sup>(10)</sup>.

Food insecure individuals have less money to spend on food, being forced not only to buy cheaper food, often with higher fat content and simple sugars, but even to reduce food intake<sup>(15-17)</sup>. Furthermore, some studies have reported lower intake of fruit, vegetables and dairy products in food insecure households<sup>(7, 18, 19)</sup>. These unhealthy eating patterns have been associated with chronic disease development

and associations between food insecurity and obesity, hypertension, diabetes *mellitus* and depression have also been described<sup>(20-23)</sup>.

The coexistence of food insecurity and overweight have been consistently reported in the last decade<sup>(24-26)</sup>. Women, not men, exhibit the strongest association between food insecurity and increased body weight. Not only do they have higher prevalence of food insecurity but they are also more likely to be overweight<sup>(12, 24, 25, 27)</sup>. They deprive themselves to feed other family members<sup>(28, 29)</sup> disrupting their eating patterns, which enhances weight gain<sup>(28, 30)</sup>. So far the main line of investigation has been to clarify the way in which food insecurity and obesity are associated and what association exists between them<sup>(25)</sup>. However, little is known about whether the factors associated with food insecurity are mediated by BMI.

In Portugal, food insecurity prevalence is still unknown. Besides, the latest data reveal that overweight is rising, affecting more than half of our population<sup>(31)</sup>. As overweight and food insecurity are strongly associated it has become important to identify the factors in this association.

Using data from the Portuguese National Health Survey, conducted between 2005 and 2006, this study aims to investigate the coexistence of food insecurity with overweight, to describe the factors associated with food insecurity in the Portuguese population and to explore if they were mediated by BMI.

## **Objectives**



This study aimed to:

- investigate the coexistence of food insecurity with overweight;
- describe the factors associated with food insecurity in the Portuguese population;
- explore if they were mediated by BMI.



## **Participants and methods**



## **Study population**

The Portuguese National Health Survey is a transversal study that relying on a multistage random probability sample of Portuguese households aims to access the health status of the Portuguese population. Data used in present analyses came from the fourth Portuguese National Health Survey held between February 2005 and January 2006. Information on food security was gathered in the last quarter of the Health Survey, comprising 9,837 individual households (collective households were excluded).

The current analysis was conducted among the 3,630 households in which the respondent claimed to be the head of the family and whose answers enabled the assessment of the household food security status. Consequently, 6,270 individuals were not included. Comparatively to the non-participants, participants group had a higher proportion of men (41.5 % v. 59.6 %,  $P<0.001$ ), of employed (38.5 % v. 59.6 %,  $P<0.001$ ), of older adults ( $\geq 60$  years: 17.5 % v. 43.3 %,  $P<0.001$ ), of individuals with lower income ( $\leq 250$  €: 1.5% v. 7.0 %,  $P<0.001$ ) and lower proportion of individuals with no education (19.5 % v. 16.9 %,  $P<0.001$ ).

Face to face interviews were used to collect information. No approval from an ethics committee was necessary since this survey was part of the official statistics and mandatory.

## **Measures**

Food security status was determined by the 6-Item Short Form of the Food Security Survey Module. This brief form of the original module with 18 questions is robust when classifying the food security status of households in the general population<sup>(32)</sup>. In surveys that cannot implement one of those measures, the six-

item module may provide an acceptable substitute. It has been shown to identify food-insecure households and households with very low food security with reasonably high specificity and sensitivity and minimal bias compared with the 18-item measure. However it does not capture the very low food secure households, those in which children's food intake has probably been reduced<sup>(33)</sup>.

Food security status was stratified in 3 categories: food secure if 0 to 1 items were scored as affirmative, low food secure if 2 to 4 items were scored as affirmative and very low food secure if 5 to 6 items were scored as affirmative<sup>(33)</sup>. Food security status was dichotomized for analysis: food secure v. food insecure.

Information about socio-economic variables was obtained through previous month's household income (defined as a categorical variable), highest level of education achieved (no education, 1st to 4th grade, 5th to 9th grade,  $\geq$  10th grade) and occupation (employed, unemployed, retired, housewife, permanently disabled and others, which includes students, unpaid internship, among others). The demographic variables were sex, age and marital status. Data on smoking habits, self-reported diabetes *mellitus*, hypertension and depression, and also self-rated health status (very bad, bad, reasonable, good and very good) were also considered.

Body mass index (weight (kg)/height (m)<sup>2</sup>) was calculated based on self-reported weight and height. It was classified according to World Health Organization criteria, both for children (5-19 years old) and adults ( $\geq$  20 years old)<sup>(34, 35)</sup>. When appropriate, BMI was dichotomized into underweight/normal if  $<$  P85 for children or  $<$  25 kg/m<sup>2</sup> for adults, and into overweight/obesity if  $\geq$  P85 for children or  $\geq$  25 kg/m<sup>2</sup> for adults. From this point on the overweight/obesity category will be solely referred to as overweight.

To evaluate associations of food insecurity with dietary habits, data on the foods eaten on the previous day and the number of main daily meals were obtained by closed-end questions. A new variable (fruits and/or vegetables) comprising the previous day intake of fruit and/or salad/boiled vegetables and/or soup was created.

### **Statistical analysis**

Qualitative variables were expressed using percentage and quantitative variables by mean and standard deviation. Chi-square tests examined the significance of the comparison between categorical variables.

Logistic regression analysis was used to build a model of food insecurity; food security was the dependent variable and gender, age, marital status, education, occupation, household income and self-rated health status were the covariates.

The model was stratified by BMI categories (underweight/normal *v.* overweight) to understand how the association between food insecurity and the studied factors varies with BMI classes.

Statistical tests were two-sided with a significance level of 5 % ( $P < 0.05$ ). All analyses were conducted using SPSS 20.0 (IBM Corp., Armonk, NY).



## Results



Food insecurity was present in 16.7 % households and 3.7 % experienced very low food security. Of the 3,630 participants, 59.4 % were male and more than two thirds were married. Half of the respondents were employed and 35.1 % were retired. Seven per cent reported a previous month income  $\leq$  250 €.

Table 1 shows the distribution of food insecurity across demographic, socio-economic and health-related variables, and the crude and adjusted odds ratios for their association. Low education level was the main factor associated with food insecurity. Completion of at least the 10th grade reduced the likelihood of food insecurity in 86 % (OR = 0.14; 95% CI 0.08, 0.24) compared with no education. Being a woman increased the odds of food insecurity by 42% (OR = 1.42; 95 % CI 1.12, 1.80). In the univariate analysis age was positively related to food insecurity but in multivariate analysis this association changed, revealing that the youngest had greater odds of food insecurity. As for occupation, the unemployed had the highest odds of food insecurity when compared to individuals with a job. A household with a previous month income  $\leq$  250 € had over 5 times the odds of food insecurity (OR = 5.30; 95 % CI 3.54, 7.95). Self-reported health status and food insecurity were inversely associated, the better the respondent rated his/her health, the lower the odds of being food insecure were. Significant association between food insecurity and smoking habits was only attained after removing the effect of confounding variables; smoking increased the odds of food insecurity by 67 % (OR = 1.67; 95 % CI 1.27, 2.21).

Food insecure women had a higher overweight prevalence than their food secure counterparts (60.6 % v. 52.5 %,  $P = 0.011$ ). For men, being overweight was

**Table 1** – Association between demographic, socioeconomic and health characteristics and food insecurity.

Characteristics	<i>n</i>	Proportion, %		$\chi^2$ <i>P</i> value	Unadjusted analyses		Adjusted* analyses		
		Food insecure <i>n</i>	Food insecure %		Food secure <i>n</i>	Food secure %	OR	95% CI	OR
<b>Sex</b>	3,630								
Male		272	44.9	1,890	62.5	1.00	Ref.	1.00	Ref.
Female		334	55.1	1,134	37.5	2.05	1.72, 2.44	1.42	1.12, 1.80
<b>Age, years</b>	3,630								
≥ 60		294	48.5	1,279	42.3	1.00	Ref.	1.00	Ref.
40-59		220	36.3	1,201	39.7	0.80	0.66, 0.96	2.03	1.49, 2.78
≤ 39		92	15.2	544	18.0	0.74	0.57, 0.95	2.82	1.84, 4.31
<b>Marital status</b>	3,630								
Single		73	12.0	285	9.4	1.00	Ref.	1.00	Ref.
Married		343	56.6	2,123	70.2	1.59	1.20, 2.10	1.02	0.72, 1.45
Other		190	31.4	616	20.4	1.91	1.57, 2.33	0.93	0.72, 1.22
<b>Education</b>	3,630								
No education		192	31.7	422	14.0	1.00	Ref.	1.00	Ref.
1st-4th grade		286	47.2	1,260	41.7	0.50	0.40, 0.62	0.59	0.45, 0.76
5th-9th grade		104	17.2	712	23.5	0.32	0.25, 0.42	0.39	0.27, 0.56
≥ 10th grade		24	4.0	630	20.8	0.08	0.05, 0.13	0.14	0.08, 0.24
<b>Occupation</b>	3,627								
Employed		214	35.3	1,634	54.1	1.00	Ref.	1.00	Ref.
Unemployed		50	8.3	81	2.7	4.71	3.22, 6.89	3.32	2.16, 5.10
Retired		234	38.6	1,040	34.4	1.72	1.41, 2.10	1.21	0.88, 1.65
Housewife		92	15.2	207	6.9	3.39	2.56, 4.51	1.67	1.18, 2.37
Permanently disabled		13	2.1	27	0.9	3.68	1.87, 7.23	1.80	0.83, 3.90
Other†		3	0.5	32	1.1	0.72	0.22, 2.36	0.74	0.20, 2.69

Table 1 Continued

Characteristics	n	Proportion, %				$\chi^2$ P value	Unadjusted analyses		Adjusted* analyses	
		Food insecure		Food secure			OR	95% CI	OR	95% CI
		n	%	n	%					
<b>Household income, €</b>	3,630									
≥ 901		95	15.7	1,391	46.0			1.00	Ref.	
501-900		178	29.4	857	28.3			3.04	2.34, 3.96	
251-500		226	37.3	578	19.1			5.73	4.42, 7.41	
≤ 250		99	16.3	154	5.1			9.41	6.79, 13.05	
Does not know/does not want to respond		8	1.3	44	1.5			2.67	1.22, 5.82	
<b>Self-rated health status</b>	3,250									
Very bad		46	8.3	86	3.2			1.00	Ref.	
Bad		129	23.4	375	13.9			0.64	0.43, 0.97	
Reasonable		254	46.0	1,081	40.1			0.44	0.30, 0.64	
Good		109	9.8	1,000	37.1			0.20	0.14, 0.31	
Very good		16	2.9	154	5.7			0.19	0.10, 0.36	
<b>Smoking</b>	3,629	124	20.5	597	19.7	0.696		1.05	0.84, 1.30	
<b>Diabetes</b>	3,628	82	13.5	291	9.6	0.005		1.47	1.13, 1.91	
<b>Hypertension</b>	3,628	229	37.8	980	32.4	0.012		1.27	1.06, 1.52	
<b>Depression</b>	3,630	63	10.4	244	8.1	0.060		1.32	0.99, 1.77	
<b>BMI, overweight</b>										
Total sample	3,566	334	57.1	1,778	59.6	0.251		0.90‡	0.75, 1.01	
Men	2,133	140	52.8	1,194	63.9	0.001		0.63‡	0.49, 0.82	
Women	1,433	194	60.6	584	52.5	0.011		1.40‡	1.08, 1.80	

BMI, body mass index; Ref., referent category.

\*Adjusted for gender, age, marital status, education, occupation, household income and self-rated health status.

†Includes students, unpaid internships and other occupations.

‡Referent category is underweight/normal BMI.

associated with a 30 % decrease in the odds of food insecurity (OR = 0.70; 95 % CI 0.52, 0.96). No significant association was found for overweight women in the adjusted model.

Table 2 shows regression models stratified by BMI categories, underweight/normal and overweight participants. Among underweight/normal BMI respondents, education was the main factor associated with food insecurity; not having education increased 12.5-fold the odds of food insecurity (OR = 0.08; 95 % CI 0.04, 0.19,  $\geq$  10th grade v. no education). In this group, being unemployed or having earned  $\leq$  250 € in the previous month more than quintupled the odds of food insecurity. Otherwise, for the overweight individuals, income was the main factor associated with food insecurity; those who earned less had five times higher odds of food insecurity than those who reported the highest income (OR = 5.61; 95 % CI 3.25, 9.68). Having more education is related to reduced food insecurity in 75 % (OR = 0.24; 95 % CI 0.11, 0.53) and being unemployed more than doubled its odds (OR = 2.36; 95 % CI 1.33, 4.18). In both categories age was inversely related to food insecurity. Among the individuals with  $\geq$  10th grade, those with overweight had three times the odds of food insecurity than those with underweight/normal BMI. Compared with their overweight counterparts, those with underweight/normal BMI had 2.5-fold higher odds of food insecurity if unemployed. Self-rated health status was strongly associated with food insecurity in underweight/normal BMI respondents.

Table 2 – Association between demographic, socioeconomic and health characteristics by BMI category.

Characteristics	Underweight/normal BMI				Overweight			
	Unadjusted analyses		Adjusted* analyses		Unadjusted analyses		Adjusted* analyses	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Sex</b>								
Male	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
Female	1.28	0.98, 1.69	1.07	0.74, 1.56	2.83	2.23, 3.60	1.73	1.25, 2.38
<b>Age, years</b>								
≥ 60	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
40-59	0.65	0.47, 0.89	1.78	1.05, 3.03	0.95	0.74, 1.21	2.04	1.37, 3.03
≤ 39	0.79	0.56, 1.12	3.39	1.77, 6.50	0.63	0.42, 0.94	2.07	1.13, 3.80
<b>Marital status</b>								
Single	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
Married	1.44	0.97, 2.16	1.24	0.74, 2.07	1.66	1.10, 2.52	0.85	0.52, 1.41
Other	1.78	1.31, 2.43	1.14	0.75, 1.74	1.98	1.51, 2.58	0.79	0.55, 1.13
<b>Education</b>								
No education	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
1st-4th grade	0.57	0.40, 0.80	0.51	0.33, 0.79	0.49	0.36, 0.65	0.67	0.47, 0.95
5th-9th grade	0.41	0.28, 0.61	0.34	0.19, 0.63	0.26	0.18, 0.39	0.40	0.24, 0.67
≥ 10th grade	0.09	0.05, 0.16	0.08	0.04, 0.19	0.08	0.04, 0.16	0.24	0.11, 0.53
<b>Occupation</b>								
Employed	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
Unemployed	6.32	3.56, 11.25	5.90	3.00, 11.59	3.78	2.25, 6.35	2.36	1.33, 4.18
Retired	1.65	1.21, 2.25	0.96	0.58, 1.58	1.68	1.28, 2.21	1.22	0.81, 1.85
Housewife	1.93	1.20, 3.09	1.04	0.58, 1.84	4.89	3.38, 7.08	2.11	1.34, 3.32
Permanently disabled	4.87	1.51, 15.64	2.18	0.61, 7.78	3.07	1.26, 7.46	1.54	0.55, 4.35
Other†	0.28	0.04, 2.12	0.28	0.03, 2.41	-	-	-	-

Table 2 *Continued*

Characteristics	Underweight/normal BMI				Overweight			
	Unadjusted analyses		Adjusted* analyses		Unadjusted analyses		Adjusted* analyses	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Household income, €</b>								
≥ 901	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
501-900	3.30	2.18, 5.02	2.38	1.47, 3.86	2.86	2.03, 4.04	2.29	1.56, 3.35
251-500	5.46	3.63, 8.21	3.57	2.13, 5.97	5.89	4.19, 8.29	3.82	2.53, 5.79
≤ 250	9.01	5.42, 14.99	5.29	2.76, 10.14	9.77	6.28, 15.20	5.61	3.25, 9.68
Does not know/does not want to respond	3.13	0.86, 11.37	4.57	1.09, 19.12	2.73	0.91, 8.21	2.47	0.74, 8.22
<b>Self-rated health status</b>								
Very bad	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.
Bad	0.48	0.25, 0.92	0.37	0.18, 0.75	0.72	0.42, 1.25	0.86	0.48, 1.54
Reasonable	0.35	0.19, 0.64	0.38	0.19, 0.73	0.50	0.30, 0.84	0.81	0.46, 1.42
Good	0.18	0.10, 0.34	0.28	0.14, 0.57	0.20	0.11, 0.35	0.46	0.24, 0.86
Very good	0.20	0.08, 0.48	0.35	0.13, 0.92	0.17	0.06, 0.43	0.42	0.15, 1.17
<b>Smoking</b>	1.13	0.84, 1.53	1.58	1.06, 2.35	0.94	0.68, 1.31	1.84	1.22, 2.78
<b>Diabetes</b>	1.56	0.98, 2.48	1.05	0.60, 1.82	1.46	1.06, 2.03	1.11	0.76, 1.62
<b>Hypertension</b>	1.17	0.86, 1.59	0.80	0.55, 1.17	1.38	1.09, 1.75	1.11	0.84, 1.48
<b>Depression</b>	1.37	0.86, 2.18	0.99	0.55, 1.78	1.38	0.95, 2.02	0.77	0.49, 1.12

BMI, body mass index; Ref., referent category.

\*Adjusted for gender, age, marital status, education, occupation, household income and self-rated health status.

†Includes students, unpaid internships and other occupations.

Differences between food secure and food insecure respondents regarding the foods consumed on the previous day and adjusted odds ratios for the intake of each food on food security status are displayed in Table 3. Bread/sandwich (97.9 % v. 95.9 %,  $P < 0.025$ ) and soft drinks (5.1 % v. 2.3 %,  $P < 0.001$ ) were eaten by a higher proportion of food insecure individuals than food secure ones. In the multivariate analysis, eating bread/sandwich was associated with a doubling in the odds of being food insecure. The intake of soft drinks in the previous day was the principal dietary factor associated with food insecurity, since their intake independently enhanced food insecurity odds by 152% (OR = 2.52; 95 % CI 1.45, 4.37). Eating fruit and/or vegetables had the biggest independent protective effect of food insecurity (OR = 0.45; 95 % CI 0.28, 0.72).

Table 3 – Reported food intake and association with food insecurity.

Intake in the previous day	Food insecure (%)	Food secure (%)	Adjusted* analyses	
			OR	95% CI
Alcoholic beverage	5.4	5.4	1.41	0.89, 2.22
Beans/chickpeas	23.9	21.0	1.16	0.91, 1.48
Bread/sandwich	97.9†	95.9	1.90	1.02, 3.55
Cakes/chocolates/desserts/other candies	22.6†	30.7	0.76	0.60, 0.96
Dairy	80.2†	87.9	0.78	0.58, 0.99
Fish	38.6†	51.7	0.70	0.57, 0.86
French fries	0.7	0.8	1.08	0.33, 3.48
Fruit	77.7†	87.3	0.56	0.44, 0.72
Fruit and/or vegetables‡	94.4†	97.5	0.45	0.28, 0.72
Fruit juice/fruit nectar	4.0†	8.1	0.63	0.39, 1.03
Meat	69.5†	76.5	0.88	0.71, 1.10
Others	22.1†	26.5	0.91	0.72, 1.15
Potatoes/rice/pasta	81.7†	87.6	0.78	0.60, 1.02
Salad/boiled vegetables	51.8†	70.0	0.54	0.44, 0.66
Savoury pastry	1.8	3.3	0.73	0.36, 1.46
Soft drink	5.1†	2.3	2.52	1.45, 4.37
Soup	68.6	72.4	0.82	0.66, 1.02
<b>Main daily meals</b>				
3	88.3	92.3	1.00	Ref.
2	10.2	6.8	1.38	0.98, 1.94
1	1.5	0.9	1.23	0.51, 2.97

Ref., referent category.

\*Adjusted for gender, age, marital status, education, occupation, household income and self-rated health status.

†Significantly different from food secure:  $P < 0.05$ .

‡Includes fruit, salad/boiled vegetables and soup intakes.

## **Discussion and conclusions**



Seventeen per cent of the Portuguese households were food insecure and 3.7 % experienced very low food security between 2005 and 2006. This prevalence is higher than in France, the only European country that previously displayed data in regards to this problem. It is also higher than in the United States or in Canada but lower than in Brazil. Only Canada showed a prevalence of very low food insecurity that was lower than the results reported in the current analysis<sup>(3-6)</sup>.

In the present study, education is the strongest studied factor independently associated with food security status. Having  $\geq 10$ th grade is associated with an 86 % decrease in food insecurity. Similar results have been found by other authors, confirming that education is a central factor in food insecurity<sup>(8, 14)</sup>.

Households with a monthly income  $\leq 250$  € had more over five times the odds of being food insecure, regardless of the BMI category. Although income and food insecurity displayed a strong association<sup>(7, 8, 12, 14, 36)</sup>, income alone does not fully explain food security status<sup>(37)</sup>. Currently financial management skills are perceived as a possible modifier of this association. In line with this, Gundersen and Garasky have shown that households with greater financial management skills are less likely to be food insecure, even those with incomes  $< 200$  % of the poverty line<sup>(38)</sup>.

Overweight was present in 57.1 % of the food insecure participants, particularly in women. A number of studies have highlighted this strong association between food insecurity and increased body weight for women<sup>(24-26)</sup>. Possible explanations include the sacrifice theory and disrupted eating patterns<sup>(25, 39, 40)</sup>. For men, being overweight decreased the odds of food insecurity even after removing the effect of confounding variables.

The unemployed, the youngest and those who rated their health worst had greater odds of food insecurity. These findings are consistent with previous studies<sup>(10, 12-14, 41)</sup>. However, contrary evidence exists on the link between food security and employment<sup>(37)</sup>. When the wages earned are inadequate to meet budgetary needs, even those who rely on employment income are exposed to food insecurity<sup>(36)</sup>.

Smoking also increased the odds of food insecurity. Similar results have been described by other authors<sup>(42, 43)</sup>. Smokers seem to allocate part of their resources to tobacco instead of food, endangering their household food security status<sup>(42, 43)</sup>. In the present sample the very low food secure participants reported the highest proportion of smokers (24.6 %). Similar<sup>(44)</sup> and opposite<sup>(42)</sup> results have been previously described. As nicotine decreases appetite, we hypothesize whether these individuals smoke in order to stave off hunger<sup>(45)</sup>.

Having soft drinks was the dietary factor strongly associated with food insecurity. Consistent with our findings other studies also reported higher soda and sweet drinks intake by food insecure individuals<sup>(6, 46)</sup>. Bread/sandwich intake was also positively associated with food insecurity probably because bread is a Portuguese staple food, often replacing a meal of potatoes/rice/pasta. Lower intake of fruit, vegetables, dairy, fish and meat in food insecure households was also previously described by other authors<sup>(6-8, 47)</sup>. However, improving the quality of the diet of these food insecure households seems a difficult job. While providing low income households with vouchers or discounts for vegetables and fruits actually increases their intakes<sup>(48)</sup>, Smith *et al.* highlighted that if the household members are given the choice on how to spend the vouchers/discount (on food items or not), food expense increases, but it is not on healthier foods<sup>(49)</sup>.

Concerning meals frequency, a significantly higher proportion of food insecure individuals reported having fewer main meals a day. Zizza *et al.* also reported a reduced meal frequency among food insecure individuals, but, since the caloric content of meals and snacks was higher, their daily energy intake was similar to the food secure ones<sup>(50)</sup>. In our study data on the quantity of the foods eaten was absent, limiting the energy intake comparison.

Present results show that both BMI categories shared the main factors associated with food insecurity, like education, occupation and income, though in different magnitudes. For the underweight/normal BMI respondents, education was the main factor associated with food insecurity; for the overweight it was income.

To our knowledge only one study, conducted in 2003 by the Doutor Ricardo Jorge National Health Institute, has attempted to reveal the food insecurity burden in Portugal. From the 647 households interviewed, 8.1 % reported a reduction in the intake of a basic food. No significant statistical associations were detected but food insecurity tended to be associated with households with  $\geq 4$  individuals, whose mean of age was  $\geq 65$  years, with a lower ratio of individuals who contribute to the family budget *v.* individuals in the household, and with higher occupation density<sup>(51)</sup>. Although this study encouraged the discussion about food insecurity in the Portuguese population, many limitations can be described. It only analysed data collected in households with a landline phone, only included households whose respondent was a woman and only accessed changes in the intake of an essential food in the previous 30 days. These limitations justified this new and improved analysis.

The main strength of present study is that representative data of the Portuguese population between 2005 and 2006 was analysed. Furthermore, as far as we

know, no other study attempted to determine whether the factors associated with food insecurity vary with BMI. Different modifiable risk factors were identified for non-overweight/overweight, showing that different public health strategies should be defined.

Some limitations should be mentioned. First, its cross-sectional design did not allow the exploration of a causal relation between the identified factors and food insecurity. Second, significant differences existed between participants and the individuals excluded from this analysis. Participants had a higher proportion of men, of employed and of older people and a lower proportion of individuals with no education what could have underestimated food insecurity frequency. However, the included sample had a higher proportion of individuals with lower income; therefore the frequency of food insecurity could have been overestimated. Third, it was impossible to determine associations between food insecurity and household composition. The lack of information did not allow us to see if food insecurity in Portugal was, as described for other populations, associated with factors such as households headed by single men or women, number of children in the household, number of individuals in the household, etc.<sup>(3, 5, 36, 52)</sup>. Fourth, data from 361 individuals who stated they were not the right person to provide information about income were included in the analyses. Although this represents a small proportion of this sample, we are not able to predict the occurrence of biased results. Moreover, we only had information on the total household income and this information about how many people rely on the head of the household was absent. Fifth, since height and weight were self-reported, BMI was probably underestimated, and therefore, the prevalence of overweight as well. Lastly, as

these data were collected eight years ago no up-to-date food insecurity panorama can be inferred from them.

Notwithstanding these concerns, the present study first exposed the burden of food insecurity in Portugal between 2005 and 2006 and revealed that education and income were the main factors associated with food insecurity. Our results have shown that factors associated with food insecurity vary with body mass index, and then that consequently different strategies for improving food security status should be considered for more effectiveness when addressing food insecurity issues. This information should be taken into account when developing policies and initiatives to improve food security status in Portugal.

Considering recent economic changes in Europe, we can hypothesise that food insecurity burden in Portugal and all over Europe is on the increase and therefore more up to date information is required to better understand this issue and to help design preventive public health strategies.



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