International Journal of Public Health (2019) 64:887–895
https://doi.org/10.1007/s00038-019-01243-y

ORIGINAL ARTICLE

Household food insecurity and socio-demographic determinants in young adults: findings from a Portuguese population-based sample

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Received: 13 March 2018 / Revised: 28 February 2019 / Accepted: 10 April 2019 / Published online: 16 April 2019

Abstract

Objectives This study evaluated the prevalence and the socio-demographic determinants of food insecurity among young adults at a time of economic crisis recovery.

Methods A cross-sectional study including 954 young adults (26 years old) from the EPITeen cohort (Porto, Portugal) was conducted. Food security status was evaluated using the *US Household Food Security Survey Module*: *Six-Item Short Form*. Associations between socio-demographic characteristics (sex, education, occupation, household size and structure and household income perception) and food insecurity were estimated using logistic regression.

Results At a time of economic crisis recovery, 11.0% of young adults experienced food insecurity. A higher odds of belonging to a food insecure household was observed in participants reporting an insufficient household income (OR = 23.3; 95% CI 11.3–47.8), those with less education (OR = 1.7; 95% CI 1.0–2.8), lower white-collar workers (OR = 2.3; 95% CI 1.2–4.2) and those living within a nuclear family including a partner and/or children (OR = 2.0; 95% CI 1.1–3.7).

Conclusions Our findings support the need for interventions targeting those from lower income, from nuclear families of young adults with a partner and/or descendants, less educated and with non-manual unskilled occupations, to reduce food insecurity, particularly in economic vulnerable settings.

Keywords Food insecurity · Prevalence · Young adults · EPITeen

Introduction

Young adulthood—approximately 18–26 years of age (Stroud et al. 2015)—is a period of the lifespan in which individuals experience increased autonomy and major changes in their lives (Keller et al. 2007), characterized by increased economic self-sufficiency with a concomitant increase in responsibilities and important changes in social roles (Baer et al. 2015; Keller et al. 2007).

During the last years, the transition from adolescence to adulthood has become more difficult, happening later and extending to older ages (Benson and Elder 2011). Along with this, the worldwide financial crisis of 2008 triggered a crisis in youth labour markets, threatening the professional future of many young people (Dalglish et al. 2015). Actually, the current young labour market is characterized by a high unemployment risk, precarious jobs, bad working conditions, poorly paid jobs and low social protection coverage (Fiori et al. 2016).

Consequently, because of the employment uncertainty and consequent economic instability, young adults are at risk of experiencing food insecurity (Baer et al. 2015; Krahn et al. 2012), which can be defined as "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Anderson 1990).

Food insecurity in young adulthood has been described in the literature, in different settings and countries, and the reported prevalence varied between 8.5 and 59.0% (Baer et al. 2015; Martin-Fernandez et al. 2013; Nur Atiqah et al. 2015; Patton-Lopez et al. 2014; Pryor et al. 2016).

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Particularly among the European population, the prevalence of food insecurity varied between 8.5 and 11.3% in France (Martin-Fernandez et al. 2013; Pryor et al. 2016) and 13.2% in Denmark (Lund et al. 2018). These estimates from European countries are much lower than the prevalence of food insecurity previously reported among Portuguese young adults in 2011–2013, during the period of the economic crisis (43.7%) (Gregório et al. 2014), but in line with a more recent publication, in which Portuguese adults, aged 18–29 years, reported a 8.6% prevalence of food insecurity (Gregório et al. 2018). As it is difficult to explain these disparities, it is of the utmost relevance to explore the scenario as well as the determinants of food insecurity in Portugal during the economic crisis recovery.

Food insecurity has been described to be determined by household income, education and age strata of the population, with a low household income and education, and young age described as its main determinants (Carter et al. 2010; Gundersen 2013). Moreover, food insecurity has been associated with adverse outcomes. Members of food insecure households tend to adopt poor dietary behaviours as a consequence of unavailability of food or inadequate food supply (Leung et al. 2014), which may increase the risk of overweight and obesity (Franklin et al. 2012; Pan et al. 2012). Associations between food insecurity and other adverse health outcomes, namely non-communicable diseases, have also been described (Pérez-Escamilla et al. 2014; Seligman et al. 2007).

To the best of our knowledge, evidence on the determinants of food security status among young adults is scarce, not only in Portugal but worldwide. Moreover, to characterize the scenario of food insecurity during the economic crisis recovery, in a large population-based cohort of young adults, from a high-income country is necessary as limited data are available.

Therefore, this study aimed to evaluate the prevalence and the socio-demographic determinants of food insecurity among young adults at a time of economic crisis recovery, using data from a population-based cohort from Porto, Portugal.

Methods

A cross-sectional study was carried out using data from the EPITeen (Epidemiological Health Investigation of Teenagers in Porto) cohort, an ongoing research project that was designed to study growth, development and health. Briefly, in 2003/2004, a cohort of adolescents born in 1990 was assembled and enrolled from public and private schools in Porto, Portugal. At the baseline evaluation, 2159 adolescents agreed to participate and provided information for at least part of the protocol (participation rate of 77.5%) (Ramos and Barros 2007). The second evaluation of the cohort occurred during the 2007/2008 school year, where 1716 (79.5%) participants were re-evaluated, and a further 783 adolescents, also born in 1990, integrated the cohort as they moved to schools in Porto after the 2003/2004 evaluation. Additional follow-ups of the cohort were performed at 21 (2011–2013) and 24 years old (2014–2015).

Between March and April 2016, at 26 years of age, cohort participants were invited to take part in a study with the specific purpose of a food security status assessment (for 326 young adults, no active contact was available). The final sample was composed of 954 individuals (Fig. 1).

The individuals included in this study (vs. not included, i.e. all the remaining participants of the cohort) were more frequently women (58.3% vs. 47.9%; $p < 0.001$), had a higher education [mean (SD) = 13.8 (1.7) vs. mean (SD) = 12.8 (2.2) years of schooling; $p < 0.001$], as well as higher parental education [mean (SD) = 11.6 (4.5) vs. mean (SD) = 9.9 (4.6) years; $p < 0.001$]. In comparison with not included participants, included individuals reported less frequently (5.6% vs. 9.6%; $p = 0.011$) a perception of insufficient household income.

The Ethics Committee of the São João University Hospital, Porto, and of the Institute of Public Health of the University of Porto approved the procedures in the cohort. The study protocol was registered with the Portuguese Data Protection Authority. Policies and procedures were developed to guarantee data confidentiality and protection. Written informed consent was obtained for participation in all evaluations, and additionally from the parents at 13 and 17 years of age. For this study, cohort participants provided assent after signing on the web-based platform or provided oral consent, depending on the method of data collection used.

Data on socio-demographic characteristics and food security status were self-reported and collected through a structured questionnaire answered using a web-based platform. For 873 of the 954 participants evaluated, the questionnaire was answered through a link to the questionnaire that was sent by email to participants. For the remaining 81 (8.5%) participants, the information was obtained using the same structure but through a computer-assisted telephone interview because no updated email address was available.

Education was evaluated in years of schooling and categorized as lower than or equal to 12 years (including primary and secondary education levels) and higher than 12 years (corresponding to a higher educational level). Occupation was classified as upper white-collar, lower white-collar and blue-collar. The upper white-collar category aggregated those within the upper four major groups of the 2010 Portuguese Classification of Occupations (PCO) (Instituto Nacional de Estatística 2011) (0. armed

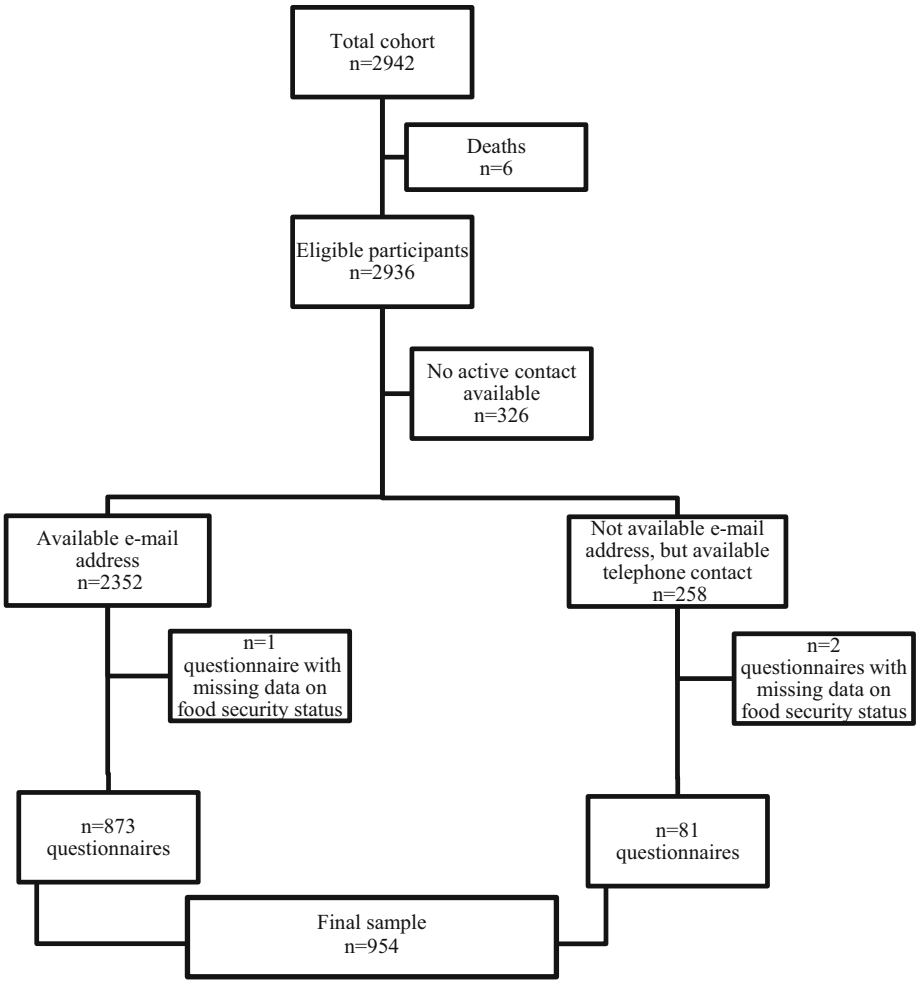

Fig. 1 Flow chart of the EPITeen participants in this study

forces occupations, 1. managers, 2. professionals and 3. technicians and associate professionals); the lower white-collar category encompassed individuals among the fourth and fifth major group of the PCO (4. clerical support workers and 5. service and sales workers). The category blue-collar contained those classified in the sixth to ninth major groups of the PCO (6. skilled agricultural, forestry and fishery workers, 7. craft and related trades workers, 8. plant and machine operators and assemblers and 9. elementary occupations). A student category was added.

The household size was the number of persons living in the household, independent of family relationships. Information concerning household structure was categorized in five categories: (1) parents-based nuclear family (participant and his/her parents and/or siblings); (2) participant-based nuclear family (participant and his/her partner and/or children); (3) extended family, which comprises family members beyond the nuclear family; (4) living alone; and (5) living with other members (comprises participants living only with non-family members or living with family and non-family members).

Household income perception was evaluated using a question with four options: "insufficient", "need to be careful about expenses", "enough to meet needs" or "comfortable". For regression analysis, the categories "enough to meet needs" and "comfortable" were combined into "enough".

Food security status was evaluated using the *US Household Food Security Survey Module*: *Six-Item Short Form* (United States Department of Agriculture 2012), which was translated by the research team to the Portuguese language (Cronbach's alpha = 0.753). The *US Household Food Security Survey Module*: *Six-Item Short Form* refers to the previous 12 months, and individuals are asked whether they were able to afford the food they need. It includes six questions concerning food running out, balanced meals, skipping or cutting the size of meals and how often, eating less than they should, and being hungry because there was not enough money for food.

The total score results from the sum of affirmative responses in each of the six questions. The participants' households were classified as "food secure" if the number of affirmative responses was equal to or less than one, "low

food secure" if there were between two and four affirmative responses or "very low food secure" if the number of affirmative responses reached five or six (United States Department of Agriculture 2012). For logistic regression analysis, the participants' households were classified as food secure and food insecure (including both low and very low food secure groups).

Statistical analysis

Continuous variables were summarized as mean and standard deviation. Categorical variables were presented as absolute numbers and percentages. Means were compared using Student's *t* test, while for proportions the Chi-square test was used.

Logistic regression models were computed to assess the associations between food insecurity and socio-demographic characteristics, and odds ratios (OR) and respective 95% confidence intervals (95% CIs) were estimated, considering complete cases for all variables. The final model included as independent variables sex, education, household income perception and household structure, based on previously described confounding variables, as well as, using a statistical criteria of significant crude associations.

Statistical analysis was carried out using SPSS Statistics 25.0 (IBM Corp., Armonk, NY, USA). The adopted significance level was 5%.

Results

The majority of the sample was composed of women (58.3%) and higher educated individuals (75.9%). Also, the EPITeen participants included in this study lived more often within a parents-based nuclear family (55.6%) (Table 1). Among the young adults who answered the food security survey module, a prevalence of household food insecurity of 11.0% was found: 8.6% with low food security and 2.4% with very low food security.

Despite a gradient across the food security status categories was verified according to the studied socio-demographic characteristics (data not shown), it was decided to present the results according to two categories of food security status—food secure and food insecure—, as only few individuals (n = 23) reported very low food security.

In the food insecure group, a lower proportion of individuals with higher education and upper white-collar workers and a higher proportion of blue-collar workers were observed. Also, food insecure young adults more often reported having the perception of an insufficient household income and were more likely to belong to a participant-based nuclear family, while those who had a food secure household reported more living within a parents-based nuclear family (Table 2).

After adjustment for sex, education, household structure and household income perception, young adults reporting insufficient household income (OR = 23.3; 95% CI 11.3–47.8) had an increased odds of belonging to a food insecure household. Also, having a lower white-collar occupation (OR = 2.3; 95% CI 1.2–4.2) and being less educated (OR = 1.7; 95% CI 1.0–2.8) were characteristics that remained associated with food insecurity in the adjusted model. Living in a participant-based nuclear family (OR = 2.0; 95% CI 1.1–3.7) was also associated with food insecurity (Table 2), regardless of sex, education and household income perception.

Discussion

At a time of economic crisis recovery, characterized by an improvement in socio-economic indicators, such as an unemployment rate that between 2008 and 2013 (7.6% and 16.2%, respectively) experienced a dramatic increase, though having decreased since then (PORDATA 2018), a considerable prevalence of household food insecurity (11.0%) was found among the young adults of the EPITeen cohort.

To the best of our knowledge, in Portugal, the first reported data of food insecurity among young adults came from the INFOFAMÍLIA survey (Gregório et al. 2014) conducted during the economic crisis. Among respondents aged less than 30 years, a food insecurity prevalence of 43.7% was described (Gregório et al. 2014). This large difference in the estimates can be explained, first by the period of evaluation—as the INFOFAMÍLIA was conducted during the crisis years, while ours represents the period of recovery. Additionally, the tool used to evaluate food security was different. More recently, another study conducted among young Portuguese adults reported a food insecurity prevalence of 8.6%; however, the food security assessment tool was also different from ours, limiting comparisons (Gregório et al. 2018).

Similar estimates to those found in our study were described among young adults in France (8.5% and 11.3%) (Martin-Fernandez et al. 2013; Pryor et al. 2016).

Our findings showed that household income perception, education, household structure and occupation were associated with food insecurity in young adults. These results are in accordance with those found by Gooding et al. (2012), which revealed that low household income was associated with food insecurity. In our study, the variable household income perception was used and can reflect the relation between household income and needs.

Table 1 Characteristics of the sample (Porto, Portugal, 2016)

	n (%)
Sex	
Women	556 (58.3)
Men	398 (41.7)
Education	
≤ 12 years	230 (24.1)
> 12 years	724 (75.9)
Occupation	
Upper white-collar	566 (59.3)
Lower white-collar	178 (18.6)
Blue-collar	49 (5.1)
Student	134 (14.0)
Missing	27 (2.8)
Household income perception	
Insufficient	55 (5.8)
Need to be careful about expenses	308 (32.3)
Enough to meet needs	348 (36.5)
Comfortable	241 (25.3)
Missing	2 (0.2)
Household size	
1 person	128 (13.4)
2 persons	185 (19.4)
3 persons	257 (26.9)
≥ 4 persons	384 (40.2)
Household structure	
Parents-based nuclear family (*Participant + parents and/or siblings*)	530 (55.6)
Participant-based nuclear family (*Participant + partner and/or children*)	143 (15.0)
Extended family[a]	114 (11.9)
Alone	128 (13.4)
Other members[b]	39 (4.1)
Items of the *US Household Food Security Survey Module: Six-Item Short Form*[c]	
"The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more". Was that often, sometimes, or never true for (you/your household) in the last 12 months?	117 (12.3)
"(I/we) couldn't afford to eat balanced meals". Was that often, sometimes, or never true for (you/your household) in the last 12 months?	166 (17.4)
In the last 12 months, since last (name of current month), did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?	50 (5.2)
[If yes above] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	34 (3.6)
In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?	52 (5.4)
In the last 12 months, were you every hungry but didn't eat because there wasn't enough money for food?	27 (2.8)
Number of affirmative responses	
0	735 (77.0)
1	114 (11.9)
2	49 (5.1)
3	24 (2.5)
4	9 (0.9)
5	12 (1.2)
6	11 (1.2)
Food security status	
Food secure	849 (89.0)
Low food secure	82 (8.6)
Very low food secure	23 (2.4)

[a]Comprises all family members beyond the nuclear family

[b]Comprises participants living only with non-family members ($n = 29$) or participants living with family and non-family members ($n = 10$)

[c]*n* (%) of affirmative responses in each item of the scale

Both education and occupation were independently associated with food insecurity. These two variables are correlated and likely measure the same socio-demographic dimension, which was reflected in the similar results obtained for education and occupation.

Individuals with a lower education were more likely to belong to a food insecure household, as previously reported by Gooding et al. (2012), which found that food insecurity was associated with lower educational attainment. In our study, significant and positive associations between having lower white-collar and blue-collar occupations and food insecurity were also observed. Although the significant association with blue-collar workers was lost in the final adjusted model, this likely happened because few individuals were classified within this group; thus, there was not enough power to observe this association.

Although the literature has described that households with more people have a higher odds of being food insecure (Carter et al. 2012; Markwick et al. 2014), in our sample of young adults, no association between household size and food insecurity was observed. However, household structure appears to be an important determinant of food insecurity not only in our study but also in other populations (Balistreri 2018; Martin-Fernandez et al. 2013). According to our results, a nuclear family composed by the young adult and his/her partner and/or children had a higher odds of being food insecure than those who belong to a nuclear family composed of his/her parents and/or

Table 2 Socio-demographic characteristics associated with food insecurity (n = 926) (Porto, Portugal, 2016)

n (%)	Food secure [n = 827 (89.3%)]	Food insecure [n = 99 (10.7%)]	Crude OR (95% CI)	Model 1 - Adjusted OR (95% CI)[c]	Model 2 - Adjusted OR (95% CI)[d]
Sex					
Women	478 (88.2)	64 (11.8)	1.3 (0.9–2.1)	1.2 (0.8–2.0)	1.1 (0.7–1.8)
Men	349 (90.9)	35 (9.1)	1	1	1
Education					
≤ 12 years	174 (81.3)	40 (18.7)	2.5 (1.6–3.9)	1.9 (1.2–3.1)	1.7 (1.0–2.8)
> 12 years	653 (91.7)	59 (8.3)	1	1	1
Occupation					
Upper white-collar	528 (93.3)	38 (6.7)	1	1	1
Lower white-collar	139 (78.5)	38 (21.5)	3.8 (2.3–6.2)	2.3 (1.2–4.2)	2.3 (1.2–4.2)
Blue-collar	41 (83.7)	8 (16.3)	2.7 (1.2–6.2)	1.3 (0.5–3.6)	1.2 (0.5–3.4)
Student	119 (88.8)	15 (11.2)	1.8 (0.9–3.3)	1.4 (0.7–2.8)	1.5 (0.8–3.0)
Household income perception					
Insufficient	29 (53.7)	25 (46.3)	25.2 (12.4–50.9)	22.1 (10.8–45.2)	23.3 (11.3–47.8)
Need to be careful about expenses	243 (81.5)	55 (18.4)	6.6 (3.8–11.4)	6.1 (3.5–10.6)	5.9 (3.4–10.2)
Enough	555 (96.7)	19 (3.3)	1	1	1
Household size					
1 person	108 (87.1)	16 (12.9)	1	1	1
2 persons	156 (86.7)	24 (13.3)	1.0 (0.5–2.0)	0.7 (0.3–1.4)	0.3 (0.1–1.4)
3 persons	233 (92.8)	18 (7.2)	0.5 (0.2–1.1)	0.4 (0.2–0.8)	0.3 (0.1–1.2)
≥ 4 persons	330 (88.9)	41 (11.0)	0.8 (0.4–1.6)	0.7 (0.4–1.4)	0.6 (0.2–2.3)
Household structure					
Parents-based nuclear family (*Participant + parents and/or siblings*)	478 (92.3)	40 (7.7)	1	1	1
Participant-based nuclear family (*Participant + partner and/or children*)	116 (82.3)	25 (17.7)	2.6 (1.5–4.4)	2.0 (1.1–3.7)	2.0 (1.1–3.7)
Extended family[a]	93 (86.9)	14 (13.1)	1.8 (0.9–3.4)	1.4 (0.7–2.8)	1.4 (0.7–2.8)
Others[b]	140 (87.5)	20 (12.5)	1.7 (1.0–3.0)	1.7 (0.9–3.2)	1.7 (0.9–3.2)

CI confidence interval and *OR* odds ratio

[a]Comprises all family members beyond the nuclear family

[b]Comprises participants living alone and participants living only with non-family members or participants living with family and non-family members

[c]Adjusted for sex, education and household income perception

[d]Adjusted for sex, education, household income perception and household structure

siblings. This finding possibly reflects the increased economic fragilities of young adults who leave their parents' home and build their own family, in comparison with those that still live with their parents.

In fact, the majority of the young adults in our sample live within a parents-based nuclear family which may reflect that the transition from adolescence to adulthood and to economic independence has been increasingly complex and lengthened (Xiao et al. 2014). Although participants in our sample had the same age, there were large differences regarding socio-economic factors and, consequently, variation concerning household structure. These results also suggest that, more than the size of the household, the household structure is more relevant for food insecurity, at least in this period of the lifespan.

Sex has been identified as a determinant of food insecurity in adults (Alvares and Amaral 2014; Chun et al. 2015) and in young adults (Gooding et al. 2012). It is believed that women are more aware of their household's food supply and more prone to abstain from food in favour

of other family members, mainly children (Chun et al. 2015). However, in our study, as in other previous studies in young adults (Baer et al. 2015; Pryor et al. 2016), no statistically significant association between sex and food security status was observed. The fact that, in our sample, more than half of the households were a parents-based nuclear family (55.6%) and only a small proportion of young adults had children (6.9%), may have precluded the observation of the previously reported relation between food insecurity and being a woman described in the literature.

The present study had some limitations that should be discussed. First, the questionnaire was translated from English to Portuguese by the research team, but a back translation, that assures the agreement of the translation of the scale (Maneesriwongul and Dixon 2004) was not performed, which can be seen as a study limitation. Even though, due to the simplicity of the scale items, we believe that this did not have a significant impact. Moreover, although in terms of validity only Cronbach's alpha was calculated, the scale revealed to have a good internal consistency, as the Cronbach's alpha was higher than 0.7 (Terwee et al. 2007). Also, the existence of recall bias cannot be excluded, as the food security status assessment referred to the previous 12 months. Food insecurity is a delicate topic, and misclassification of participants may have occurred due to social desirability bias, i.e. young adults may have omitted their real situation. In addition, as food security data were self-reported and based on an individual's self-perception, the possibility that an individual described his/her household as more or less food insecure than it was in reality cannot be discarded (Hamilton et al. 1997). Therefore, the prevalence of food insecurity could have been underestimated in our study. However, as the majority of the participants answered the food security scale through the web-based platform (91.5%), the probability of biased answers may have been reduced. Additionally, the reported food security status of the household could be biased since the questionnaire was applied regardless of being responsible or co-responsible for cooking and/or buying food for the household. However, as even young adolescents have been described to perceive the social position of their family (Bannink et al. 2016), it is believed that young adults actually know the general economic situation of the household. Nonetheless, these limitations at worst may have caused an underreporting of food insecurity, and thus, our scenario of food insecurity could be underestimated.

Although some differences in sex distribution, education attainment and household income perception between participants included in this analysis and the remaining participants of the cohort were observable, the magnitude of differences was small, and thus unlikely to limit the generalizability of our findings.

Notwithstanding the aforementioned limitations, this study is strengthened by the use of data obtained from a large population-based cohort of individuals followed since adolescence until adulthood, from different socio-economic strata. Furthermore, food security status was assessed using a widely used scale (Blumberg et al. 1999; United States Department of Agriculture 2012), which provides a more accurate definition of food insecurity and allows comparisons with results from other studies in different settings.

In young adulthood, a period of lifespan characterized by increased autonomy and responsibility, approximately one in every nine young adults belong to a food insecure household, at a time of economic crisis recovery. Food insecurity in young adults' households was highly associated with individual (education and occupation) and household socio-demographic characteristics (household structure and income).

Our findings support the need for the development of public health interventions targeted at less educated young adults, with lower white-collar occupations, who have a perception of insufficient household income and belong to a nuclear family including their partner and/or children, to reduce the burden of food insecurity, particularly in countries under economic vulnerability.

Acknowledgements The authors gratefully acknowledge the participants enrolled in EPITeen for their kindness, and all members of the research team for their enthusiasm and perseverance.

Funding This work was supported by contributions from Iceland, Liechtenstein and Norway through the European Economic Area Grants, under the Public Health Initiatives Programme (PT 06, Grant No. 118SI2). This study was also funded by FEDER through the Operational Programme Competitiveness and Internationalization and national funding from the Foundation for Science and Technology—FCT (Portuguese Ministry of Science, Technology and Higher Education) (POCI-01-0145-FEDER-016829), under the Project "A longitudinal approach to metabolically healthy obesity: from inflammation to cardiovascular risk profile" PTDC/DTP-EPI/6506/2014, by the Unidade de Investigação em Epidemiologia—Instituto de Saúde Pública da Universidade do Porto (EPIUnit) (POCI-01-0145-FEDER-006862; Ref. UID/DTP/04750/2013), the PhD Grant SFRH/BD/117371/2016 (IM), PhD Grant SFRH/BD/92370/2013 (TM), and the Postdoc Grant SFRH/BPD/88729/2012 (RL), co-funded by the FCT and the POCH/FSE Program; and the FCT Investigator contract IF/01060/2015 (ACS). This study is also a result of the Project DOCnet (NORTE-01-0145-FEDER-000003), supported by Norte Portugal Regional Operational Programme (NORTE 2020), under the PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (ERDF).

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

Alvares L, Amaral TF (2014) Food insecurity and associated factors in the Portuguese population. Food Nutr Bull 35:395–402. https://doi.org/10.1177/156482651403500401

Anderson SA (1990) Core indicators of nutritional state for difficult-to-sample populations. J Nutr 120:1555–1600. https://doi.org/10.1093/jn/120.suppl_11.1555

Baer TE, Scherer EA, Fleegler EW, Hassan A (2015) Food insecurity and the burden of health-related social problems in an urban youth population. J Adolesc Health 57:601–607. https://doi.org/10.1016/j.jadohealth.2015.08.013

Balistreri KS (2018) Family structure and child food insecurity: evidence from the current population survey. Soc Indic Res 138:1171–1185. https://doi.org/10.1007/s11205-017-1700-7

Bannink R, Pearce A, Hope S (2016) Family income and young adolescents' perceived social position: associations with self-esteem and life satisfaction in the UK Millennium Cohort Study. Arch Dis Child 101:917–921. https://doi.org/10.1136/archdischild-2015-309651

Benson JE, Elder GH (2011) Young adult identities and their pathways: a developmental and life course model. Dev Psychol 47:1646–1657. https://doi.org/10.1037/a0023833

Blumberg SJ, Bialostosky K, Hamilton WL, Briefel RR (1999) The effectiveness of a short form of the household food security scale. Am J Public Health 89:1231–1234

Carter KN, Lanumata T, Kruse K, Gorton D (2010) What are the determinants of food insecurity in New Zealand and does this differ for males and females? Aust N Z J Public Health 34:602–608. https://doi.org/10.1111/j.1753-6405.2010.00615.x

Carter MA, Dubois L, Tremblay MS, Taljaard M (2012) Local social environmental factors are associated with household food insecurity in a longitudinal study of children. BMC Public Health 12:1038. https://doi.org/10.1186/1471-2458-12-1038

Chun IA, Ryu SY, Park J, Ro HK, Han MA (2015) Associations between food insecurity and healthy behaviors among Korean adults. Nutr Res Pract 9:425–432. https://doi.org/10.4162/nrp.2015.9.4.425

Dalglish SL, Melchior M, Younes N, Surkan PJ (2015) Work characteristics and suicidal ideation in young adults in France. Soc Psychiatry Psychiatr Epidemiol 50:613–620. https://doi.org/10.1007/s00127-014-0969-y

Fiori F, Rinesi F, Spizzichino D, Di Giorgio G (2016) Employment insecurity and mental health during the economic recession: an analysis of the young adult labour force in Italy. Soc Sci Med 153:90–98. https://doi.org/10.1016/j.socscimed.2016.02.010

Franklin B, Jones A, Love D, Puckett S, Macklin J, White-Means S (2012) Exploring mediators of food insecurity and obesity: a review of recent literature. J Community Health 37:253–264. https://doi.org/10.1007/s10900-011-9420-4

Gooding HC, Walls CE, Richmond TK (2012) Food insecurity and increased BMI in young adult women. Obesity 20:1896–1901. https://doi.org/10.1038/oby.2011.233

Gregório MJ, Graça P, Nogueira PJ (2014) Household food insecurity determinants in Portugal—results from INFOFAMÍLIA National Survey (2011–2013). In: Gregório MJ (ed) Social inequalities in the access to a healthy diet: a study in the Portuguese population. PhD thesis. Faculty of Nutrition and Food Science of the University of Porto, Porto

Gregório MJ, Rodrigues AM, Graça P, de Sousa RD, Dias SS, Branco JC, Canhão H (2018) Food insecurity is associated with low adherence to the Mediterranean diet and adverse health conditions in Portuguese adults. Front Public Health 6:38. https://doi.org/10.3389/fpubh.2018.00038

Gundersen C (2013) Food insecurity is an ongoing national concern. Adv Nutr 4:36–41. https://doi.org/10.3945/an.112.003244

Hamilton WL, Cook JT, Thompson WW, Buron LF, Frongillo EA Jr, Olson CM, Wehler CA (1997) Household food security in the United States in 1995. Technical report of the food security measurement project. United States Department of Agriculture

Instituto Nacional de Estatística (2011) Classificação Portuguesa das Profissões 2010, Lisboa

Keller TE, Cusick GR, Courtney ME (2007) Approaching the transition to adulthood: distinctive profiles of adolescents aging out of the child welfare system. Soc Serv Rev 81:453–484. https://doi.org/10.1086/519536

Krahn HJ, Howard AL, Galambos NL (2012) Exploring or foundering? The meaning of employment and educational fluctuations in emerging adulthood. Youth Soc 47:245–266. https://doi.org/10.1177/0044118X12459061

Leung CW, Epel ES, Ritchie LD, Crawford PB, Laraia BA (2014) Food insecurity is inversely associated with diet quality of lower-income adults. J Acad Nutr Diet 114:1943–53.e2. https://doi.org/10.1016/j.jand.2014.06.353

Lund TB, Holm L, Tetens I, Smed S, Nielsen AL (2018) Food insecurity in Denmark-socio-demographic determinants and associations with eating- and health-related variables. Eur J Public Health 28:283–288. https://doi.org/10.1093/eurpub/ckx121

Maneesriwongul W, Dixon JK (2004) Instrument translation process: a methods review. J Adv Nurs 48:175–186. https://doi.org/10.1111/j.1365-2648.2004.03185.x

Markwick A, Ansari Z, Sullivan M, McNeil J (2014) Social determinants and lifestyle risk factors only partially explain the higher prevalence of food insecurity among Aboriginal and Torres Strait Islanders in the Australian state of Victoria: a cross-sectional study. BMC Public Health 14:598. https://doi.org/10.1186/1471-2458-14-598

Martin-Fernandez J, Grillo F, Parizot I, Caillavet F, Chauvin P (2013) Prevalence and socioeconomic and geographical inequalities of household food insecurity in the Paris region, France, 2010. BMC Public Health 13:486. https://doi.org/10.1186/1471-2458-13-486

Nur Atiqah A, Norazmir MN, Khairil Anuar MI, Mohd Fahmi M, Norazlanshah H (2015) Food security status: it's association with inflammatory marker and lipid profile among young adult. Int Food Res J 22:1855–1863

Pan L, Sherry B, Njai R, Blanck HM (2012) Food insecurity is associated with obesity among US adults in 12 states. J Acad Nutr Diet 112:1403–1409. https://doi.org/10.1016/j.jand.2012.06.011

Patton-Lopez MM, Lopez-Cevallos DF, Cancel-Tirado DI, Vazquez L (2014) Prevalence and correlates of food insecurity among students attending a midsize rural university in Oregon. J Nutr Educ Behav 46:209–214. https://doi.org/10.1016/j.jneb.2013.10.007

Pérez-Escamilla R, Villalpando S, Shamah-Levy T, Méndez-Gómez Humarán I (2014) Household food insecurity, diabetes and hypertension among Mexican adults: results from Ensanut 2012. Salud Publica Mex 56:s62–s70

PORDATA (2018) Taxa de desemprego: total e por sexo (%). https://www.pordata.pt/Portugal/Taxa+de+desemprego+total+e+por+sexo+(percentagem)-550. Accessed 11 Oct 2018

Pryor L, Lioret S, van der Waerden J, Fombonne E, Falissard B, Melchior M (2016) Food insecurity and mental health problems among a community sample of young adults. Soc Psychiatry Psychiatr Epidemiol 51:1073–1081. https://doi.org/10.1007/s00127-016-1249-9

Ramos E, Barros H (2007) Family and school determinants of overweight in 13-year-old Portuguese adolescents. Acta Paediatr 96:281–286. https://doi.org/10.1111/j.1651-2227.2007.00107.x

Seligman HK, Bindman AB, Vittinghoff E, Kanaya AM, Kushel MB (2007) Food insecurity is associated with diabetes mellitus: results from the National Health Examination and Nutrition Examination Survey (NHANES) 1999–2002. J Gen Intern Med 22:1018–1023. https://doi.org/10.1007/s11606-007-0192-6

Stroud C, Walker LR, Davis M, Irwin CE Jr (2015) Investing in the health and well-being of young adults. J Adolesc Health 56:127–129. https://doi.org/10.1016/j.jadohealth.2014.11.012

Terwee CB, Bot SDM, de Boer MR, van der Windt DAWM, Knol DL, Dekker J, Bouter LM, de Vet HCW (2007) Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 60:34–42. https://doi.org/10.1016/j.jclinepi.2006.03.012

United States Department of Agriculture (2012) US Household food security survey module: six-item short form. US Department of Agriculture, Economic Research Service. https://www.ers.usda.gov/media/8282/short2012.pdf

Xiao JJ, Chatterjee S, Kim J (2014) Factors associated with financial independence of young adults. Int J Consum Stud 38:394–403. https://doi.org/10.1111/ijcs.12106