



Family meals and food insecurity in Spanish adolescents

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ARTICLE INFO

Keywords:

Food insecurity
Food security
Home environment
Family meals
Family dinner index
Adolescents

ABSTRACT

The world is not on track to achieve the goal of food security for the global population by 2030. New approaches to understand individuals' food insecurity are needed, especially insecurity related to children and adolescents, since it is associated with health and psychosocial problems. The study aimed to characterise the family dinners among a representative cohort of schooled adolescents ($n = 1017$) and their parents ($n = 261$) in Terrassa (Catalonia, Spain) and how family dinners could be related to household food insecurity. The survey findings revealed that in 2022, 19.2% of the adolescents were experiencing household food insecurity. Adolescents with a lower socioeconomic status and of foreign origin showed the highest likelihood of experiencing household food insecurity. Household food security was also associated with some characteristics of family dinners, such as better quality and a higher frequency (seven or more dinners eaten together per week). Based on this finding, possible ways in which family dinners could offer a beneficial effect, alleviating the consequences of food insecurity in adolescents, are discussed. In line with the 2030 Agenda and the Sustainable Development Goal of guaranteeing food security, the promotion of family dinners and their quality, frequency, and duration to leverage the beneficial effect in states of household food insecurity in Spanish adolescents should be taken into account to design actions and public campaigns in Spain.

1. Introduction

Food insecurity and family meals are household environmental factors that have generated considerable interest within the scientific community, but evidence regarding potential associations between them is scarce. The United Nations 2030 Agenda for Sustainable Development (FAO, 2022; UN Department of Economic and Social Affairs, 2015) includes as its second goal achieving food security, ending hunger, and improving the world's nutrition. Nevertheless, old and emerging risks worldwide, such as global warming, pandemics, food allergies, and more, are preventing populations from meeting expected

accomplishments. The prevalence of food insecurity has been persistently rising to severe levels since 2019, reaching close to 40% of the world's population by 2021 (FAO, 2022). Food insecurity means people lack regular access to sufficient, safe, and nutritious food for normal growth and development and an active and healthy life (CE-FAO, 2008; FAO, 2003). This situation severely affects children and adolescent populations who are undergoing growth and development, where it is associated with dietary inadequacies, impaired growth and development, low educational achievement, cognitive deficits, chronic physical and mental health problems, and even death (Paslakis et al., 2021; Shankar-Krishnan et al., 2018).

Abbreviations: BMI, Body Mass Index; CFSSM-S, Spanish Child Food Security Survey Module; CHS, Community and Health Service; FDI, Family Dinner Index; FI, Food insecurity; FS, Food security; HFS, Household food security; HFI, Household food insecurity; ILOSTAT, Statistical of International Labour Organization; WHO, World Health Organization.

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<https://doi.org/10.1016/j.appet.2024.107214>

Received 7 September 2023; Received in revised form 10 January 2024; Accepted 11 January 2024

Available online 12 January 2024

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Household food insecurity (HFI) refers to any family member's food insecurity status (FAO, 2003), which makes it an interesting approach to understand home environmental risk factors that may be involved in children and adolescents' food insecurity. Indeed, HFI has been associated with trends of child malnutrition, including stunting and wasting, deficiencies in essential micronutrients, and childhood overweight and obesity (FAO, 2022). To this effect, descriptors of the household environment such as family income, maternal educational level, and other sociocultural aspects have been studied due to their relevance in the measurements of HFI in children and adolescents (Kral et al., 2017; Miller et al., 2023; Tabbakh & Freeland-Graves, 2016). Findings have been especially consistent in explaining the relationship between family income and food insecurity in children, frequently pointing towards dietary inadequacies and weight problems in children and adolescents (Kral et al., 2017; Shankar-Krishnan et al., 2018, 2021). For instance, the availability of food within the house largely depends on family income and nutrition knowledge level, which directly influence adolescents' (11–14 years old) diets and their perceptions around household food security (HFS) (Qiu et al., 2023; Tabbakh & Freeland-Graves, 2016).

Among other sociocultural aspects of the household environment, family meals and conviviality have been relevant in studying children and adolescents' health; however, evidence is scarce on possible associations between these aspects and HFI. There is not a consistent or established definition of the term "family meals" used in research, and the only common theme between all the provided definitions seems to be "sitting and eating together" (Hornung et al., 2016). Moreover, since conviviality also refers to the practice of having family meals, it should be regarded as a more precise term than "family meal". Conviviality is the social aspect of eating that involves sharing meals (a social event linked with pleasure and joy when sharing food), which is a characteristic in Mediterranean regions where family and food traditions are core activities (De la Torre-Moral et al., 2021). Conviviality during family dinners has been seen as beneficial for adolescents' food habits and health (12–16 years old), since it plays a positive role in terms of preventing eating disorders, having higher intakes of fruits and vegetables and lower intakes of sugar-sweetened beverages, and lowering the risk of developing obesity among children and adolescents (6–16 years old) (De la Torre-Moral et al., 2021; Skeer et al., 2018; Tabbakh & Freeland-Graves, 2016). In this line, of particular interest were "The National Center on Addiction and Substance Abuse at Columbia University" (CASA) survey findings showing that family meals were related to a lower risk of child and adolescent drug use and misuse (smoking, drinking, and other drugs) (CASA, 2012). Other family meal-related activities in the context of HFS are caregiver feeding practices such as feeding decisions and responsibilities (timeline, composition and type of meals, cooking self-efficacy, etc.), which can potentially be protective against childhood obesity (De Brito et al., 2022).

In general, previous studies show that adolescents report that dinner was the meal the family shared most frequently, which has led to a special focus on family dinners (Skeer et al., 2023; Valero Solis et al., 2019). There are several internal and external barriers within and outside the family unit that can limit how often meals are shared (Daragan et al., 2023). For instance, socioeconomic status determines disparities; families facing poverty often find it difficult to share meals together on a regular basis (Daragan et al., 2023).

Given that new approaches to understand food insecurity in adolescents are needed to improve the track towards the 2030 UN agenda and seeing potential connections between family meals and food insecurity in adolescents, this study aims to characterise the family dinners in a representative sample of Spanish adolescents and uncover potential relationships with adolescents' HFS.

2. Methods

2.1. Study design

The present cohort study accounts for a large representative sample of adolescents from public and grant-aided schools in Terrassa. It was carried out in the frame of a larger, funded project on weight stigma.

2.2. Participants

A representative sample of adolescents from public and grant-aided schools in Terrassa and their families (parents or tutors) was selected for this study using a random multistage cluster sampling technique. The sampling error was 2.97% under the assumption of maximum indeterminacy and a confidence level of 95.5% ($p = q = 0.5, 2\sigma$). Terrassa is the third most populous (>200,000 inhabitants) urban industrial city in Catalonia, Spain. The potential participants after sampling (enrolled in selected class lists) consisted of 1674 adolescents, corresponding to 64 classes (from seven public schools and nine grant aided schools) from the four courses of compulsory secondary education in Spain. Only adolescents with signed parental informed consent were included in the study ($n = 1171$). A further 154 adolescents were excluded due to absenteeism, language issues, refusal to participate, or failure on the survey attention check controls. The final sample of the present study therefore consisted of 1017 adolescents. The parent sample ($n = 268$) was constructed from each parent/tutor who individually agreed to take part in the study and completed the questionnaires.

2.3. Instruments

Household food security (HFS) was assessed via the Spanish adaptation of the *Child Food Security Survey Module* (CFSSM-S) (Shankar-Krishnan et al., 2018), containing nine items to analyse participants' perceptions of food insecurity in their households and their concerns around food insecurity (e.g. running out of food, eating only cheap food, eating less, etc.). The overall score of the survey ranges from 0 to 9. The food security classification as per the original study (Connell et al., 2004) and the US Department of Agriculture's new nomenclature (Nord et al., 2005, p. 60) established the following categories: 0–1 = food secure; 2–5 = low food security; and 6–9 = very low food security. For the purpose of this study, the low food security and very low food security categories were grouped and the following categories were used: food security (0–1) and food insecurity (2–9). Internal consistency of the CFSSM-S in our sample was good ($\alpha = 0.870$; $\omega = 0.888$).

Family dinners The quality of family dinners was assessed using the *Family Dinner Index* (FDI), which included eight items such as communication (conversations during family dinners), enjoyment (joy of sharing food and time with family) and presence of digital distractions. The children's FDI (FDI-C) also included meal logistics, and the parents' FDI included family bonding (Skeer et al., 2023). Both FDI-P and FDI-C overall scores range from 0 to 32 (higher scores represent more positive family meal atmospheres). The frequency of family dinners, duration, and number of participants were also obtained.

Anthropometric measures (weight and height) were taken with portable precision stadiometers and scales. Weight status was calculated according to WHO criteria, accounting for age and gender (World Health Organization, 2007), and BMI Z-scores were also computed.

Sociodemographic variables The adolescents completed a basic sociodemographic questionnaire, which included, but was not limited to, questions about gender, age, and family origin. Gender accounted for three categories (boy, girl, and nonbinary). Family origin considered six categories (Spanish/Catalan, European, Latin-American, North African, Mixed, and Others), but was transformed into just two categories (Spanish/Catalan or not Spanish/Catalan) for the analysis. Age was a continuous variable ranging from 11 to 17 years old, but was transformed into a categorical variable with three levels (11–12, 13–14 and

older than 15 years old).

The Hollingshead Two-Factor Index of Socioeconomic Status (SES) (Hollingshead, 2011) was used to estimate family socioeconomic status based on combining the parents' educational and occupational levels. Five levels of SES were obtained (low, medium-low, medium, medium-high, high), which were transformed into just two categories, lower SES (low, medium-low, and medium) and higher SES (medium-high, and high). The ILOSTAT classification, based on the *International Standard Classification of Education* (ISCED), was applied for parental educational level. Five categories were obtained (less than basic, basic, intermediate, advanced, and not stated) (International Labour Organization, 2023). Parental educational level was also transformed into two categories, higher (intermediate and advanced) and lower (basic or less than basic), while "not stated" was dismissed in the analysis.

2.4. Procedure

School participation was decided with the mediation of the *Community and Health Service* (CHS) of the City Council of Terrassa. Active parental consent and adolescent assent were collected. The design of the questionnaires was done via a specific online platform by *Digital Insights, S.L.*, and included controls for response ranges and interspersed control questions. Surveys were administered to adolescents by trained technicians in a supervised manner in the classrooms. Weight and height measurements were taken privately following a standardised protocol (Sánchez-Carracedo et al., 2013). Parents answered an online survey. Data was pseudo-anonymised. The assessment was carried out in April and May 2022. The data belongs to a larger database that has not yet been fully exploited; however, the data set is available upon request to authors. The research was approved by the ethics committees of the *Universitat Autònoma de Barcelona* (CEAAH 3451) and the *Opened University of Catalonia* (CE23-TF17). The study carried out for data collection was conducted in accordance with the guidelines established in the *World Medical Assembly's* (World Medical Association, 2013) Declaration of Helsinki. Complete details on the procedure are available in the supplementary materials.

2.5. Statistical analysis

All the hypotheses were specified before the data were collected. Likewise, the analytic plan was pre-specified and any data-driven analyses are clearly identified and discussed appropriately. Questionnaire reliability was assessed by computing Cronbach's alpha (α) and McDonald's omega (ω) values (Revelle, 2019). The descriptive analysis was carried out mainly with *Jamovi* software for Windows (Jamovi, 2022). Relative frequencies were expressed as a percentage (%) and used to describe sociodemographics, family meal components and household food security. Continuous variables were reported as mean (\bar{x}) \pm standard deviations (SD), or median (M) \pm interquartile range (IQR). Normality was assessed by applying the Kolmogorov-Smirnov test in conjunction with distribution plots (histograms) and summary statistics (skewness, kurtosis, dispersion). Participants with missing data were excluded for the variables studied in each analysis. Participants with non-binary gender represented 0.3% of the sample (n = 3); thus, we have dismissed this group in our analysis due to its very small size which is insufficient for the performed analyses. Two subgroups of adolescents based on parents' participation were considered (adolescents whose parents/tutors did and did not participate). Associations between variables were assessed with both SPSS and *Jamovi* software programs (IBM Corp, 2021; Jamovi, 2022). Graphic methods (tables and figures) were also used to show results visually. The *p*-value to consider significance interaction terms was *p* < 0.05 (two-sided).

Chi-Square tests (χ^2) were carried out to determine the existence of associations between categorical variables according to their distribution: adolescents' sociodemographics among the ones whose parents participated or not, family meals components among adolescents and

their parents, adolescents' sociodemographics among groups with or without HFI. Cramer's V coefficient was estimated to assess the strength of association of the family meals components on the groups of adolescents and their parents (low interaction effect was considered for V = 0.1, moderate effect for V = 0.3, and high effect for V = 0.5). The association and predictive effect of sociodemographic variables and family dinner components on household food security status was assessed by multinomial ordinal logistic regression, and odds ratios were calculated. Student's t-tests were carried out to distinguish statistical differences in the values of the means of FDI scores between adolescents and their parents. Effect size was estimated through Cohen's d coefficient, considering the standardised difference between the mean values of their FDI scores (low effect size was considered for |d| > 0.2, moderate for |d| > 0.5 and high for |d| > 0.8). The strength and direction of the associations of FDI with HFI, BMI Z-score and age were measured using Spearman's rho coefficient on linear correlation matrices.

3. Results

3.1. Participants' and household survey characteristics

Table 1 shows descriptive data from sociodemographic variables, weight status, and household food security distribution in the sample. Gender was similarly distributed between boys and girls, and age ranged from 11 to 17 years old. Specifically, 17.1% were aged 11–12 (18.1%

Table 1
Sociodemographic description of the sample and according to parental participation.

	Adolescents (all) (n = 1017)	Adolescents with parents' participation (n = 229)	Adolescents without parents' participation (n = 773)	p
Gender n (%)				
Girls	498 (49.0)	127 (55.5)	365 (47.2)	
Boys	516 (50.7)	102 (44.5)	405 (52.4)	
Non-binary	3 (0.3)	0	3 (0.4)	0.205
Age (years old) n (%)				
11 to 12	173 (17.0)	43 (18.8)	128 (16.6)	
13 to 14	504 (49.6)	115 (50.2)	379 (49)	
>15	340 (33.4)	71 (31)	266 (34.4)	0.358
Parental origin n (%)				
Spanish/ Catalan	745 (73.3)	200 (87.3)	536 (69.3)	
Non-Spanish/ Catalan	272 (26.7)	29 (12.7)	237 (30.7)	0.385
SES n (%)				
Low	46 (4.5)	4 (1.7)	41 (5.3)	
Medium-low	172 (16.9)	28 (12.2)	143 (18.5)	
Medium	270 (26.6)	45 (19.7)	218 (28.3)	
Medium-high	306 (30.1)	88 (38.4)	215 (27.9)	
High	221 (21.8)	64 (27.9)	154 (20)	0.758
Parental level of education n (%)				
Less than basic	8 (0.8)	1 (0.4)	6 (0.8)	
Basic	195 (19.2)	34 (14.8)	161 (20.8)	
Intermediate	283 (27.8)	57 (24.9)	224 (29)	
High	319 (31.4)	94 (41)	220 (28.5)	
Not stated	212 (20.8)	43 (18.8)	162 (21)	0.404
HFS; n (%)				
Food Security	780 (80.8)	190 (86.4)	579 (78.9)	
Food Insecurity	185 (19.2)	30 (13.6)	155 (21.1)	0.116
Weight status; n (%)				
Underweight	33 (3.3)	1 (0.4)	12 (1.6)	
Normal weight	712 (71.1)	168 (73.7)	546 (71)	
Overweight	135 (13.5)	43 (18.9)	151 (19.6)	
Obesity	121 (12.1)	16 (7)	60 (7.8)	0.805

Note. Figures indicate the number of people and the relative frequency of each group in each category. n: sample size for each group, p: χ^2 test significance (*p* value), SES: socioeconomic status, HFS: household food security.

girls and 16.1% boys), 49.6% were aged 13 (48.8% girls, 50.4% boys) and 33.3% were aged 14–17 (33.0% girls, 33.5% boys). Overweight and obesity reached 25.6% in our sample; however, most adolescents were within the normal weight range (71.1%). Most of the adolescents were Spanish/Catalan (73.3%), and were mainly from a medium (26.6%), medium-high (30.1%) or high (21.8%) socioeconomic status. Most of their parents had an intermediate (27.8%) or high (31.4%) educational level. Table 1 shows that 80.8% of the adolescents were experiencing food security at the household level, while 19.2% of adolescents were experiencing household food insecurity. Table 1 also shows the distribution of the main studied variables in subgroups segmented by parents' participation, excluding the adolescents (n = 15) who did not finish the FDI questionnaire. The adolescents whose parents did not take part in the study (n = 773) were more likely to show overweight and obesity, have a medium-low or low SES, and experience food insecurity, but the differences were not statistically significant compared to those who did participate.

3.2. Family dinners

Fig. 1 and Table 2 show lower FDI scores for adolescents than for parents (Student's t-test: 10.7 ($p < 0.001$), $|d|$: 0.659). Table 2 also shows that, when comparing with parents, adolescents reported a lower frequency of family dinners (4.93 ± 2.26 vs 6.28 ± 1.42). In addition, it is observed that most of the adolescents claimed that their family dinners lasted less than half an hour (58.8%), and less than one third (30.3%) shared their dinnertime with more than four people.

3.3. Household food insecurity

Table 3 and Fig. 2 show associations found between HFI and socio-demographic variables (SES, parental educational level, parental origin), weight status and family dinner components. The multivariate model resulting from the criterion "HFI" retained four relevant interactions. Odds ratios indicated that the risk of experiencing food insecurity at the household level in adolescents roughly doubled due to a lower socioeconomic status (OR: 2.46), foreign parental origin (OR: 1.92) and a lower frequency of family dinners (OR: 2.07). Adolescents who were underweight showed the highest probability of experiencing HFI (OR: 2.87). Other variables, such as parental educational level, age and family dinner duration, were also examined. However, no interactions were found in the multivariate model.

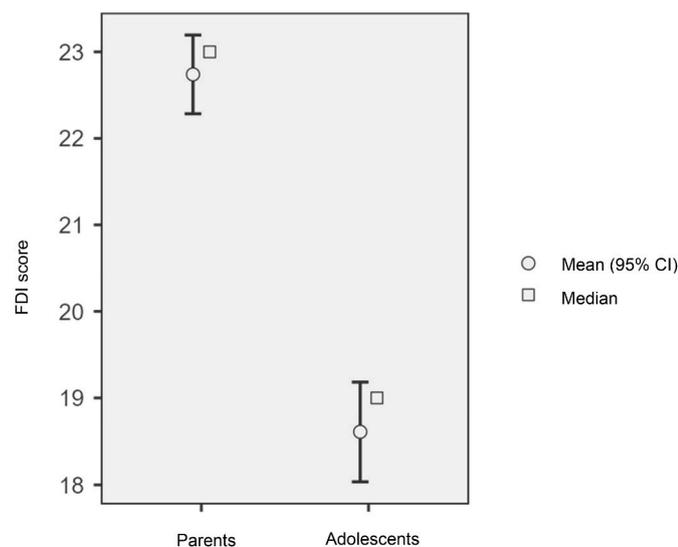


Fig. 1. Differences on family dinner index (FDI) scores.

Table 2

FDI scores and family dinner components distribution and among adolescents and parents.

	Adolescents (all) (n = 1017)	Parents (all) (n = 268)	T-test/ X^2	$ d /V$	p
Family dinner scores (median \pm IQR)					
FDI score	20 \pm 6	23 \pm 6	10.7	0.659	<0.001
Frequency of dinner per week (media \pm SD)					
Dinner/week	4.93 \pm 2.26	6.28 \pm 1.42	9.28	0.657	<0.001
Duration (n (%))					
\leq 30 min	597 (58.8)	155 (58.1)			
>30 min	419 (41.2)	112 (41.9)	1.58	0.077	0.208
People (n (%))					
\leq 4 people	708 (69.7)	236 (88.4)			
>4 people	308 (30.3)	31 (11.6)	0.24	0.030	0.624

Note: n: sample size for each group, T-test: Student's T-test coefficient (for continuous variables), X^2 : chi-square test (for categorical variables), $|d|$: Cohen's d coefficient, V: Cramer's V coefficient, p: significance of the Student's t-test or X^2 (p value); FDI: Family Dinner Index, IQR: interquartile range, SD: standard deviation, n: sample size, %: relative frequency.

Table 3

Binomial logistic regression for household food insecurity related factors (HFI).

	z	SE (z)	OR	95%CI	p
Lower socioeconomic status	4.45	0.20	2.46	0.51–1.30	<0.001
Non-Spanish/Catalan	3.12	0.20	1.92	0.24–1.06	0.002
<7 dinners per week	3.41	0.21	2.07	0.31–1.14	<0.001
Underweight	2.10	0.50	2.87	0.07–2.04	0.035

Note. z: regression coefficient, SE: standard error, OR: odd ratio, 95% CI: 95% confidence interval, p: significance of the test (p value). The reference categories for each variable were respectively: high socioeconomic status, Spanish/Catalan origin, seven dinners per week, and normal-weight.

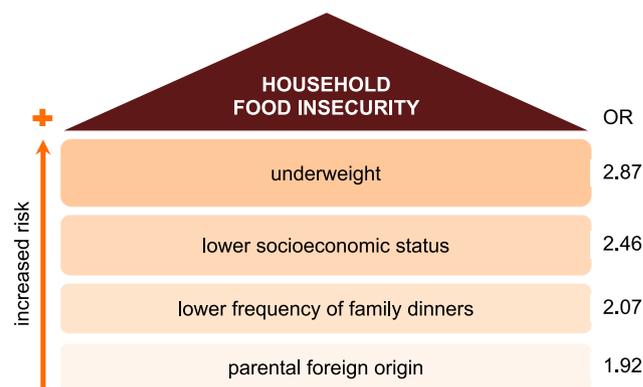


Fig. 2. Household food insecurity (HFI) risk factors in Spanish adolescents.

3.4. HFI and family dinners relationship

Table 4 shows linear correlations related to adolescents' FDI. We found FDI inversely associated with HFI ($\rho = -0.117$, $p < 0.001$) and age ($\rho = -0.144$, $p < 0.001$), including segmented analysis for subgroups based on parents' participation, showing that as FDI increased, HFS increased, and adolescents' age was lower. These relationships did not exist for the subgroup of adolescents with parents' participation but existed for the subgroup of those whose parent's data was unavailable. No relationship was observed with their BMI Z-scores.

4. Discussion

The present study aimed to characterize the relationship between family dinners and Household Food Insecurity (HFI) within the household environment in a representative sample of adolescents (n = 1017)

Table 4

Linear correlations (expressed as rho and p value) between adolescents' FDI and household food insecurity, BMI Z-scores and age.

	Adolescents (all) (n = 1017)	Adolescents with parents' participation (n = 773)	Adolescents without parents' participation (n = 229)
HFI	-0.117 (<0.001)	0.060 (0.378)	-0.124 (<0.001)
BMI Z-score	0.009 (0.784)	0.050 (0.453)	-0.007 (0.846)
Age	-0.144 (<0.001)	-0.181 (0.006)	-0.132 (<0.001)

Note. Abbreviations: rho: Spearman's rho coefficient; p: significance of the correlation matrix; BMI: Body Mass Index; FDI: family dinner index; HFI: Household food insecurity.

from the city of Terrassa (Catalonia, Spain). Socioeconomic and cultural characteristics of the household, along with the frequency and quality of family dinners, were found to be associated with HFI in adolescents.

Our study revealed that 19.2% of adolescents from Terrassa were experiencing food insecurity at the household level. Likewise, these results are consistent with a previous study using the same food insecurity assessment, which reported 18.3% of adolescents in a sample of Catalan adolescents experiencing food insecurity in 2018 (Shankar-Krishnan et al., 2018). A more recent report on food security in Spain showed that 13.3% of Spanish households were facing food insecurity by 2021. Specifically, in Barcelona province, food insecurity ranged from 8% to 23.1% among cities and neighbourhoods (Moragues-Faus & Magaña-González, 2022, p. 62).

Our findings showed that HFI in adolescents was associated with family socioeconomic factors. Adolescents from families with a lower socioeconomic status showed the highest probability of experiencing food insecurity at the household level. This finding explains a well-studied context where family incomes are a main indicator of food insecurity, as was evidenced during the COVID-19 pandemic crisis, which significantly negatively affected the economy of 28% households in Spain, forcing them to change their eating and nourishment habits (Moragues-Faus & Magaña-González, 2022, p. 62). Poverty and low incomes, either chronic or transitory, are an underlying cause of food insecurity (CE-FAO, 2008). Although our results did not evidence a significant interaction between HFI and parental educational level, it is relevant to understand family incomes together with parental education. In this context, targeting both poverty and nutritional knowledge has been proved to help to overcome children's food insecurity and benefit their health (CE-FAO, 2008; Tabbakh & Freeland-Graves, 2016).

Our study showed that food insecurity varied according to adolescents' parental origin. Most of the adolescents were from Spanish/Catalan families (73.3%), and the remaining 26.7% were foreigners (Latin American, North African, European, and mixed ethnicity families), who were more likely to experience food insecurity. In Spain, foreign families are usually immigrants who often lack economic resources, making them more vulnerable to experience HFI (Moragues-Faus & Magaña-González, 2022, p. 62). Although family origin cannot be modified, many public actions and economic benefits exist to counteract immigrants shortcomings in Spain.

On the other hand, our findings highlight that HFI is also linked to other factors that may be more easily susceptible to change than the aforementioned socioeconomics: those related to family dinners.

In our sample, the probability of experiencing HFI was double in adolescents who reported sharing fewer family dinners per week. Nevertheless, as a cross-sectional study cannot clearly establish the association's direction for different plausible reasons that could have been involved, further research is required. It could be attributed to qualitative aspects of the quality of the family meals (enjoyment, communication, etc.) that had an effect of alleviating the negative impact of food insecurity, and therefore the perception of suffering from food insecurity

collected by the questionnaire was lower in those participants with a greater frequency of family dinners. However, it is also possible that families experiencing higher levels of food insecurity would find it more difficult to sit down to regular family dinners, as seen elsewhere (Ayre et al., 2023; Middleton et al., 2023).

Further on this point, considering that our study included not only the frequency of family dinners but also the quality through the FDI, adolescents scored lower on the frequency and quality of family dinners compared to parents. These facts could be explained by the different perceptions of the concept and concerns of family dinners between parents and adolescents. In the validation study of the FDI, adolescents' lower scores could be related to differences in their motivations and reasons to eat meals together. For instance, children aged 6–11 years thought more about the logistics of family meals, finding this time important for knowing that they would get fed, whereas adolescents aged 12–16 years and parents appreciated the time to connect together that family meals provided (Skeer et al., 2018). These results align well with a recently proposed parental definition for family meals as meals that take place at home around a table, with homemade food prepared by the caregivers, and most family members gathered, enjoying conversations without other distractions (Daragan et al., 2023). These explanations also apply to the inverse associations found between adolescents' FDI score and age. Considering our results, we could understand these characteristics as indicators of family bonds, which in turn may be affected by and/or involved in adolescents' HFI.

Previous studies showed that higher frequencies of family meals have been associated with a reduction of childhood obesity and disordered eating risk (de la Torre-Moral et al., 2021; Skeer et al., 2018), and with higher nutrient-dense intakes and a more balanced diet among children (Verhage et al., 2018). Moreover, the beneficial effects of family meals have been explained for health issues such as weight problems, eating disorders, substance abuse, and more (Eisenberg et al., 2008; Valero Solis et al., 2019). A key component to explain this beneficial outcome has been the greater communication and interaction between family members as a consequence of eating dinners together more often (Offer, 2013). In Catalonia, the Public Health Agency (ASPCAT) has already started an early childhood health promotion campaign (Implicat) in which family meals are one of the recommendations provided, but it has not been evaluated. The campaign addresses families with children from 0 to 12 years old, launching key messages like "eating at least one family meal a day" amidst "quiet and peaceful conversation" could help to prevent eating disorders (Agència de Salut Pública de Catalunya (ASPCAT), 2019). Although the protective effect of family meals on food insecurity has not yet been studied, our findings highlight the relevance of having good-quality family dinners on a regular basis. By virtue of this, a beneficial effect of family dinners could be discussed as having rich and regular mealtime experiences, even in a state of food insecurity, when eating and enjoying meals together could alleviate the negative effects of food insecurity in adolescents.

This knowledge should be considered in the development of public interventions promoting actions to increase the frequency and quality of family dinners (communication, enjoyment, reduction of digital distractions, participation) to promote their beneficial effect and fight against its barriers, even beyond sociodemographic factors such as low SES or foreign ethnicity, helping to fight to meet the sustainable development goal by 2030. In this regard, new tools to measure the impact of family dinners on food security, as well as further research on longitudinal studies and the mechanisms involved, must be developed.

4.1. Strengths and limitations

This study had several strengths and limitations. Regarding the latter, it was a cross-sectional study that did not allow the interpretation of causal relationships. A possible selection and non-response bias could have occurred given that the healthier family profiles generally tended to be more eager to participate and that a significant number of families

provided negative consent or a null answer. There were also other losses due, for example, to absenteeism, which may have compromised the representativeness of the initial sample. However, in the sampling, an initial, potentially larger sample was collected in anticipation of the usual losses in this type of study. Two other factors could have caused the high non-response rate. First, the impact of the COVID-19 pandemic could have played a significant role. School management teams informed us that both the responsible tutors for consent collection and the families themselves were exhausted due to the effects of the pandemic, demonstrating reduced interest in activities not strictly related to academics during the first year of 'normalcy'. Second, the growing issue of weight stigma might have deterred participation among young individuals and their families, as seen elsewhere (Gómez, Lorenzo, & Ribes, 2022). And third, the parents' participation rate was low, which could have affected the interpretation of the results obtained from statistical analyses where parents' data was used; for instance, the mean of the family dinner frequency from the parental perception was higher than adolescents, a result that could have suffered a bias. For this reason, we did not carry out segmented analysis for parents' participation-based subgroups. Furthermore, although the Family Dinner Index tool had been previously validated, some psychometric properties have been calculated for FDI-C ($\omega = 0.671$) and FDI-P ($\omega = 0.709$), showing low internal consistency, thereby requiring further studies to increase its reliability. On the other hand, as far as we know, this is the first study worldwide to assess the relationship between household food insecurity and family dinners, including not only the frequency of family dinners but also their quality. This is therefore the first time the role of family meals as a relevant aspect for the goal of meeting food security by 2030 among Spanish adolescents has been discussed. Moreover, the sample was drawn randomly through an attentive sampling method, unlike most studies in this field, which are conducted with convenience community samples, allowing us to obtain a representative sample size ($n = 1017$) that enabled accurate statistical approaches. This study also accounts for adolescents' weight and height data taken *in situ* and not self-reported, which enhances reliability.

4.2. Conclusions

Based on our results, food insecurity, challenging the right of young individuals to a safe, healthy, and sustainable diet, reached 19.2% of adolescents at the household level in the city of Terrassa (Catalonia, Spain) by 2022. More efforts need to be made to guarantee food security and meet the second sustainable development goal by 2030. In this regard, our results support the idea that family dinners play a relevant role in the experience of household food insecurity in adolescents. Better quality and daily family dinners were related to lower probabilities of HFI in adolescents. By virtue of this finding, new tools to measure the impact of family dinners in HFI, as well as further research on longitudinal studies aiming to clarify the mechanisms involved, must be developed. In the meantime, we suggest that this knowledge could be incorporated into public interventions, addressing the matter of increasing the frequency and quality of family dinners to promote its beneficial effect towards alleviating the negative effects of household food insecurity in Spanish adolescents.

Funding

The present cohort study accounts for a large representative sample of adolescents from public and grant-aided schools in Terrassa. It was carried out in the frame of a larger, funded project on weight stigma. The research was supported by Research Grants from the Spanish Ministry of Science and Innovation (RTI2018-099293-B-I00 and PID2022-138977OB-I00).

Ethical statement

The research was approved by the ethics committees of the principal investigator's university (CE23-TF17). The study carried out for data collection was conducted in accordance with the guidelines established in the World Medical Assembly's (World Medical Association, 2013) Declaration of Helsinki ("World Medical Association Declaration of Helsinki," 2013).

CRediT authorship contribution statement

María Fernanda Barreiro-Álvarez: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis. **Miriam Latorre-Millán:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis. **Anna Bach-Faig:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Conceptualization. **Albert Fornieles-Deu:** Writing – review & editing, Software, Methodology, Investigation, Data curation. **David Sánchez-Carracedo:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

The authors have no competing interests to declare.

Data availability

Data will be made available on request.

Acknowledgments

The authors would like to thank the Community and Health Service of the City Council of Terrassa and all the adolescents and families for their participation in the study, as well as the participating schools Andersen, Can Jofresa, Can Roca, Cavall Bernat, Creixen, El Cim, Escola Goya, IES Ègara, INS El Cingle, Les Aimerigues, Montserrat Roig, Nicolau Copèrnic, Ramon Pont, Sagrat Cor de Jesús, Sant Domènec Sàvio, and Tecnos.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2024.107214>.

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