Child Indicators Research

Associations between food insecurity and psychological wellbeing, body image, disordered eating and dietary habits: evidence from Spanish adolescents

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Associations between food insecurity and psychological wellbeing, body image, disordered eating and dietary habits: evidence from Spanish adolescents

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Ethical Standards Disclosure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the ethics committee of Universitat Autònoma de Barcelona. Written informed consent was obtained from both participants and parents of participants.

Abstract

Objective: Food insecurity is defined as the lack of accessibility and affordability of safe and healthy foods at regular intervals. The first objective of this study was to examine whether food insecurity in Spanish adolescents is associated with poor psychological wellbeing. Secondly, to investigate whether it is associated with body dissatisfaction, disordered eating and poor dietary habits.

Design: A cross-sectional study was conducted in a secondary school in Catalonia, Spain with adolescent boys and girls (n=426), aged 12-16 years. The 'Spanish Child Food Security Survey Module', (CFSSM-S), socioeconomic status (SES) indicators and other validated questionnaires in Spanish were employed to assess psychological wellbeing, body image, disordered eating and dietary habits

Result: 18.3% of participants were food insecure and 81.7% were food secure. Multiple Analysis of Covariance (MANCOVA) was employed to investigate the association between food insecurity and these variables. Socioeconomic status, family affluence, weight status, age, gender and parental origin were added as adjustment variables. The overall results indicated poor psychological wellbeing, greater body dissatisfaction and higher drive for thinness in food insecure participants.

Conclusion: This is one of the first studies in Spain to examine the negative outcomes of food insecurity on adolescent health. Tackling these issues in adolescence could prevent major psychological and physiological problems in adulthood.

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Keywords: adolescents, body image, disordered eating, food insecurity, psychological wellbeing

Introduction

Definition and background

Food insecurity is defined as 'the 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; United States Department of Agriculture (USDA) 2017]. Not only is food insecurity a public health issue in low-income countries, but it has also been a concern in developed countries since the economic crisis of 2008 (Loopstra 2018). In Spain, there have been reports indicating that the crisis has resulted in an increase in depression and mental health issues during childhood and adolescence (Fernandez-Rivas and Gonzalez-Torres 2013). The crisis has also led to food insecurity issues in Spain due to several factors such as budget cuts, social inequalities and

unemployment (Ortiz-Miranda, Pérez and Alegre 2016). However, there is a lack of sufficient reference studies about the effects of the crisis, particularly food insecurity, on adolescent mental health in Spain (Fernandez-Rivas and Gonzalez-Torres 2013). Media reports (Generalitat de Catalunya 2017; Save the Children 2017) and the most recent United Nations Children's Fund (UNICEF) Innocenti report suggest a 12% food insecurity prevalence rate in Spain in households with children under 15 years (Pereira, Handa and Holmqvist 2017). To the best of our knowledge, there have been no prior studies in Spain examining the consequences of food insecurity across a wider age range of adolescents.

Considering the relevance of the food insecurity problem, studies conducted outside Spain in recent years have assessed its effects and associations with different health-related issues. There have been mostly cross-sectional studies with varied sample sizes in countries such as the United States, United Kingdom and Canada. However, there have been few studies conducted in adolescents. These studies have used different instruments including household surveys, which are based on adults' perceptions of adolescent food insecurity. Most research studies do not focus on children's' feelings and perceptions (Crous 2017) hence it is necessary to employ specific, self-reported instruments to directly assess food insecurity in adolescents. Further, these food insecurity studies have not examined adolescent wellbeing taking into account a broad range of factors such as self-esteem, positive and negative emotions, body image or drive for thinness.

Prior to discussing the associations of food insecurity with the main variables of our study, it is important to note that poverty and low socioeconomic status (SES) are also strongly associated with poor health (Link and Phelan 1996). Although there is an association between poverty and food insecurity, not all food insecure households experience poverty nor do all households living in poverty experience food insecurity (Coleman-Jensen, Rabbitt, Gregory and Singh 2017). Specific associations between both these concepts in children may vary depending on the definition of poverty (Wight, Kaushal, Waldfogel and Garfinkel 2014). Further, poverty has different impacts on food insecurity depending on whether the former is a temporary or persistent situation in households (Mahadevan and Hoang 2016).

Consequences of impaired nutritional status due to food insecurity can impact both physical and psychological health of individuals (Call, Riedel, Hein, McLoyd, Petersen and Kipke 2002). Food insecure households often experience intermittent eating patterns (Widome, Neumark-Sztainer, Hannan, Haines and Story 2009) which can result in a host of issues, such as dietary deficiencies (Kendall, Olson and Frongillo 1996), developmental issues, impaired cognitive functioning and

academic performance (Alaimo, Olson, Frongillo and Briefel 2001), poor physical functioning (Casey et al. 2005) and psychological problems (Burke, Martini, Cayir, Hartline-Grafton, and Meade 2016) in childhood (Jones 2017) and adolescence (McLaughlin et al. 2012).

Food insecurity and psychological wellbeing in adolescents

The term 'psychological wellbeing' is multidimensional (Dodge, Daly, Huyton and Sanders 2012) and there have been studies that have provided different definitions over the years (Crous 2017). According to Deci and Ryan (2008), it can be defined as 'a way of living well and realizing one's human potential more than an outcome or psychological state'. Adolescence represents a crucial period of development whereby negative factors such as poverty could lead to long-term health implications for both the individual and society (Call et al. 2002; Patton et al. 2016). Satisfaction with food has a physical and psychological aspect, which has been associated with positive emotional wellbeing in childhood and adolescence (Vaqué, González and Casas 2012; Vaqué-Crusellas, González and Casas 2015). However, food insecurity negatively impacts psychological wellbeing. Food insecure adolescents are at a higher risk of exhibiting psychological and behavioral issues compared to their food secure peers (Alaimo et al. 2001; McLaughlin et al. 2012; Bruening, Lucio and Brennhofer 2017). While social inequalities could be a risk factor for low self-esteem in adolescents (Roustit, Hamelin, Grillo. Martin and Chauvin 2010), psychological issues such as anxiety, stress, behavioral problems (Ashiabi 2005) irritability and nervousness (Gaspar de Matos, Tomé, Gaspar, Cicognani and Moreno 2016) are commonly reported in food insecure adolescents (McLaughlin et al. 2012).

There exists a plausible theory for the association between food insecurity and mental health problems in adolescents. It involves a mechanism that is triggered when the acquisition of adequate amounts of food becomes uncertain, thereby resulting in a strong stress response in individuals leading to anxiety and depression (Weinreb et al. 2002). Parents of adolescents in food insecure households too experience chronic stress due to food deprivation, which in turn could negatively affect their parenting behaviors, thus increasing risks of psychological issues in their adolescent children (Alaimo, Olson and Frongillo 2002). Parents also protect their younger children from food insecurity because they are considered more vulnerable than their older siblings, who are twice as likely to experience food insecurity (Fram et al. 2011; Bauer, MacLehose, Loth, Fisher, Larson, and Neumark-Sztainer 2015). This could possibly explain why food insecurity was found to be more strongly associated with adolescent mental health issues than other SES indicators (McLaughlin et al. 2012. In this regard, it would be important to focus on various aspects of psychological wellbeing in food insecure adolescents.

Food insecurity, disordered eating and body image in adolescents

Some studies have also examined the relationship between food insecurity and other aspects of mental health, including disordered eating (Tester, Lang and Laraia 2016). Disordered eating behavior is reported to be common among adolescents (Neumark-Sztainer, Wall, Larson, Eisenberg, and Loth 2011). Food insecure adolescents are more prone to binge eating and consuming nutritionally poorer diets (Bruening et al. 2017). The tendencies of food insecure adolescents to overeat when food is available and spending less time on physical activity (Gulliford, Nunes and Rocke 2006) in turn increases their risk of being overweight (Widome et al. 2009). Individuals with 'very low food security' are reported to experience weight stigma and also exhibit higher levels of eating disorder pathology (Becker, Middlemass, Taylor, Johnson and Gomez 2017). Since there have been few studies of food insecurity and its associations with disordered eating, further research is necessary in this area.

Studies examining the associations between body image and food insecurity have been rare in both children and adolescents. Body image refers to the perceptions and attitudes towards one's own body but not necessarily one's appearance (Cash and Pruzinsky 2004). Body dissatisfaction, on the other hand, is a condition whereby individuals are unhappy with the shape, build, weight or other parts of their body, thus increasing the risk of indulging in unhealthy eating behavior (e.g. skipping meals, smoking, taking diet pills, etc.) (Neumark-Sztainer, Paxton, Hannan, Haines, and Story 2006). In general, adolescents exhibit weight concerns and could develop body image problems at a very early age (O'Dea 1999).

Adolescent males are reported to engage in unhealthy practices such as excessive exercise and use of anabolic steroids to build muscles (McCabe and Ricciardelli 2004). Adolescent females are reported be at a higher risk of body dissatisfaction and drive for thinness (O'Dea and Caputi 2001). Food secure individuals have a steady flow of food resources hence are more likely to perceive themselves to be overweight while individuals who are food insecure due to food scarcity often perceive themselves to be thinner (Ambroziak, Azañón and Longo (2017). However, the only study to date to have examined the association between body image and food insecurity in children suggests that food insecure children might be more dissatisfied with their bodies (Altman, Ritchie, Frongillo and Madsen 2018). As a result, the relationships between food insecurity and drive for thinness and body dissatisfaction should be explored further in adolescents.

Food insecurity and dietary habits in adolescents

Food insecurity has been associated with low SES and adolescents with low SES are reported to consume less healthy diets and have fewer intakes of fruits and vegetables (Bauer et al. 2015). Furthermore, food insecure adolescents have greater access to nutritionally poor, energy dense foods (Kirkpatrick and Tarasuk 2008). Yet some studies have found no significant differences in dietary habits between food secure and food insecure children (Bhattacharya, Currie and Haider 2004). This could be explained by the fact that diets adopted by younger generations, including children and adolescents irrespective of social class, have undergone drastic changes in recent times due to increased consumption of highly processed foods and sugary drinks and lower consumption of fruits and vegetables (Grosso and Galvano 2016). In Spain too, there have been considerable changes in the dietary habits in children combined with longer periods of sedentary behavior and decreased physical activity (Serra-Majem, Román, Aranceta, Ribas and Pérez 2003; Vaqué-Crusellas et al. 2015). However, determining dietary habits in children have been considered challenging, because of the inability of children to comprehend questionnaires employed in studies, or due to recall bias which can result in significant measurement errors (Gebremariam et al. 2017).

Food insecurity, socio-demographics and weight status

Previous studies have found significant associations between food insecurity and SES (Sarlio-Lahteenkorva and Lahelma 2001) and family affluence (Fafard-St-Germain and Tarasuk 2018). Individuals of low SES often experience material hardships (Fafard-St-Germain and Tarasuk 2018). They are also at a social disadvantage of being unable to purchase and consume food of higher dietary quality (Darmon and Drewnowski 2008). There have been inconsistent findings regarding associations between food insecurity and weight status in youth (Larson and Story 2011). Some studies have reported an association between overweight and obesity with food insecurity (Kac, Velásquez-Melendez, Schlüssel, Segall-Côrrea, Silva, and Pérez-Escamilla 2012; Widome et al. 2009). Other studies have not found significant differences for weight status (Baer, Scherer, Richmond, Fleegler and Hassan 2018; Gundersen, Garasky and Lohman 2009; Lohman, Stewart, Gundersen, Garasky and Eisenmann 2009). Age is also an important factor in food insecurity studies. As previously mentioned, parents protect younger children from food insecurity more than older children, who are reported to be twice as likely to experience food insecurity (Fram et al. 2011). In the case of gender, a recent study has reported that females worldwide are at a higher risk of food insecurity when compared to males (Broussard 2019). However, another recent study reported adolescent males to be at a higher risk of food insecurity than females (Niemeier and Fitzpatrick 2019). Finally, some studies have found ethnicity to be an important factor in food insecurity, with ethnic minority households reported to be at a higher risk (Altman et al. 2018).

Main objectives and hypotheses

The first objective of our study was to determine whether food insecurity is associated with poor psychological wellbeing in Spanish adolescents. The second objective was to examine whether food insecurity is associated with body dissatisfaction, disordered eating and poor dietary habits in Spanish adolescents. To our knowledge, neither of these objectives has been studied previously in Spain. Based on the findings of previous studies, conducted outside Spain, we expect to find poorer psychological wellbeing in the form of lower self esteem, lower positive affect, higher negative affect, greater levels of stress, lower rates of coping as well as higher body dissatisfaction, greater drive for thinness and poorer dietary habits in food insecure adolescents.

Methods

Participants

The initial study sample consisted of 475 adolescent males and females, from the secondary public school of medium to medium-low SES in Terrassa, a large metropolitan city in Catalonia (Spain). Participants who took part in the study were from the four years of Compulsory Secondary Education (ESO) as per the Spanish education system (equivalent to US grades 7-10). After excluding participants that were absent at the time of the assessment (n=46) or for whom consent was not obtained (n=3), 426 participants (53% males and 47% females) took part in the study. Participants were aged 12-16 years with a mean & Standard Deviation (SD) age of 13.8 (1.2) years. They were roughly distributed across grades (7 to 10): 26.1%, 28.6%, 25.6% and 19.7% respectively. The parental origin of participants was as follows: 88% Europeans (85.2% from Spain), 6.3% other origin (4.2% mixed origins), 3.8% Latino, 1.9% Africans (1.2% from Sub-Saharan African and 0.7% from North Africa). Participants were categorized according to the following SES: high 14%; medium-high 24.5%; medium 24.7%; medium-low 27.1% and low 9.7%.

Measures

An inventory consisting of 6 complete questionnaires and 2 selected subscales from another questionnaire was employed in this study to assess food insecurity, psychological wellbeing, body image, disordered eating and dietary habits. In addition, socioeconomic indicators were assessed and height and weight were measured.

Food Insecurity

Child Food Security Survey Module – Spanish version (CFSSM-S) (Shankar-Krishnan, Penelo, Fornieles Deu and Sánchez-Carracedo 2018) contains 9 items based on participants' perceptions of food insecurity in their households. The instrument focuses on questions such as worrying about food running out, consumption of cheap foods, eating less, inability to eat a balanced diet, cutting down portion sizes, skipping meals, going hungry, and not eating for a whole day. The CFSSM-S is similar to its original English version (Connell, Nord, Lofton and Rehner 2004). The reference period of the CFSSM-S was set to 12 months. Responses were based on a Likert scale. A score of 1 was given to affirmative responses 'a lot' and 'sometimes' and 0 to negative response 'never'. Higher scores indicated food insecurity. The internal consistency (ω=.95) and the goodness of fit for the one factor model of CFSSM-S with Confirmatory Factor Analysis (CFA) (RMSEA - Root-Mean-Square Error of Approximation = 0.038, CFI - Comparative Fit Index = 0·984, TLI - Tucker–Lewis Index=0·979) were found to be excellent. In the case of measurement invariance, fit for baseline models and for configural invariance across groups of responses was satisfactory (RMSEA≤0·055, CFI≥0·942, TLI≥0·923). Full weak (equivalence of factor loadings), strong (equivalence of item thresholds) and strict (equivalence of uniqueness invariance) was achieved (P ≥ 0·105) for all the groups of responses considered. This indicated that the CFSSM-S could be used in males and females and different groups of weight status, age, SES and family affluence. Significantly higher CFSSM-S scores were found for participants with lower SES and family affluence. Although no significant differences were found for weight status, participants from the overweight and obese groups showed higher CFSSM-S scores than participants of normal weight. The following three categories of the food security classification were established in the original study (Connell et al. 2004) and as per the new nomenclature of the USDA: (USDA 2005): 0-1=food secure; 2-5=low food security and 6-9=very low food security. In this study, participants were grouped into two categories i.e. 0-1 = food secure and 2-9 = food insecure.

Psychological wellbeing

Three questionnaires were used to assess psychological wellbeing in adolescents namely the Rosenberg Self-Esteem Scale (RSES), PANASN (Positive and Negative Affect Schedule for children and adolescents) and General Health Questionnaire (GHQ12).

The Spanish version of *RSES* (Martín-Albo, Núñez, Navarro, and Grijalvo 2007) was used in this study in order to assess self-esteem in adolescents. It consists of 10 items and is identical to the original English version (Rosenberg, 1965). It is based on a 4-point Likert scale from 1 (totally disagree) to 4 (totally agree) and negative items are scored in the reverse order. Higher scores indicate higher self-esteem. The internal consistency with Cronbach's alpha (.85 to .88) and test-

retest correlation (.84) were found to be satisfactory in the original Spanish version (Martín-Albo et al. 2007). Cronbach's alpha in our study was .85.

The Spanish version of the PANASN (Sandín 2003) was employed to assess positive and negative emotions and feelings in children and adolescents. It contains 20 items, 10 for evaluating positive affect (for example: interested, excited, enthusiastic etc.) and 10 for negative affect (for example: distressed, upset, guilty etc.). It was scored as never=1, sometimes=2, a lot of times=3. Items of positive and negative affect were scored separately and higher scores indicated either affect. Internal consistency with Cronbach's alpha was acceptable (above .70) in the Spanish version (Sandín 2003). In our sample, Cronbach's alpha for PANASN positive (PANASN+) was .73 and .75 for PANASN negative (PANASN-).

The Spanish version of the *GHQ12* (López-Castedo and Fernandez 2005) consists of 12 items that evaluate adolescents' self-perceived general wellbeing of their emotional state. It was based on a 4 point Likert scale of 0-3 where negative items were scored as follows: never=0, sometimes=1, a lot of times=2 and always=3. Positive items were reverse scored. Furthermore, items were separated based on two factors that were originally named "anxiety" and "social dysfunction". Considering the content of the items and names suggested by other versions (e.g. Sánchez-López and Dresch 2008), we have renamed both factors "Stress" (I), containing references to stress and self-confidence and "Coping" (II), containing references to social dysfunction, coping skills, problem solving and enjoyment. Higher scores indicated higher stress and lower coping. Internal consistency with Cronbach's alpha was high (above .85) and test-retest correlation was .79 in the Spanish version (López-Castedo and Fernandez 2005). In our sample, Cronbach's alpha was .80 for GHQ12 stress and .71 for GHQ12 coping.

Body image and disordered eating

The Body Shape Questionnaire (BSQ) and the Body Dissatisfaction sub-scale (EDI-BD) of the Eating Disorder Inventory (EDI-3) assessed body image in adolescents. The BSQ takes into account general concerns of body shape and size while the EDI-BD subscale focuses on dissatisfaction with specific body parts (Shroff, Calogero and Thompson 2009). The Drive for Thinness sub-scale (EDI-DT) of the EDI-3 examines an excessive concern with dieting, preoccupation with weight, and fear of weight gain.

The reduced 10-item Spanish version of the *BSQ* (Warren et al 2008) was used, retaining the structure of the original English version (Cooper, Taylor, Cooper, Fairbum and Phil 1987). It was scored as never=1, rarely=2, sometimes=3, often=4, very often=5 and always=6. Higher scores

indicated higher body dissatisfaction. The 10-item version of BSQ demonstrated metric invariance and was found to be more consistent than other short versions (Warren et al. 2008). In our sample, Cronbach's alpha for the 10-item BSQ was .90.

The Spanish version of the sub-scales EDI-BD and EDI-DT from the *EDI-3* (Elosua, López-Jáuregui and Sánchez-Sánchez 2010) consists of 10 items (EDI-BD) and 7 items (EDI-DT). Negatively worded items were scored as never=0, few times=0, sometimes=1, often=2, almost always=3, always=4. Positively worded items were reverse scored. Items were separated based on subscales, BD and DT. Higher scores for BD indicated higher body dissatisfaction while higher scores for DT indicated an obsession for drive for thinness. The internal consistency with Cronbach's alpha in non-clinical samples was .44 to .95 and test-retest values were .85 to .99. In our sample, internal consistency with Cronbach's alpha was .86 for EDI BD and .83 for EDI DT.

Dietary habits

KIDMED (Serra-Majem et al. 2004), consisting of 16 items in Spanish, was used to evaluate the dietary habits of adolescents based on the adherence to the Mediterranean diet, which is considered to be the healthiest. Each item of the KIDMED is answered in affirmative (yes) or negative (no). There are 12 items signifying positive adherence to the Mediterranean diet. For example: daily intake of fruit, consumption of fresh or cooked vegetables more than once a day, etc. There are 4 items representing low adherence to the Mediterranean diet. For example: consumption of fast-food once or more per week, skipping breakfast etc. The 12 items indicating positive adherence are scored +1 for affirmative responses and 0 for negative responses. The 4 items indicating low adherence are scored -1 for an affirmative response and 0 for a negative response. Scores ranged from 0 to 12.

Other indicators

Weight Status: Height in centimeters (cm) was measured by a SECA portable stadiometer, model 214 (20-207 cm; accuracy range of 0.1cm) and weight in kilograms (kg) using SECA portable scales model 8777021094 (0-200 kg; accuracy range of 0.1 kg) in order to achieve similar consecutive measurements. Weight status was calculated using the World Health Organization (WHO) 2007 growth reference criteria (WHO 2007).

Socioeconomic Status: The '*Four-Factor Index of Social Status*' (Hollingshead 1975) was used to determine the SES of the household using a weighted average of each parent's education and occupation level. Education scores ranged from 1-7 (i.e. primary school to graduate degree) and

occupation scores ranged from 1-9 (i.e. unemployed to senior executives). SES was calculated by adding the Education score × 3 and Occupation score × 5; then, total scores, which ranged from 8-66, were categorized into five different levels, namely high (55-66), medium-high (40-54), medium (30-39), medium-low (20-29) and low (8-19).

Family Affluence: The Spanish version of the '*Family Affluence Scale III'*, *FAS-II* (Moreno et al. 2016) was used in the study, which consists of six questions asking participants about possession of a car and dishwasher, number of bedrooms, bathrooms, computers/mobile phones and vacations per year. A four point ordinal scale ranging from 0-3 was used for the six questions. The scores were added and the cut-off points set for purchasing power were 0-6 for low, 7-9 for medium and 10-13 for high.

Procedure

The Terrassa City Council Community and Health Services suggested the selection of secondary public schools on the basis of medium and medium low SES and thereafter helped us gain access to the convenience sample of the participating secondary public school. All details concerning the study were previously communicated with the principal and the executive team of the school in order to ensure maximum participation of the students. The school offers compulsory secondary education (ESO) (equivalent to US grades 7-10) and optional high school (*Batxillerat*) (equivalent to US grades 11-12). The official enrolment data of the school in 2017 indicated a total of 738 students (ESO=475; Batxillerat=263). Only students enrolled in ESO participated in the study.

The sample consisted of students from 1st to 4th year ESO. Each grade had different groups. The 1st, 2nd, 3rd and 4th year ESO had 5, 5, 4 and 3 groups respectively. All groups participated in the study. Consent forms and details of the study were sent to the parents of the participants in advance, which were signed and returned to the school for participating students. Postgraduate students of psychology were trained in all aspects of the research study including administering questionnaires, providing specific instructions to the participants and conducting anthropometry. Participants were requested to fill in a paper and pencil booklet with a battery of questionnaires including socioeconomic data. Following a standardized procedure (Sánchez-Carracedo et al. 2013), anthropometric measurements were taken simultaneously in batches in situ in a private room near the classroom where the questionnaires were administered during normal class hours. The study took place over a period of four days for 4 grades (1 hour of class time per grade and on average 4 groups per day) in April 2017.

Statistical analysis

All analyses were conducted using IBM SPSS Statistics version 25. Multiple Analysis of Covariance (MANCOVA) was used to investigate food insecurity, as an independent variable in the analysis, and its associations with psychological wellbeing, body image, disordered eating and dietary habits as dependent variables. Effect size measures (Cohen's d) were obtained and could be interpreted by means of Cohen's criteria (Cohen 1988); 0.2 indicated 'small' effect size, 0.5 'medium' and 0.8 'large'. SES, family affluence, weight status, age, gender and parental origin were used as adjustment variables (potential confounders) in this study and were added to the models.

Results

Following the food security classification established in the original instrument (Connell et al, 2004) and according to USDA's new nomenclature (USDA 2005), in this study, 81.7% of participants were food secure and 18.3% were food insecure (1.9% low food security and 16.4% very low food security).

Table 1 shows the main descriptives of gender, age, weight status, SES, family affluence and parental origin and their associations with Food Security Status. Pearson's chi-square tests reported significance for only SES ($p<.001$) and family affluence ($p<.001$) thus indicating low SES and family affluence in food insecure participants.

Table 2 provides the mean and standard deviation of all variables and MANCOVA results including B, CI (95%) and effect size (Cohen's d) for Food Security Status. Multivariate analysis of covariance (MANCOVA) was performed to determine the effect of food insecurity (CFSSM-S) on the dependent variables. The Box test reveals that equal variances cannot be assumed, $F_{(45, 44476)}=1.803$, $p=.001$. Although the result is right at the limit, some authors point out that Box's M is highly sensitive, hence unless p is <.001 and sample sizes are unequal, it has been recommended to ignore it (Tabachnick and Fidell 2019). We employed Pillai's trace as a test statistic since it is the most robust test. This criterion indicates significant differences in the associations between food insecurity and the set of dependent variables (Pillai=.070, $F_{(9, 356)}=2.96$, $p=.002$, multivariate $\eta 2 = .07$).

Several adjusted variables significantly influenced the dependent variables: weight status (Pillai=.253, $F_{(9, 356)}=13.302$, $p<.001$); age (Pillai=.087, $F_{(9, 356)}=3.751$, $p<.001$); SES (Pillai=.054, $F_{(9, 356)}=2.253$, $p=.018$) and gender (Pillai=.154, $F_{(9, 356)}=7.207$, $p<.001$). In the analysis of each dependent variable, Levene's test shows that variance homogeneity was fulfilled for all dependent variables except for body dissatisfaction (BSQ), positive affect (PANASN+) and drive for thinness

(EDI-DT). In these cases, the Welch correction was applied (Welch 1947; Ruxton 2006; Derrick, Toher and White 2016).

Regarding food security status, food insecure participants reported significantly lower scores for self-esteem ($F_{(1, 364)}$=10.30; p=.001); lower scores for positive affect ($F_{(1, 85)}$=5.79; p=.017); higher scores for stress ($F_{(1, 364)}$=12.23; p=.001) and coping ($F_{(1, 364)}$=18.19; p<.001); higher levels of body dissatisfaction for both (BSQ) ($F_{(1, 85)}$=10.22; p=.002) and EDI-BD ($F_{(1, 364)}$=15.59; p=<.001) and higher scores for drive for thinness ($F_{(1, 85)}$=11.72; p=.001). The effect size for these variables ranged on average between medium to large. Body dissatisfaction (EDI-BD) in food insecure participants showed the highest effect. No significant differences were found for dietary habits and negative affect (see Table 2). The overall results indicate poorer psychological wellbeing with lower self-esteem, lower positive affect, higher levels of stress and lower coping, greater body dissatisfaction and higher drive for thinness in food insecure adolescents.

Discussion

The current study has examined the associations between food insecurity and psychological wellbeing, body image, disordered eating, and dietary habits in Spanish adolescents. There are reports from survey data indicating food insecurity prevalence rates in households in Spain. However, to the best of our knowledge, this is the first study to examine the relationship between food insecurity and crucial variables by means of self-reported perceptions in Spanish adolescents. The overall results of our study indicate poor psychological wellbeing, greater body dissatisfaction and higher drive for thinness in food insecure Spanish adolescents.

Regarding food security status, 18.3% of participants in this study experienced food insecurity while 81.7% of participants were found to be food secure. It is important to note that the participants belonged to medium to medium-low SES from the city of Terrassa in Catalonia, Spain. Although 18.3% is a fairly high prevalence rate for food insecurity in adolescents in a developed nation such as Spain, our data is not representative of the entire Spanish population. Reports have indicated 20% poverty (Generalitat de Catalunya 2017) and 23% rise in severe child poverty in Catalonia in recent years (Save the Children 2017). Furthermore, the prevalence rate of adolescent food insecurity (18.3%) in our study is similar to the 18% child food insecurity rate reported in the 2016 annual household food security survey conducted by the USDA in the United States (Coleman-Jensen et al 2017; Feeding America 2018). The UNICEF Innocenti report in 2017, consisting of nationally representative data from 147 countries on households with children under 15 years of age, reported a prevalence rate of 12% in Spain (Pereira et al 2017). Although the

prevalence rate in Spain is lower than the rate observed in our study, it is important to note that the UNICEF Innocenti report includes children under 15 years old. Our study included adolescents of 12 to 16 years and, as previously discussed, older children are at a higher risk of food insecurity (Fram et al 2011; Bauer et al 2015). Differences in methodology, (telephone surveys) and the use of a similar, yet different instrument [Food Insecurity Experience Scale (FIES)] to assess food insecurity in the UNICEF Innocenti report, are important factors that could explain the disparity in food insecurity rates. As a result, future studies are required in order to determine the prevalence rates of food insecurity across a wider age range of adolescents in Spain.

The first objective of our study was to assess whether food insecurity is associated with poor psychological wellbeing in Spanish adolescents. There have been studies, which have focused on various aspects of psychological wellbeing in children and adolescents. These studies have examined indicators, such as depression, anxiety and social dysfunction (Siddique and D'Arcy 1984), self-esteem (Roustit et al. 2010), autonomy (Crous 2017), positive and negative affect (Ong, Bergeman, Bisconti, Wallace 2006), etc. Food plays a crucial role in the life of children and adolescents as it has not only a physical dimension but also a psychological component, which has to be examined (Vaqué et al. 2012). In this study, we assessed the associations of psychological wellbeing in adolescents with food insecurity by taking into account a wide range of relevant indicators during adolescence such as self-esteem, positive and negative emotions, stress and coping.

Self-esteem is considered an important factor of psychological wellbeing that can fluctuate in adolescence (Moksnes, Moljord, Espnes, and Byrne 2010; Erol and Orth 2011). It is a crucial indicator of health outcomes and low self-esteem can affect key areas of life during adolescence (Erol and Orth 2011). Adolescents with low self-esteem are reported to be at a higher risk of poorer mental health in comparison to those with higher self-esteem (Trzesniewski, Donnellan, Moffitt, Robins, Poulton and Caspi 2006). Low self-esteem in adolescents has also been linked to social inequalities (Roustit et al. 2010). The food insecure group in our study reported lower self-esteem with a medium-large effect size. It was also reported in the research conducted in food insecure adults by the National Research Council and Institute of Medicine (2013). This indicates that food insecurity could have a very negative impact on an individual's self-esteem. Since only few studies have focused on the association between food insecurity and self-esteem, further research, especially in adolescents, is recommended in order to examine this association more closely and confirm these findings.

Fewer positive affect were found in food insecure adolescents in comparison to the food secure group. Satisfaction with food has been associated with positive emotional wellbeing in childhood and adolescence (Vaqué-Crusellas et al. 2015). Positive emotions have been linked to subjective wellbeing and happiness, which can include various factors such as intellectual performance; ability to concentrate; problem solving skills etc. (Hofmann, Sawyer, Fang and Asnaani 2012). Positive affect has been noted in highly resilient individuals and it serves as a protective factor in combating daily stress while also providing protection against mental disorders. It has been proposed that a deficit of positive emotions and excessive negative emotions can lead to psychological issues (Hofmann et al. 2012; Gross and Jazaieri 2014). Prior research has provided data about food insecurity and its associations with both depression (Alaimo et al 2002) and anxiety (Ashiabi 2005). However, there have been no previous food insecurity studies that have examined the deficit of positive affect in adolescents. Major stressful events can lead to a lack of positive emotions in adolescents (Young, Sandman and Craske 2019). Lower positive affect in food insecure adolescents in our study supports the notion that food insecurity could be a stressful event as worrying about procuring food triggers anxiety (Poole-Di Salvo, Silver and Stein 2016) and emotional issues during adolescence (Moksnes et al. 2010).

Our results indicate higher scores in the stress subscale and lower scores in the coping subscale in food insecure adolescents compared to their food secure peers with a medium effect size. The 'stress' and 'coping' subscales assess a complex group of contents, including stress, self-confidence, coping skills, problem solving, enjoyment and social dysfunction. Rather than a major negative life event, an accumulation of minor distressing events could trigger stress in adolescents, negatively impacting their lives for variable amounts of time (Fields and Prinz 1997; Ong et al. 2006). Stress is a common factor noticeable in food insecure individuals (Bernal, Frongillo, and Jaffe 2016) which could be due to continuous periods of worrying about getting their next meal, eating poor quality food and having to ultimately reduce portion sizes (Che and Chen 2001).

During stressful events, adolescents often exhibit passive coping in order to avoid confronting problems (Fields and Prinz 1997). Lower scores in the 'coping' subscale which also includes social dysfunction, can be worrisome in food insecure adolescents. Social dysfunction is related to the inability to cope effectively during stressful events (Rubin, Coplan and Bowker 2009). Due to this, adolescents often stop engaging in school activities and avoid interacting with peers (Ashiabi 2005). Our findings are aligned with previous studies, which have found that food insecure adolescents exhibit higher levels of stress and anxiety (Kleinman et al. 1998) and low coping skills at school (Ashiabi 2005).

The second objective of our study was to determine whether food insecurity is associated with disordered eating, body dissatisfaction and poor dietary habits in Spanish adolescents. In the case of disordered eating, our findings indicate higher scores for drive for thinness in food insecure adolescents in comparison to their food secure counterparts with a medium effect size. According to some studies, eating and weight-related disorders, such as weight stigma and concerns about gaining weight, are common in food insecure households (Becker et al. 2017). Food insecure adolescents are prone to binge eating behavior when food is available (Tester et al. 2016). Binge eating has often been associated with shame and guilt (Sanftner, Barlow, Marschall and Tangney 1995) and food insecure individuals are at a higher risk of being overweight (Widome et al. 2009). Thus, these factors could subsequently increase the risk of drive for thinness in food insecure adolescents. To our knowledge, drive for thinness has not been studied in the context of food insecurity and our study adds this important factor to the list of disordered eating behaviors.

Our results show higher body dissatisfaction in food insecure adolescents with a medium to large effect size. In general, weight concerns, weight control behaviour and body dissatisfaction are commonly reported in adolescents (O'Dea 1999; O'Dea and Caputi 2001). According to Ambroziak et al. (2017), food insecure individuals often perceive themselves to be thin due to food scarcity and have a distorted (thinner) body image. The findings of our study suggest that food insecure adolescents are more dissatisfied with their bodies. This is in alignment with a recent study (Altman et al 2018) that reported for the first time in body image literature that food insecurity was associated with greater body dissatisfaction in children. As explained by Altman et al, (2018), food insecurity is a stressful situation whereby children become more conscious about the shape and size of their bodies hence this could result in greater degrees of body dissatisfaction. However, there is still limited literature in this area and to our knowledge this is the first study to examine this association with adolescents.

Dietary habits of adolescents were reported by determining their adherence to the Mediterranean diet. Our results were unable to find differences in dietary habits based on participants' food security status. Food insecure adolescents are considered to be at a greater risk of consuming poor quality diets (Kirkpatrick and Tarasuk 2008). Both food insecurity and poor diet quality has been independently associated with poor mental health (Davison, Gondara and Kaplan 2017). However, similar to our result, other authors (Bhattacharya et al 2004) have found no differences in diet quality between food secure and food insecure children. This could be attributed to the possibility that schoolchildren, unlike adults, might not be as affected by the lack of food resources at home.

They might be able to compensate at school or elsewhere, thereby minimizing drastic reductions in diet quality (Bhattacharya et al 2004). Furthermore, in recent times, diets consumed by children and adolescents, irrespective of SES, have undergone drastic changes such as higher intake of calorie laden and highly processed foods including soft drinks and meat products combined with a lower intake of fruits and vegetables (Grosso and Galvano 2016). Changes in dietary habits, decreased physical activity and sedentary behavior have also been reported in Spanish children (Serra-Majem, Román, Aranceta, Ribas and Pérez 2003; Vaqué-Crusellas et al. 2015). This could explain the lack of differences in dietary habits between food secure and food insecure participants. Another point to consider is that the KIDMED specifically focuses on diet quality rather than quantity. Food scarcity is a common factor in food insecure households, which cannot be measured by the KIDMED. In the case of children and adolescents, high measurement error has been reported while assessing dietary habits due to recall bias and lack of comprehension of the instrument employed in studies (Gebremariam et al. 2017). As a result, future research in food insecurity should focus on developing an effective instrument, which can successfully measure dietary habits in adolescents considering both diet quality and quantity.

Strengths and limitations

To the best of the authors' knowledge, it is the first food insecurity study conducted in Spanish adolescents with a specific instrument with good psychometric properties, which has been previously validated in Spanish (Shankar-Krishnan et al. 2018). There have been very few previous food insecurity studies with Mediterranean samples and our study is the first in Spain to focus on self-reported perceptions of several variables related to psychological wellbeing. We consider our overall findings, reporting poorer psychological wellbeing, higher body dissatisfaction and drive for thinness in food insecure adolescents, to be consistent with previous studies. As far as we know, a highly relevant positive association between food insecurity and higher body dissatisfaction in Spanish adolescents has been found for the first time in this field. This study also focuses on 'drive for thinness', an important factor in disordered eating behavior to be considered in food insecurity studies. Finally, weight status, which was included as a potential confounder in the analysis together with other confounders, was not self-reported but was measured objectively.

This study also has some limitations, which includes a limited sample size. The time taken to complete the inventory was fairly long (1 hour) though the participants had a short break for taking the anthropometric measurements. Our study did not find an association between food insecurity and dietary habits in adolescents. Diet quantity is an important factor in the context of food insecurity, which our study did not include. Previous literature has also reported binge-eating

behavior to be common in the case of food insecure individuals hence an assessment focusing on this variable could have shed light on its association in adolescents. Also, being a cross-sectional study, causality cannot be inferred. Finally, our study is not a representative sample of food insecurity in Spain as its rates could vary in different Spanish regions. Considering the lack of previous studies of the association between food insecurity and psychological wellbeing, disordered eating and body image perceptions, further studies would have to be carried out to confirm these findings.

Conclusion

The preliminary findings of this food insecurity study in Spanish adolescents could be of interest to researchers, psychologists and public health practitioners. The negative outcomes of food insecurity in the field of psychological wellbeing, body image and disordered eating pose threats to society and should be tackled early during adolescence to prevent serious psychological and physiological issues in the future. Changes in public health policies; psychological counseling in schools and the re-introduction of programs including subsidized school meals are measures that could be implemented. Community targeted information for food insecure families such as healthy cooking and eating and food bank vouchers could also help adolescents and their families overcome or reduce some of the issues imposed by food insecurity. In addition, public health awareness in local communities about food insecurity would be essential in order to minimize the stigma and shame among individuals inflicted by food insecurity.

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Table 1: Descriptives and tests of significance for gender, grade (age), weight status, SES, FAS and parental origin based on a comparison between food secure and food insecure groups

		Food Security Status		Test of significance	
Variable	*Level*	Food secure *n* (%)	Food insecure *n* (%)	χ^2	*P*
Gender	Males	189 (44.4)	37 (8.7)	1.209	.272
	Females	159 (37.3)	41 (9.6)		
Grade (age)	01 (12-13 years)	92 (21.6%)	19 (4.5%)	1.087	.780
	02 (13-14 years)	96 (22.5%)	26 (6.1%)		
	03 (14-15 years)	91 (21.4%)	18 (4.2%)		
	04 (15-16 years)	69 (16.2%)	15 (3.5%)		
Weight-status	Normal weight	233 (57.7%)	46 (11.4%)	1.919	.383
	Overweight	71 (17.6%)	18 (4.5%)		
	Obesity	27 (6.7%)	9 (2.2%)		
SES	High	57 (13.5%)	2 (0.5%)	54.203	**<.001**
	Medium-high	97 (23.0%)	6 (1.4%)		
	Medium	86 (20.4%)	18 (4.3%)		
	Medium-low	84 (20.0%)	30 (7.1%)		
	Low	20 (4.8%)	21 (5%)		
FAS	High	166 (39.0%)	14 (3.3%)	27.997	**<.001**
	Medium	149 (35.0%)	45 (10.6%)		
	Low	33 (7.7%)	19 (4.5%)		
Parental origin	European	310 (72.8%)	64 (15.0%)	3.048	.384
	Other origin	20 (4.7%)	8 (1.9%)		
	Latino	12 (2.8%)	4 (0.9%)		
	African	6 (1.4%)	2 (0.5%)		

Note: Food Security Status: score 0-1=food secure; score 2-9=food insecure. SES: Socioeconomic Status; FAS: Family Affluence Scale. In bold, significant differences

Table 2: Descriptives and MANCOVA for variables based on comparison of total scores between food secure and food insecure groups

	Food Security Status										
	Food secure			Food insecure							
	Males	Females	Total	Males	Females	Total		MANCOVA		CI 95%	Cohen's d
	M(SD)	*M(SD)*	*M(SD)*	*M(SD)*	*M(SD)*	*M(SD)*	B	$F_{(df)}$	*p*		
RSES Self-esteem	33.31 (4.34)	30.30 (5.42)	31.93 (5.08)	30.14 (4.79)	27.06 (4.92)	28.43 (5.07)	2.245	10.30 (1, 364)	**.001**	0.87 to 3.62	0.69
PANASN- Negative affect	16.99 (3.27)	18.66 (3.26)	17.76 (3.36)	17.14 (4.05)	20.08 (3.26)	18.77 (3.90)	-0.761	2.40 (1, 364)	.122	-1.72 to .20	0.28
PANASN+ Positive affect	24.57 (3.04)	24.24 (2.94)	24.42 (2.99)	23.17 (3.63)	22.33 (4.21)	22.71 (3.96)	1.094	5.79 (1, 85)*	**.017**	.20 to 1.98	0.35
GHQ12 Stress	5.17 (3.37)	6.76 (4.06)	5.90 (3.78)	7.00 (3.78)	9.69 (4.11)	8.49 (4.16)	-1.896	12.23 (1, 364)	**.001**	-2.96 to -.83	0.58
GHQ12 Coping	3.60 (2.38)	4.45 (3.07)	3.99 (2.75)	4.86 (2.83)	6.94 (2.59)	6.02 (2.88)	-1.696	18.19 (1, 364)	**<.001**	-2.47 to -.91	0.50
BSQ Body dissatisfaction	12.23 (3.29)	16.48 (8.41)	14.19 (6.53)	14.90 (6.11)	20.44 (10.99)	17.97 (9.49)	-3.005	10.22 (1, 85)*	**.002**	-4.85 to -1.15	0.46
EDI-BD Body dissatisfaction	4.75 (6.31)	9.33 (8.70)	6.85 (7.83)	9.28 (7.12)	14.44 (9.01)	12.14 (8.56)	-3.947	15.59 (1, 364)	**<.001**	-5.91 to -1.98	0.80
EDI-DT Drive for thinness	3.71 (4.22)	6.94 (7.03)	5.20 (5.90)	7.07 (6.39)	9.64 (8.23)	8.49 (7.52)	-2.760	11.72 (1, 85)*	**.001**	-4.34 to -1.17	0.60
KIDMED Dietary habits	6.87 (2.35)	6.55 (2.46)	6.72 (2.40)	5.97 (2.63)	5.97 (2.29)	5.97 (2.43)	0.381	1.23 (1, 364)	.268	-.29 to 1.05	0.19

Note: Food Security Status: score 0-1=food secure; score 2-9=food insecure; RSES: Rosenberg Self-Esteem; PANASN: Positive and Negative Affect Schedule for children and adolescents; GHQ12: General Health Questionnaire; BSQ: Body Shape Questionnaire; EDI-BD: Eating Disorder Inventory (Body Dissatisfaction); EDI-DT: Eating Disorder Inventory (Drive for Thinness); KIDMED: Mediterranean Diet Quality Index. M = mean; SD = standard deviation; df = degrees of freedom, CI 95% = confidence interval 95%. Significant differences in bold. All variables adjusted for gender, parental origin, age, weight status, socioeconomic status and family affluence. *Degrees of freedom (df) corrected for non-homogeneity of variances. In bold, significant differences.