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Assessing the prevalence and potential drivers of food insecurity and the relationship with mental wellbeing in UK university students: A cross-sectional study

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Abstract

Food insecurity (FI) among university students in the United States has been associated with poor mental wellbeing, but very little is known about the relationship between FI and mental wellbeing in the UK university population. Here we examined the prevalence of FI, determined potential drivers for it and its relationship with mental wellbeing and coping ability. Students studying at UK universities ($n = 289$) completed an online self-reported questionnaire to obtain socio-economic characteristics including financial status, FI status (Household Food Insecurity Access scale), mental wellbeing (Warwick-Edinburgh Mental Wellbeing Scale) and coping ability (coping flexibility scale). FI was observed in 28% of the participants and was associated with financial independence, running out of money, borrowing money and lacking confidence to purchase healthy foods ($p < 0.05$). Although we cannot determine directionality, logistic regression analysis revealed those who were judged as FI were more likely to shop often (OR = 3.139 95% CI 1.533–6.429), never snacked between meals (OR = 4.261 95% CI 1.309–13.875) and the amount of food purchased was affected by perceptions of the price of food in general (OR = 2.954 95% CI 1.675–5.210). Financial instability and the inability to access nutritious food may contribute to the decrease in mental wellbeing ($p < 0.01$) and lower ability to cope with stressful situations ($p < 0.01$) in food-insecure students although the direction of these relationships cannot be determined from this cross-sectional study. This study has identified that there is a need to develop appropriate strategies to combat FI in university students and to improve mental health.

KEYWORDS
coping strategies, food insecurity, food security, mental health, university students, wellbeing

INTRODUCTION

Food insecurity (FI) is defined as "a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life" and has become a serious global public health concern (FAO, IFAD, UNICEF, WFP & WHO, 2022). The UK Food Security report revealed that approximately 7%–8% of the United Kingdom (UK) population were regarded as food insecure in the 2019–2021 financial year (Francis-Devine et al., 2023; GovUK, 2021). The doubling in the prevalence of FI (The Food Foundation, 2023) to around 17% since then is reinforced by the upsurge in the use of food banks in the United Kingdom with 600 000 more people using them in 2020–2021 compared to the previous year (Trust TT, 2022). COVID-19, the increase in the cost

of living and limited financial resources are factors contributing to this rise in food bank use (The Food Foundation, 2021).

Although many population sub-groups are at increased risk of FI, observational studies conducted across the globe, particularly in the United States, Australia, Malaysia, Canada and Greece, have shown an increase in the prevalence of FI in those attending university (Ahmad et al., 2021; El Zein et al., 2019; Hughes et al., 2011; Oh et al., 2022; Riddle et al., 2020; Shi et al., 2021; Sprake et al., 2018; Ukegbu et al., 2019; Weaver et al., 2020). Globally, the prevalence of FI among university students is variable ranging from 12.5% to 84% (Bruening et al., 2017). However, factors associated with the development of FI among the university student population are not fully understood, although the limited studies conducted so far have outlined financial hardship, socio-economic status, race, sexual orientation, cooking ability and unemployment as the biggest predictors (Ahmad et al., 2021; El Zein et al., 2019; Hughes et al., 2011; Oh et al., 2022; Reeder et al., 2020; Riddle et al., 2020; Shi et al., 2021; Sprake et al., 2018; Ukegbu et al., 2019; Weaver et al., 2020; Wolfson et al., 2022, 2023). The increased financial burden of university study along with the lack of funds to consistently access affordable and nutritious food and unhealthy eating habits, may in turn negatively affect student academic performance, physical health and mental health including depression, stress and anxiety (Ahmad et al., 2021; El Zein et al., 2019; Hughes et al., 2011; Oh et al., 2022; Riddle et al., 2020; Shi et al., 2021; Sprake et al., 2018; Ukegbu et al., 2019; Weaver et al., 2020).

A recent study conducted for the Food Standards Agency in 2022 reported that four out of ten university students in England were classified as food insecure with the highest levels noted among students at universities based in the North West of England (Armstrong et al., 2023). Furthermore, one in ten UK university students were reported to have used a food bank during the 2021/2022 academic year (Brown, 2022). This could potentially be due to the 14% increase in living costs since 2021 related to increased tuition fees and the 61% increase in rent observed over the last decade (Unipol, 2021). Furthermore, 82% of students worry about making ends meet, while four out of five students thought of dropping out of university, with 52% of these thinking of dropping out because of money worries (Brown, 2022). Furthermore, a survey of 3500 UK university students in 2022 reported that 96% of students had reduced their spending, with some only having £50 a month to purchase food and other personal items after essential bills were paid. Of those who had reduced their spending, 92% reported that this had affected their mental wellbeing (NUS, 2022), although only one in five had had help with this.

There are currently over two million university students in the United Kingdom. These are the future global citizens, leaders and innovators, but very little is known about the prevalence or potential drivers of FI in those studying in the United Kingdom nor do we know the potential implications of FI on mental wellbeing. The evidence cited above shows that FI in UK university students is higher than the UK national average and may be associated with poor mental wellbeing and ability to cope in stressful situations. Here we aimed to examine the prevalence of FI in students studying at UK universities and determine the potential drivers and its relationship with mental wellbeing and coping ability.

MATERIALS AND METHODS

Ethical standard

This study was conducted according to the guidelines laid down in the School of Biosciences Research Ethics Committee at the University of Nottingham (SBREC2021_08). Completion of the questionnaire was taken as informed consent from all participants.

Participants

Students at universities across the United Kingdom were invited to complete an online questionnaire disseminated via email to the Nottingham universities and disseminated to the wider population via social media sites such as Twitter, Facebook and Instagram and a dedicated website. The use of social media enabled us to reach students at various locations in the United Kingdom, of different ethnicities and socio-economic status. All those over the age of 18 years old and currently studying at a UK university were eligible to participate to ensure equality and diversity.

Study design

A newly designed questionnaire consisting of 48 questions, taking no more than 20 minutes to complete was developed for completion online via mobile devices or computers hosted by online surveys (JISC, Bristol, UK). The questionnaire collected sociodemographic characteristics alongside food security prevalence, feeding behaviours including cooking skills, ability to cope and adapt to different situations, and health and mental wellbeing. These were assessed using validated tools that included the Household Food Insecurity Access Scale (HFIAS; Coates et al., 2007), the Coping Flexibility Scale (CFS; Kato, 2012), and the Warwick-Edinburgh Mental

Wellbeing Scale (WEMWBS; Marmara et al., 2022; Tennant et al., 2007). The survey was conducted from February to December 2021.

Measures

Sociodemographic and student characteristics

Sociodemographic data included age, gender, ethnicity, marital status, living situation and sources of financial support (family/parent, government/federal grants, scholarships, loans and/or other sources), employment and disposable income (income remaining following payment of essential bills). Student characteristics data included anthropometric measurements (self-reported height, weight, hip and waist circumference), type of university degree (undergraduate, postgraduate [research or taught]), degree subject, type of study (full time or part-time) and current grade band. We also acquired information on health behaviours including eating habits, consumption of alcohol, smoking and food shopping patterns.

Household food insecurity

FI was measured by the Household Food Insecurity Access Scale (HFIAS). The HFIAS is composed of a set of nine questions called "occurrence questions" and each question is followed by a frequency-of-occurrence question to determine how frequently the condition occurs. The participants were asked to choose the best answer that described their experience over the past 4 weeks. The responses to the occurrence questions are coded as No with 0 and Yes with 1, while the frequency-of-occurrence questions are coded as Rarely 1, Sometimes 2, and Often 3. The HFIAS scores are calculated for each student by summing the codes for each frequency-of-occurrence question. The maximum score is 27, and the minimum score is 0. Higher scores indicate more FI, while lower scores indicate less FI. We further categorised the data as food secure, mildly food insecure, moderately food insecure or severely food insecure following the guidelines published by Coates et al. (2007). This scale has been used in several countries with a wide range of populations including university/college students (Abu et al., 2023; Abu & Oldewage-Theron, 2019; Celik et al., 2023; Rizk et al., 2023; Theodoridis et al., 2018; Wagner et al., 2021), as this tool can distinguish household food security status across different cultural contexts. Furthermore, in the current study, the HFIAS showed strong internal consistency, with a Cronbach's alpha value of 0.805 in the sample. The information generated by the HFIAS can be used to assess the prevalence of household FI (access component) and to detect changes in the FI situation of a population over time.

Coping strategies

The ability to cope with stressful situations was assessed using the Coping Flexibility Scale (CFS). Coping Flexibility is defined as "the ability to discontinue an ineffective coping strategy and produce and implement an alternative coping strategy." (Kato, 2012). This scale has been used in several studies within adult populations, demonstrating that it is a valid and reliable approach. The CFS contains 10 questions divided into two subscales based on dual process theory; evaluation coping (e.g. I only use certain ways to cope with stress) and adaptive coping (e.g. when a stressful situation has not improved, I try to think of other ways to cope with it); each subscale has five items rated on a 4-point scale. Participants ranked how much each item applied to them over the last 4 weeks: not applicable 0, somewhat applicable 1, applicable 2, and very applicable 3 (Kato, 2012). The scale was calculated by summing the student scores, then presenting the results as a mean and standard deviation. Higher scores indicate more effective coping with stressful situations.

Mental wellbeing

Mental health and wellbeing were assessed by the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS; NHS Health Scotland, University of Warwick and University of Edinburgh, 2006). The scale was developed to assess the mental wellbeing of the general population and the evaluation of projects, programmes and policies that aim to improve mental health and not to diagnose disorders (Marmara et al., 2022; Tennant et al., 2007). The scale is a short and robust tool for monitoring mental health in populations since it can distinguish between different population groups in a way that is consistent with other population surveys and is relatively unsusceptible to bias (Marmara et al., 2022; Tennant et al., 2007). It has been validated for use in the United Kingdom with a large population sample over the age of 16 years, including university students, the general population and focus groups (Maheswaran et al., 2012; Tennant et al., 2007). The scale contains 14 items, and participants were asked to choose the best answers that reflected their experience with each statement over the last 4 weeks. The statements, worded positively, cover individual wellbeing and psychological functioning. The score is calculated by summing responses to each item answered on a 1 to 5 Likert scale, None of the time 1, Rarely 2, Some of the time 3, Often 4 and All of the time 5 and

then presenting the results as a mean and standard deviation. The minimum score is 14, and the maximum is 70. A high score is indicative of better wellbeing. The students' scores were classified by following the cut points approach of WEMWBS, where the top 15% of scores range from 60–70 and the bottom 15%, 14–42. However, we combined high-level scores with medium scores since there were fewer than five students in the high-level score category and most statistical tests, particularly Chi Square, require five or more observations in a group (Yates, 1934).

Data and statistical analysis

Only data from students who completed all questions were included in the data analysis. The food security questions were coded using HFIAS instructions that required summing the question codes, and students were classified into four groups: food secure, mild insecurity, moderate insecurity and severe insecurity (Coates et al., 2007). The CFS and WEMWBS were analysed by summing each individual item score using ranking orders and presenting them as means and standard deviations. The Statistical Package for Social Sciences (SPSS version 27; IBM, Hampshire, United Kingdom) was used to analyse the data. Descriptive statistics were used to summarise the sociodemographic characteristics. A chi-square (χ^2) test was used to examine the associations between FI and other variables such as sociodemographic, socio-economic and food and health behaviours. To determine any significant differences in correlations between HFIAS, WEMWBS and CFS, the independent T-Test was used. Binary logistic regression was used to assess the likelihood of a variable to be predictive factor for the development of FI; these included those associated with finance and access to food. The results were expressed as odds ratios with 95% confidence intervals (CIs). A p value of ≤0.05 was considered statistically significant.

RESULTS

Participants

A total of 289 students studying in UK universities completed a self-reported online questionnaire. Participant characteristics are presented in Table 1. The largest proportion of participants were between the age of 21–25 years old (45.7%), of normal body mass index (BMI; between 18.5–24.9 kg/m² [53.6%]), female (72.7%), of white British ethnicity (42.6%), studying full-time (91.3%), classed as an undergraduate student (63.2%) and living in shared housing (49.3%). Interestingly, most students classed themselves as financially dependent (62.7%), supported by their parents (70.5%) and not working (62.6%) or looking for work (60.8%). Furthermore, most participants had a student loan, which required repayment (67.9%). Most students reported a disposable income greater than £200 per month (43.3%).

Prevalence of food insecurity among UK university students

The HFIAS revealed that almost a third of the participants were food insecure (28%; Figure 1a). Further classification of those who were food insecure revealed that a third were mildly food insecure (32.1%), a third were moderately food insecure (34.6%) and a third were as being severely food insecure (33.3%; Figure 1b).

Sociodemographic characteristics based on food security status

There were no significant differences between participant characteristics, including sex, ethnicity, age, BMI status, accommodation type and degree level and food security status (Table 1). Our findings revealed that food insecure students were more likely to consider themselves financially independent (46.3%) compared to food secure students (33.8%; $\chi^2 = 3.793$, $p = 0.05$). Those who were evaluated as food insecure were more likely to be looking for employment (51.1%; $\chi^2 = 3.732$, $p = 0.05$) alongside their studies when compared to food secure students. In addition, there was a trend for food insecure students to have less disposable income, with 39.5% having less than £100 per month compared to the 46.1% of food secure students who reported having more than £200 per month although this did not reach statistical significance ($\chi^2 = 5.164$, $p = 0.08$). Moreover, food insecure students were significantly less confident in managing money to purchase healthy foods, with only 12.8% always having confidence compared to 25.6% of food secure students ($\chi^2 = 11.049$, $p < 0.05$). Food insecure students were less likely to have savings (53.2%; $\chi^2 = 5.240$, $p < 0.05$), and tended to borrow money often (21.3%, $\chi^2 = 12.699$, $p < 0.005$) compared to food secure students (67.9% and 12.3%, respectively). Overall, food insecure students were more likely to run out of money to spend on food (38.2%) compared to food secure students (11.7%; $\chi^2 = 34.061$, $p < 0.001$; Table 1).

Food behaviours, accessibility pattern and food security status

We observed that food insecure students were significantly less likely to eat three meals per day (42.0%) compared to food secure students (59.4%; $\chi^2 = 7.145$,

TABLE 1 Sociodemographic characteristics of the UK university students based on food security status.

| Variable | HFIAS score | | Total participants | |
| | FS | FI | | |
	$n = 208$ (72%)	$n = 81$ (28%)	$n = 289$ (100%)	p
Gender				
Male	53 (25.6)	25 (31.6)	78 (27.3)	ns
Female	154 (74.4)	54 (68.4)	208 (72.7)	
Age (Years)				
18–20	78 (37.5)	36 (44.4)	114 (39.4)	ns
21–25	100 (48.1)	32 (39.5)	132 (45.7)	
26 and above	30 (14.4)	13 (16.0)	43 (14.9)	
Ethnicity				
White British	88 (42.3)	35 (43.2)	123 (42.6)	ns
Black	32 (15.4)	12 (14.8)	44 (15.2)	
Asia	68 (32.7)	27 (33.3)	95 (32.9)	
Mixed	8 (3.8)	3 (3.7)	11 (3.8)	
Other White	12 (5.8)	4 (4.9)	16 (5.5)	
BMI				
$<18.5\,\mathrm{kg/m^2}$	19 (9.6)	9 (11.8)	28 (10.2)	ns
$18.5–24.9\,\mathrm{kg/m^2}$	113 (57.1)	34 (44.7)	147 (53.6)	
$25–30\,\mathrm{kg/m^2}$	34 (17.2)	20 (26.3)	54 (19.7)	
$30\,\mathrm{kg/m^2}$ and above	32 (16.2)	13 (17.1)	45 (16.4)	
Studying status				
Undergraduate	126 (60.9)	56 (69.1)	182 (63.2)	ns
Postgraduate	81 (39.1)	25 (30.9)	106 (36.8)	
Full-time student	193 (92.8)	71 (87.7)	264 (91.3)	
Faculty				
Science	92 (44.4)	34 (42.5)	126 (43.9)	ns
Social Sciences	64 (30.9)	18 (22.5)	82 (28.6)	
Engineering	27 (13.0)	14 (17.5)	41 (14.3)	
Arts	24 (11.6)	14 (17.5)	38 (13.2)	
Average grade				
N/A	40 (21.3)	12 (15.4)	52 (19.5)	ns
59% and less	24 (12.8)	12 (15.4)	36 (13.5)	
60% and above	124 (66.0)	54 (69.2)	178 (66.9)	
Accommodation				
Shared house	98 (47.6)	43 (53.8)	141 (49.3)	ns
Private sector (university halls/catered/ not catered)	53 (25.7)	19 (23.8)	72 (25.2)	
Live with family	39 (18.9)	9 (11.3)	48 (16.8)	
Live alone	16 (7.8)	9 (11.3)	25 (8.7)	
Financially independent				
Yes	69 (33.8)	37 (46.3)	106 (37.3)	0.05
No	135 (66.2)	43 (53.8)	178 (62.7)	
Job				
Yes	74 (35.6)	34 (42.0)	108 (37.4)	ns
No	134 (64.4)	47 (58.0)	181 (62.6)	

(Continues)

TABLE 1 (Continued)

| | HFIAS score | | | |
| | FS | FI | Total participants | |
Variable	n = 208 (72%)	n = 81 (28%)	n = 289 (100%)	p
Trying to find a job				
Yes	47 (35.1)	24 (51.1)	71 (39.2)	0.05
No	87 (64.9)	23 (48.9)	110 (60.8)	
Disposable income/month				
£0–100	45 (25.3)	30 (39.5)	75 (29.5)	0.08
£101–200	51 (28.7)	18 (23.7)	69 (27.2)	
£201 and greater	82 (46.1)	28 (36.8)	110 (43.3)	
Money spent on food/week				
£0–60	162 (80.6)	61 (76.3)	223 (79.4)	ns
£61 and more	39 (19.4)	19 (23.8)	58 (20.6)	
Financial support				
Parental	146 (72.6)	52 (65.0)	198 (70.5)	ns
Grants/scholarships	63 (30.9)	32 (40.0)	95 (33.5)	ns
Student loans	140 (68.0)	55 (67.9)	195 (67.9)	ns
Savings	131 (67.9)	42 (53.2)	173 (63.6)	0.02
Borrowed money				
Never	143 (70.1)	38 (47.5)	181 (63.7)	0.002
Sometimes	36 (17.6)	25 (31.3)	61 (21.5)	
Often	25 (12.3)	17 (21.3)	42 (14.8)	
Feel confident in managing money to buy healthy foods				
Never	12 (5.8)	12 (15.4)	24 (8.4)	0.01
Sometimes	65 (31.4)	29 (37.2)	94 (33.0)	
Most of the time	77 (37.2)	27 (34.6)	104 (36.5)	
Always	53 (25.6)	10 (12.8)	63 (22.1)	
Run out of money for food				
Never	130 (63.4)	22 (28.9)	152 (54.1)	0.01
Sometimes	51 (24.9)	25 (32.9)	76 (27.0)	
Most of the time	24 (11.7)	29 (38.2)	53 (18.9)	

*Note*: $p \leq 0.05$ deemed as statistically significant.

Abbreviations: FI, food insecurity; FS, food security; HFIAS, Household Food Insecurity Access Scale.

$p < 0.01$; Table 2), as well as being more likely to never have a snack between meals (12.3% vs. 3.9% food secure; $\chi^2 = 8.187$, $p < 0.05$). However, food insecure students were more likely to drink alcohol more than 2 days a week (42.5% vs. 30% food secure; $\chi^2 = 7.262$, $p < 0.05$) and smoke at least 1–4 days a week (22.8% vs. 11.6% food secure; $\chi^2 = 6.004$, $p = 0.05$). Furthermore, only 31.3% of food insecure students were always able to shop for food compared to 65.7% of food secure students ($\chi^2 = 32.811$, $p < 0.001$), while 24.1% of food insecure students reported that they had difficulties acquiring a variety of nutritious foods compared to only 6.9% of food secure students ($\chi^2 = 16.332$, $p < 0.001$; Table 2) potentially due to the distance to food shops (46.9%; $\chi^2 = 7.538$, $p < 0.005$), the price of food (46.9%; $\chi^2 = 16.605$, $p < 0.001$), and the availability

of food storage rooms and cooking equipment (28.4%; $\chi^2 = 4.411$, $p < 0.05$; Table 3). However, no significant differences were found between food insecure and food secure students in the frequency of fruit and vegetable consumption.

Effect of food security on mental wellbeing and coping flexibility

The WEMWBS revealed that a higher proportion of food insecure students had lower mental wellbeing (55.5%) compared to food secure students (44.5%, $\chi^2 = 4.398$, $p < 0.05$). The average WEMWBS score for food insecure students is categorised as being low mental wellbeing (WEMWBS score 14–42)
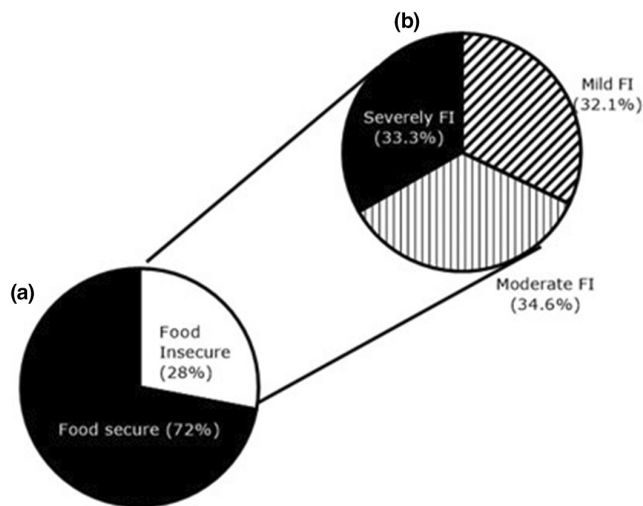
FIGURE 1 Prevalence of food insecurity in UK university students. Students were classified according to their household indicator access scale (HFIAS) score (Coates et al., 2007). Pie chart to show prevalence in (a) total population ($n=289$) and (b) food insecure population ($n=81$). FI, food insecure.

compared to food secure students being categorised as medium-high wellbeing (WEMWBS score 43–60; WEMWBS score (mean ± SEM): food secure 45.6 ± 0.86; food insecure 39.6 ± 1.5; t(df) = 3.496, $p < 0.001$, Figure 2a). Furthermore, we observed that those classed as food insecure had significantly lower evaluation coping compared to the food secure students (Evaluation [mean ± SEM]: food secure 12.06 ± 0.19; food insecure 11.27 ± 0.34; t[df] = 2.516, $p < 0.05$; Figure 2b), suggesting an inability to abandon any ineffective coping strategies. No difference was observed in the willingness to consider alternative coping strategies between the FS and FI groups (Adaptive [mean ± SEM]: food secure 12.27 ± 0.23; food insecure 12.04 ± 0.0.35; t[df] = 0.5169, $p = $ n.s.; Figure 2b).

Potential predictors of food insecurity in students

Logistic regression revealed that the factors that remained significantly associated with FI were running out of money for food, less confidence in managing money to purchase healthy food, difficulty going shopping for food, ability to go shopping, dietary patterns including less snacking and perceptions of the price of food in general (Table 4). Those who shopped sometimes or often were three to seven times more likely to be food insecure (Sometimes: OR 6.564 95% CI 3.238, 13.303; Often: OR 3.139 96% CI 1.533, 6.429; $p < 0.005$), while those who never consumed snacks were four times more likely to be food insecure (OR 4.261 95% CI 1.309, 13.875; $p < 0.02$). Price of food was also a predictor of being food insecure with those

who found food expensive being three times more likely to be food insecure (OR 2.954 95% CI 1.675, 5.210). Financially independent students were more likely to be food insecure although this failed to reach significance (OR: 1.654 95% CI 0.912, 3.00; $p = 0.09$).

DISCUSSION

The purpose of this study was to examine the prevalence of FI in UK university students and determine the associated drivers and to explore the potential influence of FI on mental health outcomes, particularly mental wellbeing and the ability to cope in stressful situations. We found that in 2021, approximately 28% of the respondents were evaluated as being food insecure and although this is similar to the prevalence reported by Sackey et al. (2021) in the United States (28.5%), it is lower than that observed by Armstrong et al. (2023) who found that 44% of university students in the United Kingdom reported FI in 2022. This 1.5-fold increase in just 1 year indicates the need to understand the potential drivers of FI in university students in order to develop effective interventions.

Similar to studies conducted in the United States (Ryan et al., 2020), Australia (DeBate et al., 2021), and Malaysia (Ahmad et al., 2021; Bruening et al., 2018; Davitt et al., 2021), we found no significant differences in food security status according to demographics such as gender, ethnicity, accommodation, type of degree or subject. Although some studies have shown that FI impacts students' academic performance (Martinez et al., 2018; Ryan et al., 2020), and affects their ability to meet academic responsibilities (Ashley et al., 2018), and eventually to be less successful in completing their degrees (Britt et al., 2017; Wolfson et al., 2022), we found no significant differences between the two groups in terms of academic performance. A potential reason for this difference could be that we did not distinguish between undergraduate and postgraduate students since Bruening et al. (2018) found that FI only negatively affected the academic performance of first year university students.

According to the studies conducted across the globe, FI is higher in those having financial difficulties due to inadequate finance, loans/scholarship and high living expenses (Bruening et al., 2017; Martinez et al., 2018; Mialki et al., 2021; Owens et al., 2020; Payne-Sturges et al., 2018) and our results were no different. We have observed that food insecure students were more likely to be financially independent with no parental help, with less disposable income, which could, in part, explain the higher number of food insecure students trying to find a job. Regression analysis showed that these factors were twice as likely to predict the potential of developing FI. Furthermore, poor financial management can also lead to FI due to the lack of funds to buy food. In

TABLE 2 Food behaviours and accessibility patterns of the UK university students based on food security status.

	HFIAS score		Total participants	
	FS	FI		
Variable	n = 289 (100%)	n = 81 (28%)	n = 208 (72%)	p
Main meal/day				
1–2 meals	84 (40.6)	47 (58.0)	131 (45.5)	0.008
3+ meals	123 (59.4)	34 (42.0)	157 (54.5)	
Snack/day				
Never	8 (3.9)	10 (12.3)	18 (6.3)	0.04
Once	66 (31.9)	28 (34.6)	94 (32.6)	
Twice	70 (33.8)	21 (25.9)	91 (31.6)	
More than twice	63 (30.4)	22 (27.2)	85 (29.5)	
Eating fruit				
0–1 day/week	31 (15.0)	17 (21.5)	48 (16.8)	ns
2–4 days/week	73 (35.3)	34 (43.0)	107 (37.4)	
5–6 days/week	43 (20.8)	15 (19.0)	58 (20.3)	
Everyday	60 (29.0)	13 (16.5)	73 (25.5)	
Eating vegetables				
0–1 day/week	20 (9.7)	11 (13.8)	31 (10.8)	ns
2–4 days/week	56 (27.1)	27 (33.8)	83 (28.9)	
5–6 days/week	40 (19.3)	13 (16.3)	53 (18.5)	
Everyday	91 (44.0)	29 (36.3)	120 (41.8)	
Consuming alcohol				
Never	73 (36.0)	31 (38.8)	104 (36.7)	0.03
Once a week	69 (34.0)	15 (18.8)	84 (29.7)	
More than 2 days/week	61 (30.0)	34 (42.5)	95 (33.6)	
Smoking				
Never	161 (77.8)	52 (65.8)	213 (74.5)	0.05
1–4 days/week	24 (11.6)	18 (22.8)	42 (14.7)	
More than 5 days/week	22 (10.6)	9 (11.4)	31 (10.8)	
Able to shop for food				
Sometimes	31 (15.0)	34 (42.5)	65 (22.6)	0.001
Often	40 (19.3)	21 (26.3)	61 (21.3)	
Always	136 (65.7)	25 (31.3)	161 (56.1)	
Difficulty shopping				
Difficult	14 (6.9)	19 (24.1)	33 (11.7)	0.001
Not difficult at all	190 (93.1)	60 (75.9)	250 (88.3)	

Note: $p \leq 0.05$ deemed as statistically significant.

Abbreviations: FI, food insecurity; FS, food security; HFIAS, Household Food Insecurity Access Scale.

line with this, we observed a trend towards food insecure students having less disposable income, although Silva et al. (2017) showed that students who have extra money tended to spend it on other items such as clothes, mobile phones and alcohol than food. Our findings support this with a higher proportion of food insecure students consuming alcohol more than 2 days a week. This lack of ability to budget could be a potential reason behind why food insecure students were significantly more likely to run out of money to purchase food and borrowed money more often compared to food secure students (Gundersen & Garasky, 2012; Hiller et al., 2021). Furthermore, these students lacked confidence in purchasing cheaper healthier foods, which could restrict their access to adequate food, ultimately contributing to consuming fewer meals and snack observed by us and others (Coates et al., 2007; Gundersen & Seligman, 2017; Gundersen & Ziliak, 2015).

TABLE 3 Factors affecting UK university student to access a variety/high quality food based on food security status.

| | HFIAS score | | Total participants | |
| | FS | FI | | |
Variable	n = 208 (72%)	n = 81 (28%)	n = 289 (100%)	*p*-value
Distance to food shops	62 (29.8)	38 (46.9)	100 (34.6)	0.006
Reliable and adequate public transport	10 (4.8)	4 (4.9)	14 (4.8)	ns
Knowledge and cooking skills to prepare healthy meals	37 (17.8)	12 (14.8)	49 (17.0)	ns
Availability of healthy foods	26 (12.5)	15 (18.5)	41 (14.2)	ns
Availability of culturally appropriate foods		9 (11.3)	33 (11.5)	ns
Food storage rooms and cooking equipment available at home	36 (17.3)	23 (28.4)	59 (20.4)	0.036
Space to prepare food and cooking facilities	22 (10.6)	12 (14.8)	42 (11.8)	ns
Inadequate time to shop, prepare and cook food	61 (29.3)	27 (33.3)	34 (11.8)	ns
Price of food	47 (22.6)	38 (46.9)	88 (30.4)	0.001

Abbreviations: FI, food insecure; FS, food secure; HFIAS, Household Food Insecurity Access Scale.
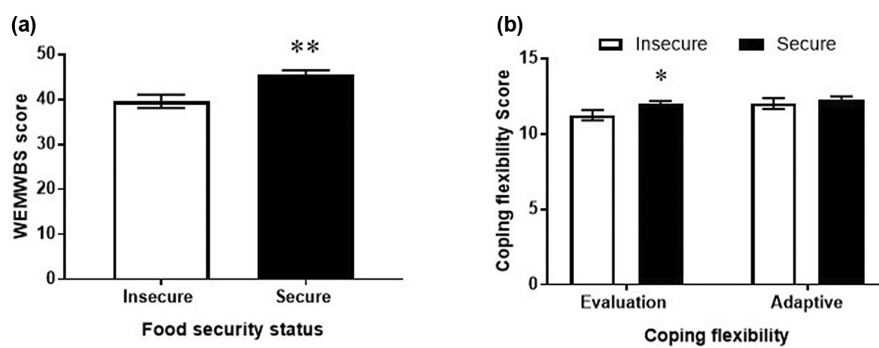
FIGURE 2 Food insecure students have lower mental wellbeing and ability to cope with stressful situations. Mental wellbeing score according to (a) the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS; Tennant et al., 2007) and (b) coping flexibility scale (Kato, 2012) associated with their household indicator access scale (HFIAS) score (Coates et al., 2007). Data presented as mean ± SEM, *p < 0.05, **p < 0.01.

TABLE 4 Logistic regression analysis of food insecurity (FI) by financial status and food behaviours.

Characteristics	Beta	OR (95%CI)	*p* value
Financial independence	0.503	1.654 (0.912–3.00)	0.09
Running out of money for food	−1.356	0.258 (0.134–0.494)	<0.001
Less confidence in managing money to purchase healthy food	−1.314	0.269 (0.099–7.30)	0.010
Borrowing money	−0.642	0.526 (0.281–0.986)	0.05
Difficulty shopping for food	−1.383	0.251 (0.116–0.544)	<0.001
Able to shop			
Sometimes	1.882	6.564 (3.238–13.303)	<0.001
Often	1.144	3.139 (1.533–6.429)	0.002
Snack			
Never	1.450	4.261 (1.309–13.875)	0.02
Price	1.083	2.954 (1.675–5.210)	<0.001
Food storage	0.540	1.716 (0.904–3.257)	0.09

Abbreviations: CI, confidence intervals; OR, odds ratio.

We also found that those who were food insecure were three times more likely to shop for food more often than those who were food secure. This may be due to lack of storage facilities for larger amounts of food, difficulty in shopping and transporting food, and distance to food shops alongside poor culinary knowledge as

observed by Davitt et al. (2021). Additionally, they found that lower cooking self-efficacy increased the risk of FI in university students during the COVID-19 pandemic (Davitt et al., 2021).

It has been well established that the lack of good nutrition can interfere with the wellbeing of individuals. A recent meta-analysis suggested that FI has a significant effect on the likelihood of being stressed or depressed (Pourmotabbed et al., 2020), supporting the results in this study with food insecure students having a lower mental wellbeing score. Furthermore, this was associated with a lower ability to cope with stressful situations leading to the employment of ineffective strategies such as changing eating habits for the worse (Broton & Goldrick-Rab, 2016). We observed that food insecure students changed their food intake by consuming fewer than three meals per day and snacking less and were more likely to smoke and consume more alcohol, factors associated with appetite suppression (Perkins et al., 1996; Yeomans, 2010). However, whether these students made unhealthy food choices as a result of low coping abilities cannot be determined in a cross-sectional study such as this one, although many studies have shown that food insecure individuals are more likely to have unhealthy dietary practices (Becerra et al., 2017; Ranjit et al., 2020; Shi et al., 2021).

Limitations of the study

There are a number of limitations in this study; firstly, the participants were largely female suggesting that the findings may not be generalised to the entire UK student population. A potential reason for this may be that women are more likely to participant in survey studies when compared to men (Curtin et al., 2000). Indeed many have shown this including (Armstrong et al., 2021) who investigated the effects of COVID-19 on FI, reporting that 63% of participants were female and 39% were food insecure. However, it is also known that women are more likely to suffer from FI than men as suggested by a systematic review by Jung et al. (2017) which found that female-led households were 75% more likely to be food insecure than male-led families. Furthermore, while the study included students across the United Kingdom, we are unable to identify geographical locations and therefore are unable to state where the prevalence of FI would be higher. We are also aware that the number of students who completed the questionnaire is low considering there were approximately two million students studying at higher education providers in 2021–2022. However, in the current culture, university students are surveyed about multiple topics by universities and therefore may have survey fatigue which may have been a hindrance in obtaining larger numbers. Another limitation is the self-reporting nature of the study which may

result in social desirability bias although all participants were informed that the questionnaire was only intended for research use and was confidential with no personal information obtained. Finally, the cross-sectional nature of this study means that the direction of the relationships between FI, coping ability and mental wellbeing cannot be determined.

Significance

Despite these limitations and the low numbers responding, this study found that FI is common among UK university students, and although an inability to manage money well may be a predictor for FI, it is unknown whether this is the reason behind the decrease in mental wellbeing and needs to be further investigated. But it is probable that students' poor financial management of limited resources may put them in a precarious financial situation, and there is the potential for higher education settings to provide advice on financial management, on developing resource management skills, including improved cooking skills based on the facilities available to the students, good decision-making and prioritisation of spending, and practical education on food variety.

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