

Prevalence of food insecurity and associated factors among Cairo University students

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Background/aim

Food insecurity (FI) is a major public health issue. The susceptibility to FI varies along life course; however, university is a potential period of particular vulnerability. The figures of food-security status among Egyptian university students are scarce. The present study aims to assess the prevalence of FI among Cairo University students, identify the associated sociodemographic factors, and determine its relation with the students' health status.

Patients and methods

A cross-sectional study included ($n=500$) 241 female and 259 male students. They were interviewed using a questionnaire consisting of demographic variables, the US Adulthood Food Security Survey Module. The 19-item Pittsburgh Sleep Quality Index, 14-item Cohen's Perceived Stress Scale, and Eating Attitudes Test-26.

Results

The mean age of the students was 23.78 ± 4.3 years old. Sixty-six percent of the students were food-insecure, while 25% with very low food security. Significant relationships were identified between FI with sex, residence, parents' education, working beside studying, family head, family size, and average monthly income ($P < 0.01$). FI was associated with poor sleep quality and stress ($P < 0.01$).

Conclusions

FI is a significant problem with high prevalence among Cairo University students and has negative implication on mental health. It is recommended to screen for FI and implement policy and program initiatives, as well as addressing solutions for FI among university students.

Keywords:

food insecurity, sociodemographic factors, universities

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Introduction

The US Department of Agriculture defined food insecurity (FI) as 'limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways' [1]. FI refers to running out of food without being able to afford more, or eating a poor-quality diet due to limited financial ability [2]. It is considered a 'nutrition quality gap' [3].

The fast-growing world's population, declining in the global economy, rising global food and oil prices, affected the food security worldwide [4]. The world nowadays is facing a challenge in providing sustainable, inexpensive, and nutritious food. FI continues to be a global problem. Nearly a quarter of the world population are experiencing moderate or severe FI, especially in low-income and middle-income countries [4,5].

Egypt's ability to feed itself has become a challenge, especially in rapid population growth and raised poverty rates [6]. Poor people are not able to get

balanced essential nutrients and they are vulnerable to food-price fluctuations. Although food subsidization has played an important role in the protection of poor from the impact of high food prices, yet they are not designed to resolve all poverty-related challenges [5].

FI imposes health care, economic, and social burden on governments and societies. It contributes to various nutritional, life-threatening health complications and developmental problems throughout the life cycle [2].

University years are considered one period of life when FI becomes pronounced. Most of the university students become more independent, occasionally live on their own, and manage the demands of both employment and studying. They become overburdened with the cost of living, housing, and

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utility expenses in addition to educational cost [7]. This can exacerbate economic stress and lead to the displacement of their money in issues other than purchasing nutritious food and consuming lower-quality dietary patterns [8,9].

Studies showed that FI is highly prevalent among university students [10]. Food-insecure students experience increased rates of depression, anxiety, sleep disorders, obesity, and impaired physical and mental health. It leads to decreased ability to concentrate and low academic achievement, which undermine the goal of university education [11].

Although FI among university students is a main national health problem and a significant public health issue, it is not sufficiently taken into consideration. There is a rising need of considerable understanding as these students representing a large sector of the population will contribute to the future progression and prosperity, and securing their food is an urgent need [12,13].

This study aimed to first assess the prevalence of FI among university students and its related sociodemographic characteristics and second examine the relation between food-security status and mental health, such as sleeping disorder, perceiving stress, and eating disorders. The results may aid to advocate further research on a wider scale and inform policies to save the well-being of students by decreasing the prevalence of FI.

Patients and methods

Patients

The study included 500 Cairo University students. They included 241 (48.2%) female and 259 (51.8%) male students. Their mean age was 23.78 ± 4.3 years old.

Ethical approval

The study was approved by Research Ethical Committee Faculty of Medicine Cairo University with approval registered by no I-220315. The researcher respected all the principles of ethics of the Helsinki declarations. The students were informed about the purpose of the research and signed informed consent. They were assured about the confidentiality of data.

Study design

A cross-sectional study started from August 2019 to March 2020.

Data-collection tools

Weight and height were measured for the students using digital scale and wall-fixed tape. BMI was calculated as weight/height in m^2 .

All the questionnaires were translated into Arabic and then retranslated to ensure validity. They were revised by public health professionals to ensure their relevance to the study objectives and their cultural acceptability. They included the following.

Sociodemographic characteristics

The survey included questions on sociodemographic factors associated with FI among university students, which was based on previous studies [12,14]. The students were asked to self-report age, sex, parents' education level, parents' employment, residence, and monthly income on average.

US Adulthood Food Security Survey Module

Adult Food Security Survey Module (AFSSM) is shown in Table 1. It is a subset of the US Household Food Security Survey Module used for correct evaluation and determining the status of household food security. US AFSSM is meant to measure the prevalence of household FI and prevalence of hunger. It focuses on the insufficient amount of food or nutritious food due to lack of financial resources. It measures many characteristic conditions and behaviors of FI, including anxiety over food supply, decreased quality and quantity of consumed food, and skipping meals due to lack of money [15,16].

Referring to the Guide of Measuring the Food Security, summation of the affirmative response numbers was done to obtain a raw score that ranged from 0 to 10. The students were categorized to one of four food-security categories: high food security (problems of no food access, having a raw food-security score of zero), marginal food security (anxiety over food supply, having a raw food-security score 1–2), low food security (reduced diet quality and variety, having a raw food-security score 3–5), and very low food security (multiple indications of disrupted eating patterns and reduced intake of food, having a raw food-security score 6–10) [15].

The food-security status was then dichotomized to food-secure (high food security or marginal food-security status) and food-insecure (low food security or very low food-security status). That was done for analysis purposes and in accordance with the US

Table 1 Questionnaire items and coding of response options as insecure or secure in the 10-item US Adulthood Food Security Survey Module

Items	Affirmative response(s) (food-insecure)	Negative response (s) (food-secure)
10-item Food Security Survey Module		
HH2. I am worried whether my food would run out before I got money to buy more	Often true, sometimes true	Never true, do not know
HH3. The food that I bought just did not last, and I did not have enough money to get more	Often true, sometimes true	Never true, do not know
HH4. I could not afford to eat balanced meals	Often true, sometimes true	Never true, do not know
AD1. In the last 12 months, did you ever cut the size of your meals or skip meals because there was not enough money for food?	Yes	No, do not know
AD1a. In the last 12 months, how often did this happen?	Almost every month, some months but not every month	Only 1 or 2 months, do not know
AD2. In the last 12 months, did you ever eat less than you felt you should because there was not enough money for food?	Yes	No, do not know
AD3. In the last 12 months, were you ever hungry but did not eat because there was not enough money for food?	Yes	No, do not know
AD4. In the 12 months, did you lose weight because there was not enough money for food?	Yes	No, do not know
AD5. In the last 12 months, did you ever not eat for a whole day because there was not enough money for food?	Yes	No, do not know
AD5a. In the last 12 months, how often did this happen?	Almost every month, some months, but not every month	Only 1 or 2 months, do not know

Department of Agriculture Economic Research Service [2] as shown in Table 2.

Assessment of the health status

Sleep quality

The 19-item Pittsburgh Sleep Quality Index is a valid and reliable tool used to measure the sleep quality of the students over the past month. It has internal consistency and a reliability coefficient (Cronbach's alpha) of 0.83 [17]. It gives a total score that ranges from 0 to 21. A total score more than 5 indicates a 'poor' sleep quality [18].

Perceived stress

The 14-item Cohen's Perceived Stress Scale (PSS) was used to measure the students' perceived stress [19]. It has strong internal consistency ($\alpha=0.84-0.86$) and good test-retest reliability ($r=0.85$). Cohen's PSS measures the degree of perceiving the situations as stressful during the past month. Every item in the scale gives a score ranging from 0 to 4 where 4 is the highest perception of stress. The scores of the items were summed, giving a total score ranging from 0 to 56. The higher the scores, the higher stress. The stress score of 28 or higher was classified as high stress [20].

Eating disorders

The symptoms of eating disorders of the students were measured by a reliable and valid instrument, the Eating Attitudes Test-26 (EAT-26). Test and retest reliability for EAT-26 ranged from 0.84 to 0.89 [21]. The total score was calculated by summing the responses of all items, the maximum score was 78. A score of 20 or

Table 2 Food-security categories based on the number of affirmative responses to the US Adult Food Security Survey Module

Food-security status	Affirmative responses	Food-security category	Household conditions
Food-secure	0	High food security	No food-access problems
	1–2	Marginal food security	Anxiety over household-food shortage
Food-insecure	3–5	Low food security	Reduced diet quality, variety, and appeal
	5	Very low food security	Reduced food intake and disrupted eating patterns

higher referred to eating-behavior problems and high risk of eating disorders [22].

Smoking and physical activity

The students were asked if they were smoking or practicing physical activity, and the answers were in the form of yes or no (All the questionnaires were translated into arabic then retranslated to ensure validity. They were translated by public health professionals to ensure their relevance to the study objectives and their cultural acceptability.)

Study population and data-collection technique

The sample-size calculations showed that at least 323 students required to achieve statistically representative data. It was based on population size of 210 000 students, 95% confidence interval, 5% margin of error, and assuming 70% the prevalence of FI based

on previous studies [23]. The study included 500 students who were selected for the sample size.

The students were selected through simple random-sample technique, irrespective of their faculties. They were approached in the university central library and after their lectures. The interview took 15 min.

Statistical analysis

χ^2 test of association was used to determine the associations between food-security status with both the demographic variables and health status of the students. To quantify the association between food-security status and the demographic variables, odds ratio with 95% confidence interval was calculated. Independent *t* test was used to compare between mean $\pm$ SD of BMI. Statistical significance was determined at *P* value less than 0.05. The analysis was done by SPSS for Windows software package, version 22.0 (SPSS Inc., Chicago, Illinois, USA).

Results

The data presented in Table 3 indicated that approximately half of the students were females

(48.2%) and 51.8% were males. Their mean age was 23.78 $\pm$ 4.3 years old and the majority (72%) aged from 18 to 25 years old. Most of the students (61.6%) were living in urban areas and about 39.2% were working besides studying. Regarding the number of family members, nearly half of the students (49.4%) reported that their families consisted of more than five members. Parents' education showed that fathers who had university degrees or further studies were 52% and that was higher than mothers where 41.4% of them were university graduates or had higher education. About 65% of the students had average monthly family income below 5000 LE, and 68% had their families headed by father.

The relation between food-security status and sociodemographic characteristics is presented in Table 3. Using bivariate analysis, food security was higher among females compared with males ($P<0.01$), and it is higher among those aged from 18 to 25 years old. Food-security status was significantly associated with the place of residence ($P<0.01$), the findings indicated that the proportion of food-insecure was higher among students living in rural areas. Food

Table 3 Food-security status and demographic characteristics of the students

Demographic characteristics	Food-security status [n (%)]		Total [n (%)]	OR (95% CI)	<i>P</i> value ^a
	Food-secure	Food-insecure			
Sex					
Male	72 (42.4)	187 (56.7)	259 (51.8)	0.56 (0.38–0.81)	<0.01
Female	98 (57.6)	143 (43.3)	241 (48.2)		
Age					
18–25	109 (64.1)	251 (76.1)	360 (72)	1.77 (1.18–2.66)	0.005
>25	61 (35.9)	79 (23.9)	140 (28)		
Residence					
Urban	144 (84.7)	164 (49.7)	308 (61.6)	5.6 (3.5–9)	<0.01
Rural	26 (15.3)	166 (50.3)	192 (38.4)		
Working and studying					
Yes	26 (15.3)	170 (51.5)	196 (39.2)	0.17 (0.10–0.27)	<0.01
No	144 (84.7)	160 (48.5)	304 (60.8)		
Number of family members					
Five members or less	116 (68.2)	137 (41.5)	253 (50.6)	3.026 (2.04–4.47)	<0.01
More than 5	54 (31.8)	193 (58.5)	247 (49.4)		
Father's education					
High education	135 (79.4)	125 (37.9)	260 (52.0)	6.32 (4.1–9.65)	<0.01
Moderate or low education	35 (20.6)	205 (62.1)	240 (48.0)		
Mother's education					
High education	109 (64.1)	98 (29.7)	207 (41.4)	4.23 (2.85–6.26)	<0.01
Moderate or low education	61 (35.9)	232 (70.3)	293 (58.6)		
Family income					
Below 5000 LE	75 (44.1)	250 (75.8)	325 (65.0)	0.25 (0.17–0.37)	<0.01
>5000 LE	95 (55.9)	80 (24.2)	175 (35.0)		
Head of the family					
Father	146 (85.9)	194 (58.8)	340 (68.0)	4.2 (2.6–6.9)	<0.01
Mother or others (brother, NGOs ^b , etc.)	24 (14.1)	136 (41.2)	160 (32.0)		

^a χ^2 *P* values compare the difference by food-security status and sociodemographic characteristics. ^bNGOs refer to nongovernmental organizations. *P* value less than 0.05 is statistically significant.

security was higher among students who were not working beside studying ($P<0.01$). Moreover, FI is shown to be significantly related with increased number of family members ($P<0.01$) and lowered parents' education ($P<0.01$). Additionally, a significant relation was observed between lower monthly family income and FI ($P<0.01$). Specifically, the greater proportion of food-insecure students reported that their monthly family income was below 5000 LE. The findings also showed that FI was higher among students where the head of the family was not the father and the students were significantly more likely to be food-insecure than their counterparts ($P<0.01$).

About 82% of respondents affirmed (sometimes true or often true) that they are worried that their food would run out without being able to get more (Q: H2).

Moreover, 79% of them affirmed that the food did not last and often did not have money to get more foods (Q: H3). About 71% of the students could not afford to eat balanced meals (consists of all major food groups) (Q: H4). Nearly half of the students (48%) cut the size of meal or skip meals because of the lack of money for the food in the last 12 months (Q: AD1). About 62% of the participated students affirmed that they eat less than they felt because of the lack of money (Q: AD2), as shown in Fig. 1.

In Fig. 2, the responses to the US AFSSM showed that 34% (170) of the students were food-secure with 60 (12%) having high food security and 110 (22%) with marginal food security. Then 66% (330) of the students were classified as food-insecure, consisting of 205 (41%) with low food security and 125 (25%) with very low food security.

Figure 1

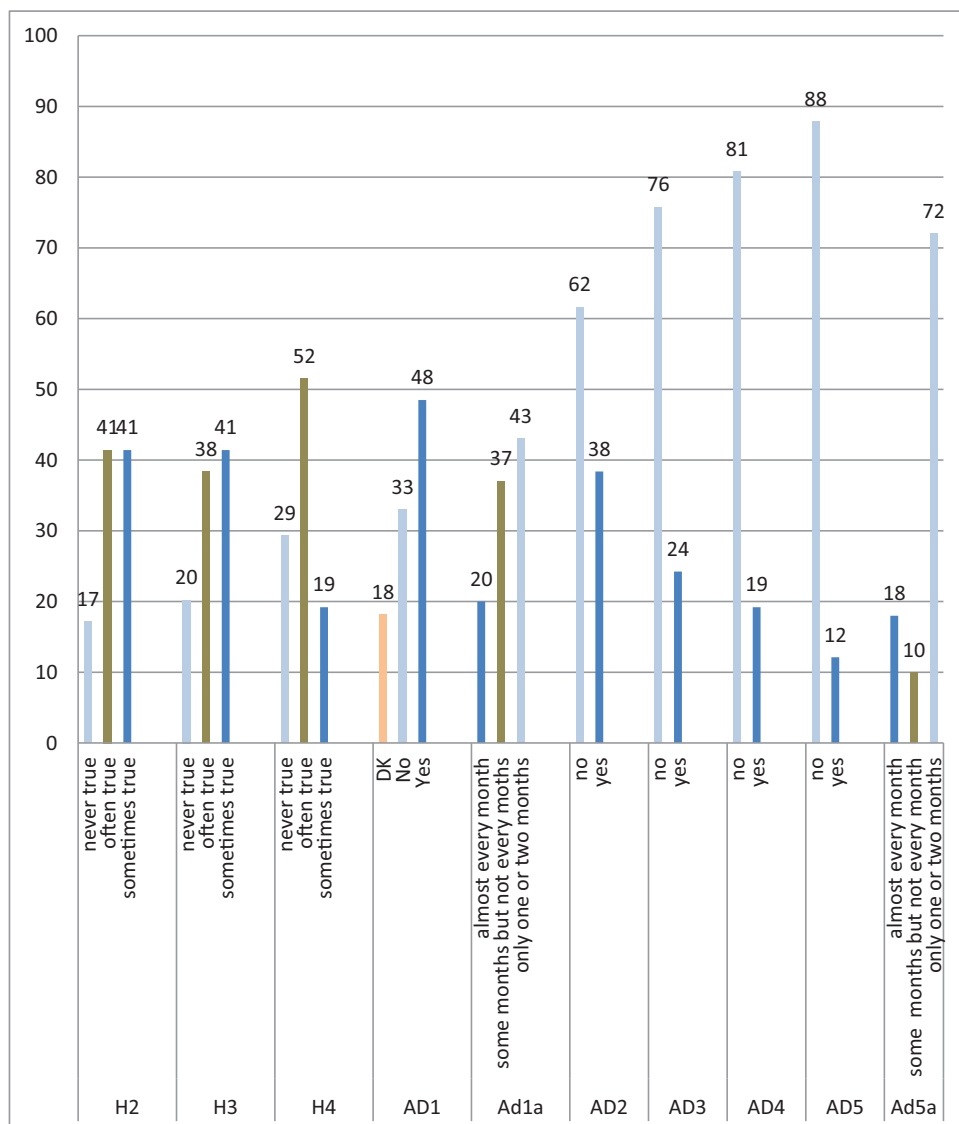
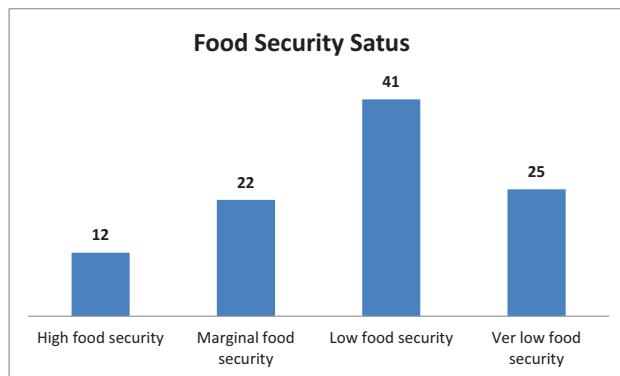


Figure 2



Percent distribution of food-security status among the university students.

Table 4 Reliability test of Adult Food Security Survey Module and psychometric scales

Psychometric scale	Cronbach's alpha
Adulthood Food Security Survey Module	0.931
Pittsburgh Sleep Quality Index	0.798
Cohen's Perceived Stress Scale	0.876
Eating Attitudes Test-26	0.891

As shown in Table 4, the reliabilities were checked against the Nunnally's recommended standards (Cronbach's alpha ≥ 0.70) to ensure that they are reliable indicators of the construct 114. The Cronbach's alpha 0.931, 0.798, 0.876, and 0.891 for AFSSM, Pittsburgh Sleep Quality Index, PSS, and EAT-26, respectively. This confirms that the items identified are cohesive enough to represent adequately a single concept.

The data presented in Table 5 show that the mean BMI was significantly higher among food-insecure students, P value less than 0.01. Obesity was higher among females where 63% of them were obese. The majority of overweight/obese students, 66%, were food-insecure.

Table 6 compares food-insecure and food-secure students among health variables. It was shown that 64% of the students had poor sleep quality. Food-security status is significantly associated with sleep quality ($P < 0.01$). A higher proportion of food-insecure was among those students with poor sleep quality. The prevalence of high stress among the students was 49.8%. Food-insecure students had

Table 5 Anthropometric measures of the students

Anthropometric measures	Food-secure	Food-insecure	P value
BMI (kg/m^2)			
Mean $\pm$ SD	24.8 $\pm$ 4.65	26.7 $\pm$ 6.5	<0.01
Overweight/obese (BMI ≥ 25) [n (%)] $n = 373$	127 (34)	246 (66)	<0.01

Table 6 Food security and health status of the students

Health status	Food-security status [n (%)]		Total [n (%)]	P value ^a
	Food-secure	Food-insecure		
Sleep quality ^b				
Good	98 (57.6)	81 (24.5)	179 (35.8)	<0.01
Poor	72 (42.4)	249 (75.5)	321 (64.2)	
Perceived stress ^c				
Low or moderate stress	127 (74.7)	124 (37.6)	251 (50.2)	<0.01
High stress	43 (25.3)	206 (62.4)	249 (49.8)	
Eating disorders ^d				
No	38 (22.4)	59 (17.9)	97 (19.4)	0.23
Yes	132 (77.6)	271 (82.1)	403 (80.6)	
Smoking				
No	156 (91.8)	235 (71.2)	391 (78.2)	<0.01
Yes	14 (8.2)	95 (28.8)	109 (21.8)	
Physical activity				
No	47 (27.6)	211 (63.9)	258 (51.6)	<0.01
Yes	123 (72.4)	119 (36.1)	242 (48.4)	

^a χ^2 P values compare the difference by food-security status and health status of the students; P value less than 0.05 is statistically significant.

^bPittsburgh Sleep Quality Index (PSQI) scale of ranges from 0 to 21, with cores more than or equal to 5 considered poor sleep quality 48.

^cCohen's Perceived Stress Scale (PSS) ranges from 0 to 56. Higher scores more than or equal to 28 considered more stress 49. ^dEating Attitudes Test-26 scale ranges from 0 to 78, scores more than or equal to 20 indicating disordered eating 52, 53.

significantly higher perceived stress ($P<0.01$), compared with food-secure students ($P<0.001$). Additionally, 78.2% of the students were nonsmokers and food-insecurity was significantly higher among nonsmokers ($P<0.01$). Nearly half (51.6%) did not practice physical activity. FI was significantly higher among students who did not practice physical activity ($P<0.01$). There was no significant difference between food-secure and food-insecure students regarding eating disorders.

Discussion

The study has examined the prevalence and associated factors of FI among Cairo University students. It was found that the prevalence of FI among the students was 66% consisting of 41% with low food security and 25% with very low food security. There were no previous studies assessing FI among university students in Egypt to our knowledge, but this prevalence was nearly 3.5-fold greater than the Egyptian national average, which was 17%, as reported by World Food Program and Central Agency of Mobilization and Statistics in 2011, and higher than the previous estimate in 2009, which was 14% [24]. The depicted prevalence of FI was higher than that observed among Nigerian University students [25], and was nearly similar among the students at South African University in Free State [26] and Kwazulu-Natal [27]. Other similar studies in the United States [28] and Australia [29] showed lower prevalence of FI.

This difference attributed to various underlying factors behind FI in developing countries, such as poverty, population growth, sex inequality, inadequate education, and declining availability and/or accessibility to adequate health and social services. It can also be related to the deficiency of both financial aid and nutritional targeted programs for university students [9].

The study showed that FI was significantly higher among male students, this may be explained that male students are considering Cairo University as their first choice for enrollment due to lack of universities in their governorates, also, it is one of the largest, oldest, and prestigious public universities in Egypt. The students became overburdened with high living expenses in the city as they have to travel a long distance everyday (~150–200 km), so they become loaded with travel expenses as the university does not offer any long-distance transportation. A study conducted in Nigeria showed equal distribution of FI among male and female students [25].

It was revealed in the current study that rural-resident students had significantly higher FI than urban residents and that was similar to a Nigerian study [25]. Rural population face greater financial burden and have higher poverty rates when compared with urban population [24].

Regarding educational level, it was shown that parents' education increased the vulnerability of the students to FI as it was higher among students whose parents had moderate or low level of education. This was similar to the study of Guerrero *et al.* [30], among Wisconsin residents and El Zein *et al.* [9], among US college students. This observed association may be attributed to the fact that education gives better job opportunities and hence better income so that families become able to fill their nutritional needs.

It was observed from the study that FI was significantly higher among students who were working besides studying. Most students work to improve their economic status. It is difficult for the students to find a proper job with a proper wage as most jobs require qualifications and experience, moreover, they do not have the time for work as they are full-time students. Because of their low income, they cannot afford to buy a balanced meal and that was claimed by nearly half of the surveyed students. Patton-López *et al.* [31] found that employment failed to meet the students' financial demands and ability to purchase adequate food.

Household size was another factor as it was shown to have an influence on food-security status. It was depicted from the study that increasing family size significantly increased the risk of FI. More family members exert more pressure on the household resources and negatively impact the household income, which is the primary cause and significantly associated with FI [32].

The study showed that FI was significantly higher among students whose father was not the head of the family. This can be explained that the father can work in more than one job to support his family financially. Mothers are usually less educated than the father and cannot have a good paying job as she prefers to be a housewife and raises her children. Similarly, a study done in Brazil [33] showed that when the mother was the head of the family, the risk of FI was increased. On the contrary, Kassie *et al.* [34] established that households headed by females were more food-secure compared with the male-headed counterparts.

It was observed from the study that students experiencing FI had a significantly higher BMI than food-secure students, which is similar to the study of Martinez *et al.* [35]. The study supported the hypothesis that FI can cause weight gain as a result of consumption of calorie-dense, poor-quality diets, and metabolic changes as a result of undereating episodes. Increased BMI can also be related to the observed sleep sufficiency, and lack of practicing physical activity among the food-insecure surveyed students [36]. The current study depicted a significant relation between FI with poor sleeping quality and perceiving stress. FI acts as a toxic stressor that disrupts physiological functioning and impairs mental health. It was observed to be associated frequently with higher levels of depression, anxiety, sleep disorder, and stress [37]. Similarly, Ding *et al.* [38] reported that FI might be a cause that contributes to depression among females, and it was found that they were more likely to report sleep complaints compared with the food-secure counterparts. A recent study reported that food-insecure students were three-times higher than their colleagues for the risk of anxiety and depression. Another study found that FI was associated with stigma and it played a role in students' social isolation among urban-college freshmen [39].

The present study showed no observed association between FI and eating disorders. This was perhaps due to unawareness of the students about eating disorders and it needs further in-depth research and interviewing the students to observe their eating behavior. That contradicts a study done in the United States, which found that students who have experienced FI had higher disordered eating behaviors than food-secure students. That can be explained that eating disorders among food-insecure students were related to the psychological stress and possible deviations from healthy eating patterns [9].

The proportion of food-insecure was significantly higher among the students who did not practice physical activity. That was similar to Quyen *et al.* [40] who showed that adults from food-insecure houses were less likely to practice physical activities. This can be explained by two possible mechanisms. The first, FI, could lead to nutrient insufficiency, distress, and poorer health and, so lesser amount and lower intensity of physical activity. Second, a lower amount and intensity of physical activity could lead to poorer general health, higher health costs, lower work productivity, and therefore being unable to afford

enough food. It is possible that the two mechanisms operate simultaneously.

Conclusion

The study showed that FI is present among Cairo University students with high prevalence. It gave evidence that FI was considered to be a significant concern and a major issue. The study highlighted the potential sociodemographic factors that could lead to FI and it has negative health implications. These inputs help in supporting policy makers, academic counselors, nutrition, and health practitioners with information that aids in setting national policy plans.

Policy

The results of the study proved that there is a need for nutritional program for university students. There has to be frequent assessment of the students' sociodemographic characteristics and screening of FI, and then saving their data in a properly well-established information system with regular updating. That can help to identify and prioritize students with the greatest risk for FI as well as program evaluation. The university can provide subsidiary meals by cooperating with nonprofit organizations, also, they can give tuition discount or some sort of scholarship to the students.

Limitations of the study

This study came up with a substantial advance in understanding the FI. It would be great if we could survey more students across the university to compare the FI between different academic levels and programs. But due to the limited resources, we could not achieve that.

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Conflicts of interest

There are no conflicts of interest.

References

- 1 United States Department of Agriculture Economic Research Service 2019. Food security in the U.S. measurement. Available at: <http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/measurement.aspx>. [Accessed date June 2020].

- 2 Bickel G, Nord M, Price C, Hamilton W, Cook J. Guide to measuring household food security, revised. Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service; 2000.
- 3 United States Department of Agriculture. Creating a USDA for the 21st Century. Agency Financial Report; 2015.
- 4 FAO, IFAD, UNICEF, WFP and WHO. The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. Rome: FAO; 2019.
- 5 World Food Program. The status of poverty and food security in Egypt: analysis and policy recommendations. Preliminary Summary Report; 2013.
- 6 Murthy VH. Food insecurity: a public health issue. *Public Health Rep* 2016; 131:655–657.
- 7 Heerman WJ, Wallston KA, Osborn CY, Bian A, Schlundt DG, Barto SD, Rothman RL. Food insecurity is associated with diabetes self-care behaviours and glycaemic control. *Diabet Med* 2016; 6:844–850.
- 8 Seiwright AN, Callis Z, Flatau P. Food insecurity and socioeconomic disadvantage in Australia. *Int J Environ Res Public Health* 2020; 17:559.
- 9 El Zein A, Shelnutt KP, Colby S, Vilaro MJ, Zhou W, Greene G, *et al.* Prevalence and correlates of food insecurity among U.S. college students: a multi-institutional study. *BMC Public Health* 2019; 19:660.
- 10 Morris LM, Smith S, Davis J, Null DB. The prevalence of food security and insecurity among Illinois University Students. *J Nutr Educ Behav* 2016; 48:376–382.e1.
- 11 Bruening M, Argo K, Payne-Sturges D, Laska MN. The struggle is real: a systematic review of FI on postsecondary education campuses. *J Acad Nutr Diet* 2017; 117:1767–1791.
- 12 Nikolaus CJ, Ellison B, Nickols-Richardson SM. Are estimates of food insecurity among college students accurate? Comparison of assessment protocols. *PLoS One* 2019; 14:e0215161.
- 13 Tarasuk V, Fafard St-Germain AA, Mitchell A. Geographic and socio-demographic predictors of household food insecurity in Canada, 2011–12. *BMC Public Health* 2019; 19:12.
- 14 Tabrizi JS, Nikniaz L, Sadeghi-Bazargani H, Farahbakhsh M, Nikniaz Z. Socio-demographic determinants of household food insecurity among Iranian: a population-based study from Northwest of Iran. *Iran J Public Health* 2018; 47:893–900.
- 15 U.S. Adult Food Security Survey Module: Three-stage design, with screeners. US Department of Agriculture Economic Research Service. Available at: <https://www.ers.usda.gov/media/8279/ad2012.pdf>. [Accessed date January 2021].
- 16 United States Department of Agriculture Economic Research Service 2020. Definitions of food security. Available at: <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/definitions-of-food-security.aspx>. [Accessed date January 2021].
- 17 Carole S. The Pittsburgh Sleep Quality Index (PSQI). *Best Pract Informat Care Older Adults* 2012; 6:1.
- 18 Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989; 28:193–213.
- 19 Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983; 24:385–396.
- 20 Shah M, Hasan S, Malik S, Sreeramareddy CT. Perceived stress, sources and severity of stress among medical undergraduates in a Pakistani medical school. *BMC Med Educ* 2010; 10:2.
- 21 Banasiak SJ, Wertheim EH, Koerner J, Voudouris NJ. Test-retest reliability and internal consistency of a variety of measures of dietary restraint and body concerns in a sample of adolescents girls. *Int J Eat Disord* 2001; 29:85–89.
- 22 Constain GA, Rodriguez-Gazquez ML, Ramirez Jimenez GA, Gomez Vasquez GM, Mejia Cardona L, Cardna Velez J. Diagnostic validity and usefulness of the eating attitudes test-26 for the assessment of eating disorders risk in a Colombian male population. *Aten Primaria* 2017; 49:206–213.
- 23 Uzundu C, Ogazi J, Orame N, Okoye C, Igboke C. Factors that enable food insecurity among orphan and vulnerable households in South-east Nigeria. *J Food Sec* 2017; 5:223–231.
- 24 World Food Program. Food Security And Nutritional Status In Egypt Worsening Amidst Economic Challenges. 2013.
- 25 Ukegbu P, Nwofia B, Ndudiri U, Uwakwe N, Uwaegbute A. Food insecurity and associated factors among university students. *Food Nutr Bull* 2019; 40:271–281.
- 26 Van den Berg L, Raubenheimer J. Food insecurity among students at the University of the Free State, South Africa. *South Afr J Clin Nutr* 2015; 28:160–169.
- 27 Job N. Food security status and related factors of undergraduate students receiving financial aid at the University of Kwazulu-natal, Pietermaritzburg Campus. Pietermaritzburg: University of Kwazulu-natal; 2014.
- 28 Darling KE, Fahrenkamp AJ, Wilson SM, D'Auria AL, Sato AF. Physical and mental health outcomes associated with prior food insecurity among young adults. *J Health Psychol* 2017; 22:572–581.
- 29 Whatnall MC, Hutchesson MJ, Patterson AJ. Predictors of food insecurity among Australian university students: a cross-sectional study. *Int J Environ Res Public Health* 2019; 17:60.
- 30 Guerrero N, Walsh MC, Malecki KC, Nieto FJ. Urban-rural and regional variability in the prevalence of food insecurity: the survey of the health of Wisconsin. *WMJ* 2014; 113:133–138.
- 31 Patton-López MM, López-Cevallos DF, Cancel-Tirado DI, Vazquez L. Prevalence and correlates of food insecurity among students attending a midsize rural university in Oregon. *J Nutr Educ Behav* 2014; 46:209–214.
- 32 Wight V, Kaushal N, Waldfogel J, Garfinkel I. Understanding the link between poverty and food insecurity among children: does the definition of poverty matter?. *J Child Poverty* 2014; 20:1–20.
- 33 Bittencourt LS, Santos SMCD, Pinto EDJ, Aliaga MA, Ribeiro-Silva RDC. Factors associated with food insecurity in households of public schoolstudents of Salvador City, Bahia, Brazil. *J Health Popul Nutr* 2013; 31:471–479.
- 34 Kassie M, Ndiritu SW, Stage J. What determines gender inequality in household food security in Kenya? Application of exogenous switching treatment regression. *World Dev* 2014; 56:153–171.
- 35 Martinez SM, Grandner MA, Nazmi A, Canedo ER, Ritchie LD. Pathways from food insecurity to health outcomes among California University Students. *Nutrients* 2019; 11:1419.
- 36 Morales ME, Berkowitz SA. The relationship between food insecurity, dietary patterns, and obesity. *Curr Nutr Rep* 2016; 5:54–60.
- 37 Bruening M, van Woerden I, Todd M, Laska MN. Hungry to learn: The prevalence and effects of food insecurity on health behaviors and outcomes over time among a diverse sample of university freshmen. *Int J Behav Nutr Phys* 2018; 15:9.
- 38 Ding M, Keiley MK, Garza KB, Duffy PA, Zizza CA. Food insecurity is associated with poor sleep outcomes among US adults. *J Nutr* 2015; 145:615–621.
- 39 Bruening M, Brennhof S, van Woerden I, Todd M, Laska M. Factors related to the high rates of food insecurity among diverse, Urban College Freshmen. *J Acad Nutr Diet* 2016; 116:1450–1457.
- 40 Quyen G, Edward A, Gallegos D, Justin B. Household food insecurity is associated with less physical activity among children and adults in the U.S. population. *J Nutr* 2014; 144:1797–1802.