



Food insecurity, dietary intake, and their impact on mental health among university students in Bangladesh

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ABSTRACT

Objective: University students, a significant demographic within the adult population, may often face increased susceptibility to psychological distress and decreased resilience, probably due to the challenges of adjusting to a new life in university. Hence, this study aimed to explore how food insecurity and dietary intake are associated with psychological distress and resilience among university students in Bangladesh.

Methods: Information was collected from May to June 2024 among a sample of 450 students from Noakhali Science and Technology University, Noakhali district, Bangladesh, using a structured questionnaire assessing socio-demographic characteristics, food insecurity status, dietary intake, psychological distress, and resilience.

Results: Results revealed higher level of psychological distress and lower level of resilience among university students. Regression analysis (adjusted for socio-demographics) showed a significant positive association between food insecurity and psychological distress ($b = 0.437, P = 0.005$); however, food consumption score was negatively associated with psychological distress ($b = -0.047, P = 0.012$), indicating higher levels of distress among students experiencing higher food insecurity and lower dietary intake. On the other hand, resilience was observed to be negatively associated with food insecurity ($b = -0.33, P = 0.003$), suggesting that students facing higher food insecurity exhibited lower resilience levels.

Conclusion: The findings provided compelling evidence of the significant impact of food insecurity and dietary intake on mental health outcomes (psychological distress and resilience) among university students. Thus, addressing targeted interventions to improve university students' food insecurity and dietary intake to mitigate their psychological distress and resilience is of urgent need.

1. Introduction

Psychological distress refers to non-specific symptoms of stress, anxiety, and depression that can exacerbate the challenges associated with food insecurity, leading to detrimental effects on students' overall health and academic performance (Viertö et al., 2021). Conversely, resilience, the ability to adapt and recover from adversity, may be a protective factor, helping students navigate food-related challenges more effectively, thereby mitigating psychological distress (Whatnall et al., 2019). Higher levels of resilience are linked to lower levels of psychological distress for university students. Resilient individuals are better equipped to adapt to the transitional nature of university life, including academic pressures, social adjustments, and personal development challenges. They demonstrate excellent problem-solving skills, emotional regulation abilities, and a positive outlook, all of which

contribute to their capacity to navigate stressful situations without succumbing to psychological distress (Ünlü Kaynakçı and Yerin, 2023).

Food insecurity exists when people have limited or uncertain availability of nutritionally adequate and safe foods that meet their dietary needs and food preferences for an active and healthy life (Loofbourrow and Scherr, 2023). It is also a nutritional situation that affects diet and body weight and influences psychological well-being. Food insecurity, in particular, incorporates psychological acceptability difficulties, such that an individual may experience feelings of deprivation due to limited food choices and anxiety about food sources, which might adversely affect psychological health (Myers, 2020). Food insecurity become a growing concern within higher education institutions, particularly in developing countries. Students in higher education (university students), a significant segment of the adult population of society, are more likely to experience food insecurity because of their tight budgets and

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adjusting to a new life in university, changes in housing and lifestyle, the pressure of advance education, and limited access to financial resources (Kelemu et al., 2020). However, this issue not only influences their physical health but also significantly affects their mental well-being and dietary habits (Loofbourrow and Scherr, 2023). Students who experience food insecurity are more likely to eat unhealthy foods and have psychological distress (Meza et al., 2019; Ryan et al., 2022).

Higher psychological misery among university students is also associated with unhealthy lifestyle behaviors, improper dietary intake, excessive consumption of alcohol and smoking, physical inactivity, and irregular sleep patterns (Whatnall et al., 2019). More research has recently been conducted to investigate the relationship between eating habits and psychological well-being. Consuming fruits and vegetables and having regular breakfast is linked to improved self-reported health, happiness, and sleep but is adversely associated with mental anguish and depression. Unhealthy eating habits, such as consuming soft drinks, fast food, and sweets, skipping breakfast, and intake of caffeine, is linked to mental health issues such as depression (Banta et al., 2019; Li et al., 2017; Wattick et al., 2018). Research on Iranian children and adolescents found a significant link between junk food consumption and mental discomfort, including worry, sadness, bewilderment, insomnia, anxiety, anger, and feelings of worthlessness (Hong and Peltzer, 2017).

To the best of our knowledge, no study has been conducted to assess psychological distress and resilience and their association with food insecurity and dietary intake among university students in Bangladesh. There is an urgent need to explore the broader impacts of food insecurity and dietary intake on psychological distress and resilience of young adults in educational settings (García-Martínez et al., 2022). By employing a cross-sectional design, this study aimed to determine the extent to which students' food insecurity status and dietary behaviors influence psychological distress and resilience, offering insights into potential interventions that could support student well-being and academic success.

2. Methods

2.1. Study design, settings, and data collection

This cross-sectional study was conducted from 19/05/2024 to 02/06/2024 among the students of Noakhali Science and Technology University (NSTU), Bangladesh. NSTU is a public university in the Noakhali district of Bangladesh. It has a land area of 101 acres (0.41 km²) and > 6000 undergraduate and graduate students studying at various faculties.

The principal investigator trained some graduate students of Department of Food Technology and Nutrition Science, NSTU regarding data collection processes. In the current study, data collection procedures were conducted as follows:

1. The data collectors approached the prospective subjects and informed them about the objectives and details of the study, potential benefits, and any risks involved.
2. Informed consent (oral and written) was obtained from the students interested in participating in the study and data were collected through a face-to-face interview that took approximately 10–15 min.

2.2. Participants

The students currently studying for at least one year at any faculty of NSTU were recruited in this study. Students with severe acute illnesses (i. e., infections) or who declined to participate were excluded. Sample size was estimated based on Cochran's formula of Z^2pq/d (Sultana et al., 2022), where Z was 1.96 at a 95 % confidence interval, p was the estimated proportion of the population (i.e., assuming 50 % in this case), q was 1-p, and d was the margin of error at 5 %. After considering a 10 % non-response rate, the total sample size was 422. However, information from 450 students was randomly collected for better confidence.

2.3. Study instruments

First, a structured questionnaire was designed in English based on the literature, which was then transferred to Bengali (local language) for better understanding. Two public health experts reviewed the draft questionnaire and necessary modifications were done based on their feedback. To maintain clarity and prevent bias, the English version was translated into Bengali and then back-translated into English by two bilingual professionals. A pilot study was then conducted on 30 students before final data collection to assess the validity and reliability of the questionnaire, but the findings of this were excluded from the final analysis. The final questionnaire was developed based on the findings of the pilot study. The final questionnaire comprised two parts: socio-demographic information and assessment scales.

2.3.1. Socio-demographic questions

The socio-demographic information comprised gender, age, accommodation, academic status, faculty, marital status, family residence, monthly family income, father's education, father's occupation, mother's education, and mother's occupation.

2.3.2. Food consumption score (FCS)

The FCS serves as a proxy indicator for assessing caloric intake and diet quality at the household level, reflecting food security status (WFP, 2008). The FCS has already been validated among Bangladeshi adult population (Rahman et al., 2022). The respondents were asked about their frequency of consumption of various food items over last seven days. Food items were grouped into nine standard food groups with a maximum value of seven days in a week. The consumption frequencies of foods within the same group were totaled and then multiplied by the weight assigned to each food group. The weighted scores for each food group were then summed to obtain the overall score. The standard food groups and their respective weights used in the FCS calculation are detailed elsewhere (WFP, 2008). The formula for calculating FCS is as follows:

$$FCS = \sum x_i \times \sum a_i$$

Where, x_i is frequencies of food consumption (number of days for which each food group was consumed during the past seven days) and a_i is weight of each food group. Lastly, the status of food consumption was determined based on the scores as follows: poor (0–21), borderline (21.5–35), and acceptable (> 35).

2.3.3. Food insecurity experience scale (FIES)

The FIES is a tool to measure food access at the individual/household level over the preceding 12 months due to financial constraints or limited resources. It is an experience-based measure of the severity of the food insecurity condition of an individual/household (that is, the constraints on the ability to access food). This scale comprised eight questions designed to assess the various dimensions of food insecurity, including concerns about food availability, dietary diversity, meal skipping, and hunger (Coates et al., 2007). Participants were asked to respond to each question by indicating whether they experienced the described scenario during the past year with two possible options: "Yes" or "No." A raw score of 0 was assigned for negative responses and 1 for affirmative responses. The overall FIES score was the sum of the scores from all eight questions, which was then categorized into the following severity levels: food secure (0), mild food insecurity (1–3), moderate food insecurity (4–6), and severe food insecurity (7–8) (Ya et al., 2021).

2.3.4. Kessler psychological distress scale (K10)

The K10, a widely recognized instrument used to assess an individual's level of psychological distress, was developed by Kessler et al. (Kessler et al., 2002) This K10 scale consists of 10 items designed to measure symptoms of anxiety and depression experienced over the past

30 days, for example, “about how often did you feel hopeless” over the past 30 days. The questions cover various aspects of psychological distress, including feelings of nervousness, hopelessness, restlessness, worthlessness, etc. Participants responded to each question using a 5-point Likert scale, ranging from 1 (none of the time) to 4 (all of the time). The scores for all ten questions were summed to obtain a total score ranging from 10 to 50, where higher scores indicated higher levels of psychological distress. The reliability of the K10 scale was tested using Cronbach’s coefficient alpha (α), and a value of 0.822 was obtained.

2.3.5. Brief resilience scale (BRS)

Resilience involves the ability of the participants to rebound from stress as an underlying psychological trait (Whatnall et al., 2019). It was assessed using the BRS. On this six-item scale, the participants were asked to rate their level of responses using a 5-point Likert scale, scoring from strongly disagree (1) to strongly agree (5). Half of the six items were negatively, and half were positively worded. The scores of the negatively worded questions were reversed during the analysis. The participants’ mean scores for each item were analyzed, and the participants had low, normal, and high resilience when their average scores for items were between 1.00 and 2.99, 3.00–4.30, and 4.31–5.00, respectively. The reliability of the scale was verified using Cronbach’s coefficient alpha ($\alpha = 0.709$).

2.4. Ethical approval

The study protocol was approved by the Ethical Committee of Noakhali Science and Technology University (Reference no: NSTU/SCI/EC/2024/248).

2.5. Statistical analysis

The socio-demographics were presented by frequency and percentages. The K10 and BRS scales were presented as mean and standard deviation (SD). The Shapiro-Wilk test was performed for the continuous variables to determine the normality of the distribution. Pearson’s correlation was conducted to ascertain the relationship of psychological distress and resilience with food insecurity and dietary intake among participants. At the same time, the association between the variables detailed was analyzed using the F test. A linear regression analysis was performed to control the relationship between each variable. All statistical analyses were done using Statistical Package for the Social Sciences (SPSS) (version 27.0) for Windows (SPSS, Inc. Chicago. IL, USA), and $P < 0.05$ was set as statistical significance.

3. Results

The sociodemographic characteristics of the participants ($n = 450$) are presented in Table 1. The gender distribution showed 55.6 % female students and 44.4 % males. Most of the participants were between 21 and 25 years old and predominantly resided in university halls (71.3 %). Most were undergraduate students (86.2 %), whereas only 13.8 % were doing postgraduate. More than half of the participants were from the science faculty (58.7 %), followed by arts (23.5 %), business (9.8 %), and engineering (8.0 %). Nearly all of the participants were unmarried (93.8 %). The participants came from both rural (45.6 %) and urban (54.4 %) backgrounds, with more than half (67.8 %) having a monthly family income exceeding 15,000 BDT. Tertiary education levels were more common among fathers (62.2 %) than mothers (46.4 %). Most fathers were employed (66.4 %), and most mothers were housewives (88.2 %). Majority of the students had acceptable food consumption, while only one-tenth reported to be food secured. The Shapiro-Wilk test gave a p -value above 0.05, indicating that the data followed a normal distribution without significant deviation.

Table 2 presents the mean scores and SD for each item on the K10, highlighting the frequency and variability of psychological distress

Table 1

Socio-demographic characteristics of participants in Bangladesh, 2024.

Variables	Frequency	%
Gender		
Male	200	44.4
Female	250	55.6
Age (years)		
≤20	43	9.6
21–25	382	84.8
>25	25	5.6
Accommodation		
University hall	321	71.3
With family/friends/mess	129	28.7
Academic status		
Undergraduate	388	86.2
Postgraduate	62	13.8
Faculty		
Science	264	58.7
Engineering	36	8.0
Business	44	9.8
Arts	106	23.5
Marital status		
Unmarried	422	93.8
Currently married	27	6.0
Divorced/separated/widowed	1	0.2
Family residence		
Rural	205	45.6
Urban	245	54.4
Monthly family income (BDT)		
≤15,000	145	32.2
>15000	305	67.8
Father’s education		
No formal schooling	37	8.2
Primary	56	12.4
Secondary	77	17.2
Tertiary	280	62.2
Father’s occupation		
Service	299	66.4
Self-employed	151	33.6
Mother’s education		
No formal schooling	22	4.9
Primary	91	20.2
Secondary	128	28.5
Tertiary	209	46.4
Mother’s occupation		
Service	53	11.8
Housewife	397	88.2
Food Consumption Score (FCS)		
Poor	11	2.4
Borderline	58	12.9
Acceptable	381	84.7
Food security status (FIES)		
Food secured	47	10.4
Mild food insecurity	148	32.9
Moderate food insecurity	205	45.6
Severe food insecurity	50	11.1

BDT: Bangladeshi taka, FIES: Food insecurity experience scale.

Table 2
Distribution of measurement items for the 10-item Kessler psychological distress scale among participants in Bangladesh, 2024.

Questions (During the last 30 days, about how often did you ...)	Mean	SD
feel tired out for no good reason?	2.59	1.14
feel nervous?	2.70	1.03
feel so nervous that nothing could calm you down?	2.29	1.03
feel hopeless?	2.52	1.18
feel restless or fidgety?	2.73	1.24
feel so restless you could not sit still?	2.15	1.10
feel depressed?	2.88	1.27
feel that everything was an effort?	2.87	1.18
feel so sad that nothing could cheer you up?	2.65	1.20
feel worthless?	2.76	1.24

SD: Standard deviation.

symptoms experienced by respondents over the last 30 days. On average, respondents reported moderate fatigue with a mean score of 2.59 and a standard deviation of 1.14, indicating low variability in fatigue experiences. The average score for feeling so nervous that nothing could calm them down was 2.29, with an SD of 1.03, showing moderate distress with some variability. The average scores for other symptoms, such as the feelings of nervousness, hopelessness, fidgety, restlessness, depression, effortfulness, sadness, and worthlessness, were in the range of 2.15–2.88, indicating a moderate level of the symptoms with variability in responses observed by the SD (1.03–1.27). Psychological distress was prevalent among the students. Around 78.2 % of the students had mild/moderate/severe levels of psychological distress.

The data outlining the BRS measurement items among the participants are delineated in Table 3. The mean score for nearly all the items was close to 3.00 (2.92–3.29), with a standard deviation of 0.99–1.22. This suggests that, on average, respondents reported neutral agreement with the statements, and most demonstrated normal resilience. Half of the students (50.9 %) were observed to have low resilience, and about 45.1 % of the students had normal resilience.

Table 4 examines the level of psychological distress and resilience according to food insecurity and dietary intake of the participants. It was observed that the students who were food secured had lower psychological distress (K10 score) compared to food insecured (23.21 ± 7.84 vs. 29.00 ± 6.80) students. Moreover, those with acceptable food consumption had lower K10 score than with borderline food consumption (25.75 ± 7.29 vs. 29.16 ± 6.49). Regarding resilience, no statistically significant differences were noted between any of food insecurity or food consumption score categories.

Fig. 1 illustrates the correlation between psychological distress with food insecurity and food consumption score (Fig. 1a and b), as well as the correlation between resilience with food insecurity and food consumption score (Fig. 1c and d). Psychological distress was found to be positively correlated with food insecurity ($r = 0.154$) and negatively correlated with food consumption scores ($r = -0.135$). Both were statistically significant ($P < 0.05$), indicating that students had lower psychological distress when they were more food insecure and had higher food consumption scores. There was a significant ($P < 0.05$) negative correlation between resilience and food insecurity ($r =$

Table 3
Distribution of measurement items for the Brief resilience scale among participants in Bangladesh, 2024.

Items	Mean	SD
1. I tend to bounce back quickly after hard times	2.92	1.22
2. I have a hard time making it through stressful events	3.18	0.99
3. It does not take me long to recover from a stressful event	2.98	1.13
4. It is hard for me to snap back when something bad happens	3.12	0.99
5. I usually come through difficult times with little trouble	3.29	1.09
6. I tend to take a long time to get over set-backs in my life	3.08	1.19

SD: Standard deviation.

-0.125), suggesting that resilience decreases as food insecurity increases. A positive correlation between resilience and food consumption scores was also observed ($r = 0.089$); however, the relation was statistically insignificant ($P > 0.05$).

Table 5 presents a linear regression analysis examining the influence of food insecurity and food consumption scores on psychological distress and resilience among participants, adjusted for socio-demographic variables. Results revealed that an increase in food insecurity status increased psychological distress by 0.437 times ($P = 0.005$). However, psychological distress reduced as food consumption scores enhanced ($b = -0.047$, $P = 0.012$). Concerning resilience, increment in food insecurity status resulted in 0.33 times decrease in resilient score, in a statistically significant manner ($P = 0.003$).

4. Discussion

The present study investigated the association of psychological distress and resilience with food insecurity and dietary intake among university students in Bangladesh. Psychological distress was highly prevalent among the students (78.2 %) compared to the previous studies conducted on the students of Saudi Arabia (31 %) (Hakami, 2018), China (40.7 %) (Tang et al., 2018), Northeast Ethiopia (53.2 %) (Kelemu et al., 2020), Ireland (41.9 %) (Deasy et al., 2014), and Ethiopia (21.6 %) (Dessie et al., 2013). However, Zhang et al. (Zhang et al., 2018) and Stallman (Stallman, 2010) observed a higher prevalence of psychological distress among students in China (90.86 %) and Australia (83.90 %), respectively. Psychological distress is a significant concern for young adults, particularly during their university days. Various factors contribute to this distress due to the rapid changes and challenges in their social and physical environments. Cultural beliefs, peer relationships, and the transition from home to university all play a role in influencing students' behavior and adjustment (Tang et al., 2018; Dyson and Renk, 2006; Chhetri et al., 2021).

In this study, half of the students had low resilience, which align with the previous studies among dental students in Bangladesh (Sabrina et al., 2021) and medical students in Poland (Forycka et al., 2022). However, a meta-analysis by Chua et al. (Chua et al., 2023) observed a pooled prevalence of low resilience of about 36 % among 13,931 students across 18 countries, which was slightly lower than the findings of this study. The discrepancy in the prevalence of psychological distress and resilience with the previous studies might be due to the different assessment scales with varying values of cutoff and/or having different sociodemographic attributes and cultures and/ or variations in the comprehension of social self-assurance, self-assessment, and adaptive behavior patterns (Sahoo and Khess, 2010; Litwic-Kaminska et al., 2023).

Food and psychological distress are interrelated (Myers, 2020). In this study, food insecurity status were found to be positively associated with psychological distress. Previous studies also reported a significant positive association between food insecurity and multiple indicators of psychological distress (Meza et al., 2019; Bruening et al., 2018; Perkins et al., 2018; Jones, 2017). Myers (Myers, 2020) reviewed a few previous cross-sectional and longitudinal studies, including primary and secondary data, from countries of varying income levels among different populations, such as adults, college students, individuals with chronic diseases, and parents. The review highlighted the increasing occurrence of psychological problems among food-insecure students. Compared to food-secure students, individuals experiencing food insecurity are more likely to face poor mental health outcomes, thereby causing lower academic performance and reduced grade point averages (Maroto et al., 2015). Still, more qualitative research and longitudinal studies are required to explore the mechanism behind the dynamic association between food insecurity and psychological distress among university students.

Unhealthy and poor dietary habits have not been conclusively proven as a cause of psychological disorders. Still, it has been predicted

Table 4
Relationship of psychological distress and resilience with food insecurity and dietary intake among participants in Bangladesh, 2024.

Variable			K10			BRS	
		Mean (SD)	F	Sig.*	Mean (SD)	F	Sig.*
Food insecurity	Food secured	23.21 (7.84)	5.37	0.001	3.08 (0.61)	2.13	0.095
	Mild	26.20 (7.44)			3.06 (0.54)		
	Moderate	26.06 (6.76)			2.93 (0.54)		
	Severe	29.00 (6.80)			2.97 (0.23)		
	Poor	23.55 (3.01)			2.93 (0.37)		
Food consumption score	Borderline	29.16 (6.49)	6.49	0.002	2.95 (0.31)	0.23	0.793
	Acceptable	25.75 (7.29)			3.00 (0.55)		

BRS: Brief resilience scale, K10: 10-item Kessler Psychological Distress scale, SD: Standard deviation.*One-way ANOVA test.

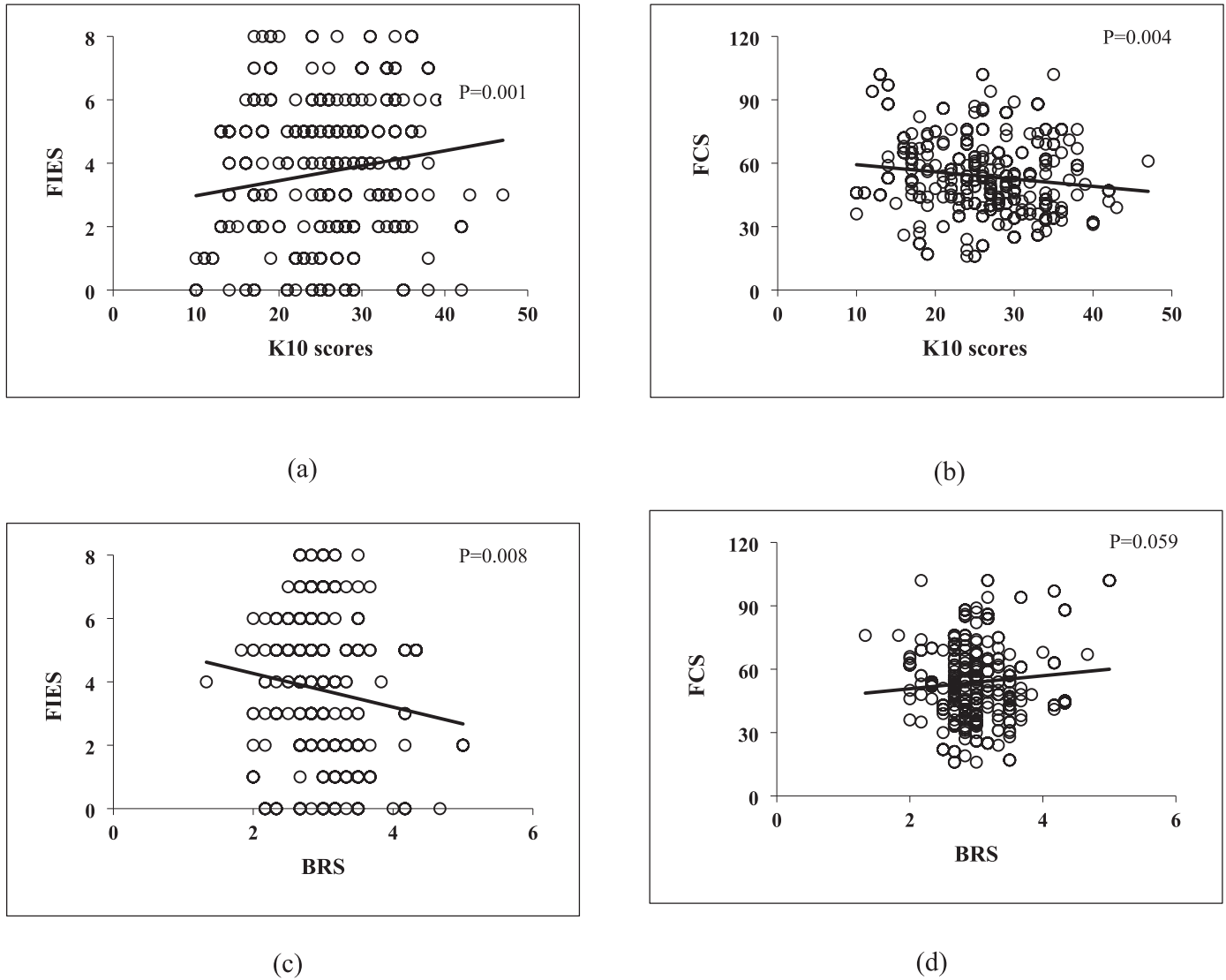


Fig. 1. Correlation of 10-item Kessler psychological distress scale (a and b) and Brief resilience scale (c and d) scores with Food insecurity experience scale and food consumption score among participants in Bangladesh, 2024. BRS: Brief resilience scale, FCS: Food consumption score, FIES: Food insecurity experience scale, K10: 10-item Kessler Psychological Distress scale.

that good dietary behavior may protect from various mental health-related issues (Banta et al., 2019). Like the findings of this study, a few kinds of literature also reported a significant negative association between food consumption and psychological distress. For example, multivariate regression models including 2710 students of the University of Newcastle, Australia, determined that after adjustment for the potential confounders, high intake of fruit and vegetables, frequent

eating of breakfast, and less consumption of soft drinks and takeaway foods associated with low psychological distress (Whatnall et al., 2019). In addition, a meta analysis by Li et al. (Li et al., 2017) suggested that healthy eating behavior (high consumption of fruits, vegetables, antioxidant-rich foods, low-fat foods, fish, etc.) may reduce the risk of mental health problems, such as depression. In contrast, a western diet (processed foods, fatty foods, refined grains, sweets, alcohol, soft drinks,

Table 5
Multiple linear regression analysis for psychological distress and resilience explained by food insecurity and dietary intake among participants in Bangladesh, 2024.

Variables	K10 ^b		BRS ^c	
	b	95 % CI	b	95 % CI
Food insecurity	0.44	[0.13, 0.74]	−0.33	[−0.06, −0.01]
Food consumption score	−0.05	[−0.08, −0.01]	0.002	[−0.001, 0.004]

b: Unstandardized regression coefficient, BRS: Brief resilience scale, CI: Confidence interval, K10: 10-item Kessler Psychological Distress scale. ^cThe regression models was adjusted for gender, age, accommodation, academic status, faculty, marital status, family residence, monthly family income, father's education, father's occupation, mother's education, and mother's occupation.

etc.) may enhance its risk. Thus, healthy eating may correspond with lower levels of psychological distress in university students, thereby improving their overall mental health and well-being (Wattick et al., 2018; Ramón-Arbués et al., 2021).

A significant negative correlation between food insecurity and resilience observed in this study reveals that students facing food insecurity tend to have lower levels of resilience, which may exacerbate the adverse effects of psychological distress. The findings of this study are in line with the previous research by Bubis et al. (Bubis et al., 2023) who studied among college students via social media and messaging platforms. They explored the negative correlation between resilience and food insecurity and reported that food-insecure individuals were more likely to feel stressed and less confident in their ability to handle stress. Nevertheless, the findings of the present study underscore the importance of resilience as a protective factor against the detrimental impacts of stressors such as food insecurity and suggest the importance of resilience-focused interventions in promoting the mental health and well-being of the university students (Ünlü Kaynakçı and Yerin, 2023).

This study contributes to understanding the interplay between psychological distress, resilience, food insecurity, and dietary intake among university students. By identifying the key factors influencing mental health outcomes in this population, policymakers and educators can develop targeted interventions to promote students' well-being and academic success. Firstly, addressing food insecurity, such as campus food assistance programs and financial aid initiatives, may help alleviate psychological distress and enhance resilience among vulnerable students. Additionally, promoting healthy dietary behaviors and nutritional literacy through education and campus-wide initiatives could mitigate the adverse effects of poor nutrition on mental health. Moreover, incorporating resilience-building strategies into university curricula and student support services may empower students to cope with stressors and challenges better, reducing their susceptibility to psychological distress.

5. Limitations

This study has several limitations. Firstly, it is a descriptive and cross-sectional study, which limits the ability to establish cause-effect relationships. Secondly, the sample is not representative although a large number of subjects were included. Thirdly, NSTU is a university situated in a rural area, where the students were relatively uniform and the data were self-reported through face-to-face interviews. This interview-based data collection method, while ensuring higher response rates and clarification opportunities, may have introduced social desirability bias compared to an online-based survey. Participants might have been reluctant to disclose sensitive information about their food insecurity status, psychological distress, or resilience levels when directly interacting with interviewers, potentially leading to underreporting of negative experiences. This effect may be particularly pronounced when discussing mental health issues or financial hardships in Bangladeshi cultural contexts, where such topics can carry stigma. Future studies

might benefit from employing mixed methods or anonymous self-administered questionnaires to potentially reduce this bias. Therefore, the findings would be more significant if data were collected using multiple methodologies from a diverse group of university students across Bangladesh.

6. Conclusion

This study was the first to explore the intricate association of psychological distress and resilience with food insecurity and dietary intake among university students in Bangladesh. Results revealed higher level of psychological distress and lower level of resilience among university students. After adjusting for socio-demographic variables, the regression model demonstrated a significant positive and a significant negative association of food insecurity and food consumption score with psychological distress, respectively, revealing that students who experienced higher food insecurity and lower dietary intake tended to report elevated psychological distress. Moreover, a significant negative association between resilience and food insecurity was found, indicating that students were 0.33 times more resilient when their food insecurity decreased. This study identified that addressing food insecurity and ensuring adequate nutrition could be critical in mitigating psychological distress and enhancing resilience, thereby improving the students' overall well-being. Future interventions should consider these factors to create a supportive environment promoting mental health and academic success.

CRedit authorship contribution statement

Marjia Sultana: Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Towhid Hasan:** Writing – review & editing, Formal analysis, Conceptualization. **Md. Mahmudul Hasan Shohag:** Writing – original draft, Data curation. **Nibadita Majumder:** Writing – original draft, Data curation. **Nishat Subah Tithi:** Writing – original draft, Data curation. **Md. Mahbub Alam:** Data curation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data presented in this study are available on request from the corresponding author.

References

Banta, J.E., Segovia-Siapco, G., Crocker, C.B., et al., 2019. Mental health status and dietary intake among California adults: a population-based survey. *Int. J. Food Sci. Nutr.* 70, 759–770.
Bruening, M., van Woerden, I., Todd, M., et al., 2018. 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. Act.* 15, 9.
Bubis, S., Chowdhury, U., Nagorny, K., et al., 2023. Effects of food insecurity on nutrition, stress, and resilience. *Physiology* 38, 5730130.

- Chhetri, B., Goyal, L.M., Mittal, M., et al., 2021. Estimating the prevalence of stress among Indian students during the COVID-19 pandemic: a cross-sectional study from India. *Journal of Taibah University Medical Sciences* 16, 260–267.
- Chua, J.H., Cheng, C.K.T., Cheng, L.J., et al., 2023. Global prevalence of resilience in higher education students: a systematic review, meta-analysis and meta-regression. *Current Psychology* 42, 22645–22663.
- Coates, J., Swindale, A., Bilinsky, P., 2007. Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide (v. 3). FHI, Washington, D.C., p. 360/FANTA.
- Deasy, C., Coughlan, B., Pironom, J., et al., 2014. Psychological distress and coping amongst higher education students: a mixed method enquiry. *PloS One* 9, e115193.
- Dessie, Y., Ebrahim, J., Awoke, T., 2013. Mental distress among university students in Ethiopia: a cross sectional survey. *Pan Afr. Med. J.* 15, 95.
- Dyson, R., Renk, K., 2006. Freshmen adaptation to university life: depressive symptoms, stress, and coping. *J. Clin. Psychol.* 62, 1231–1244.
- Forycka, J., Pawłowicz-Szlarska, E., Burczynska, A., et al., 2022. Polish medical students facing the pandemic-assessment of resilience, well-being and burnout in the COVID-19 era. *PloS One* 17, e0261652.
- García-Martínez, I., Augusto-Landa, J.M., Quijano-López, R., et al., 2022. Self-concept as a mediator of the relation between university students' resilience and academic achievement. *Frontiers in Psychology* 12 (Original Research).
- Hakami, R.M., 2018. Prevalence of psychological distress among undergraduate students at Jazan University: a cross-sectional study. *Saudi Journal of Medicine and Medical Sciences* 6 (82–88), 20180416.
- Hong, S.A., Peltzer, K., 2017. Dietary behaviour, psychological well-being and mental distress among adolescents in Korea. *Child Adolesc. Psychiatry Ment. Health* 11 (56), 20171128.
- Jones, A.D., 2017. Food insecurity and mental health status: a global analysis of 149 countries. *Am. J. Prev. Med.* 53, 264–273.
- Kelemu, R.T., Kahsay, A.B., Ahmed, K.Y., 2020. Prevalence of mental distress and associated factors among Samara University students. *Northeast Ethiopia. Depression Research and Treatment* 2020, 7836296.
- Kessler, R.C., Andrews, G., Colpe, L.J., et al., 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol. Med.* 32, 959–976.
- Li, Y., Lv, M.R., Wei, Y.J., et al., 2017. Dietary patterns and depression risk: a meta-analysis. *Psychiatry Res.* 253 (373–382), 20170411.
- Litwic-Kaminska, K., Błachnio, A., Kapsa, I., et al., 2023. Resilience, positivity and social support as perceived stress predictors among university students. *Int. J. Environ. Res. Public Health* 20, 6892.
- Loofbourrow, B.M., Scherr, R.E., 2023. Food insecurity in higher education: a contemporary review of impacts and explorations of solutions. *Int. J. Environ. Res. Public Health* 20, 5884.
- Maroto, M.E., Snelling, A., Linck, H., 2015. Food insecurity among community college students: prevalence and association with grade point average. *Community College Journal of Research and Practice* 39, 515–526.
- Meza, A., Altman, E., Martinez, S., et al., 2019. "It's a feeling that one is not worth food": a qualitative study exploring the psychosocial experience and academic consequences of food insecurity among college students. *J. Acad. Nutr. Diet.* 119, 1713–1721.e1711.
- Myers, C.A., 2020. Food insecurity and psychological distress: a review of the recent literature. *Current Nutrition Reports* 9, 107–118.
- Perkins, J.M., Nyakato, V.N., Kakuhikire, B., et al., 2018. Food insecurity, social networks and symptoms of depression among men and women in rural Uganda: A cross-sectional, population-based study. *Public Health Nutrition* 21, 838–848.
- Rahman, M.N., Alam, S.S., Mohsin, F.M., et al., 2022. Dietary habits, food consumption, energy and nutrients intake of adults of selected areas of Bangladesh. *Indian Journal of Public Health Research & Development* 13, 188–197.
- Ramón-Arbués, E., Granada-López, J.-M., Martínez-Abadía, B., et al., 2021. Factors related to diet quality: a cross-sectional study of 1055 university students. *Nutrients* 13, 3512.
- Ryan, R.A., Murphy, B., Deierlein, A.L., et al., 2022. Food insecurity, associated health behaviors, and academic performance among Urban University undergraduate students. *J. Nutr. Educ. Behav.* 54, 269–275.
- Sabrina, F., Chowdhury, M.T.H., Nath, S.K., et al., 2021. Psychological distress among Bangladeshi dental students during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health* 19, 20211224.
- Sahoo, S., Khess, C.R.J., 2010. Prevalence of depression, anxiety, and stress among young male adults in India: a dimensional and categorical diagnoses-based study. *J. Nerv. Ment. Dis.* 198, 901–904.
- Stallman, H.M., 2010. Psychological distress in university students: a comparison with general population data. *Aust. Psychol.* 45, 249–257.
- Sultana, M., Dhar, S., Hasan, T., et al., 2022. Knowledge, attitudes, and predictors of exclusive breastfeeding practice among lactating mothers in Noakhali. *Bangladesh. Heliyon* 8, e11069.
- Tang, F., Byrne, M., Qin, P., 2018. Psychological distress and risk for suicidal behavior among university students in contemporary China. *J. Affect. Disord.* 228, 101–108.
- Ünlü Kaynakçı, F.Z., Yerim, Güneri O., 2023. Psychological distress among university students: the role of mindfulness, decentering, reappraisal and emotion regulation. *Curr. Psychol.* 42, 14823–14833.
- Viertiö, S., Kiviruusu, O., Piirtola, M., et al., 2021. Factors contributing to psychological distress in the working population, with a special reference to gender difference. *BMC Public Health* 21, 611.
- Wattick, R.A., Hagedorn, R.L., Olfert, M.D., 2018. Relationship between diet and mental health in a young adult appalachian college population. *Nutrients* 10, 957.
- WFP, 2008. Food Consumption Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis. World Food Programme, Rome.
- Whatnall, M.C., Patterson, A.J., Siew, Y.Y., et al., 2019. Are psychological distress and resilience associated with dietary intake among Australian university students? *Int. J. Environ. Res. Public Health* 16, 20191024.
- Ya, R.M., Sidek, S., Ab Rahman, J., et al., 2021. Translation and validation of food insecurity experience scale (FIES). *Malays. J. Nutr.* 27.
- Zhang, M., Zhang, J., Zhang, F., et al., 2018. Prevalence of psychological distress and the effects of resilience and perceived social support among Chinese college students: does gender make a difference? *Psychiatry Res.* 267, 409–413.