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Original Research

Stress, Dietary Patterns, History of Stomach Disorders, and Gastrointestinal Symptoms in Boarding-School Students

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ABSTRACT

Introduction: Stress, dietary behaviors, and previous stomach disorders may be associated with gastrointestinal symptoms among adolescents in boarding-school settings.

Objective: To assess associations of stress, dietary patterns, and history of stomach disorders with self-reported gastrointestinal symptoms in boarding-school students in Lebak Regency, Indonesia.

Method: This cross-sectional study included 111 students selected using stratified sampling. Questionnaire data were analyzed using modified Poisson regression to estimate prevalence ratios (PRs) and 95% confidence intervals.

Result: In the reported full model, stress (PR = 1.59; 95% CI 1.16–2.19) and history of stomach disorders (PR = 1.57; 95% CI 1.15–2.15) were positively associated with gastrointestinal symptoms, while inadequate dietary patterns showed an inverse association (PR = 0.57; 95% CI 0.38–0.85). Dietary category counts are inconsistent across the submitted tables and require verification.

Conclusion: Stress, previous stomach disorders, and dietary-pattern classifications were associated with questionnaire-based gastrointestinal symptoms. Cross-sectional measurement, overlapping questionnaire constructs, and inconsistent dietary counts limit interpretation.

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INTRODUCTION

Gastrointestinal symptoms is a global health problem that continues to receive public health attention due to its high prevalence worldwide More than 40% of people worldwide suffer from functional gastrointestinal (GI) disorders (1). This affects individuals of all ages but is more common among adolescents, particularly those aged 15–25. Studies have reported a gastritis prevalence of 24.6% among individuals aged 10–25. Several studies have shown a high prevalence of gastrointestinal symptoms among adolescents, including students and school-age populations (2).

Gastrointestinal symptoms is a condition that characterized by dyspeptic symptoms such as abdominal pain or burning, nausea, vomiting, bloating, postprandial fullness, epigastric discomfort, early satiety, and decreased appetite. However, these symptoms are nonspecific and may occur in gastritis, functional dyspepsia, gastroesophageal reflux disease, peptic ulcer disease, and other gastrointestinal conditions. Therefore, symptom-based assessment should be distinguished from a clinical diagnosis of gastritis, which requires appropriate clinical evaluation (3). Therefore, this study assessed self-reported gastrointestinal symptoms rather than clinically confirmed gastritis.

Lifestyle factors such as an unhealthy diet and high stress levels may play a significant role in the development of these symptoms (4,5). Irregular eating habits, rushing, overeating, and consuming spicy or heavily seasoned foods are consistently associated with gastrointestinal symptoms. Several studies have shown that adolescents with poor eating habits are more likely to develop these symptoms. Furthermore, psychological stress has been shown to significantly contribute to gastrointestinal symptoms among adolescents, with moderate stress being the most common trigger (6). These risk factors are particularly relevant among students living in boarding schools, where structured daily routines, limited free time, and academic demands can lead to irregular meal schedules and increased stress. Students may delay or skip meals for fear of being late for school or other obligations, increasing their susceptibility to gastritis. Stress can be influenced by internal factors, such as frustration and adaptation challenges, and external factors, including environmental changes and limited communication with family. Gastrointestinal symptoms can disrupt daily activities and health-related behaviors (7)**.**

Previous studies examining the relationship between diet, stress, and gastrointestinal symptoms among adolescents have yielded inconsistent findings. Although some studies have reported a significant association between poor eating habits, stress, and the symptoms, others have found only one of these factors to be significant. Therefore, this study aimed to explore the relationship between eating habits, stress levels, history of stomach disorders and gastrointestinal symptoms among students at Boarding School, with the hope that the findings will contribute to prevention strategies and health promotion efforts among adolescents in Banten Province.

METHOD

This study utilized a cross-sectional design conducted within a single observation period. The research was carried out in La Tansa Boarding School, Lebak Regency, Banten Province, Indonesia, between January and April 2025. A total of 111 respondents were selected from accessible population who met the eligibility criteria, as illustrated in Figure 1. The sampling technique used was stratified random sampling. Students were stratified according to class level. Within each stratum, eligible students were selected using a random selection procedure. The

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sampling process also considered the distribution of sex within the student population. No replacement was performed after selection, and students who did not meet the eligibility criteria were excluded according to the predefined criteria.

Participants included registered as students at the designated Boarding School, students who are willing to participate and have signed an informed consent. Although the students were still adolescents and required parental informed consent, obtaining written consent was difficult due to their residence in a dormitory. Consequently, informed consent was obtained only verbally through the students' dormitory supervisors before questionnaire administration. Exclusion criteria included students who had previously been diagnosed with gastritis before entering the boarding school, and students who were not present during the study.

The sample size was determined using the standard formula for estimating population proportions, as proposed by Lemeshow (1991), which is commonly applied to calculate the minimum sample size required to compare two proportions in cross-sectional or prevalence studies through manual calculation(8). The sample was selected from a population that met the inclusion criteria and was representative of the broader target population. The required sample size was computed using the following formula:

$$n = \frac{Z_\alpha{}^2 PQ}{d^2}$$

n = 96 samples

Description:

n = sample size

Zα = 1.96 (95% confidence level)

P = 0.536 (proportion of gastrointestinal symptoms in students based on literature)

Q = 1 – P = 0.464

D = Margin of error (0.1)

The minimum sample size was approximately 96 participants. To reduce the risk of sample dropout from groups that met the inclusion criteria, the sample size was increased by approximately 10%. This adjustment was intended to ensure that the number of samples analyzed remained adequate. The minimum total sample size was calculated as 106. A total of 111 eligible students were ultimately included in the analysis. Data collection involved interviews using a demographic questionnaire to gather general participant information.

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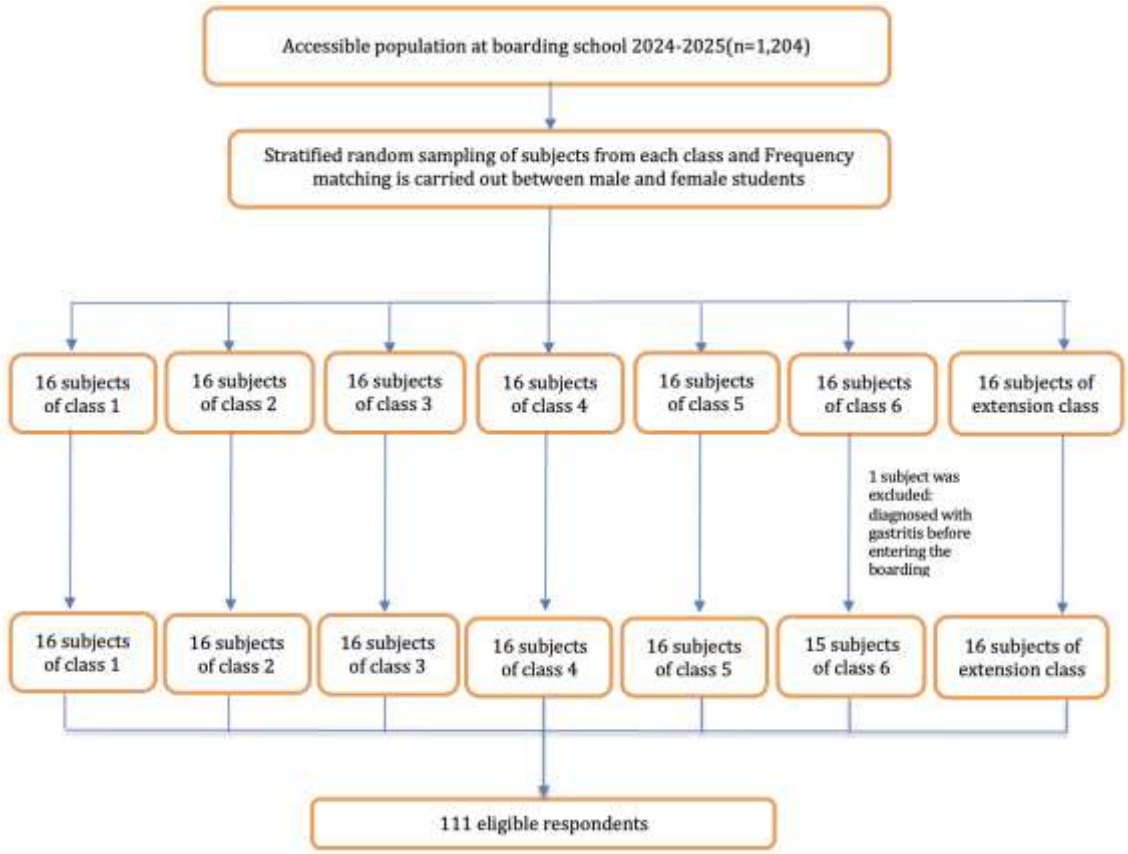


Figure 1. Sampling Process

Gastrointestinal symptoms was defined as symptoms including abdominal pain, a feeling of fullness, bloating, nausea, sometimes vomiting, belching, loss of appetite, and a sour taste in the mouth (9). The term gastrointestinal symptoms used in this study refers to a constellation of subjective complaints rather than a clinical diagnosis by self reported symptoms. The gastrointestinal symptoms questionnaire used was adapted from previous research that has been declared valid and reliable (10). This questionnaire consisted of 14 questions with response options on a Likert scale (never, sometimes, often, and very often). Each item is scored from 1 to 4, giving a gastrointestinal symptoms subscale score of 14–56. Determination of gastrointestinal scoring categorization on the questionnaire based on hypothetical scores. Scores are categorized into low (14-27), moderate (28-41), and high (42-56). Then these were categorized into mild and moderate-severe gastrointestinal symptom. The scope of this questionnaire included gastrointestinal complaints (in the form of abdominal pain, burning/discomfort in the chest, nausea, dizziness, bloating), symptoms that arise when consuming coffee/caffeine and acidic foods, symptoms that arise when eating late, skipping breakfast, skipping snacks, skipping lunch, and skipping dinner.

Stress levels were defined as the body's physiological and non-specific response to internal and external demands and pressures (11). The stress level questionnaire was based on the Indonesian version of the DASS-42 criteria, which has been declared valid and reliable in previous research testing (12). This questionnaire consisted of 14 statements with response options on a Likert scale (never, sometimes, often, very often. Each item is scored from 0 to 3, giving a stress subscale score of 0–42. The results of stress level measurements in this questionnaire are divided into normal (score 1-14), mild (score 15-18), moderate (score 19-25),

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severe (score 26-33), and very severe (score≥34). Then these were categorized into stress and no stress. The statements in the questionnaire cover attitudes towards certain situations, difficulties in relaxing/resting, attitudes of annoyance/anger/anxiety, tolerance of disturbances, tense and easily agitated conditions.

The dietary pattern variable is defined as respondents' eating habits, which include food type, meal frequency, meal time, and types of food and drinks (13). This questionnaire used was adapted from previous research that has been declared valid and reliable(14). This questionnaire consisted of 16 statements with response options on a Likert scale (never, sometimes, often, very often. Each item is scored from 1 to 4, giving a dietary pattern subscale score of 16–64. Determination of dietary habits scoring categorization on the questionnaire based on hypothetical scores. Scores are categorized into adequate dietary patterns (41–64), and inadequate dietary patterns (16–40). Question items in the questionnaire include meal frequency, meal schedule, amount of food consumed, snack consumption habits, rice for breakfast, types of food consumed (spicy food, sour food, instant food), coffee consumption, consumption of soft drinks, and volume of water consumed. Additional variables included age, gender, and history of stomach disorder. Data processing involved editing, coding, scoring, and entry. Analysis included univariate, bivariate (poisson regression with robust standard errors**,** $p < 0.05$), and multivariate methods (modified poisson regression), where appropriate using STATA version 16 and reporting prevalence ratios (PR) with 95% confidence intervals.

The study protocol was approved by the Institutional Review Board of Faculty of Medicine and Health Sciences, Sultan Ageng Tirtayasa University (IRB No. 36/UN.43.20/KEPK/2025). The research data came from primary data of student in boarding school of Lebak Regency, Banten Province, Indonesia. All data used in this study will be kept the confidentiality of the subject's identity and the confidentiality of the data is only for research purposes.

RESULTS

The age range of respondents in this study ranged from early to late adolescence, ranging from 12 to 18 years with an average age of around 15 years. Of these, the early adolescence was slightly dominant (53.15 %). The samples of male and female students were nearly equal due to frequency matching. More than half of the respondents reported experiencing stomach problems, at 53.15 %. The majority of respondents (90.09 %) had adequate diet, as shown in table 1. The normal stress level group had 40.54 % respondents. Most students do not have experience fasting voluntarily on Mondays and Thursdays (63.96%). The respondents experienced low gastrointestinal symptoms were 56.76 % respondents.

Table 1. Frequency Distribution Based on Students Characteristics (n = 111)

Characteristics	Frequency Distribution		Mean ± SD
	n	%	
Age (years)			15.22 ± 1.72*
Early Adolescence (12-15 years old)	59	53.15	
Late Teens (16-18 years old)	52	46.85	
Gender			
Male	56	50.45	
Female	55	49.55	
History of stomach disorders			

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Characteristics	Frequency Distribution		Mean ± SD
	n	%	
Yes			
No	59	53.15	
Dietary Habit	52	46.85	
Inadequate Diet			
Adequate Diet	7	6.31	
Stress Level	100	90,09	
Normal			
Mild	45	40.54	
Moderate	22	19.82	
Severe	30	27.03	
More Severe	11	9.91	
Fasting History	3	2.70	
Yes			
No	40	36.04	
Gastrointestinal Symptoms	71	63.96	
Low			
Moderate	63	56.76	
High	44	39.64	
	4	3.60	

Values are presented as number (%).

* Values are presented as mean ± SD

Based on bivariate analysis in table 2, this study showed a significant relationship in crude model between stress and gastrointestinal symptoms. Respondents with stress had a 59.09 % higher prevalence of gastrointestinal symptoms. There is a significant association between stress and gastrointestinal symptoms. Respondents in group stress had a 1.96 times higher prevalence of gastrointestinal symptoms compared to the no stress group (PR 1.96; 95% CI 1.41–2.71). A history of stomach disorders was significantly associated with gastrointestinal symptoms. Adolescents with a history of stomach disorders had a 1.72-fold higher prevalence of gastrointestinal symptoms compared with those without a history of stomach disorders (PR 1.72, 95% CI 1.23–2.43). Inadequate dietary habit was significantly associated with gastrointestinal symptoms. Participants with inadequate dietary habits had a 47% lower prevalence of gastrointestinal symptoms compared with those with adequate dietary habits (PR 0.53, 95% CI 0.34–0.83). Furthermore, there was no statistically significant relationship between age (p = 0.341) and gender (p = 0.400) with gastrointestinal symptoms.

Multivariate analysis yielded a significant full model (p-value < 0.005) comprising the variables of stress (PR 1.59; 95% CI 1.16-2.19), dietary habits (PR 0.57; 95% CI 0.38-0.85), and history of stomach disorders (PR 1.57; 95% CI 1.15-2.15) that statistically significant to gastrointestinal symptoms, as shown in table 2.

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Table 2. The Relationship between Variables and Gastrointestinal Symptoms (n = 111)

Variables	Gastrointestinal Symptoms (Moderate-High)		Gastrointestinal Symptoms (Low)		Crude*	P value	Full-model*PR
	n	%	n	%			
Age (years)							
Early Adolescence (12-15 years old)	28	47.46	31	52.54	1.17 (0.85-1.62)	0.341	-
Late Teens (16-18 years old)	20	38.46	32	61.54	1.00 (reference)		
Gender							
Male	22	39.29	34	60.71	0.87 (0.63-1.21)	0.400	-
Female	26	42.27	29	52.73	1.00 (reference)		
History of stomach disorders							
Yes	34	57.63	25	42.37	1.72 (1.23-2.43)	0.002	1.57 (1.15-2.15)
No	14	26.92	38	73.08	1.00 (reference)		1.00 (reference)
Dietary Habit							
Inadequate Diet	23	31.94	49	68.06	0.53 (0.34-0.83)	0.005	0.57 (0.38-0.85)
Adequate Diet	25	64.10	14	35.90	1.00 (reference)		1.00 (reference)
Stress							
Yes	39	59.09	27	40.91	1.96 (1.41-2.71)	<0.001	1.59 (1.16-2.19)
No	9	20.00	36	80.00	1.00 (reference)		1.00 (reference)
Fasting History							
Yes	24	60.00	16	40.00	1.65 (1.09-2.51)	0.018	1.20 (0.83-1.75)
No	24	33.80	47	66.20	1.00 (reference)		1.00 (reference)

*Values are presented as prevalence ratio (95% confidence interval)

PRModified Poisson Regression, significant at p<0.25 (or p>0.25 for a variable considered sufficiently important) and analyzed in the full model.

DISCUSSION

Adolescence represents a critical transitional period during which individuals begin to develop independent dietary habits and lifestyles, while simultaneously being vulnerable to various health problems, including gastrointestinal disorders (15). A prior history of gastric disorders among adolescents in boarding schools constitutes important information for analysis, as it may serve as a predisposing factor that increases susceptibility to gastrointestinal symptoms. Adolescents with a history of gastritis often exhibit irregular eating behaviors, such as consuming fewer than three meals per day, skipping breakfast, and frequently consuming spicy or acidic foods, including popular street foods such as instant noodles and seasoned fried snacks. These dietary habits may exacerbate gastric irritation and support the association between unhealthy eating habits and the development of gastrointestinal symptoms (16). In Indonesia, several factors have been identified as contributors to gastrointestinal symptoms, including poor dietary patterns, stress, age, sex, and the consumption of coffee and alcohol. Among senior high school and vocational school students, gastrointestinal symptoms had been associated with diets that are considered adequate but nutritionally unbalanced and mild stress levels (17).

In this study, the most frequently reported symptoms included burning sensation or pain when eating late, followed by decreased appetite and discomfort associated with skipping

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breakfast. However, some symptom items explicitly refer to meal-timing behaviors, such as eating late or skipping breakfast. Therefore, these findings should be interpreted cautiously because the measurement of gastrointestinal symptoms may partially overlap conceptually with the assessment of dietary habits. This overlap may inflate the observed association between dietary habits and gastrointestinal symptoms and limits the ability to distinguish an independent association from measurement-related effects. In addition, because of the cross-sectional design, these findings should not be interpreted as evidence that irregular meal timing or skipping meals causes gastrointestinal symptoms (18).

The term “gastrointestinal symptoms” used in this study refers to a constellation of subjective complaints rather than a clinical diagnosis. These symptoms may arise from various gastrointestinal conditions, including gastritis, peptic ulcer disease, or functional disorders. As such, the symptoms identified through questionnaires reflect respondents’ perceptions rather than medically confirmed diagnoses. Therefore, although reported symptoms may suggest gastritis, definitive diagnosis requires further clinical evaluation. This study focuses on perceived symptoms rather than diagnostic confirmation (19).

Dietary patterns encompass the frequency, type, and quantity of food intake and are influenced by physiological needs, cultural norms, and socioeconomic conditions. In the present study, commonly reported dietary patterns included skipped meals, limited dietary diversity, and inadequate nutritional balance. High consumption of carbohydrate-rich foods combined with relatively low intake of protein, fiber, fruits, and vegetables, as well as frequent consumption of fried and spicy snacks, may reflect dietary challenges commonly encountered among adolescents in boarding-school settings. Previous studies have suggested that dietary factors, including frequent consumption of spicy or acidic foods and irregular meal patterns, may influence gastrointestinal function through changes in gastric acid secretion, mucosal function, or other physiological pathways. However, these mechanisms were not directly assessed in the present study and therefore should be regarded as plausible explanations rather than mechanisms demonstrated by our findings. Busy schedules, limited meal availability or time, and nutritional awareness may also contribute to dietary patterns among adolescents. Thus, the dietary findings in this study should be interpreted as associations with gastrointestinal symptoms rather than evidence that specific dietary practices cause gastrointestinal symptoms (20). Monotonous food consumption lacking essential nutrients further exacerbates inadequate daily intake (21,22).

Adolescents are particularly susceptible to stress due to increasing academic demands, life transitions, and psychosocial pressures. Stress arises from both internal factors, such as physical condition, motivation, and personality traits, and external factors, including family dynamics, academic workload, peer relationships, and environmental changes. Female adolescents tend to report higher stress levels than males, potentially due to differences in emotional processing and coping mechanisms. Stress triggers physiological responses that increase gastric acid secretion through neuroendocrine pathways, contributing to mucosal irritation and inflammation (23).

The stomach possesses intrinsic defense mechanisms, including acidic pH, a protective mucus layer, and adequate microcirculation. However, these defenses can be disrupted by dietary and psychological stressors, increasing vulnerability to mucosal injury. Diets high in fat, spicy, acidic, and processed foods, as well as carbonated beverages, stimulate gastric acid secretion and may worsen gastritis. Irregular eating schedules, such as skipping breakfast or delaying meals,

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leave the stomach empty for prolonged periods, further increasing acid production and mucosal irritation (24).

Stress also plays a critical role in gastritis pathophysiology by increasing acetylcholine and histamine levels, altering gastric pH, reducing mucosal blood flow, and promoting oxidative stress. The release of stress hormones such as cortisol and adrenaline further stimulates gastric acid secretion, exacerbating mucosal damage. Behavioral responses to stress, including skipping meals or consuming spicy foods, may further trigger symptom recurrence (25). A history of gastritis or other gastric disorders represents an important predisposing factor for symptom recurrence. In individuals with prior gastric conditions, the stomach becomes more sensitive to triggers such as poor diet and stress. Increased gastrin production, vagal nerve stimulation, and excessive hydrochloric acid secretion collectively contribute to symptom development. These findings support the theory that previous gastric disorders increase mucosal sensitivity, making individuals more vulnerable to gastritis-related symptoms later in life (6,25).

This study has several methodological strengths, including its focus on an understudied adolescent population in boarding schools, the use of stratified random sampling, a prespecified sample size, clearly defined eligibility criteria, and standardized data collection instruments. The use of the Indonesian version of the DASS-42 and previously validated questionnaires provided a structured approach to assessing stress, dietary habits, and gastrointestinal symptoms. The use of prevalence ratios with 95% confidence intervals was appropriate for the cross-sectional design and allowed the magnitude of the observed associations to be expressed directly in terms of prevalence.

However, these strengths should be considered alongside important methodological limitations. Most importantly, there is potential overlap between the dietary exposure and the gastrointestinal symptom outcome. Some outcome items refer explicitly to dietary behaviors, including pain or burning when eating late and discomfort associated with skipping breakfast. Because these dietary behaviors were also incorporated into the assessment of dietary habits, the exposure and outcome constructs are not completely independent. This represents a major threat to internal validity and may have inflated the observed association between dietary habits and gastrointestinal symptoms through measurement overlap. Therefore, the association between dietary habits and gastrointestinal symptoms should be interpreted cautiously and should not be considered evidence of an independent causal relationship. Future studies should use outcome measures that assess gastrointestinal symptoms independently of specific dietary behaviors and, where possible, should incorporate clinically validated assessments.

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CONCLUSION

Based on the findings of this cross-sectional study, stress levels, dietary habits, and history of stomach disorders were significantly associated with gastrointestinal symptoms among students in the boarding-school setting. However, these findings should be interpreted as associations rather than causal relationships, as the cross-sectional design does not establish temporality or causality. In addition, potential overlap between dietary-behavior items and the gastrointestinal symptom outcome may have influenced the observed dietary association. The findings highlight the potential relevance of stress management, healthy and regular dietary practices, and monitoring of gastrointestinal symptoms in boarding-school health programs. Boarding-school health services may consider providing nutrition education and health

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promotion activities in collaboration with nutrition professionals and local health services. Routine attention to students with a history of stomach disorders or gastrointestinal symptoms may also be considered as part of existing student health services. However, the effectiveness of specific interventions, including meal scheduling, screening procedures, or regular health monitoring, was not evaluated in this study and should be investigated in future longitudinal or intervention studies.

AUTHOR'S CONTRIBUTION STATEMENT

Conceptualization: IMS, SFA, OR. Data curation: IMS, SA. Formal analysis: IMS, SA. Funding acquisition: None. Methodology: IMS, SA, OR. Project administration: IMS, SA, OR. Visualization: IMS. Writing – original draft: IMS, SA. Writing – review & editing: IMS.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare for this study.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors made limited use of ChatGPT (GPT-4, OpenAI) during manuscript preparation, primarily for language suggestions and minor corrections in some sections. All subsequent content was independently reviewed and edited by the authors, who are solely responsible for the accuracy, interpretation, and scientific content of the published article.

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