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The Relationship between Academic Stress, Emotional Eating Behavior, and Nutrient Intake with Nutritional Status among Students of YPHB Senior High School, Bogor

Ristia Rahmah, Ali Khomsan*

Faculty of Medicine and Nutrition, IPB University, Bogor, Indonesia

Corresponding Author's Email: khomsanali@apps.ipb.ac.id

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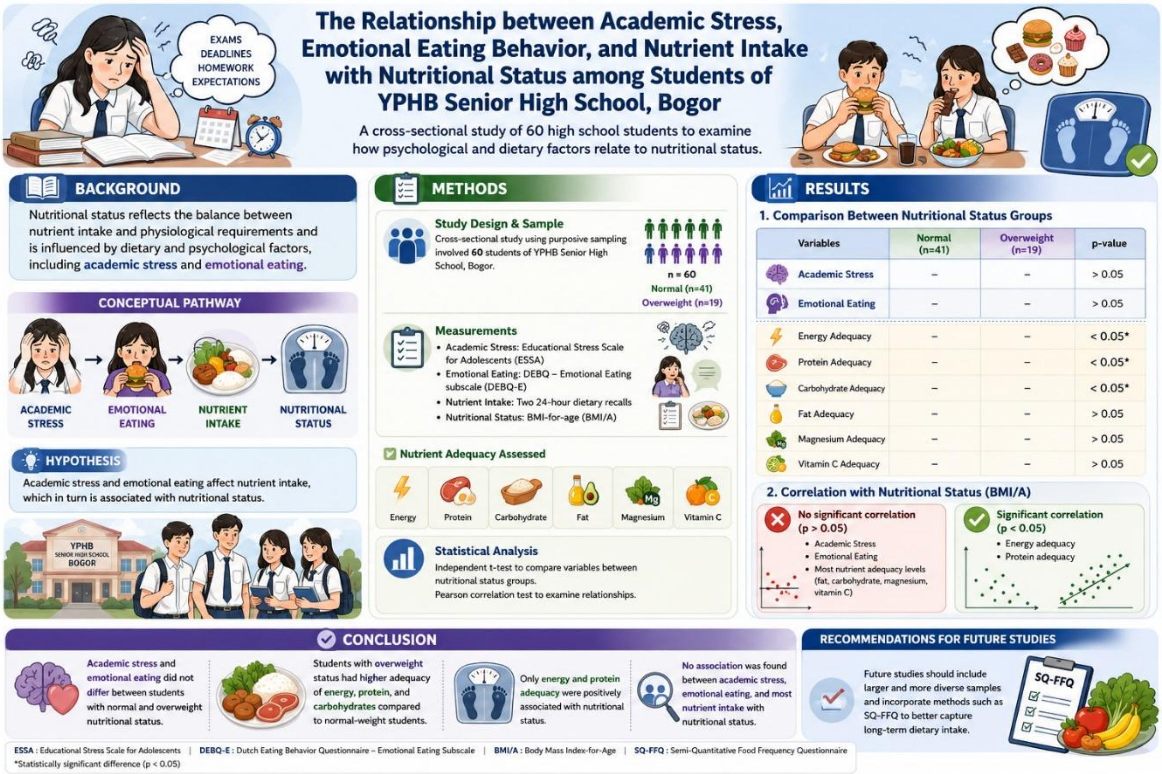
ABSTRACT

Nutritional status reflects the balance between nutrient intake and physiological requirements and is influenced by dietary and psychological factors, including academic stress and *emotional eating*. Academic stress may trigger emotional responses that lead to *emotional eating*, which can alter dietary intake and eventually affect nutritional status. This study aimed to analyze the relationships between academic stress, *emotional eating*, and nutrient intake with nutritional status, and to compare these variables across nutritional status groups. This cross-sectional study, using purposive sampling, involved 60 high school students (41 with normal nutritional status and 19 overweight). Academic stress and *emotional eating* were assessed using the Educational Stress Scale for Adolescents (ESSA) and the Emotional Eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ-E). Nutrient intake was measured using two 24-hour dietary recalls, while nutritional status was determined based on BMI-for-age (BMI/A). Data were analyzed using the independent *t-test* and Pearson correlation test. The results showed no significant differences in academic stress and *emotional eating* ($p>0.05$). Significant differences were found in energy, protein, and carbohydrate adequacy ($p<0.05$), while fat, magnesium, and vitamin C adequacy did not differ significantly ($p>0.05$). Correlation analysis indicated that academic stress, *emotional eating*, and most nutrient adequacy levels were not associated with nutritional status ($p>0.05$), except for energy and protein ($p<0.05$). Future studies should include larger and more diverse samples and incorporate methods such as SQ-FFQ to better capture long-term dietary intake.

Key Messages:

- The study found that academic stress, *emotional eating*, and the adequacy levels of carbohydrates, fat, magnesium, and vitamin C were not associated with nutritional status, whereas energy and protein adequacy levels were significantly associated with students' nutritional status.
- This study simultaneously examined the relationships between academic stress, *emotional eating*, and nutrient intake with nutritional status, and compared these variables between students with normal and overweight status.
- These findings may serve as a basis for schools and health professionals to design adolescent nutrition and health promotion programs that not only focus on stress management but also emphasize improving the quality and adequacy of nutrient intake.

GRAPHICAL ABSTRACT



INTRODUCTION

Nutritional status is an indicator that reflects the balance between nutrient intake and the body's nutritional requirements, and serves as a measure to assess nutritional adequacy and detect nutritional disorders (1). In adolescents, this balance is particularly crucial due to rapid physical growth, increased nutrient requirements and independence in food choices, which are not always healthy. This condition increases adolescents' vulnerability to the triple burden of malnutrition in Indonesia, encompassing undernutrition, overnutrition, and micronutrient deficiencies (2). Data from the 2023 Indonesian Health Survey (SKI) indicate that among adolescents aged 16–18 years, the prevalence of undernutrition, overweight, and obesity was 6.6%, 8.8%, and 3.3%, respectively, with higher rates of overweight (8.9%) and obesity (4.2%) observed in West Java than the national average. Nutritional problems in this age group affect not only physical health but also long-term outcomes: undernutrition impairs growth and cognitive development, while overnutrition increases the risk of non-communicable diseases such as hypertension and type 2 diabetes (3). Therefore, identifying factors influencing adolescent nutritional status is essential for early prevention.

Nutritional status results from the interaction of multiple factors. It is directly determined by dietary intake and infectious diseases, and indirectly influenced by genetic, parenting, environmental, and psychological state (4). Psychological factors, particularly stress, are often overlooked despite their important role in adolescents. Emotional problems in adolescence generally arise from intrapersonal, academic, and environmental sources, with academic stress being the most prevalent. Academic stress arises when students' coping capacity is exceeded by academic demands, including workload, difficulty understanding material, grading systems, and competition, resulting in negative emotional, cognitive, and behavioral responses (5). A study by Inayah et al. (6) found that 93% of students at SMAN 1 Kadamean experienced high levels of academic stress. Such prolonged pressure may subsequently alter adolescents' eating patterns and behaviors.

The relationship between stress and nutritional status can be explained through physiological and behavioral pathways. The body's response to stress varies; acute stress may suppress appetite, whereas chronic stress triggers cortisol release from the adrenal glands, increasing appetite and preference for energy-dense foods (7). This variation explains why stress may lead to undernutrition in some adolescents and overweight in others. When eating becomes a coping mechanism for emotional distress, emotional eating may occur, characterized by

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eating in response to negative emotions rather than physiological hunger (8). Emotional eating is considered a maladaptive coping strategy, as it often involves high-calorie, high-fat, and high-sugar foods, increasing total energy intake and the risk of overweight and obesity (9).

Changes in dietary patterns due to academic stress and emotional eating may affect not only energy and macronutrient intake but also micronutrient intake, such as magnesium and vitamin C. Magnesium is an essential mineral involved in energy metabolism, nerve function, and stress regulation. Inadequate magnesium intake may increase susceptibility to stress, while chronic stress can increase magnesium excretion, indicating a bidirectional relationship (10). Vitamin C, on the other hand, functions as an antioxidant that protects cells from oxidative stress, supports immune function, and contributes to the synthesis of catecholamines and neurotransmitters involved in stress regulation (11).

Based on this rationale, dietary intake serves as a direct factor linking psychological conditions to nutritional status. Although several studies have demonstrated associations between academic stress, emotional eating, nutrient intake, and adolescent nutritional status (12–14), most have examined these variables separately and within a single nutritional status group. Studies comparing these variables between adolescents with normal and overweight/obese status remain limited. Therefore, this study aims to analyze differences in academic stress, emotional eating behavior, and nutrient intake between students with normal and overweight nutritional status, as well as to examine their associations with nutritional status. It is hypothesized that differences exist between nutritional status groups and that these variables are significantly associated with students' nutritional status.

METHODS

This study used a *cross-sectional* design and was conducted at YPHB Senior High School, Bogor, in May 2026. The study population were all students in grades X5–X8, totaling 118 students. Subjects were selected using *purposive sampling* according to the inclusion criteria: aged 15–17 years, actively participating in school activities, not currently following a diet, willing to participate in all study activities, and having normal nutritional status (−2 SD to +1 SD), *overweight* (+1.0 SD ≤ z < +2.0 SD), or obesity (≥+2.0 SD) based on BMI-for-age (BMI/A). The exclusion criteria were absence during data collection and incomplete study data. The minimum sample size was calculated using the Lemeshow (1997) formula, based on an adolescent *overweight* prevalence of 8.9% in West Java and a population of 118 students in grades X5–X8. After accounting for a 10% dropout rate, the minimum sample size was 28 subjects per group, or 56 subjects in total. Subject recruitment began with nutritional status screening based on school anthropometric data, which identified 34 students with overnutrition (*overweight* and obesity). Subsequently, students with normal nutritional status were selected using *simple random sampling* to obtain a comparable number of subjects, resulting in 68 prospective study subjects. All prospective subjects underwent repeat measurements of body weight and height to determine nutritional status based on current anthropometric data. Subjects who withdrew, were absent during data collection, or had incomplete study data were subsequently excluded. Based on this process, 60 students met the study criteria, consisting of 41 students with normal nutritional status and 19 students with overnutrition.

The data collected included subject characteristics (age, sex, and pocket money), academic stress, *emotional eating* behavior, nutrient intake (energy, protein, fat, carbohydrates, magnesium, and vitamin C), and nutritional status. Nutritional status was determined based on BMI/A from body weight measured using a digital scale (accuracy of 0.1 kg) and height measured using a stadiometer (accuracy of 0.1 cm) by trained enumerators. Nutritional status was then categorized as normal (−2 SD to +1 SD) or overnutrition, including *overweight* (+1.0 SD ≤ z < +2.0 SD) and obesity (≥+2.0 SD), based on BMI/A according to the Ministry of Health guidelines (15). Academic stress was measured using the *Educational Stress Scale for Adolescents* (ESSA), while *emotional eating* behavior was measured using the *Dutch Eating Behavior Questionnaire-Emotional* (DEBQ-E). Nutrient intake was assessed through two 24-hour *food recalls* conducted on a weekday and a weekend day.

Individual energy requirements were calculated using the Harris–Benedict equation to estimate basal metabolic rate (BMR) based on age, sex, body weight, and height, and were then multiplied by the activity factor (16). The activity factors used ranged from 1.40–1.44 for males aged 16–17 years and 1.47–1.50 for females aged 16–17 years (17). For subjects with overnutrition, ideal body weight based on the Indonesian Recommended Dietary Allowances (RDA) was used. Nutrient adequacy levels were calculated by comparing actual intake with individual energy and nutrient requirements. Macronutrient adequacy levels (energy, protein, carbohydrates, and fat) were categorized as inadequate (<90% of RDA), adequate (90–119% of RDA), and excessive (≥120% of

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RDA) based on the WNPG guidelines (18). Meanwhile, micronutrient adequacy levels (magnesium and vitamin C) were categorized as inadequate (<77% of RDA) and adequate (≥77% of RDA) based on Gibson (19).

Data were analyzed using spreadsheet and statistical software. Descriptive analysis was performed to describe the characteristics of the subjects. The normality of each variable was assessed using the *Kolmogorov–Smirnov* test, and the data were normally distributed (p>0.05). Differences between nutritional status groups were analyzed using the *Independent t-test* based on the continuous scores of each variable, namely ESSA scores, DEBQ-E scores, and the percentage of nutrient adequacy levels, with a significance level of p<0.05. Categories of academic stress, *emotional eating*, and nutrient adequacy were used only for descriptive presentation. Associations between variables were analyzed using the Pearson correlation test with a significance level of p<0.05.

CODE OF HEALTH ETHICS

This study received ethical approval from the Research Ethics Committee for Human Subjects at Universitas Ahmad Dahlan (Approval No. REC-UAD/01/02/05-2026/222).

RESULTS

Based on Table 1, most subjects had normal nutritional status (68.3%), with a mean *z*-score of 0.46±1.42. Conversely, some subjects had overnutrition, including *overweight* (13.3%) and obesity (18.3%). Overall, the proportion of subjects with overnutrition was 31.6%.

Table 1. Distribution of subject by nutritional status

Classification	**Number (n)**	**Percentage (%)**
Normal	41	68.3
Overweight	8	13.3
Obesity	11	18.3
Mean ± SD	0.46 ± 1.42	
Total	**60**	**100**

Based on Table 2, most subjects in both groups were 16 years old. Among the normal nutritional status group, 68.3% of subjects were 16 years old, compared with 84.2% in the overnutrition group. By sex, males were more prevalent in the overnutrition group (68.4%) than females (31.6%). In contrast, females were slightly more prevalent in the normal nutritional status group (53.5%) than males (46.5%). In addition, most subjects in both groups had a high daily pocket money category (≥IDR 15,000), with 95.3% in the normal nutritional status group and 89.5% in the overnutrition group.

Table 2. Subject characteristics

Family Characteristics	**Normal (n=41)**		**Overnutrition (n=19)**	
	n	**(%)**	**n**	**(%)**
Age				
15	11	26.8	3	15.8
16	28	68.3	16	84.2
17	2	4.9	0	0.0
Sex				
Male	19	46.3	13	68.4
Female	22	53.7	6	31.6
Pocket money (IDR/day)				
Low (<IDR 15.000)	1	2.4	2	10.5
High (≥ IDR 15.000)	40	97.6	17	89.5

Table 3 presents the distribution of subjects according to academic stress levels and *emotional eating* behavior. In general, most students experienced moderate academic stress (61.3%). In the normal nutritional status group, the majority experienced moderate stress (67.4%), whereas the overnutrition group was predominantly

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characterized by high stress (52.6%). Regarding *emotional eating* behavior, 51.7% of students overall were classified as *emotional eaters*. In the normal nutritional status group, most subjects were classified as *non-emotional eaters* (51.2%), whereas the overnutrition group was predominantly classified as *emotional eaters* (57.9%). The *Independent t-test* showed no significant differences in academic stress (p=0.069) or *emotional eating* (p=0.492) between the normal nutritional status and overnutrition groups (p>0.05).

Table 3. Distribution of subjects by academic stress and emotional eating

Variable	Category	Nutritional Status						*p-value*[1]
		Normal (n=41)		Overnutrition (n=19)		Total (n=60)		
		n	%	n	%	n	%	
Academic stress	Low	1	2.4	0	0	1	1.7	0.069
	Moderate	28	68.3	9	47.4	37	61.7	
	High	12	29.3	10	52.6	22	36.7	
	Mean ± SD	53.6 ± 8.9		58.1 ± 7.1		55.2 ± 8.6		
Emotional eating	Non-emotional eater	21	51.2	8	42.1	29	48.3	0.492
	Emotional eater	20	48.8	11	57.9	31	51.7	
	Mean ± SD	30.6 ± 9.4		30.3 ± 6.7		31.1 ± 8.6		

[1]*Independent t-test*

Table 4 shows the distribution of subjects according to macronutrient adequacy levels. Generally, most students had adequate energy intake (55.9%), inadequate protein intake (60.0%), excessive fat intake (58.3%), and inadequate carbohydrate intake (75.0%). In the normal nutritional status group, most subjects had adequate energy intake (56.1%), inadequate protein intake (70.7%), excessive fat intake (53.7%), and inadequate carbohydrate intake (85.4%). Meanwhile, in the overnutrition group, most subjects had adequate energy (52.6%) and protein (47.4%) intake, excessive fat intake (68.4%), and inadequate carbohydrate intake (52.6%). The *Independent t-test* showed significant differences in energy (p=0.000), protein (p=0.009), and carbohydrate adequacy (p=0.011), with *p*-values <0.05. No significant difference was found in fat adequacy between the two groups (p>0.05).

Table 4. Distribution of subjects by macronutrient adequacy levels

Nutrient[1]	Nutritional status						*p-value*[1]
	Normal (n=41)		Overnutrition (n=19)		Total (n=60)		
	n	%	n	%	n	%	
Energy adequacy							
Inadequate (<89% of RDA)	18	43.6	3	15.8	21	35.0	0.000*
Adequate (89−119% of RDA)	23	56.1	10	52.6	33	55.0	
Excessive (>120% of RDA)	0	0.0	6	31.6	6	10.0	
Mean ± SD	88±13		105±16		93±16		
Protein							
Inadequate (<89% of RDA)	29	70.7	7	36.8	36	60.0	0.009*
Adequate (89−119% of RDA)	9	22.0	9	47.4	18	30.0	
Excessive (>120% of RDA)	3	7.3	3	15.8	6	10.0	
Mean ± SD	81±20		96±20		86±21		
Fat							
Inadequate (<89% of RDA)	8	19.5	2	10.5	10	16.7	0.150
Adequate (89−119% of RDA)	11	26.8	4	21.1	15	25.0	
Excessive (>120% of RDA)	22	53.7	13	68.4	35	58.3	
Mean ± SD	120±34		134±36		125±35		
Carbohydrate							
Inadequate (<89% of RDA)	35	85.4	10	52.6	45	75.0	0.011*
Adequate (89−119% of RDA)	6	14.6	7	36.8	13	21.7	
Excessive (>120% of RDA)	0	0.0	2	10.5	2	3.3	
Mean ± SD	75±13		92±25		80±19		

[1]*Independent t-test*

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Table 5 presents the distribution of subjects according to micronutrient adequacy levels. Most subjects had inadequate magnesium (65.0%) and vitamin C (88.3%) intake. In the normal nutritional status group, most subjects had inadequate magnesium (61.0%) and vitamin C (90.2%) intake. Similarly, in the overnutrition group, most subjects had inadequate magnesium (73.7%) and vitamin C (84.2%) intake. The *Independent t-test* showed no significant differences in magnesium (p=0.185) or vitamin C adequacy (p=0.209), with *p*-values >0.05.

Table 5. Distribution of subjects by micronutrient adequacy levels

Nutrient[1]	**Normal (n=41)**		**Overnutrition (n=19)**		**Total (n=60)**		***p-value***[1]
	n	**%**	**n**	**%**	**n**	**%**	
Magnesium adequacy							
Inadequate (<77% of RDA)	25	61.0	14	73.7	39	65.0	0.859
Adequate (>77% of RDA)	16	39.0	5	26.3	21	35.0	
Mean ± SD	69.7 ± 26.8		60.7 ± 23.5		25.9±21.5		
Vitamin C adequacy							
Inadequate (<77% of RDA)	37	90.2	16	84.2	53	88.3	0.354
Adequate (>77% of RDA)	4	9.8	3	15.8	7	11.7	
Mean ± SD	28.6 ± 29.9		39.2 ± 44.0		32.0±34.9		

[1]*Independent t-test*

Data in Table 6 show significant associations between energy and protein adequacy and nutritional status (p<0.05). The correlation coefficients were positive and weak, indicating that higher energy and protein adequacy tended to be associated with higher nutritional status. Nonetheless, no significant associations were found between fat and carbohydrate adequacy, academic stress, *emotional eating*, and nutritional status (p>0.05). Data in Table 7 shows no significant associations between magnesium and vitamin C adequacy and nutritional status (p>0.05).

Table 6. Associations of academic stress, emotional eating, and macronutrient intake with nutritional status

Variable	**r**	***p-value***[1]
Energy adequacy	0.313	0.015*
Protein adequacy	0.320	0.013*
Fat adequacy	0.157	0.231
Carbohydrate adequacy	0.129	0.326
Academic stress	0.213	0.102
Emotional eating	0.132	0.315

[1]*Pearson correlation*

Table 7. Association of micronutrient intake with academic stress

Variable	**r**	***p-value***[1]
Magnesium adequacy	-0.196	0.133
Vitamin C adequacy	0.051	0.696

[1]*Pearson correlation*

DISCUSSION

School students are vulnerable to stress, particularly stress arising from academic demands. Academic stress is a condition experienced by students as a result of pressure or demands in the academic environment, characterized by negative cognitive, physical, behavioral, and emotional responses (20). The Independent t-test showed no significant differences in academic stress (p=0.069) or emotional eating behavior (p=0.492) between the normal and overnutrition groups (p>0.05). This finding is consistent with a study conducted among students at SMAN 1 Surade, which reported no difference in stress levels between obese and non-obese groups (21). These findings suggest that stress may not be a direct determinant of nutritional status, as its effects may depend on individual responses to stress. Individuals who use problem-focused coping tend to address the source of stress without altering their eating behavior, whereas those who use emotion-focused coping may be more likely to use food as an outlet for their emotions (22).

Consistent with the absence of differences in academic stress between the two groups, emotional eating behavior also did not differ significantly. Emotional eating refers to eating in response to negative emotions, such

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as stress, sadness, and anxiety, and may serve as a coping mechanism. Among adolescents, particularly those experiencing academic stress, difficulties in regulating emotions may increase the tendency to use eating as a coping mechanism for alleviating negative emotions (23,24). This finding is consistent with a previous study that also reported no difference in emotional eating behavior among adolescents with normal, overweight, and obese nutritional status ($p=0.189$). The study explained that the tendency toward emotional eating may occur among adolescents across different nutritional status categories because this behavior is influenced by various factors, including emotional regulation, eating habits, family environment, and individual psychological characteristics (25). However, the findings of this study differ from previous study which reported significant differences in stress levels and emotional eating between obese and non-obese students ($p<0.05$) (26). These differences may be related to variations in respondent characteristics, sample size, sampling techniques, study design, and social support across studies.

Nutrient intake refers to the amount of nutrients obtained from daily food consumption. The amount of nutrient intake may vary among individuals depending on age and sex, as nutritional requirements also vary across these groups (27,28). Nutrient intake is then used to calculate nutrient adequacy by comparing actual nutrient intake with individual nutritional requirements. The Independent t-test showed significant differences in energy ($p=0.000$), protein ($p=0.009$), and carbohydrate adequacy ($p=0.011$) between the normal and overnutrition groups ($p<0.05$). This finding is consistent with a previous study reporting that obese individuals had higher energy, protein, and carbohydrate intake and adequacy levels than non-obese individuals ($p<0.05$) (29). The study suggests that individuals with overnutrition tend to consume higher amounts of macronutrients, resulting in higher adequacy levels.

For energy adequacy, the overnutrition group had a higher mean energy intake (2301 ± 354 kcal/day) and energy adequacy (105 ± 16%) than the normal nutritional status group (1831 ± 314 kcal/day and 88 ± 13%, respectively). Physiologically, when energy intake consistently exceeds energy expenditure, excess energy is stored as adipose tissue, which may increase body weight and contribute to overweight and obesity (30). A similar pattern was observed for protein intake and adequacy. The overnutrition group had a higher mean protein intake (79.1 ± 18.1 g/day) and protein adequacy (96 ± 20%) than the normal nutritional status group (63.8 ± 18.9 g/day and 81 ± 20%, respectively). Protein consumed in excess of the body's requirements is not stored as protein but undergoes deamination, with the resulting metabolic products potentially converted into fat and stored as energy reserves (31). Carbohydrate adequacy showed a similar pattern. Although carbohydrate adequacy remained inadequate in both groups, the overnutrition group had higher mean carbohydrate intake (299.0 ± 76.9 g/day) and adequacy (92 ± 25%) than the normal nutritional status group (234.5 ± 46.7 g/day and 75 ± 13%, respectively). Carbohydrates are the body's primary source of energy, and excessive carbohydrate intake may increase insulin secretion and triglyceride levels. Excess glucose may be stored as glycogen or converted into fat. When this process occurs over a prolonged period, increased fat accumulation may contribute to overweight (29).

In contrast to energy, protein, and carbohydrate adequacy, no significant differences were found between the two groups in fat ($p = 0.150$), magnesium ($p = 0.859$), or vitamin C adequacy ($p = 0.354$). The absence of significant differences may be related to relatively similar intake patterns for these nutrients between the two groups. Mean fat adequacy exceeded the recommended level in both groups, reaching 120 ± 34% in the normal nutritional status group and 134 ± 36% in the overnutrition group, with mean fat intakes of 69.5 ± 20.0 g/day and 81.2 ± 21.3 g/day, respectively. Meanwhile, mean magnesium intake and adequacy remained below the recommended levels in both groups.

The Pearson correlation test showed no significant association between academic stress and nutritional status ($p = 0.102$; $r = 0.213$). This finding differs from several previous studies that reported a significant association between stress and nutritional status (12,13). Physiologically, stress may affect nutritional status through changes in eating behavior mediated by activation of the hypothalamic-pituitary-adrenal (HPA) axis. Activation of this axis increases cortisol secretion, which may stimulate appetite. However, stress may also suppress appetite in some individuals through increased epinephrine secretion (32). These differences in response may cause the effects of stress on nutritional status to vary among individuals, as nutritional status can also be influenced by various factors, such as food intake, physical activity, and parenting practices (33). In addition, differences in students' coping mechanisms may explain why stress does not necessarily result in changes in nutritional status. The present finding is consistent with a previous study that also found no significant association between stress and nutritional status ($p > 0.05$) (34).

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The Pearson correlation test showed no significant association between emotional eating and nutritional status ($p = 0.315$; $r = 0.132$). This finding is consistent with a previous study (12), but differs from another study (14), which reported that higher emotional eating scores were associated with a greater tendency toward overnutrition. Theoretically, emotional eating may function as a coping mechanism for stress, leading individuals to increase food consumption in response to emotional distress and potentially affecting nutritional status (35). However, this association was not observed in the present study. One possible explanation is that not all students cope with negative emotions through eating. Previous research has shown that students may also use other coping strategies when experiencing stress, including exercising, playing games, watching movies, listening to music, socializing, and seeking support from friends or family (36). Furthermore, nutritional status is influenced by various factors, including dietary intake, physical activity, nutrition knowledge, parental involvement, and peer influence; therefore, emotional eating alone may not be sufficient to influence nutritional status (12).

The Pearson correlation test showed significant positive associations between nutritional status and energy adequacy ($p = 0.015$; $r = 0.313$) and protein adequacy ($p = 0.013$; $r = 0.320$). The correlation coefficients indicated moderate associations, suggesting that higher energy and protein adequacy tended to be associated with higher nutritional status. These findings are consistent with previous studies reporting associations between energy adequacy, protein intake, and nutritional status (14,36). The association between energy adequacy and nutritional status may be explained by the storage of excess energy as adipose tissue when energy intake consistently exceeds energy expenditure, thereby contributing to increased body weight (38). Protein also plays an important role in the growth, formation, and maintenance of body tissues. Adequate protein intake may additionally reflect better overall dietary quality and is often accompanied by adequate energy intake, which may contribute to better nutritional status (37).

In contrast, no significant associations were found between fat adequacy ($p = 0.231$; $r = 0.157$) or carbohydrate adequacy ($p = 0.326$; $r = 0.129$) and nutritional status. This finding differs from previous study (39), which reported a significant association between fat adequacy and nutritional status ($p < 0.05$). The study explained that fat adequacy may be closely related to nutritional status because fat provides 9 kcal per gram and therefore contributes substantially to overall energy balance. Regarding carbohydrate adequacy, the present finding also differs from a previous study (40), which found a significant positive association between carbohydrate adequacy and BMI-for-age ($p < 0.05$). The study suggested that higher carbohydrate adequacy was associated with higher BMI-for-age z-scores because carbohydrates are the body's primary source of energy. When carbohydrate intake exceeds requirements, excess carbohydrates may be converted into fat, potentially contributing to overweight and obesity (40). The absence of significant associations between fat and carbohydrate adequacy and nutritional status in the present study may be related to relatively small variations in intake between groups, which may have limited the ability to detect statistically significant relationships. In addition, nutritional status is influenced by other factors, including physical activity, nutrition knowledge, genetic factors, and overall dietary patterns (41). Nevertheless, the present findings are consistent with previous studies that also found no significant associations between fat or carbohydrate intake and nutritional status ($p > 0.05$), possibly because most subjects had relatively homogeneous dietary intake patterns (41,39).

The Pearson correlation test also showed no significant associations between magnesium adequacy ($p = 0.133$; $r = -0.196$) or vitamin C adequacy ($p = 0.696$; $r = 0.051$) and academic stress. Physiologically, magnesium may contribute to stress regulation through its role in the HPA axis. Magnesium can suppress the release of adrenocorticotropic hormone (ACTH) from the pituitary gland and reduce adrenal sensitivity to ACTH, thereby contributing to the regulation of cortisol production and potentially reducing excessive anxiety and stress responses (42). However, the non-significant association in the present study is consistent with a previous study (43) that also found no significant association between magnesium levels and stress. Vitamin C also has a potential role in the stress response because of its antioxidant properties and its ability to reduce cortisol levels and attenuate physiological responses to stress. Adequate vitamin C intake may therefore contribute to the regulation of stress symptoms. The present findings differ from those of a previous study, which reported that vitamin C supplementation reduced stress levels (44). This discrepancy may be related to differences in the method of intake assessment. The previous study evaluated vitamin C supplementation at a measured dose, whereas the present study assessed vitamin C intake from daily food consumption. In addition, academic stress is a multifactorial condition influenced not only by nutrient intake but also by academic workload, social support, and individuals' ability to perceive and respond to stressors (20). Another consideration is the use of two 24-hour food recalls in

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the present study. Although this method can provide information on dietary intake, it reflects relatively short-term consumption and may not adequately represent habitual magnesium or vitamin C intake. Therefore, combining 24-hour recalls with a semi-quantitative food frequency questionnaire (SQ-FFQ) may provide a more representative assessment of habitual micronutrient intake (45).

CONCLUSION

The results showed no significant differences in academic stress or emotional eating behavior between the normal and overnutrition groups ($p>0.05$). The normal group was predominantly characterized by moderate academic stress (67.4%) and non-emotional eating behavior (51.2%), whereas the overnutrition group was predominantly characterized by high academic stress (52.6%) and emotional eating behavior (57.9%). In contrast, significant differences were found in energy, protein, and carbohydrate adequacy between the two groups ($p<0.05$), with higher mean adequacy levels in the overnutrition group. No significant differences were found in fat, magnesium, or vitamin C adequacy between the groups ($p>0.05$). Correlation analysis showed that academic stress and emotional eating were not significantly associated with nutritional status, whereas energy and protein adequacy were significantly associated with nutritional status ($p<0.05$). Fat and carbohydrate adequacy were not associated with nutritional status, while magnesium and vitamin C adequacy were not associated with academic stress ($p>0.05$). Thus, significant associations with nutritional status were found only for energy and protein adequacy, while academic stress and emotional eating showed no significant associations. These findings may provide a basis for schools to develop counseling and health promotion programs focusing on stress management and healthy eating habits. Future research should involve larger, balanced, and more representative samples; consider other factors that may influence nutritional status, such as physical activity, nutrition knowledge, parenting practices, and peer influence; and use longitudinal designs. Combining two 24-hour dietary recalls with a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) is also recommended to provide a more accurate assessment of long-term nutrient intake, particularly magnesium and vitamin C.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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