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The Association Between Stress Levels and Nutritional Status Among Preclinical Medical Students at The State University of Gorontalo

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ABSTRACT

Introduction. Malnutrition remains a global public health concern with significant implications for young adults, including medical students who are exposed to high academic demands that may induce persistent stress and subsequently affect eating behavior and nutritional status. This study aimed to identify stress levels and nutritional status and to analyze the relationship between the two among preclinical medical students at the Faculty of Medicine, Gorontalo State University. **Methods.** An observational analytical study with a cross-sectional design was conducted involving 191 respondents selected through total sampling. Stress levels were assessed using the Medical Student Stressor Questionnaire (MSSQ), while nutritional status was determined based on Body Mass Index (BMI) obtained from standard anthropometric measurements. Data were analyzed using Spearman's correlation test. **Results.** The results showed that most students experienced moderate stress levels (51.8%), with academic-related stressors being the most dominant, and the majority of respondents had normal nutritional status (56.5%). Bivariate analysis demonstrated no significant correlation between stress levels and nutritional status ($r = -0.131$; $p = 0.071$). **Conclusion.** In conclusion, stress levels were not significantly associated with nutritional status among preclinical medical students. Other factors, such as daily calorie intake, physical activity, sleep duration, and genetic or family history, may play a more prominent role in determining nutritional status. Nevertheless, stress management interventions and the promotion of healthy lifestyles remain important to support the overall well-being of medical students.

1. Introduction

Malnutrition remains a major global public health concern, encompassing a wide spectrum ranging from nutrient deficiencies to excessive nutritional intake. According to the World Health Organization in 2024, approximately 2.5 billion adults worldwide experience imbalances in nutritional status, including 890 million individuals with obesity and 390 million with undernutrition.[1] In Indonesia, data from the 2023 Indonesian Health Survey show that 14.4% of adults are overweight and 23.4% are obese, indicating a growing burden of nutritional imbalance among young adults. This condition is particularly concerning in populations exposed to high academic stress, such as medical students, whose demanding educational environment may influence eating behavior, metabolic regulation, and overall nutritional status. However, despite the increasing prevalence of stress-related problems in medical education, evidence regarding the association between stress levels and nutritional status remains inconsistent, particularly among preclinical medical students in Indonesia. Therefore, this study is necessary to address this knowledge gap and to support the development of evidence-based health promotion and stress management strategies within medical education settings.[2]

Stress is an adaptive psychophysiological response to various environmental demands that exceed an individual's coping capacity. Medical education students face significant academic pressure, far higher than that experienced by students in other fields of study.[3] Previous studies have shown that 52.6% of medical students experience moderate stress, while 55% to 56.6% experience severe stress related to academic aspects.[4] The characteristics of medical education, which include extensive volumes of material, high

frequencies of evaluation, intensive laboratory practicums, and strict clinical competency demands, create an academic environment with sustained pressure, as consistently reported in studies on medical student stress and learning environments.[5-7]

Neurobiological mechanisms link stress to changes in nutritional status through activation of the hypothalamic–pituitary–adrenal axis.[8] Acute stress can suppress appetite through the release of corticotropin-releasing hormone, whereas chronic stress increases preferences for energy-dense foods through elevated glucocorticoid levels and leptin resistance.[5] This biphasic pattern produces heterogeneous responses, in which some individuals exhibit reduced food intake while others demonstrate increased emotional consumption.[12]

Previous literature shows contradictory results regarding the relationship between stress and nutritional status. Several studies have found significant associations, such as research conducted among students at the University of Lampung that identified a significant correlation between stress levels and nutritional status.[9] However, other studies have reported no significant relationship, including research at Tarumanagara University. These discrepancies may be attributed to differences in dietary patterns, academic workload intensity, coping mechanisms, and sociocultural as well as geographical contexts that influence students' lifestyle behaviors. For example, variations in local food availability, eating habits, and the structure of medical curricula across regions may modify how stress affects nutritional status. This heterogeneity highlights that nutritional status is a multifactorial outcome and underscores the importance of conducting context-specific research, thereby supporting the significance and novelty of investigating this relationship among preclinical medical students in Gorontalo.[10]

Preliminary observations from in-depth interviews with 10 students from the Faculty of Medicine, Universitas Negeri Gorontalo, revealed that 8 out of 10 students had experienced stress during their studies, with 7 of them reporting impacts on eating patterns, sleep quality, and concentration during learning. These findings underscore the relevance of empirical investigation into the dynamics between academic stress and nutritional status in the local population. This study aims to identify stress levels, nutritional status, and analyze the relationship between the two among preclinical medical students at Universitas Negeri Gorontalo, with the expectation of providing empirical evidence for the development of more targeted and effective student health intervention programs.

2. Methods

This study was an observational analytic study with a cross-sectional design to analyze the association between two variables without providing any intervention to the subjects. The study population comprised all preclinical students of the Medical Study Program at Universitas Negeri Gorontalo who were registered and actively enrolled at the time of the study. Data collection was conducted in November 2025, during the active academic semester, a period characterized by routine academic activities and evaluative demands that may influence students' stress levels. Sampling was conducted using sampling was conducted using a total sampling technique, including 191 preclinical students who met the inclusion criteria. The inclusion criteria consisted of active preclinical-level students, willingness to participate indicated by signing informed consent, and presence during data collection. The exclusion criteria included students who were on academic leave, had a history of chronic diseases affecting nutritional status, or were undergoing a special diet based on medical advice.

The independent variable was stress level, measured using the Medical Student Stressor Questionnaire (MSSQ), which consists of 40 items assessing six main stressor domains, including academic stressors, intrapersonal–interpersonal stressors, teaching–learning process stressors, social stressors, drive–desire stressors, and group activity stressors. Respondents rated each item using a Likert scale of 0–4 (0 = does not cause stress; 4 = causes severe stress). Mean scores were calculated for each domain and categorized as follows: mild stress (0–1.00), moderate stress (1.01–2.00), severe stress (2.01–3.00), and very severe stress (3.01–4.00). The dependent variable was nutritional status, measured using Body Mass Index (BMI), calculated as the ratio of body weight in kilograms to the square of height in meters (kg/m^2). Anthropometric measurements were conducted by the researcher and trained assistants using a digital scale (accuracy 0.1 kg) and a microtoise (accuracy 0.1 cm), following standard protocols with subjects removing footwear, wearing light clothing, and standing upright. Nutritional status classification adopted the standards of the Indonesian Ministry of Health, namely severe underweight (BMI <17.0 kg/m^2), mild underweight (BMI 17.0–18.4 kg/m^2), normal (BMI 18.5–25.0 kg/m^2), overweight (BMI 25.1–27.0 kg/m^2), and obese (BMI >27.0 kg/m^2).

The data collection procedure began with an explanation of the study objectives and the acquisition of written informed consent from respondents. Completion of the MSSQ was carried out individually within 5–10 minutes in a conducive environment. Subsequently, anthropometric measurements were conducted in a separate room to maintain respondent privacy. The collected data were verified for completeness before processing. Data analysis was performed using SPSS statistical software version 25.0. Univariate analysis was conducted to describe the frequency distribution of respondent characteristics, stress levels, and

nutritional status using frequency and percentage distribution tables. Prior to bivariate analysis, data normality was assessed using the Shapiro–Wilk test. The results indicated that the data were not normally distributed ($p < 0.05$). Therefore, bivariate analysis was performed using Spearman's rank correlation test to analyze the association between stress levels and nutritional status, with the level of significance set at $\alpha = 0.05$ and a 95% confidence interval.

3. Results

Based on Table 1, the characteristics of the respondents showed a predominance of female students, totaling 137 students (71.7%), while male students accounted for 54 students (28.3%). The age distribution of respondents ranged from 17 to 23 years, with the majority of students aged 20 years (30.4%), followed by those aged 21 years (26.7%). This age range represents the late adolescent to early adulthood phase, which is typical of preclinical medical students.

In Table 2, the distribution of stress levels indicates that the majority of respondents (51.8%) experienced moderate stress, comprising 99 students, followed by severe stress in 71 students (37.2%). A smaller proportion experienced mild stress (10.5%, n = 20), and only one student (0.5%) experienced very severe stress. Cumulatively, 89.0% of students experienced stress at moderate to severe levels.

Table 3 shows that the majority of respondents had normal nutritional status, totaling 108 students (56.5%). The overweight category included 41 students classified as mildly overweight (21.5%) and 14 students as severely overweight (7.3%). On the other hand, mild underweight was observed in 18 students (9.4%), while severe underweight was found in 10 students (5.2%).

Table 4 shows that the bivariate analysis using Spearman's correlation test yielded a correlation coefficient of $r = -0.131$ ($p = 0.071$) between stress levels and nutritional status. A p-value greater than the significance level of $\alpha = 0.05$ indicates that there is no statistically significant association. The negative and weak correlation coefficient indicates a very minor tendency toward a negative relationship that does not reach statistical significance.

Table 1. Distribution of respondent characteristics by sex and age

Respondent Characteristics	Number (n)	Percentage (%)
Sex		
Female	137	71.7
Male	54	28.3
Age (years)		
17	12	6.3
18	21	11.0
19	30	15.7
20	58	30.4
21	51	26.7
22	11	5.8
23	8	4.2
Total	**191**	**100.0**

Table 2. Distribution of stress levels among preclinical medical students at Universitas Negeri Gorontalo (n = 191)

Stress Level	Number (n)	Percentage (%)
Mild	20	10.5
Moderate	99	51.8
Severe	71	37.2
Very severe	1	0.5

Table 3. Distribution of nutritional status among preclinical medical students at Universitas Negeri Gorontalo (n = 191)

Nutritional Status	Number (n)	Percentage (%)
Severe underweight	10	5.2
Mild underweight	18	9.4
Normal	108	56.5
Overweight	41	21.5
Obese	14	7.3

Table 4. Relationship between stress levels and nutritional status among preclinical medical students at Universitas Negeri Gorontalo

Variable	r	*p-value*
Stress Level vs Nutritional Status	-0.131	0.071

4. Discussion

The predominance of moderate to high stress levels among preclinical medical students may be influenced by several factors related to both individual characteristics and the academic environment. Female students constituted the majority of the study population, and previous studies have reported that female medical students tend to experience higher perceived stress, which may be related to differences in emotional responses, coping mechanisms, and academic expectations. In addition, the preclinical phase of medical education is characterized by intensive coursework, frequent examinations, and high-performance demands, which can contribute to sustained stress exposure. These findings are consistent with the study conducted by Novitasari and Kumala, which reported a higher proportion of female students in groups experiencing elevated stress levels during preclinical medical training.[7]

Women tend to have more sensitive stress responses compared to men. This condition is influenced by biological factors, particularly the role of estrogen and progesterone hormones in emotional regulation and stress responses. Estrogen is known to increase the sensitivity of the nervous system to psychosocial stressors through activation of the HPA axis, resulting in increased cortisol secretion.[14] This condition makes women more vulnerable to psychological stress, especially in situations with high academic demands. In addition to biological factors, psychological and social aspects also contribute. Female students tend to have high academic expectations of themselves, are more sensitive to environmental evaluations, and respond more emotionally to academic pressure.[15]

The Academic Related Stressor (ARS) domain was the most dominant in this study, with 49.2% of students experiencing severe stress in this domain. The finding that ARS was the most dominant stressor is consistent with the study by Sajuni and Agus at the Faculty of Medicine, Universitas Surabaya, which reported that the highest mean stress scores were found in the ARS domain.[16] Academic pressure, particularly related to the volume of material, frequency of examinations, strict assessment standards, and demands for clinical competence, is a major factor contributing to increased stress among medical students. Academic stressors include dense course material loads, demands to understand complex medical concepts, high examination frequency, and pressure to achieve optimal academic performance.[10]

The predominance of normal nutritional status among preclinical medical students suggests that, despite exposure to academic stress, most students are able to maintain an adequate balance between energy intake and expenditure. This may reflect relatively preserved eating patterns, adaptive coping strategies, or sufficient access to food resources during the preclinical phase of medical education. Similar patterns have been reported in previous studies, including research conducted by Angie et al. among medical students at the Faculty of Medicine, Universitas Lampung, which also indicated that normal nutritional status was the most common category observed.[6] This indicates that most medical students can maintain an ideal nutritional balance despite facing high academic pressure.[17]

The predominance of normal nutritional status indicates that most students have achieved a balance between nutrient intake and the body's energy requirements. Theoretically, normal nutritional status reflects a state of energy homeostasis, in which energy intake, energy expenditure, and body metabolism are balanced.[18] This condition is important in young adults because it is associated with physical fitness, immune function, and the ability to concentrate during academic activities. Students with normal nutritional status are generally able to maintain relatively regular and balanced eating patterns despite being in a demanding academic environment. As future healthcare professionals, medical students generally have better knowledge regarding nutrition and health, which leads them to maintain body weight within normal limits.[19]

The presence of overnutrition among a proportion of preclinical medical students indicates a potential shift toward unhealthy lifestyle patterns, which may include inadequate physical activity, irregular eating habits, and increased consumption of energy-dense foods. Academic demands during medical training can contribute to sedentary behavior and limited time for structured physical activity, potentially increasing the risk of excess body weight. This finding highlights the importance of early lifestyle interventions aimed at promoting balanced nutrition and regular physical activity among medical students, even during the preclinical phase. The figure is consistent with the trend reported by Angie et al. among final-year students at Universitas Lampung, where 34.8% of students were found to experience overnutrition.[6] The high prevalence of overnutrition among medical students is often associated with a sedentary lifestyle, which is a logical consequence of high academic demands. Students spend most of their time in a sitting position during lectures, practicums, and independent study, which drastically reduces daily

energy expenditure.[20] This condition is further exacerbated by unhealthy eating patterns. Students with busy schedules tend to choose fast food that is high in calories, saturated fat, and simple sugars due to practicality and accessibility.[21]

The occurrence of undernutrition among preclinical medical students suggests that a subset of students may experience inadequate energy intake or irregular eating patterns during the early phase of medical training. Factors such as academic stress, time constraints, appetite changes, and suboptimal dietary choices may contribute to insufficient nutritional intake. Undernutrition in young adults is a concern because it can negatively affect physical health, cognitive performance, and academic functioning, underscoring the need for nutritional awareness and supportive interventions within medical education settings. Physiologically, undernutrition occurs due to prolonged energy deficits, causing the body to utilize energy reserves in the form of fat and muscle protein to maintain vital functions.[22] This mechanism is characterized by reduced body mass, decreased subcutaneous fat tissue, and impaired immune function. Under these conditions, the body's metabolism adapts by slowing basal metabolic rate, decreasing thyroid hormone production, and reducing protein synthesis. If this condition is not promptly addressed, it may disrupt learning processes, concentration, and student productivity.[23]

The absence of a significant association between stress levels and nutritional status in this study should be interpreted with caution and does not necessarily indicate the absence of a true relationship. One possible explanation is that the study may have been underpowered to detect a weak or moderate association, despite including all eligible preclinical students. While the sample size was adequate for descriptive analysis, it may not have been sufficient to capture subtle effects of stress on nutritional status, particularly when stress responses vary widely among individuals.

Another important consideration is the use of Body Mass Index as an indicator of nutritional status. BMI reflects long-term energy balance and body composition rather than short-term physiological changes. Stress, especially when acute or fluctuating, may influence eating behavior, appetite, or metabolic responses without producing immediate changes in body weight.[11] As a result, BMI may not be sensitive enough to detect the early or transient effects of stress on nutritional status.

In addition, nutritional status is influenced by multiple factors beyond psychological stress, including dietary intake, physical activity, sleep patterns, and genetic predisposition. [12] These factors were not comprehensively assessed in this study and may have acted as confounding variables, potentially attenuating the observed association between stress levels and nutritional status. Therefore, future studies should consider using more sensitive nutritional indicators and longitudinal designs to better capture the dynamic relationship between stress and nutritional outcomes among medical students.

This finding is consistent with the study by Novitasari and Kumala conducted among students at Universitas Tarumanagara, which obtained a p-value of 0.185 and likewise found no significant association.[7] According to Novitasari and Kumala, this phenomenon occurs because stress does not directly alter nutritional status but instead affects eating behavior, which is highly individual and variable.[8] The risk of stressed groups experiencing abnormal nutritional status was found to be lower than that of non-stressed groups, suggesting that emotional factors alone are not sufficiently strong to change an individual's nutritional status without the influence of other factors such as food availability and self-control.

Physiologically, the relationship between stress and nutritional status is indeed complex and non-linear. This is because individual stress coping mechanisms vary widely. Stress can trigger two different patterns of eating responses, namely emotional under-eating and emotional over-eating.[24] In some individuals, stress reduces appetite through increased Corticotropin-Releasing Hormone (CRH), which decreases food intake, whereas in others, chronic stress increases cortisol, ghrelin, and Neuropeptide Y (NPY) activity, thereby promoting increased consumption of energy-dense foods.[3]

In addition to biological mechanisms, there are also protective factors that may explain the absence of a significant relationship between stress and nutritional status. Medical students possess relatively good health literacy, including an understanding of the risks of obesity and overweight for non-communicable diseases.c This knowledge may trigger compensatory behaviors, such as attempting to control dietary patterns or engaging in light physical activity even when under stress.

Based on the existing results and theories, stress among medical students has a greater impact on mental health aspects than on direct changes in nutritional status. The impact of stress on nutritional status becomes evident only when stress is chronic and accompanied by significant changes in eating behavior and physical activity. Therefore, stress management efforts remain important as part of student health promotion, even though they may not always be directly reflected in nutritional status indicators.

5. Conclusion

Stress levels among preclinical medical students at Universitas Negeri Gorontalo were predominantly in the moderate to severe categories, with academic stressors as the main source of pressure, while the majority maintained normal nutritional status despite a significant prevalence of overnutrition and

undernutrition. There was no significant association between stress levels and nutritional status, indicating that nutritional status is a multifactorial phenomenon influenced by nutritional literacy, dietary patterns, physical activity, and diverse individual coping mechanisms. Holistic intervention programs integrating stress management, continuous nutrition education, and the promotion of physical activity are needed to support optimal health among medical students. Future studies are recommended to examine and control other confounding variables not explored in this study, such as daily caloric intake (24-hour food recall), physical activity levels, sleep duration, and genetic or family history factors.

6. Author Contribution

N.A.S.D. conceived the study, conducted data collection, performed statistical analysis, and drafted the original manuscript. C.R.K. contributed to nutritional assessment, data interpretation related to nutritional status, and critical revision of the manuscript. S.M.P. contributed to the physiological interpretation of stress mechanisms, provided scientific input, and reviewed the manuscript critically. V.N.A.K. contributed to data collection, nutritional data analysis, and manuscript editing. S.A.I. contributed to the study design from a public health perspective, data interpretation, and overall manuscript review. All authors reviewed and approved the final version of the manuscript.

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