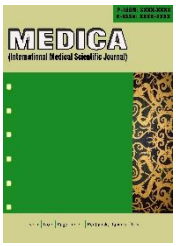
MEDICA

(International Medical Scientific Journal)
Vol.8, No.6, June 2026, pp. 368 – 380
ISSN 2622-660X (Online), ISSN 2622-6596 (Print)
https://journal.ahmareduc.or.id/index.php/medica



Analysis of Dietary Patterns and Nutritional Adequacy in Relation to Nutritional Status

Rifana Cholidah[1]✉, Emmy Amalia[2], Ario Danianto[2], Dyah Purnaning[2], Zahro Ananta[2], Ni Kadek Sintha Amanda[2]

[1] Department of Nutrition, Faculty of Medicine and Health Sciences, University of Mataram, Mataram City, West Nusa Tenggara, Indonesia
[2] Faculty of Medicine and Health Sciences, University of Mataram, Mataram City, West Nusa Tenggara, Indonesia

Info Article

Article History:
Received:
20 May 2026
Accepted:
14 June 2026
Published:
15 June 2026

Keywords:
Nutritional Status
Dietary Patterns
Medical Students

Abstract

University students are vulnerable to unhealthy eating behaviors due to academic demands, time constraints, and reliance on convenience foods, which may affect their nutritional status. This study aimed to assess nutritional status, dietary patterns, and nutritional adequacy among second-semester students at the Faculty of Medicine and Health Sciences, University of Mataram, and to examine their associations. A cross-sectional study was conducted among 215 students. Nutritional status was determined using body mass index (BMI), while dietary intake was assessed through 24-hour food records analyzed using NutriSurvey. Participants had a mean age of 18.81 ± 0.75 years and a mean BMI of 21.83 ± 4.18 kg/m², with 66.51% classified as having normal nutritional status. The study shows that most students have inappropriate dietary patterns (66.51%) and inadequate macronutrient intake, particularly carbohydrates. Although 69.77% achieved adequate total energy intake, the overall dietary pattern reflected an imbalanced macronutrient distribution. No significant association was found between dietary patterns and nutritional status (p = 0.109) or between nutritional adequacy and nutritional status (p = 0.295). These findings suggest that factors beyond dietary intake alone may influence nutritional status among university students. Therefore, targeted nutrition education and behavior-based interventions are needed to promote healthier eating habits among future health professionals.

Corresponding Author:
✉ Rifana Cholidah
Department of Nutrition, Faculty of Medicine and Health Sciences, University of Mataram, Mataram City, West Nusa Tenggara, Indonesia
Email: rifana.cholidah@unram.ac.id

1. INTRODUCTION

Nutrition remains a major public health issue globally and continues to be a concern in both developed and developing countries (Muridzo Muonde et al., 2024). Nutritional issues encompass both undernutrition and overnutrition, both of which can negatively impact short- and long-term health. According to the World Health Organization (WHO), more than 390 million children and adolescents aged 5–19 are overweight or obese, while approximately 160 million others are underweight (WHO, 2025). This demonstrates the double burden of nutrition, a global challenge.

In Indonesia, nutritional problems among adolescents also remain high. The 2018 basic health research (Riskesdas) and the 2023 Indonesian Medical Survey reported the nutritional status of adolescents aged 16–18 years. Based on the 2018 Riskesdas, the prevalence of underweight adolescents was 8.1% (1.4% severely underweight and 6.7% underweight), while overweight was 13.5% (9.5% overweight and 4.0% obese) (Indonesian Ministry of Health, 2018). In the 2023 SKI, the prevalence of undernutrition increased slightly to 8.3%, while overnutrition decreased to 12.1% (Indonesian Minsitry of Health, 2023). These data indicate that nutritional problems among adolescents are ongoing and tend to fluctuate (Parajuli & Prangthip, 2025).

Adolescence is a transitional period between childhood and adulthood, marked by rapid growth and development, both physically, psychologically, and intellectually (Gniewosz & Gniewosz, 2020; Mastorci et al., 2024). During this phase, nutritional needs increase to support optimal growth and development. Nutritional status is the result of the balance between nutrient intake and body needs, and is influenced by various factors such as diet, physical activity, and eating behavior. One of the main factors determining nutritional status is an unbalanced diet (Krispul & Mahmudiono, 2025; Torres et al., 2025).

University students in late adolescence and early adulthood occupy a nutritionally vulnerable position. Academic demands, time constraints, financial limitations, and independent living converge to disrupt structured eating, increase reliance on convenient and energy-dense foods, and reduce dietary diversity (Avram et al., 2024; Jurado-Gonzalez et al., 2025; Khajuria et al., 2025; Sogari et al., 2018). These behavioral changes raise the risk of both macronutrient imbalance and overall nutritional compromise, positioning this population as a meaningful but frequently overlooked group in nutritional surveillance.

Research on the relationship between diet and nutritional status among adolescents has produced conflicting results. Studies reporting significant associations stand alongside those that found no significant relationship (Andriani & Indrawati, 2021; Dini et al., 2025; Elda et al., 2026; Veronika et al., 2021), and the reasons for these discrepancies remain incompletely explored. A recurring limitation in this literature is its reliance on dietary pattern classification alone, without concurrent assessment of nutritional adequacy that is, the degree to which intake meets quantitative requirements for energy and specific macronutrients. Dietary pattern and nutritional adequacy capture different dimensions of dietary behavior: a student may follow an irregular eating pattern yet still meet energy requirements through energy-dense foods, or conversely display structured meal timing while consuming macronutrient-deficient diets. Treating these as interchangeable has likely contributed to inconsistent findings across studies. Furthermore, the majority of existing research focused on adolescents aged 13–17, leaving late adolescents, particularly college students, underrepresented in the evidence base (Winpenny et al., 2017). Medical students present a further distinctive case: their nutritional knowledge exceeds that of the general student population, yet this knowledge does not reliably

translate into healthier dietary behavior (Alghamdi et al., 2021) a disconnect that warrants specific investigation.

This study therefore aimed to assess nutritional status, dietary patterns, and nutritional adequacy among second-semester students at the Faculty of Medicine and Health Sciences, University of Mataram, and to examine the associations between these variables. By evaluating dietary patterns and nutritional adequacy as independent constructs alongside nutritional status, this study addresses a gap in the current literature and contributes evidence relevant to nutrition intervention in late adolescents within an academic health sciences setting.

2. METHOD

This study is an analytic observational study using a cross-sectional approach. Samples meeting the study criteria underwent a series of examinations during the study period. The study was conducted at the Faculty of Medicine and Health Sciences (FMHS), University of Mataram (Unram). The study sample consisted of second-semester students of the Faculty of Medicine and Health Sciences, Medical Study Program. Data collection took place over several months, from April to May 2025.

The study population comprised second-semester students of the Medical Study Program, class of 2024. Purposive sampling was applied to select participants meeting predefined eligibility criteria. Inclusion criteria were: enrollment at FMHS Unram, class of 2024; age 17–19 years; and willingness to participate. Students were excluded if they had a history of infectious diseases (HIV or tuberculosis) or metabolic disorders affecting nutritional status (hypothyroidism or hyperthyroidism), as these conditions could confound the relationship between dietary intake and anthropometric outcomes.

Sample size was calculated using the Lemeshow formula for cross-sectional studies, based on a prevalence of inappropriate dietary patterns of 52.9% from a prior comparable study (Andriani & Indrawati, 2021), with a 95% confidence level (Z = 1.96) and a margin of error of 5%, yielding a minimum required sample of 192 participants. A total of 215 students were enrolled, providing adequate statistical power to detect associations of the expected magnitude.

Dietary intake was assessed using a single 24-hour dietary recall, in which participants reported all foods and beverages consumed during the preceding 24 hours. Interviewers were trained to use standardized food models and portion guides to minimize estimation error. The 24-hour recall is widely used in nutritional epidemiology and is considered appropriate for describing population-level dietary intake when individual variation is accounted for at the group level. However, a single recall may not fully capture habitual intake due to day-to-day dietary variability, this limitation is acknowledged and discussed accordingly. Anthropometric measurements included weight and height. Body weight was measured using a calibrated digital scale and height using a stadiometer. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2) and used to classify nutritional status into five categories: severely underweight (<17.0), underweight (17.0–18.4), normal (18.5–24.9), overweight (25.0–27.0), and obese (>27.0 kg/m^2), following Indonesian Ministry of Health criteria.

Dietary data obtained from 24-hour food records were analyzed using NutriSurvey software to estimate daily energy and macronutrient intake. Dietary patterns were evaluated by comparing macronutrient distribution with World Health Organization (WHO) recommendations, namely carbohydrate intake of 55–75%, total fat 15–30%, and protein 10–15% of total energy intake. Participants who met at least two of these macronutrient criteria were categorized as having an appropriate diet. Nutritional adequacy was

determined by comparing nutrient intakes obtained from NutriSurvey with the Recommended Dietary Allowance (RDA). Macronutrient adequacy (carbohydrate, protein, and fat) was classified into two categories: inadequate (<80% of RDA) and adequate (≥80% of RDA). Participants who met at least two macronutrient adequacy criteria were considered to have adequate nutritional intake. All data were analyzed using SPSS version 28. Univariate analysis was performed to describe respondent characteristics, including gender, age, height, weight, body mass index (BMI), dietary patterns, and macronutrient adequacy levels. Bivariate analysis was performed using the chi-square test to examine the relationship between dietary patterns and nutritional status, as well as between nutritional adequacy and nutritional status. Nutritional status was categorized into five groups: severely underweight, underweight, normal, overweight, and obese. A p-value <0.05 was considered statistically significant. To determine the simultaneous effect of dietary patterns and nutritional adequacy on nutritional status, an ordinal logistic regression analysis was performed, with nutritional status as the dependent variable and dietary patterns and nutritional adequacy as the independent variables.

All analyses were performed using IBM SPSS Statistics for Windows, Version 28.0 (IBM Corp., Armonk, NY, USA) at a 95% confidence level. Univariate analysis described participant characteristics including sex, age, BMI, dietary patterns, and macronutrient adequacy. For bivariate analysis, nutritional status was grouped into three categories (underweight, normal, overweight/obese) to satisfy chi-square assumptions regarding minimum expected cell frequencies. The chi-square test examined associations between dietary patterns and nutritional status, and between nutritional adequacy and nutritional status; Cramér's V was calculated as a measure of effect size. To assess the simultaneous contribution of dietary patterns and nutritional adequacy to nutritional status, ordinal logistic regression was performed with nutritional status as the dependent variable. A p-value < 0.05 was considered statistically significant.

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, University of Mataram (No. 174/UN18.F8/ETIK/2025). As the study did not involve any invasive procedures, all participants voluntarily agreed to participate and provided informed consent before data collection.

3. RESULTS AND DISCUSSION

This study involved 215 second-semester students from the Faculty of Medicine and Health Sciences (FMHS), University of Mataram. Demographic characteristics are presented in Table 1.

Table 1. Frequency distribution by demographic characteristic.

Characteristics	n = 215 n/mean (%/SD)
Sex	
Male	67 (31.16)
Female	148 (68.84)
Age (years)	18.81 ± 0.75
Height (cm)	160.41 ± 7.85
Weight (kg)	56.57 ± 13.99
Body Mass Index (kg/m²)	21.83 ± 4.18

As presented in Table 1, the majority of participants were female (68.84%), with a mean age of 18.81 ± 0.75 years, mean height of 160.41 ± 7.85 cm, mean weight of 56.57 ± 13.99 kg, and mean BMI of 21.83 ± 4.18 kg/m².

Building upon these baseline characteristics, the nutritional status of the students was assessed using body mass index (BMI) classification, and the distribution of nutritional status is presented in Figure 1.

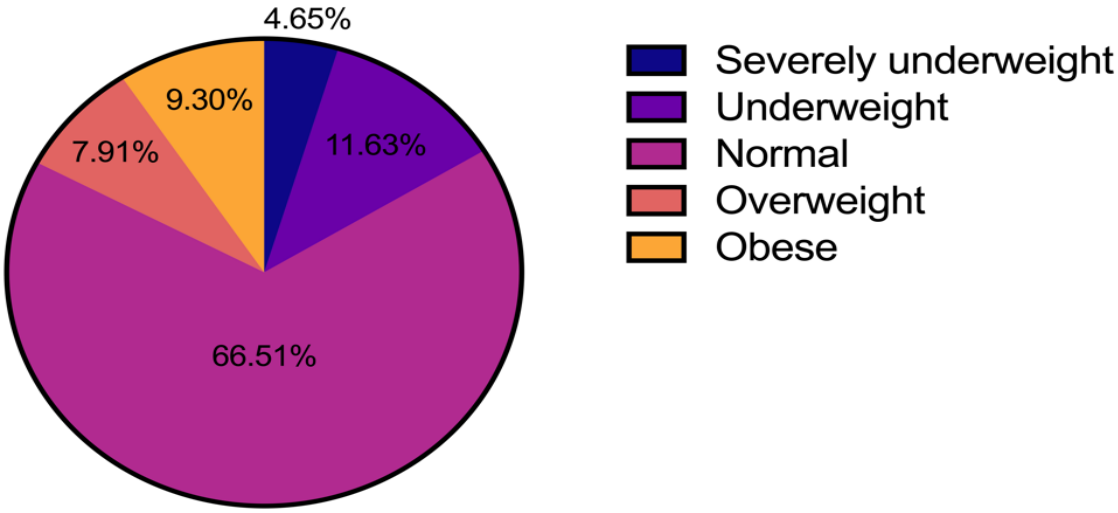


Figure 1. Distribution of nutritional status.

Most students (66.51%) were classified as having normal nutritional status, indicating that the majority maintained a BMI within the healthy range. However, a substantial proportion fell outside normal boundaries: 4.65% were severely underweight, 11.63% underweight, 7.91% overweight, and 9.30% obese. Taken together, 33.49% of students exhibited abnormal nutritional status. The simultaneous presence of undernutrition students with insufficient body mass relative to height and overnutrition students accumulating excess body mass within the same cohort reflects a dual nutritional burden that is not reducible to a single dietary problem.

Given that nutritional status is closely influenced by dietary behavior, dietary patterns were subsequently evaluated based on macronutrient intake. The distribution of dietary patterns among the participants is shown in Figure 2

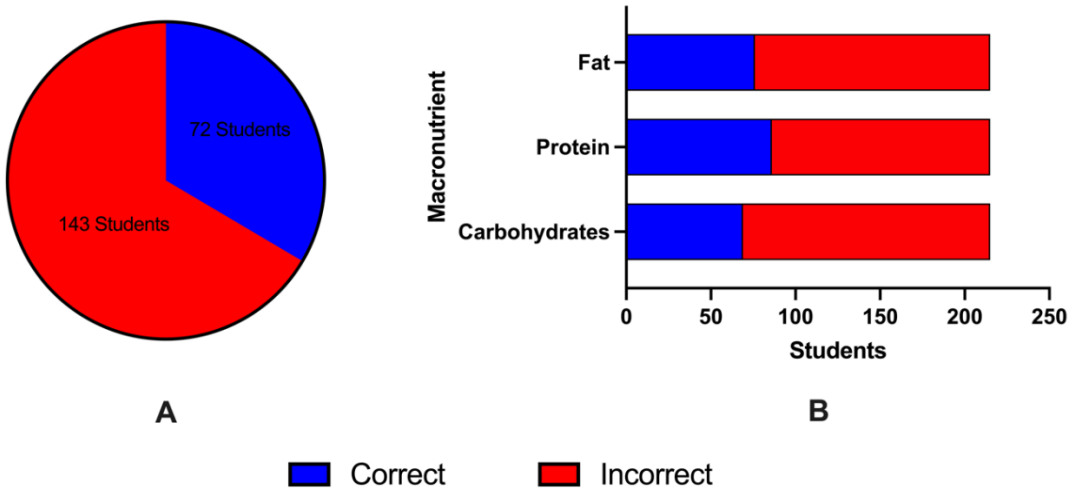


Figure 2. Dietary Patterns. (a) Distribution and (b) dietary patterns overview.

Dietary patterns, assessed through 24-hour food records analyzed with NutriSurvey software, revealed that most students (66.51%) had inappropriate dietary patterns, while only 33.49% met criteria for appropriate dietary patterns. Examination at the macronutrient level showed that inadequate intake was recorded across all three major macronutrients: 67.91% of students had inadequate carbohydrate intake, 60.00% had inadequate protein intake, and 64.65% had inadequate fat intake. Carbohydrate inadequacy was the most prevalent single macronutrient deficit, affecting more than two-thirds of the cohort. The co-occurrence of inadequate intake across multiple macronutrients is particularly concerning, as overall dietary quality depends on the balance of macronutrient distribution rather than on the adequacy of any single component in isolation. A student consuming insufficient carbohydrate while also consuming below-recommended fat intake, for instance, will have a dietary pattern that is structurally imbalanced regardless of total caloric intake. This pattern of multi-macronutrient inadequacy suggests that the dietary profiles of these students are not simply low in calories but are compositionally misaligned with nutritional recommendations.

To further examine the quality of dietary intake, nutritional adequacy was assessed in relation to recommended nutrient requirements. The distribution of nutritional adequacy, both overall and at the macronutrient level, is presented in Figure 3.

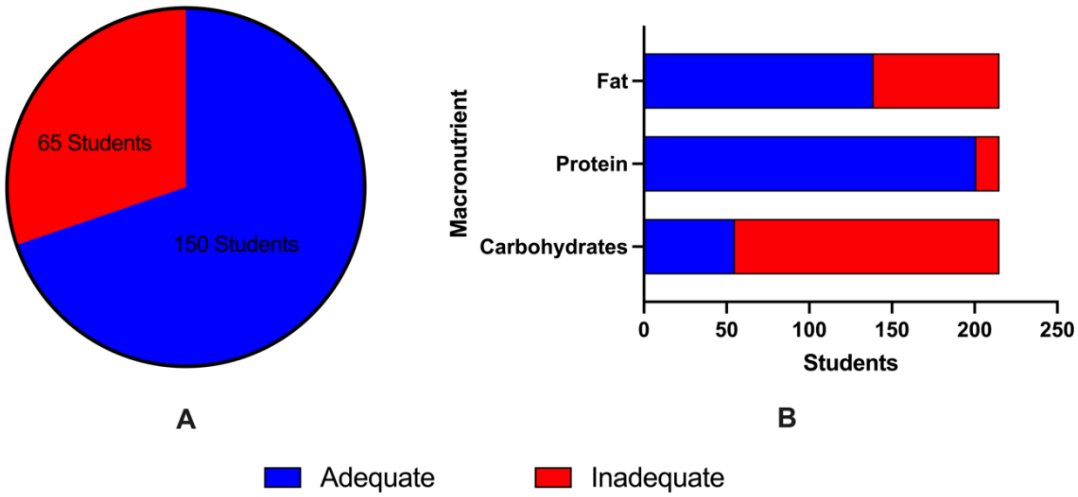


Figure 3. Nutritional Adequacy. (a) Overall level and (b) macronutrients.

Nutritional adequacy analysis produced a finding that appeared, at first, to contradict the dietary pattern data (Figure 3). When assessed at the level of total energy, 69.77% of students met their daily energy requirements, a figure that might suggest adequate overall nutritional intake. However, disaggregation by macronutrient revealed a substantially different picture. Carbohydrate adequacy stood at only 25.58% meaning that fewer than one in four students consumed carbohydrates at recommended levels. Fat adequacy was 64.65%, and protein adequacy reached 93.49%, indicating that protein intake was near-sufficient or sufficient for most students. This distribution reveals that total energy requirements were being met not through balanced macronutrient intake, but through disproportionately high protein and fat consumption that compensated energetically for severely deficient carbohydrate intake. In practical terms, students were consuming enough total calories, but those calories were derived from a macronutrient profile skewed heavily toward protein and fat rather than the carbohydrate-dominant

pattern recommended by nutritional guidelines. This dissociation between energy quantity and macronutrient quality is a central finding of this study and has implications distinct from simple caloric insufficiency.

Following the descriptive assessment of nutritional status, dietary patterns, and nutritional adequacy, inferential analyses were conducted to evaluate the relationships among these variables. Chi-square analysis was employed to examine the distribution of dietary patterns and nutritional adequacy across nutritional status categories, with the results presented in Figures 4 and 5.

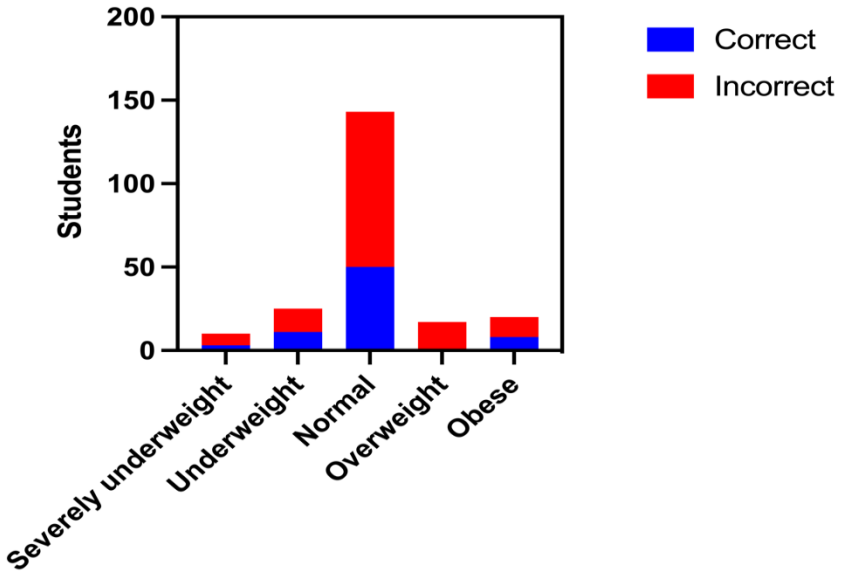


Figure 4. Relationship between dietary patterns and nutritional status.

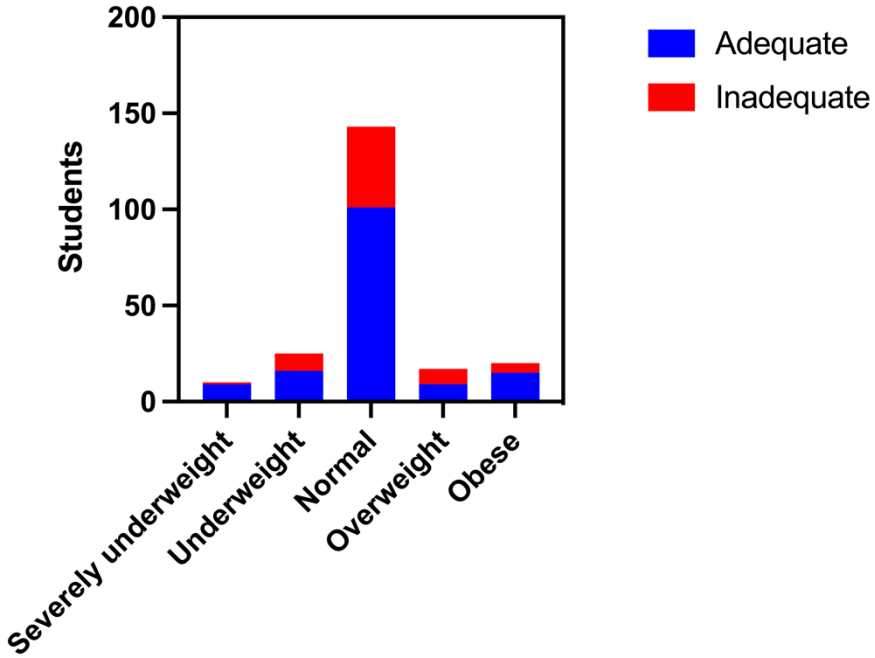


Figure 5. Relationship between nutritional adequacy and nutritional status.

No statistically significant association was found between dietary patterns and nutritional status ($p = 0.109$, Cramér's $V = 0.10$), nor between nutritional adequacy and nutritional status ($p = 0.295$, Cramér's $V = 0.07$). Examination of Figures 4 and 5 confirms that neither appropriate nor inappropriate dietary patterns, nor adequate or inadequate nutritional intake, were distributed in a consistent direction across nutritional status categories. Students classified as normal, underweight, or overweight showed no systematic alignment with dietary pattern or nutritional adequacy categories. Ordinal logistic regression further confirmed that neither dietary patterns nor nutritional adequacy independently or jointly predicted nutritional status category ($p > 0.05$), indicating that these dietary variables, as measured in this study, do not function as significant determinants of BMI-based nutritional status in this cohort.

The results collectively reveal three intersecting patterns: a dual nutritional burden in nutritional status, broad macronutrient imbalance in dietary behavior, and a dissociation between energy sufficiency and macronutrient quality none of which were statistically linked to nutritional status as measured by BMI. Each of these patterns warrants interpretation in the context of existing evidence. The prevalence of abnormal nutritional status observed in this study substantially exceeds the 7% reported by Ramadea et al. (2024) among Indonesian university students but aligns more closely with findings from Bede et al. (2020), who documented over 20% abnormal nutritional status among medical students in Cameroon. The gap between the present study and the Indonesian benchmark may reflect differences in study setting, socioeconomic composition, and dietary environment between universities in different regions of Indonesia. The FMHS Mataram cohort draws students from Eastern Indonesia, a region with distinct food culture, income distribution, and campus food infrastructure relative to universities in Java or Bali where prior Indonesian studies were predominantly conducted. More broadly, the coexistence of undernutrition and overnutrition within a single cohort of health sciences students is particularly notable given that these individuals receive formal education in nutrition and are expected to develop nutritional competencies as part of their professional training. The persistence of abnormal nutritional status despite this educational exposure suggests that nutritional knowledge is insufficient on its own to ensure healthy dietary behavior. Behavioral, economic, and environmental determinants including food access on and around campus, financial constraints, time pressures from academic workload, and social eating norms likely exert stronger proximal influence on dietary behavior than declarative nutritional knowledge.

The prevalence of inappropriate dietary patterns (66.51%) and macronutrient-level deficits across carbohydrates, protein, and fat is consistent with a broader pattern documented in university student populations globally. Dietary quality is substantially determined by macronutrient balance; imbalance across two or more macronutrient components degrades overall dietary quality (Krispul & Mahmudiono, 2025). Alzahrani et al. (2020) identified smoking, living alone, rented accommodation, divorced parents, and irregular physical activity as significant predictors of poor dietary habits among university students, highlighting the role of living conditions and lifestyle factors that extend well beyond nutritional knowledge. Khajuriah et a. (2025) found that only approximately 37% of university students in India had good dietary habits, a figure strikingly close to the 33.49% with appropriate dietary patterns in the present study. Health sciences students, despite receiving formal nutrition education, may struggle to apply these principles in daily life due to demanding academic schedules, limited availability and affordability of healthy food options on campus, and reliance on convenient, calorie-dense processed foods that are disproportionately available near university campuses in Indonesia. The finding that

two-thirds of students in a health sciences program exhibit inappropriate dietary patterns points to a structural gap between nutritional knowledge and dietary practice a gap that additional knowledge transmission alone is unlikely to close.

The dissociation between total energy sufficiency (69.77%) and severely deficient carbohydrate adequacy (25.58%) represents a pattern of hidden macronutrient malnutrition increasingly documented in developing-country populations (Widiastuti et al., 2023). In this model, caloric needs are nominally met, but the macronutrient composition of the diet deviates substantially from recommendations. The energetic compensation provided by high protein and fat intake masks an underlying carbohydrate deficit that would be invisible to assessments focused solely on total caloric adequacy. This has specific health implications. Excessive protein consumption over time increases renal workload and has been associated with adverse metabolic outcomes in susceptible populations (Ko et al., 2020; Delimaris, 2013). Hernández-Alonso et al. (2016) found that higher total protein intake was associated with greater all-cause mortality risk in substitution models where protein replaced carbohydrate or fat. For young adults whose dietary habits are still forming and whose patterns established during university years tend to persist into adulthood, the long-term implications of sustained macronutrient imbalance include elevated risk of metabolic disease, impaired renal function, and potentially compromised cognitive performance all of which bear on both personal health and future professional effectiveness as clinicians.

The absence of statistically significant associations between dietary variables and nutritional status is consistent with prior studies in adolescent and university populations (Andriani & Indrawati, 2021; Dini et al., 2025) and warrants interpretive care rather than dismissal. Three explanations collectively account for the null findings. First, BMI-based nutritional status reflects the cumulative product of long-term dietary history, habitual physical activity, individual metabolic efficiency, and socioeconomic conditions — none of which were captured by a single 24-hour food record or controlled for in this analysis (Dash et al., 2022; Ge et al., 2025; Gherasim et al., 2020; Theodorakis et al., 2024). A student with inappropriate current dietary patterns may maintain normal BMI through high physical activity or favorable metabolic efficiency, such that the cross-sectional relationship between current diet and current BMI is genuinely weak even when the longitudinal relationship between habitual diet and nutritional status is meaningful. Second, the narrow age range (18–20 years) and homogeneous academic context of this cohort likely compressed variance in nutritional status, reducing the statistical power available to detect associations. The weak effect sizes observed (Cramér's V = 0.07–0.10) are consistent with associations too small for this sample to reliably detect, rather than with a true absence of any relationship. Third, a single 24-hour food record is subject to within-person day-to-day dietary variability and social desirability bias, introducing measurement error that attenuates observed associations toward the null (Borges et al., 2023; Gurinović et al., 2017; Yang et al., 2010). The null findings therefore reflect methodological constraints as much as they reflect the underlying biology of diet-status relationships in this population.

The high prevalence of poor dietary behavior in a cohort of future health professionals carries implications that extend beyond individual nutritional health. Dietary habits established during young adulthood tend to track into later life, and clinicians whose own nutritional behaviors are suboptimal may be less effective as dietary counselors for their patients (Alghamdi et al., 2021). Health professionals who model poor dietary behavior whether consciously or not may also undermine the credibility of nutritional guidance they provide in clinical settings. Addressing this gap requires interventions that

operate at the level of the campus food environment and behavioral skill-building, rather than additional knowledge transmission. Practical approaches include subsidized canteens offering nutritionally balanced meals at accessible price points, peer-led nutrition counseling programs that normalize healthy dietary behavior within the student community, and integration of applied nutrition practicum modules into the curriculum that require students to plan, prepare, and evaluate their own dietary patterns as part of their professional training.

This study has several limitations that should be considered when interpreting the findings. Dietary assessment relied on a single 24-hour food record, which captures one day's intake and does not represent habitual dietary behavior, day to day variability in food consumption means that individual students may have been misclassified with respect to their usual dietary patterns and macronutrient adequacy. The cross-sectional design precludes causal inference: associations observed between variables reflect co-occurrence at a single time point rather than directional relationships. Physical activity, sleep quality, socioeconomic status, and cumulative dietary history are established determinants of BMI-based nutritional status but were not measured in this study, leaving these confounders uncontrolled in the analysis. The sample was drawn from one faculty at one institution, limiting the generalizability of findings to other university populations in Indonesia or other low- and middle-income country settings. Finally, BMI as the sole measure of nutritional status does not capture body composition, visceral fat distribution, or micronutrient status, each of which provides complementary and clinically relevant information about nutritional health that BMI alone cannot convey.

Future research should address these limitations through more robust dietary assessment methods, including multiple non-consecutive 24-hour recalls combined with validated food frequency questionnaires, to better characterize habitual macronutrient intake and reduce attenuation bias. Studies incorporating objective physical activity measurement, validated sleep quality instruments, and socioeconomic variables would allow more comprehensive modeling of the determinants of nutritional status in this population. Longitudinal designs following students from enrollment through graduation would clarify whether dietary patterns established during early university years predict nutritional outcomes over time and whether academic progression with its increasing nutrition education content produces measurable improvements in dietary behavior. Body composition assessment using bioelectrical impedance analysis or dual-energy X-ray absorptiometry would complement BMI-based classification and enable more precise characterization of nutritional risk. Finally, controlled intervention studies evaluating the effectiveness of campus-level dietary programs including food environment modifications, skills-based nutrition education integrated into the curriculum, and peer counseling models are warranted and would generate evidence directly relevant to improving dietary behavior in health sciences student populations across Indonesia.

4. CONCLUSION

Second-semester students at the Faculty of Medicine and Health Sciences, University of Mataram, exhibited a dual nutritional burden alongside poor dietary quality. Dietary patterns were predominantly inappropriate, with carbohydrate intake severely inadequate despite apparent energy sufficiency a dissociation indicating that total energy adequacy does not reflect macronutrient balance in this population. Nutritional status was not significantly associated with dietary patterns or nutritional adequacy, findings consistent with the multifactorial determination of BMI-based nutritional status, in which physical activity, metabolism, and cumulative dietary history interact with current intake.

The absence of association should not be read as evidence that diet is irrelevant; single 24-hour recall data capture intake variability poorly, and longitudinal studies incorporating habitual dietary assessment, physical activity, and socioeconomic variables are needed to clarify these relationships. The high prevalence of poor dietary behavior among health sciences students signals a gap between nutritional knowledge and practice that classroom instruction alone does not resolve. Campus-level interventions addressing the food environment and practical dietary skills are warranted, particularly given that these students will assume dietary counseling roles as future clinicians.

5. ACKNOWLEDGEMENT

While compiling our research, the author received valuable help and support from various individuals. We would like to thank all of the participants who participated in this study. We would like to thank the University of Mataram for funding this research.

REFERENCES

Alghamdi, S. A., Alqarni, A. A., Alghamdi, A. F., Alghamdi, T. K., Hasosah, N. M., Aga, S. S., & Khan, M. A. (2021). Knowledge, attitude, and practices regarding dietary habits among medical and non-medical university students. *Journal of Family Medicine and Primary Care*, 10(9), 3436–3443. https://doi.org/10.4103/jfmpc.jfmpc_2227_20

Alzahrani, S. H., Saeedi, A. A., Baamer, M. K., Shalabi, A. F., & Alzahrani, A. M. (2020). Eating habits among medical students at King Abdulaziz University, Jeddah, Saudi Arabia. *International Journal of General Medicine*, 13, 77–88. https://doi.org/10.2147/IJGM.S246296

Andriani, F. W., & Indrawati, V. (2021). Gaya hidup sedentari, screen time, dan pola makan terhadap status gizi remaja SMAN 1 Bojonegoro. *Jurnal Gizi dan Kesehatan Nusantara,* 1(1), 14-22. Retrieved from https://ejournal.unesa.ac.id/index.php/GIZIUNESA/article/view/41269

Avram, C., Nyulas, V., Onisor, D., Georgescu, I. M., Szakacs, J., & Ruta, F. (2024). Food behavior and lifestyle among students: The Influence of the University Environment. *Nutrients*, 17(1), 12–25. https://doi.org/10.3390/nu17010012

Bede, F., Cumber, S. N., Nkfusai, C. N., Venyuy, M. A., Ijang, Y. P., Wepngong, E. N., & Nguti Kien, A. T. (2020). Dietary habits and nutritional status of medical school students: the case of three state universities in Cameroon. *Pan African Medical Journal*, 35(1), 15–25. https://doi.org/10.11604/pamj.2020.35.15.18818

Borges, T. L. D., de Lima, M. F. S., Lima, S. C. V. C., & Bagni, U. V. (2023). Accuracy of dietary intake assessments using food records based on photographic images captured by visually impaired people. *Plos One*, 18(2), e0280725. https://doi.org/10.1371/journal.pone.0280725

Dash, I., Sampson, U., Sahu, P. K., Kumar, S., & Panda, J. (2022). Nutritional status associated with metabolic syndrome. *International Journal of Health Sciences*, 2364–2372. https://doi.org/10.53730/ijhs.v6nS5.9148

Delimaris, I. (2013). Adverse effects associated with protein intake above the recommended dietary allowance for adults. *ISRN Nutrition*, 2013, 1–6. https://doi.org/10.5402/2013/126929

Dini, B., Lubis, T. N., & Sellia, S. (2025). The relationship between dietary patterns and nutritional status among female adolescents at SMK Negeri 8 Pekanbaru. *Journal Maternitas Kebidanan*, 10(2), 182–190. https://doi.org/10.34012/jumkep.v10i2.7711

Elda, F., Novirsa, R., Kasra, K., Azmi, F., Delviana, A., & Surya, R. F. (2026). Eating patterns and body image in relation to nutritional status among adolescents in Padang City high

schools. *Amerta Nutrition*, 10(1), 44–51. https://doi.org/10.20473/amnt.v10i1.2026.44-51

Ge, L., Li, R., & Yap, C. W. (2025). The interplay of nutritional status and physical function on health outcomes in older adults: a longitudinal study in Singapore. *The American Journal of Clinical Nutrition*, 122(3), 811–819. https://doi.org/10.1016/j.ajcnut.2025.07.014

Gherasim, A., Arhire, L. I., Niță, O., Popa, A. D., Graur, M., & Mihalache, L. (2020). The relationship between lifestyle components and dietary patterns. *Proceedings of the Nutrition Society*, 79(3), 311–323. https://doi.org/10.1017/S0029665120006898

Gniewosz, G., & Gniewosz, B. (2020). Psychological adjustment during multiple transitions between childhood and adolescence. *The Journal of Early Adolescence*, 40(4), 566–598. https://doi.org/10.1177/0272431619858422

Gurinović, M., Zeković, M., Milešević, J., Nikolić, M., & Glibetić, M. (2017). Nutritional assessment. In *Reference Module in Food Science*. Elsevier. https://doi.org/10.1016/B978-0-08-100596-5.21180-3

Hernández-Alonso, P., Salas-Salvadó, J., Ruiz-Canela, M., Corella, D., Estruch, R., Fitó, M., Arós, F., Gómez-Gracia, E., Fiol, M., Lapetra, J., Basora, J., Serra-Majem, L., Muñoz, M. Á., Buil-Cosiales, P., Saiz, C., & Bulló, M. (2016). High dietary protein intake is associated with an increased body weight and total death risk. *Clinical Nutrition*, 35(2), 496–506. https://doi.org/10.1016/j.clnu.2015.03.016

Indonesian Ministry of Health. (2018). *The results of basic medical research (Riskesdas) 2018*. Jakarta: Indonesian Ministry of Health.

Indonesian Ministry of Health. (2023). *The Indonesian Health Survey (IHS) 2023*. Jakarta: Indonesian Ministry of Health.

Jurado-Gonzalez, P., López-Toledo, S., Bach-Faig, A., & Medina, F.-X. (2025). Barriers and enablers of healthy eating among university students in Oaxaca de Juárez: a mixed-methods study. *Nutrients*, 17(7), 1263. https://doi.org/10.3390/nu17071263

Khajuria, A., Yadav, S. S., Somanadhapai, S., Thapa, R., Singh, M. J., Bansal, P., Vats, N., Rishi, N. N., Kumar, L., Sharma, N., Chandrabanshi, A., Arren, A., Bharti, S., Singh, S., Gupta, S. K., Sharma, S., Gupta, N., & Singh, S. S. (2025). Influence of dietary habits and lifestyle practices on the health and well-being of University Students: A Survey Investigation. *Journal of Lifestyle Medicine*, 15(2), 66–79. https://doi.org/10.15280/jlm.2025.15.2.66

Ko, G.-J., Rhee, C. M., Kalantar-Zadeh, K., & Joshi, S. (2020). The effects of high-protein diets on kidney health and longevity. *Journal of the American Society of Nephrology*, 31(8), 1667–1679. https://doi.org/10.1681/ASN.2020010028

Krispul, A., & Mahmudiono, T. (2025). Dietary pattern and nutritional intake: implications for the nutritional status of Papuan University Students in Surabaya. *Media Gizi Kesmas*, 14(2), 250–256. https://doi.org/10.20473/mgk.v14i2.2025.250-256

Mastorci, F., Lazzeri, M. F. L., Vassalle, C., & Pingitore, A. (2024). The transition from childhood to adolescence: between health and vulnerability. *Children*, 11(8), 989. https://doi.org/10.3390/children11080989

Muridzo Muonde, Tolulope O. Olorunsogo, Jane Osareme Ogugua, Chinedu Paschal Maduka, & Olufunke Omotayo. (2024). Global nutrition challenges: A public health review of dietary risks and interventions. *World Journal of Advanced Research and Reviews*, 21(1), 1467–1478. https://doi.org/10.30574/wjarr.2024.21.1.0177

Parajuli, J., & Prangthip, P. (2025). Adolescent nutrition and health: a critical period for nutritional intervention to prevent long term health consequences. *Current Nutrition Reports*, 14(1), 116-130. https://doi.org/10.1007/s13668-025-00706-4

Ramadea, M., Kurniati, A. M., Marwoto, J., Husin, S., Wardiansyah, W., & Adenina, S. (2024). Knowledge and perceptions of nutrition and weight among first-year medical students at Sriwijaya University. *Biomedical Journal of Indonesia*, 10(3), 98–103. https://doi.org/10.32539/bji.v10i3.202

Sogari, G., Velez-Argumedo, C., Gómez, M. I., & Mora, C. (2018). College students and eating habits: a study using an ecological model for healthy behavior. *Nutrients*, 10(12), 1823-1839. https://doi.org/10.3390/nu10121823

Theodorakis, N., Kreouzi, M., Pappas, A., & Nikolaou, M. (2024). Beyond calories: individual metabolic and hormonal adaptations driving variability in weight management—a state-of-the-art narrative review. *International Journal of Molecular Sciences*, 25(24), 13438-13465. https://doi.org/10.3390/ijms252413438

Torres, K., Cáceres-Durán, M. A., Orellana, C., Osorio, M., & Simón, L. (2025). Nutritional imbalances among university students and the urgent need for educational and nutritional interventions. *Frontiers in Nutrition*, 12(3), 1551130-1551138. https://doi.org/10.3389/fnut.2025.1551130

Veronika, A. P., Puspitawati, T., & Fitriani, A. (2021). Associations between Nutrition Knowledge, Protein-Energy Intake and Nutritional Status of Adolescents. *Journal of Public Health Research*, 10(2), 2239-2244. https://doi.org/10.4081/jphr.2021.2239

WHO. (2025, August 5). *Obesity and overweight [Internet]*. Geneva: WHO. Retrieved from https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Widiastuti, I. G. A. K., Sutiari, N. K., & Sutiari, L. S. A. (2023). Body image perception is associated with nutritional status of adolescent girls: A cross-sectional study in Denpasar City, Bali Province, Indonesia. *Public Health and Preventive Medicine Archive*, 11(2), 191–200. https://doi.org/10.53638/phpma.2023.v11.i2.p07

Winpenny, E. M., Penney, T. L., Corder, K., White, M., & van Sluijs, E. M. F. (2017). Change in diet in the period from adolescence to early adulthood: a systematic scoping review of longitudinal studies. *International Journal of Behavioral Nutrition and Physical Activity*, 14(1), 60-76. https://doi.org/10.1186/s12966-017-0518-7

Yang, Y. J., Kim, M. K., Hwang, S. H., Ahn, Y., Shim, J. E., & Kim, D. H. (2010). Relative validities of 3-day food records and the food frequency questionnaire. *Nutrition Research and Practice*, 4(2), 142-148. https://doi.org/10.4162/nrp.2010.4.2.142