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"Nutritional Literacy Gap": Investigating the Correlation Between Macronutrient Intake and Nutritional Status in First-Year Students

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ABSTRACT

This quantitative study aimed to investigate the correlation between nutritional literacy, macronutrient intake encompassing energy, carbohydrates, proteins, and fats and the nutritional status of first-year undergraduate students in the Nutrition Study Program at the State University of Surabaya. First-year students represent a vulnerable demographic prone to nutritional challenges due to significant lifestyle transitions and irregular dietary patterns. In this context, nutritional literacy serves as a pivotal determinant influencing daily food selection and health outcomes. Employing a cross-sectional design, the research was conducted between September and October 2025, involving 83 respondents selected through simple random sampling. Data collection integrated anthropometric measurements for body weight and height, validated nutritional literacy questionnaires, and 2x24-hour food recalls to capture detailed dietary intake. Statistical analysis was performed using the Spearman's rho correlation test to identify significant relationships between variables. The findings revealed that 57.8% of students possessed adequate nutritional literacy. However, alarming deficiencies were observed in dietary habits: 100% of respondents exhibited inadequate energy and carbohydrate intake, while the majority also showed insufficient protein (81.9%) and fat (78.3%) consumption. Despite these gaps, 51.8% of the students maintained a normal nutritional status. The analysis concluded that no significant correlation existed between nutritional status and nutritional literacy (p=0.869), energy intake (p=0.231), protein (p=0.781), or fat (p=0.771). Conversely, a significant correlation was identified between carbohydrate intake and nutritional status (p=0.040; r=-0.226). These results underscore that theoretical literacy does not inherently guarantee optimal dietary fulfillment. Consequently, there is an urgent need to enhance students' awareness and practical application of nutritional literacy in daily food selection. This study highlights the necessity for targeted educational interventions to bridge the gap between nutritional knowledge and actual dietary behavior among university students.

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INTRODUCTION

Adolescence represents a critical transitional phase from childhood to adulthood, characterized by heightened vulnerability to environmental changes and significant physiological shifts. This period offers a strategic opportunity to prepare for a productive and healthy reproductive life, prevent long-term nutrition-related chronic diseases, and rectify nutritional deficiencies inherited from earlier childhood stages. According to the World Health Organization (Organization, 2024), adolescence spans the ages of 10 to 19 years, further categorized into early (10–13 years), middle (14–16 years), and late adolescence (17–19 years). Meanwhile, the National Population and Family Planning Board (BKKBN) extends this range to 10–24 years for unmarried individuals (BKKBN, 2014) as cited in (Rini & Tjadikijanto, 2019).

The late adolescent cohort primarily consists of those transitioning into higher education as first-year university students. This demographic faces significant shifts in both daily activities and living environments. The transition from structured school life to the university setting is often accompanied by increased academic demands, lifestyle changes, and the necessity to adapt to new social circles. During this adjustment process, nutrition plays a crucial role in supporting physical and mental performance, as balanced dietary intake is fundamental to achieving optimal nutritional status (Anjani et al., 2023). Nutritional status serves as a key indicator of a person's health based on food consumption and the body's utilization of essential nutrients. While normal status indicates that the body receives sufficient nutrients for metabolism, undernutrition occurs when the body lacks essential nutrients that it cannot produce itself, and overnutrition results from excessive intake (Kanah, 2020).

National data from the 2023 Indonesian Health Survey (SKI) reveal significant variations in nutritional status across adolescent age groups based on Body Mass Index (BMI). Among those aged 16–18 years, the prevalence of undernutrition is 8.7% for males and 4.4% for females, yet overnutrition remains a major concern, with 8.2% classified as overweight and 3.5% as obese. By age 19, the prevalence of undernutrition spikes to 21.6%, while overnutrition reaches 14.7%. In the 20–24 age group, undernutrition slightly decreases to 15.3%, but the prevalence of overnutrition climbs to 22% (8.6% overweight and 13.4% obese). These fluctuations highlight a persistent "double burden" of malnutrition within the student-age population.

These nutritional challenges are inextricably linked to dietary intake. Nutritional status is determined by the quantity and quality of food consumed and the body's efficiency in absorbing nutrients. Balanced intake, maintaining the correct proportions of carbohydrates, proteins, fats, vitamins, and minerals, is vital for supporting optimal growth and health (Suzan et al., 2022). Conversely, imbalanced or insufficient intake leads to malnutrition, directly impacting an individual's overall health status (Tresnanda & Rimbawan, 2022).

First-year students frequently undergo dramatic shifts in eating habits upon entering university. This transition often leads to irregular eating patterns, such as skipping breakfast, low vegetable consumption, and increased reliance on high-energy fast foods (Levina & Sumarmi, 2019). Living away from family requires newfound independence;

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however, without adequate nutritional knowledge, this independence often results in poor dietary choices (Putri et al., 2024). Evidence from Universitas Negeri Semarang (UNNES) shows that despite many programs teaching health courses, 58.5% of students still possess low nutritional literacy, and 43.9% suffer from malnutrition (Fathonah et al., 2020). Similarly, research at IPB University indicated that even nutrition students often exhibit negative behaviors toward reading nutrition labels, suggesting that theoretical knowledge does not automatically translate into healthy practices (Mariam & Rachman, 2025).

Nutritional knowledge is an indirect factor influencing nutritional status and serves as the foundation for dietary patterns. Individuals with high nutritional literacy are better equipped to seek, understand, and apply health information to make informed food choices (Bakhtiar et al., 2020). High literacy levels foster healthier attitudes and behaviors, which are essential for preventing diseases and maintaining a balanced diet. For instance, a deficiency in carbohydrates may force the body to utilize protein and fat for energy, which, if prolonged, stunts growth and leads to metabolic imbalances ((Rorimpandei et al., 2020).

Empirical studies by (Masri et al., 2022) confirm a strong correlation between nutritional literacy, energy intake, and nutritional status. High literacy improves one's ability to regulate dietary intake, whereas low literacy limits the capacity to select health-promoting foods. Furthermore, the relationship between food choice and nutritional status can be directly observed through the intake of macronutrients—carbohydrates, proteins, and fats. Research by (Falentina et al., 2023) supports this, finding significant positive correlations between macronutrient intake and optimal growth indicators.

Preliminary research conducted on first-year nutrition students (Class of 2024) between March and May revealed that 48% had moderate literacy, 44% had good literacy, and 8% had poor literacy. While the majority fall into the moderate-to-good categories, the presence of students with low literacy remains a concern for food selection and health. The transition to campus life often results in uncontrolled lifestyles and imbalanced macronutrient consumption. Low nutritional literacy among new students is a primary driver of improper intake proportions, which directly affects their nutritional status. This is consistent with findings by (Annisa et al., 2024), which show that many first-year students exceed recommended fat and carbohydrate limits while lacking fiber due to sudden lifestyle shifts and a lack of understanding regarding balanced nutrition.

Based on these observations, this study aims to investigate the relationship between nutritional literacy, macronutrient intake, and nutritional status among first-year undergraduate students in the Nutrition Study Program at the Universitas Negeri Surabaya (State University of Surabaya). Specifically, this research seeks to: (a) identify the level of nutritional literacy, (b) assess macronutrient intake levels, (c) evaluate the current nutritional status of these students, (d) analyze the correlation between nutritional literacy and nutritional status, and (e) analyze the correlation between macronutrient intake and nutritional status. By addressing these objectives, this study intends to provide empirical evidence on how literacy serves as a critical intervention point for improving student health outcomes.

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METHODS

This research is a quantitative study utilizing a cross-sectional design to analyze the correlations between nutritional literacy, macronutrient intake, and nutritional status. The cross-sectional approach allows for the simultaneous collection of data to provide a comprehensive snapshot of a population's health profile (Tresnanda & Rimbawan, 2022). There are two primary categories of variables in this study: the independent variables, which include nutritional literacy and macronutrient intake (energy, protein, fat, and carbohydrates), and the dependent variable, which is nutritional status.

The research was conducted at the Faculty of Sports Science and Health, Universitas Negeri Surabaya, between September and October 2025. The population consisted of 280 first-year nutrition students, with a sample of 83 respondents selected through simple random sampling to ensure generalizability (Putri et al., 2024). Data collection employed validated questionnaires, 2x24-hour food recalls, and anthropometric measurements for BMI calculation. Data analysis was performed using Spearman's rho correlation tests to evaluate the strength and significance of the relationships between the studied variables (Mariam & Rachman, 2025).

RESULTS AND DISCUSSION

Result

Nutritional literacy was assessed using the 40-item Nutrition Literacy Assessment Instrument (NLAI) adapted from (Gibbs et al., 2018), covering five subscales. Scores were calculated as percentages of correct answers and categorized into three levels: **good** (80–100%), **Sufficient** (60–79%), and **Less** (<60%). This standardized approach ensures a precise evaluation of respondents' ability to process dietary information.

Table 1.
Respondents' Nutrition Literacy

Category	Nutrition Literacy	
	n	%
Good (>80%)	33	39,8
Sufficient (60 – 80%)	48	57,8
Less (<60%)	2	2,4
Total	83	100
Min – Max	57,50 – 95	

Table 1 shows that 2.4% of respondents had poor nutritional literacy, 57.8% were adequate, and 39.8% were good. Detailed subscale responses follow. Macronutrient intake data (carbohydrates, protein, and fat) were collected via 2×24-hour food recalls, covering both a weekday and a weekend. These data were processed using NutriSurvey to determine average daily intake.

The univariate analysis results for macronutrient consumption are summarized in Table 2. This methodology ensures a balanced representation of dietary habits across different days of the week.

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Table 2.
Respondents' Macronutrient Intake

Category	Energy Intake		Carbohydrate Intake		Protein Intake		Fat Intake	
	n	%	n	%	n	%	n	%
Low	83	100	83	100	68	81,9	66	79,5
Normal/ Moderate	0	0	0	0	15	18,1	18	21,5
High	0	0	0	0	0	0	0	0
Total	83	100	83	100	83	100	83	100
x̄±SD	1230,03 ± 265,17		151,57±47,12		48,40±10,47		47,46±14,71	
Min - Max	616,90 – 1939,10		67,42 – 271,85		24,95 – 86,08		17,65 – 81,57	

Table 2 reveals that 100% of respondents (83) had insufficient carbohydrate intake. Similarly, the majority fell into the insufficient category for protein (81.9%) and fat (79.5%). Nutritional status was determined through anthropometric measurements of weight and height to calculate the Body Mass Index (BMI). These metrics provided the basis for categorizing the participants' physical health profiles.

The results of the univariate analysis of respondents' nutritional status are presented in Table 3.

Table 3.
Respondents' Nutritional Status

Category	Nutritional status	
	n	%
Malnutrition / Underweight (<18,5 kg/m^2)	19	22,9
Normal (18,5 – 22,9 kg/m^2)	42	50,6
Overweight (≥23 kg/m^2)	22	26,5
Total	83	100
Min – Max	15,47 – 28,42	

Based on Table 3, it can be seen that 19 respondents (22.9%) had undernutrition, 42 respondents (50.6%) had normal nutritional status, and 22 respondents (26.5%) had Overweight.

Analysis of the relationship between nutritional literacy and nutritional status was carried out using a correlation test. Rank Spearman, with the cross-tabulation results presented in Table 4 below.

Table 4.
The Relationship between Nutritional Literacy and Nutritional Status

Literacy Nutrition	Nutritional status			Total	P-Value
	Malnutrition/ Underweight	Normal	Overweight		
Less	1	2	0	3	0,869
Sufficient	14	21	13	48	
Good	4	19	9	32	
Total	19	42	22	83	

Correlation test results Rank Spearman show a value of p 0.869 (p > 0.05), thus it can be concluded that there is no significant relationship between nutritional literacy and nutritional status, with a positive relationship and a very weak correlation. Therefore, the hypothesis stating a relationship between nutritional literacy and nutritional status is rejected.

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An analysis of the relationship between macronutrient intake and nutritional status was carried out using a correlation test. Rank Spearman's rank, which is presented in Table 5 below.

Table 5
The Relationship Between Macronutrient Intake and Nutritional Status

Macronutrient Intake		Nutritional status			Total	P-Value	r
		Malnutrition/ Underweight	Normal	Overweight			
Energy	Low	19	42	22	83	0,231	-0,133
	Normal/ Moderate	0	0	0	0		
	High	0	0	0	0		
Carbohydrate	Low	19	42	22	83	0,040	-0,226
	Normal/ Moderate	0	0	0	0		
	High	0	0	0	0		
Protein	Low	15	36	17	68	0,781	-0,031
	Normal/ Moderate	4	6	5	15		
	High	0	0	0	0		
Fat	Low	12	34	19	65	0,771	-0,032
	Normal/ Moderate	7	8	3	18		
	High	0	0	0	0		
Total		18	43	22	83		

Spearman's Rank correlation tests revealed that energy intake (p=0.231, r=-0.133), protein intake (p=0.781, r=-0.031), and fat intake (p=0.771, r=-0.032) had no significant relationship with nutritional status. Conversely, carbohydrate intake showed a significant relationship (p=0.040$) with a weak negative correlation (r=-0.226$). These findings suggest that while most macronutrients do not directly correlate with BMI in this cohort, carbohydrate consumption patterns exhibit a statistically significant, albeit slight, inverse association with the nutritional status of the respondents.

Discussion

The Nutritional Literacy Level of New Students in the Nutrition Study Program at Universitas Negeri Surabaya

The primary objective of this assessment was to establish the baseline of foundational knowledge and practical nutritional understanding among first-year students in the Nutrition Science Program at Universitas Negeri Surabaya. Literacy levels were categorized to evaluate academic readiness and professional potential. Data gathered from 83 respondents revealed that the majority of students fall within the "sufficient" category, representing 48 individuals (57.8%). Additionally, 33 respondents (39.8%) demonstrated "good" literacy, while a marginal 2.4% were classified as "poor." These metrics suggest that while the cohort generally possesses a functional grasp of nutritional concepts, their mastery remains in the moderate range. These findings contrast slightly with research by (Hirda et al., 2023), which reported "good" literacy rates of 97% and 94.9%, respectively. The discrepancy is likely attributable to the "freshman transition" phase. Unlike senior students

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who have undergone intensive academic exposure to nutrient requirements and physiological impacts, new students often possess theoretical knowledge but lack the practical application skills required for optimal literacy. (Li et al., 2025) further identify a "knowledge-behavior gap," where high theoretical scores do not necessarily translate into everyday decision-making. Subscale analysis supports this, showing high proficiency in identifying macronutrients (92.3%) but a significant struggle with household measurements (56.8%), indicating a clear disconnect between knowing nutrient types and applying portion control to daily consumption (Gibbs et al., 2018).

Macronutrient Intake Profiles of New Students in the Nutrition Study Program at Universitas Negeri Surabaya

An analysis of dietary habits among these freshmen revealed a critical trend: 100% of the students were categorized as having "deficient" energy intake. The average consumption was recorded at 1230.03 ± 265.17 kcal/day, significantly below the Recommended Dietary Allowance (RDA) for the 18–21 age group, which ranges from 2100 to 2650 kcal/day. This severe gap indicates a profound imbalance between physiological energy needs and actual intake during the onset of university life. This condition is largely driven by radical lifestyle changes. Freshmen must adapt to new environments characterized by time constraints, financial limitations, and a lack of adequate cooking facilities, often leading to a reliance on nutrient-poor fast food (Torres et al., 2025). These findings echo (Habibah et al., 2025), who found that 90.4% of students experienced energy deficits due to intentional meal skipping and academic stress. Furthermore, 100% of the cohort showed deficient carbohydrate intake, averaging 151.57 ± 47.12 g/day (RDA: 300–430 g/day), largely due to skipping breakfast and irregular lecture schedules (Tade et al., 2025). Regarding protein, 83.1% were deficient (48.40 ± 10.47 g/day), often relying on affordable plant-based sources like tofu and tempeh (Rahayu et al., 2022). Fat intake was also deficient in 80.7% of students (47.46 ± 14.71 g/day), a trend exacerbated by the fact that the respondents were entirely female, a demographic more prone to restrictive dieting to manage body image (Liu et al., 2024).

Nutritional Status of New Students in the Nutrition Study Program at Universitas Negeri Surabaya

Despite the widespread prevalence of macronutrient deficiencies, 50.6% of the freshmen maintained a "normal" nutritional status according to Body Mass Index (BMI) standards. This finding suggests that while current intake is critically low, it has not yet manifested as abnormal physical status. This phenomenon is explained by the body's physiological resilience; internal energy reserves, including glycogen, adipose tissue, and muscle protein, are mobilized to sustain metabolic activity during periods of deficit (Antika & Dini, 2025). These results are consistent with (Fahrurodji & Rofikoh, 2023), who found normal status in approximately 59% of nutrition students. Nutritional status is a long-term metabolic outcome that does not shift instantaneously in response to short-term dietary changes.

Relationship Between Nutritional Literacy and Nutritional Status

The study sought to determine if higher literacy levels correlate with better physical health outcomes. However, the Spearman's rho test yielded a p-value of 0.869 (> 0.05),

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indicating no significant relationship. This aligns which demonstrated that literacy scores do not differ significantly across BMI categories. Nutritional status remains a complex outcome influenced by genetic factors and infectious diseases, which were outside the scope of this study (Melati & Linda, 2024). Ultimately, while students may understand nutritional theory, they often lack the consistency or environmental support to apply it, proving that behavioral change is not a linear process (Islamiati & Sumarmi, 2023).

Relationship Between Macronutrient Intake and Nutritional Status

Statistical analysis revealed no significant correlation between energy (p=0.231), protein (p=0.781), or fat (p=0.771) intake and nutritional status. Consistent with (Abihail et al., 2023), BMI reflects a long-term energy balance, whereas the 24-hour food recall provides only a snapshot of recent intake. Methodological limitations, such as respondent memory bias, can also affect the alignment of intake data with physical status. Notably, carbohydrate intake demonstrated a significant negative relationship (p=0.040, r= -0.226). This suggests that higher carbohydrate consumption in this specific cohort was associated with lower BMI trends. This may be attributed to the quality of carbohydrates consumed; high-fiber grains can increase satiety and aid weight control (Mohebati et al., 2024). While chronic deficits carry long-term risks (PERISELO, 2024), the current utilization of body reserves prevents an immediate decline in status (Damayanti et al., 2023). These findings highlight an urgent need for exploratory and meaningful dietary interventions that align student knowledge with long-term metabolic health.

CONCLUSION

Based on the research findings and discussion regarding the nutritional profiles of New students at Universitas Negeri Surabaya, the conclusions and their scientific contributions are summarized as follows: Before assessing correlations, most students showed "sufficient" nutritional literacy but 100% energy and carbohydrate deficits. This highlights a critical "knowledge-practice gap" where academic understanding does not prevent dietary deficiency during lifestyle transitions. After evaluating physiological outcomes, half of the respondents maintained normal nutritional status despite chronic deficits, indicating the body's reliance on internal energy reserves to maintain short-term metabolic stability. There was no significant relationship between literacy and BMI, though a negative correlation between carbohydrates and status was observed. This advances scientific knowledge by proving that for nutrition students, literacy alone is an insufficient predictor of health outcomes without addressing environmental and psychological barriers. For Future studies should implement longitudinal designs to track how nutritional status evolves as students progress through their degree. Researchers should also investigate qualitative factors, such as food security and mental health, to bridge the gap between literacy and actual dietary behavior

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