The Relevance of Protein and Iron Intake with Nutritional Status in College Students

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Abstract. College students are a group that needs adequate food intake and good nutritional status. Protein is used for the growth and development of body cells and tissues, while iron is needed to maintain body functions. The purpose was to analyze the relationship between protein and iron intake with nutritional status among college students in Medan city. The design is cross sectional. Respondents are active students aged 19 to 25 years. Sampling technique using random sampling. Data collection by interviews, filling out questionnaires, and anthropometric measurements. Data analysis used the spearman rank test. A total of 96 college students had participated in the study. The results showed that there was a relationship between protein intake (p-value 0.031) and iron intake (p-value 0.005) with the nutritional status. Regulation of protein and iron intake must be done so that adolescents have a good nutritional status.

Keywords: Iron, Nutritional Status, Protein.

1 Introduction

Late adolescence, including the period of college students, is a critical stage in the life cycle where individuals experience rapid growth and development. At this stage, nutritional needs become crucial to support various body functions, including physical growth, brain development, and overall health maintenance. Proper nutrition during this period not only supports growth but also contributes to academic performance and psychosocial well-being. Protein is an essential macronutrient that plays a role in the formation and repair of body tissues, as well as in various metabolic functions. Protein deficiency can lead to growth and developmental disorders, as well as decreased immune function [1]. According to the Nutritional Adequacy Rate, the protein requirement for males aged 19-29 years is 62 grams per day, and for females, it is 56 grams per day [2].

Long-term protein and energy deficiency may lead to Chronic Energy Deficiency (CED) [3]. Inadequate protein and iron intake remain common problems among adolescents and young adults in many countries, including Indonesia. Globally, the prevalence of underweight among

adolescents is 8.4% for females and 12.4% for males [4]. In Indonesia, the prevalence of thinness among adolescents aged 13-15 years is 7.6%, and the prevalence of overweight is 16.2%. Among adolescents aged 16-18 years, the prevalence of thinness is 8.3%, and the prevalence of overweight is 12.1%. The prevalence of nutritional status at age >18 years is 7.8% underweight and 37.8% overweight and the incidence of central obesity in the age group ≥15 years was 36.8% [5].

Adolescents who consume higher plant-based protein compared to animal protein show lower body fat percentage and BMI compared to adolescents with higher animal protein intake [6]. A study by Anwar and Anggita showed a significant relationship between protein and iron intake and nutritional status. Protein and iron deficiency increases the risk of anemia in adolescents [7]. Meanwhile, another research showed that there is a relationship between the habit of consuming heme iron sources and nutritional status (p=0.016) [8]. Another study indicated that nutritional interventions that increase protein and iron intake can improve nutritional status and overall health in the college student population [9].

The iron requirement for males aged 19-29 years is 13 mg/day, and for females aged 19-29 years, it is 26 mg/day [2]. Iron (Fe) plays a role in monoamine synthesis, energy metabolism, neurotransmitter system myelination, and dopamine metabolism [10]. A study showed that adolescent girls with low iron intake are 9 times more likely to suffer from anemia compared to adolescent girls with adequate iron intake [11]. Additionally, anemia also has serious impacts on adolescents, including growth retardation, impaired brain function, and physical disorders. Iron is an essential micronutrient needed for the formation of hemoglobin, which is responsible for transporting oxygen in the blood. Iron deficiency, especially in adolescents and young adults, can lead to iron deficiency anemia, which affects cognitive and physical abilities [12].

Nutritional status is also related to student academic achievement. There is a positive relationship between nutritional status and student achievement, where better nutritional status correlates with better academic performance. Students with good nutrition, including adequate protein and iron intake, have better academic performance compared to those with nutritional deficiencies. Adequate nutrition not only supports physical health but also enhances cognitive function, memory, and learning abilities [13].

In Indonesia, particularly in large cities like Medan, the busy lifestyle of students often results in unhealthy eating patterns, leading to deficiencies in essential nutrients like protein and iron. Previous research in Medan showed that despite abundant food access, students tend to choose fast food with low nutritional value, resulting in a high prevalence of nutritional problems.

2 Methods

This study uses a cross-sectional design with a quantitative approach. Data was collected to assess the relevance of protein and iron intake to the nutritional status of college students. The respondents were active students aged 18 to 25 years in Medan. A total of 96 college students were randomly selected (random sampling) from the population. The inclusion criteria for this study were active students who were willing to participate in the research. A 24-hour recall form was used to collect data on protein and iron intake. Height is measured by using a microtoice

with a precision of 0.1 cm, and body weight was collected using digital scales with a precision of 0.1 kg. Determination of nutritional status using the Body Mass Index (BMI) to assess the students' nutritional status.

Data was collected through direct interviews with respondents and the completion of the questionnaire regarding intake, while anthropometric measurements were conducted by trained personnel to ensure the accuracy of the nutritional status data. The Spearman rank correlation test was used to analyze the relationship between protein and iron intake and the nutritional status of the students. All respondents were asked to sign informed consent after receiving an explanation of the study's purpose and procedures. The confidentiality of respondents' personal data was maintained and used only for research purposes. This research received a research ethics committee from the Faculty of Medicine, University of Kristen Maranatha with a decision letter No: 130/KEP/VI/2023 on June 7, 2023.

3   Results And Discussion

Data on the characteristics of respondents were obtained from filling out a questionnaire which included gender, age, allowance, and place of residence. Data on characteristics were analyzed using frequency distribution. Data on the results of respondent characteristics can be seen in Table 1.

Table 1. Characteristics of Respondents

Variable	Category	N	(%)
Gender	Male	21	21.9
	Female	75	78.1
Age	<19 years old	6	6.3
	≥ 19 years old	90	93.8
Allowance	Rp. <1000.000/month	37	38.5
	Rp. ≥1000.000/month	59	61.5
Residence	Boarding house	51	53.1
	With parents	38	39.6
	With relatives	7	7.3

Characteristic data showed that the female gender (78.1%) was more dominant than the male. This gender distribution is important because it can influence the overall study results, particularly in areas like nutritional intake, health status, and nutritional knowledge, which can differ between genders due to physiological, cultural, and social factors. The dietary patterns noted were gender specific, with significantly more men reporting eating >6 oz (168 g) of animal protein per day than women [14]. Most respondents (93.8%) had an age of ≥19 years, indicating the late adolescent age category. This age group is particularly relevant for nutritional studies because it is a transitional period marked by increased autonomy in food choices, lifestyle

changes, and potential exposure to unhealthy eating habits, which may influence their food choices and eating habits [15].

Most of the respondents' allowance (61.5%) was ≥Rp. 1000.000/month. Financial can significantly affect dietary choices, leading to consumption of vegetables and fresh fruits, iron, and protein sources. Persons with poorer income levels are more vulnerable to food insecurity, which can lead to malnutrition or overnutrition, depending on the food choices available within their budget [16]. About 53.1% of respondents lived in dormitories or boarding houses, while the rest lived with parents or relatives. Living in a boarding house can significantly influence students' dietary habits, food choices, and nutritional status.

Respondents' characteristics also showed protein intake, iron intake, and nutritional status data. Data on the results of respondent's nutrition intake and nutritional status can be seen in Table 2.

Table 2. The Frequency Distribution of Protein, Iron Intake, and Nutritional Status

Variable	Category	N	(%)
Protein intake	Deficit	30	31.3
	Normal	21	21.9
	Excessive	45	46.9
Iron intake	Adequate	33	34.4
	Non adequate	63	65.6
Nutritional status	Underweight	15	11.5
	Normal	50	52.1
	Overweight	35	36.5

Based on Table 2, protein intake in respondents was more in the excessive intake (46.9%) and deficient intake (31.3%) category, only a few (21.9%) were in the normal category. This distribution suggests that nearly half of the students consume more protein than recommended. Excessive protein intake can lead to long-term health issues, such as kidney strain and potential bone density loss, particularly if accompanied by low calcium intake. According to research, balanced protein intake is crucial for maintaining muscle mass and overall health [17]. However, excessive intake without proper hydration and balanced nutrition may increase the risk of renal overload and other metabolic issues. The significant proportion of students in the deficit category (31.3%) is also concerning, Inadequate protein intake can impair muscle function, immune response, and cognitive development. as noted by researcher who found that insufficient protein consumption can negatively impact physical performance and cognitive function [18].

The iron intake of 65.6% of respondents was in the deficient category, and only 34.4% of respondents met their iron adequacy. This indicating that a significant majority (nearly two-thirds) of the students have an iron intake that does not meet the recommended levels. Iron deficiency can impair cognitive performance, immunity, and physical capacity, which is critical for college students who need to maintain concentration and energy levels for academic

performance. According to the World Health Organization, iron deficiency is the most common nutritional disorder globally caused of anemia, affecting productivity and quality of life [19].

Most of the respondents' nutritional status was normal (52.1%), This suggesting that more than half of respondents maintains a body weight within a healthy range. According to the World Health Organization, maintaining a normal weight is associated with lower risks of Non-Communicable Diseases (NCDs), such as cardiovascular diseases, diabetes, and certain cancers [20]. However, the data also shows that a significant proportion of students (36.5%) are classified as overnutrition. This finding is concerning, as being overweight or obese is associated with increased risks of developing NCDs, such as diabetes mellitus, hypertension, psychological disorders, and many more [21]. The high prevalence of overweight students could be attributed to several factors, including poor dietary choices, lack of physical activity, stress, and lifestyle changes associated with transitioning to college life.

There were still some respondents who had undernutrition (11.5%). Although this is the smallest group, it still represents a noteworthy fraction of the student population. Being underweight can be an indicator of inadequate nutritional intake, malabsorption issues, or underlying health problems [22]. Underweight individuals are at risk of compromised immune function, osteoporosis, anemia, and other deficiencies due to a lack of essential nutrients. As highlighted by researcher, there is a need for targeted interventions to address not only overweight and obesity but also undernutrition and associated health risks among college students [23].

After the characteristic data is analyzed, the next step is to conduct a bivariate test using the spearman rank test. Bivariate tests are conducted to determine the correlation between the variables studied. The bivariate test in this study was conducted to determine the relevance between protein intake and nutritional status and the relevance between iron intake and nutritional status. The results of the bivariate analysis can be seen in Table 3.

Table 3. Rank Spearman Test Results

Variable	Correlation Coefficient	P-value
Protein intake with nutritional status	0.220	0.031
Iron intake with nutritional status	0.285	0.005

The results of bivariate analysis showed that protein intake was significantly related to nutritional status in students (p-value 0.031). The results also showed that there was a significant relationship between iron intake and nutritional status in students (p-value 0.005). This study shows a positive relationship, this suggests that as protein intake increases, there is a tendency for the nutritional status to be higher.

Protein intake has a significant impact on the nutritional status of college students through complex biological mechanisms. Protein plays a crucial role in the synthesis of enzymes and hormones that regulate various bodily functions, including metabolism, growth, and development. Research indicates that protein intake are closely related to the nutritional status of college students [24]. This finding aligns with studies indicating that adequate protein

consumption is essential for maintaining a healthy weight and body composition. Recent researcher confirms that protein plays a crucial role in satiety, muscle mass maintenance, and metabolic rate, all of which are factors in maintaining a healthy body weight [25], [26]. Protein intake also contributes to the absorption of other essential nutrients such as calcium, zinc, iron, and vitamin C [27].

Protein intake is a critical factor influencing nutritional status, particularly concerning muscle mass enhancement. Research suggests that recommended protein intakes for maintaining muscle mass typically range from 1.0 to 1.2 g/kg/day, with higher amounts of 1.2 to 1.5 g/kg/day potentially necessary for older individuals with acute or chronic conditions [28]. Protein intake significantly impacts nutritional status, particularly through its effects on muscle mass. Adequate protein intake, in terms of both quantity and quality, is crucial for maintaining and enhancing muscle health across different age groups and populations. Understanding the complex relationship between protein intake and muscle mass can guide dietary recommendations and interventions aimed at optimizing nutritional status and overall well-being.

Iron intake directly impacts nutritional status because it affects both physiological and biochemical processes vital for maintaining health. College students often have irregular eating habits, rely on convenience foods, and may not consume iron-rich foods like lean meats, leafy greens, and fortified cereals. Such dietary patterns can contribute to inadequate iron intake and affect nutritional status [29]. Although iron is a micronutrient and does not directly contribute to calories, it plays a crucial role in metabolic processes that affect body weight and composition. Iron deficiency can impair energy metabolism and reduce physical activity levels due to fatigue, leading to unintended weight changes or difficulty maintaining a healthy weight. A studied found that individuals with adequate iron levels had better physical performance and energy levels, which can support healthy body weight and muscle mass maintenance [30].

Adequate iron intake is crucial for preventing iron-deficiency anemia, which can affect overall health, energy levels, and body weight [31]. Researcher highlights that iron deficiency can have widespread effects on health, including reduced physical fitness, impaired cognitive function, and compromised immune responses, which collectively can impact overall nutritional status [32]. A deficiency in iron can lead to compromised immune function, making an individual more susceptible to infections and illnesses, which in turn affects their overall nutritional status. Frequent illness can result in poor appetite, reduced nutrient absorption, and weight loss, further deteriorating nutritional health [33].

4   Conclusions

The study results showed a significant relationship between protein and iron intake with nutritional status among college students in Medan city. Students who have consume enough protein and iron intake will have a greater chance of having a normal nutritional status, compared to students who did not consume enough protein and iron. The higher the protein and iron intake, the higher the nutritional status of adolescents. Adolescents need to manage their nutrient intake according to their daily needs. Regulation of protein and iron intake must be done so that adolescents have a good nutritional status.

Acknowledgment

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