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The Relationship Between Nutritional Knowledge, Physical Activity, and Exercise Intensity with Body Composition in Yasfi Bekasi High School

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Abstract

The increase in cases of overweight and obesity among adolescents is a serious challenge for public health in Indonesia. Low physical activity, high-calorie diets, and lack of nutritional knowledge are the main factors that affect the body composition and nutritional status of adolescents. This study aims to analyze the relationship between nutritional knowledge, physical activity, and exercise intensity on the body composition of students at Yasfi Bekasi High School. The research method used a quantitative approach with a cross-sectional study design on 114 respondents selected through total sampling. Data were collected through a nutritional knowledge questionnaire, the Global Physical Activity Questionnaire (GPAQ), and an exercise intensity instrument, while body composition was measured using the Bioelectrical Impedance Analysis (BIA) method. Data analysis was performed descriptively and bivariately using the Spearman Rank correlation test with a significance level of 0.05. The results showed that the majority of respondents had good nutritional knowledge (85.1%) and high physical activity (64.9%). A significant relationship was found between nutritional knowledge, physical activity, and exercise intensity with nutritional status ($p < 0.05$). Students with good nutritional knowledge and high physical activity tended to have a normal Body Mass Index (BMI), while respondents with low activity showed a tendency toward overweight. In conclusion, good nutritional knowledge, regular physical activity, and sufficient exercise intensity are an important combination in maintaining ideal body composition in adolescents. These findings emphasize the need for integrated nutrition education and physical activity promotion programs in schools to foster healthy lifestyles from an early age.

How to Cite

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INTRODUCTION

Adolescent health and fitness are important indicators in the development of quality human resources. One of the current global challenges is the increasing prevalence of obesity and overweight among adolescents. According to the World Health Organization (WHO, 2023), approximately 20% of adolescents aged 10–19 years worldwide are overweight, and 6% are obese. This condition reflects an imbalance between energy intake and physical activity, which triggers various metabolic disorders.

In Indonesia, the Basic Health Research (Riskesdas, 2023) shows that the prevalence of overweight and obesity among adolescents aged 13–18 years is 15.8% and 9.2%, respectively, an increase compared to 2018. This increase is influenced by low physical activity, high consumption of fast food, and a lack of nutritional knowledge among adolescents. In fact, nutritional knowledge has a direct influence on eating habits and weight control.

Several studies have shown a significant relationship between nutritional knowledge, physical activity, and the nutritional status of adolescents.(Roring et al., 2020) found that nutritional knowledge and exercise intensity were positively related to the nutritional status of adolescent girls. Research by (Gizi et al., 2019) also revealed a correlation between nutritional intake, physical activity, and the physical fitness of physical education teachers. (Damayanti et al., 2016) added that adolescents with balanced nutritional knowledge tend to have a more ideal body image and body composition.

In addition, (Mulyadi et al., 2013) found a relationship between physical activity and nutritional knowledge with the macronutrient composition of adolescents, while (Januari et al., 2019) emphasized that physical activity and balanced nutritional knowledge correlate with the nutritional status of adolescent girls. (Fitri et al., 2017) in AcTion Journal explain that moderate-intensity physical activity can maintain better body fat composition in children and adolescents.

Recent research by (Ilmu et al., 2017) also shows that a combination of low nutritional knowledge and physical activity increases the risk of obesity. A study by (Clara et al., 2024) proves the relationship between eating behavior and physical activity on body composition in high school students. In addition, (Correlation et al., 2021) emphasized that the adequacy of macro nutrients and physical activity together affect the fitness and body proportions of adolescent athletes(Putra & Rizqi, 2018) in the Gaster Journal also showed that body mass index is related to the activity level of adolescent girls.

However, most of the above studies still focus on single variables such as nutritional knowledge or physical activity, without integrating both with exercise intensity and body composition measured objectively. Therefore, this study aims to analyze the relationship between nutritional knowledge, physical activity, and exercise intensity on the body composition of Yasfi High School students using the Bioelectrical Impedance Analysis (BIA) method.The novelty of this research lies in its holistic examination of multidimensional factors influencing adolescent health, integrating nutritional knowledge, physical activity, exercise intensity, eating behaviors, and body composition—measured via Bioelectrical Impedance Analysis (BIA) for BMI, body fat percentage, and lean muscle mass—rather than isolating variables. By focusing specifically on high school students, it reveals how imbalances in these elements contribute to underweight or overweight conditions, with empirical data showing that over half of respondents (53.5%) have good nutritional intake yet face varying BMI outcomes due to energy balance issues. This approach uniquely serves as a foundation for school-based policies promoting nutrition education and physical activity, offering actionable insights for preventive interventions that challenge simplistic diet-focused views and emphasize comprehensive health strategies. This approach is expected to provide a comprehensive picture of the multidimensional factors that influence adolescent health and serve as a basis for policies promoting nutrition and physical activity in schools.

METHODS

This study used a descriptive quantitative approach with a cross-sectional study design, in which data collection was conducted at one time without providing intervention to respondents. This design was chosen because it can describe the relationship between lifestyle behaviors and body composition efficiently in one observation period (ACSM, 2021).

The population in this study was all 120 students of Yasfi Bekasi High School in the 2025/2026 academic year. The sampling technique used total sampling, considering that the population size was less than 200 respondents, so that all members of the population could be used as research samples.

Nutrition knowledge variables were me-

asured using a questionnaire adapted from instruments by (Florence et al., 2020) and Notoatmodjo (2018), which had undergone a validity test. Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ) developed by the WHO (2010), covering physical activity in school, home, and leisure environments. Exercise intensity was assessed using a questionnaire developed by Haryatno (2019), covering frequency, duration, and level of effort during exercise. Meanwhile, body composition was measured using the Bioelectrical Impedance Analysis (BIA) method to obtain data on body fat percentage, lean muscle mass, and Body Mass Index (BMI).

The research was conducted in November 2025 at Yasfi High School in Bekasi. The research procedure included the preparation of instruments, providing information to respondents, filling out questionnaires, measuring body composition using BIA, and data processing. All data were then analyzed using SPSS software.

Data analysis was conducted in two stages. Univariate analysis was used to describe the distribution of each research variable, while bivariate analysis used Spearman's Rank correlation test to assess the relationship between variables at a significance level of 0.05 (Ode et al., 2025).

RESULTS AND DISCUSSION

This section of the study presents findings related to nutritional knowledge, physical activity, exercise intensity, and the nutritional status of students at Yasfi Bekasi High School. This presentation is based on previous scientific theories and findings which explain that a person's nutritional status is the result of a complex interaction between energy intake, energy expenditure, and an individual's capacity to understand and apply the principles of balanced nutrition.

According to the World Health Organization (WHO, 2020), energy imbalance—whether due to excessive intake or lack of physical activity—is the main cause of overweight and obesity in adolescents. In addition, the National Institutes of Health (NIH, 2018) emphasizes that nutritional knowledge influences eating behavior, including an individual's ability to choose the right foods according to their body's needs. Meanwhile, the physical activity theory from the American College of Sports Medicine (ACSM, 2021) states that moderate to high-intensity physical activity plays a significant role in controlling body composition through increased energy expenditure and improved metabolism.

The results of the analysis in this study were compiled based on these theories to provide an empirical description of how nutritional knowledge, physical activity levels, and exercise intensity contribute to variations in the body mass index (BMI) and body composition of respondents. The descriptive and bivariate analyses used in this study are expected to strengthen the scientific evidence regarding the importance of active lifestyles and nutritional understanding in preventing nutritional problems in adolescents.

Tabel 1. Descriptive Statistics

	N	Mean	Std. Deviation
Body mass index	114	22.441	5.3708
Nutrition Knowledge	114	22.17	2,739
Physical activity	114	616.82	551,155
Exercise Intensity	114	20.75	2.953
Valid N (listwise)	114		

The descriptive **Tabel 1** shows the results of the analysis of 114 respondents. The Body Mass Index (BMI) variable has a minimum value of 14.4 and a maximum of 39.5, with a mean value of 22.44 and a standard deviation of 5.37. This indicates that most respondents have a normal nutritional status, but there is considerable variation between individuals.

The Nutrition Knowledge variable has a value range of 11 to 25, with an average of 22.17 and a standard deviation of 2.74. This value indicates that the respondents' level of nutrition knowledge is generally good, although there are still differences in the level of understanding between individuals.

Furthermore, the Physical Activity variable shows a minimum value of 20 and a maximum of 2773, with an average value of 616.82 and a standard deviation of 551.16. The high standard deviation indicates considerable variation in the respondents' physical activity levels. This indicates that some respondents have low physical activity, while others have very high physical activity.

Meanwhile, the Exercise Intensity variable has a minimum value of 14 and a maximum of 27, with an average of 20.75 and a standard deviation of 2.95. This average indicates that respondents generally have exercise intensity in the moderate to fairly active category.

Overall, these descriptive data show that respondents have a relatively normal body mass index and good nutritional knowledge, but with high variation in physical activity and exercise intensity levels. This can be the basis for further

analysis of the relationship between nutritional status, nutritional knowledge, physical activity, and exercise intensity on individual health status or performance.

Tabel 2. Calculation results table BMI (Body Mass Indexs) classification * PG (Nutrition Knowledge) classification Crosstabulatio

			PG Classification			Total
			Good	Adequate	Poor	
BMI classification	Severe weight deficiency	Count	9	1	0	10
		% within BMI classification	90.0	10.0	0	100.0
	Mild weight deficiency	Count	16	3	0	19
		% within BMI classification	84.2	15.8	0	100.0
	Severe overweight	Count	21	3	0	24
		% within BMI classification	87.5	12.5	0	100.0
	Mild overweight	Count	2	2	1	5
		% within BMI classification	40.0	40.0	20	100.0
	Normal	Count	49	5	2	56
		% within BMI classification	87.5	8.9	3.6	100.0
	Total	Count	97	14	3	114
		% within BMI classification	85.1	12.3%	2.6	100.0

Tabel 2 BMI classification * PG classification Crosstabulation. Based on the results of a cross-analysis between BMI classification and PG (Nutrition Knowledge) classification, it was found that most respondents (85.1%) had a good PG classification, although there were variations in the BMI category. Respondents with normal nutritional status had the highest proportion in the good PG (Nutrition Knowledge) category (87.5%), followed by groups with overweight and underweight. Interestingly, the group with mild overweight showed a decline in nutrition knowledge quality, with 20% of respondents falling into the poor NK category. This indicates that weight imbalance, especially towards overweight, begins to have an impact on the decline in an individual's nutritional status or fitness.

Tabel 3 BMI classification * AF classification Crosstabulation. Based on a cross-analysis between BMI classification and physical activity level (AF), it was found that most respondents were in the very active category (64.9%). In the underweight group, more than 70% were classified as very active, suggesting that high physical activity may contribute to low body weight. Conversely, in the overweight group, the proportion of inactive individuals increased to 25%. Meanwhile, the normal BMI group also showed a predominance of very high activity (66.1%), indicating a positive relationship between physical activity and weight balance. Overall, these results indicate that physical activity plays an important role in maintaining ideal nutritional status and body composition.

Tabel 3 Calculation results table BMI (Body Mass Indexs) classification * AF (Physical Activity) classification Crosstabulation.

			AF Classification			Total
			Active	Less Active	Very Active	
BMI classification	Severe underweight	Count	2	0	8	10
		% within BMI classification	20.0	0.0	80.0	100.0
	Mild weight deficiency	Count	3	2	14	19
		% within BMI classification	15.8	10.5	73.7	100.0
	Severe overweight	Count	4	6	14	24
		% within BMI classification	16.7	25.0	58.3	100.0
	Mild overweight	Count	3	1	1	5
		% within BMI classification	60.0	20	20	100.0
	Normal	Count	9	10	37	56
		% within BMI classification	16.1	17.9	66.1	100.0
	Total	Count	21	19	74	114
		% within BMI classification	18.4	16.7	64.9	100.0

Tabel 4 Calculation results table BMI (Body Mass Indexs) classification * IF (Exercise Intensity) classification Crosstabulation.

			IF Classification		Total
			Good	Fair	
BMI classification	Severe weight loss	Count	4	6	10
		% within BMI classification	40.0	60	100.0
	Mild weight deficiency	Count	11	8	19
		% within BMI classification	57.9	42.1%	100.0
	Severe overweight	Count	15	9	24
		% within BMI classification	62.5	37.5	100.0
	Mild overweight	Count	3	2	5
		% within BMI classification	60.0	40.0	100.0
	Normal	Count	28	28	56
		% within BMI classification	50.0	50.0	100.0
	Total	Count	61	53	114
		% within BMI classification	53.5	46.5	100.0

Tabel 4 BMI Classification * IF Classification Crosstabulation. Based on the cross-analysis between BMI classification and IF classification, it was found that most respondents (53.5%) were in the good IF category, although the distribution

varied across each BMI category. Respondents with normal nutritional status showed a balanced proportion between good and adequate IF (50% each), so there was no dominance of IF quality in this BMI category. The group with mild underweight had a higher proportion of good IF (57.9%), while the group with severe underweight showed a downward trend in IF quality, with 60% of respondents in the adequate IF category. These findings indicate that the more severe the condition of malnutrition, the greater the likelihood of individuals experiencing a decline in IF quality.

Meanwhile, the overweight group—both mild and severe—still showed a dominance of good IF, at 60% and 62.5%, respectively. However, a downward trend in IF quality was still evident as nutritional status deviated further from the normal range, whether toward underweight or overweight. This suggests that nutritional imbalance can impact IF quality, although the effect is more pronounced in the severe underweight category.

The results of the study show a significant relationship between nutritional knowledge, physical activity/exercise intensity, and nutritional status (BMI). This relationship can be seen from the pattern of respondents with normal BMI who consistently have good nutritional knowledge, high levels of physical activity, and balanced nutritional intake.

Relationship Between Nutritional Knowledge and BMI

Most respondents (85.1%) had good nutritional knowledge, with the highest proportion found in the normal BMI group (87.5%). This indicates that nutritional knowledge plays an important role in weight control. Respondents who understand basic nutritional principles, such as energy balance, food composition, and daily requirements, tend to be able to maintain their weight within the ideal range.

This finding is in line with the research by (Ode et al., 2025), which states that good nutritional knowledge plays a significant role in regulating diet and preventing obesity. Conversely, poor nutritional knowledge has the potential to cause unbalanced consumption patterns that lead to extreme weight gain or loss.

The Relationship Between Physical Activity and BMI

Analysis between BMI classification and physical activity (PA) levels shows that most respondents (64.9%) are classified as very active, especially in the normal BMI group (66.1%) and the severely underweight group (80%). However, in the severely overweight group, the proportion of physical activity decreases, with 25% of respondents classified as less active.

These findings indicate that physical activity plays an important role in maintaining the body's energy balance. Individuals who regularly engage in physical activity are more likely to maintain their ideal weight. This is in line with the WHO (2020) opinion, which emphasizes that at least 150 minutes of moderate to vigorous physical activity per week can help control weight and reduce the risk of metabolic diseases.

Relationship Between Exercise Intensity/Nutritional Intake and BMI

To further support the analysis of BMI classification and nutritional intake (IF), consider these expert insights: The World Health Organization (WHO) emphasizes that "obesity results from an imbalance between energy intake and energy expenditure, where energy intake exceeds energy expenditure over time" (WHO, 2020), which aligns with the finding that even overweight respondents with around 60% good IF may consume nutritious foods excessively. Nutritionist Marion Nestle adds, "It's not just what you eat, but how much you eat relative to what you burn. People can have 'good' diets but still gain weight if calories in exceed calories out" (Nestle, 2013, in "Why Calories Count"), highlighting why quality intake doesn't always prevent imbalances. Additionally, the Harvard School of Public Health notes that "body weight is regulated by the balance between energy intake from food and energy expenditure through physical activity and metabolism" (Harvard T.H. Chan School of Public Health, 2022), reinforcing that nutritional status hinges on equilibrium rather than intake alone, as evidenced by the 60% sufficient IF in severely underweight groups who still lack adequate energy. These perspectives collectively underscore that BMI outcomes depend on caloric balance, not merely the quality or quantity of food consumed.

The Relationship Between the Three Variables and Nutritional Status

To reinforce the notion that a synergy of nutritional knowledge, high physical activity, and a balanced diet fosters normal BMI while imbalances lead to underweight or overweight issues, consider these authoritative perspectives: The World Health Organization (WHO) states that

"maintaining a healthy body weight requires a balance of energy intake from nutritious foods and energy expenditure through physical activity" (WHO, 2021), underscoring how these combined elements support optimal BMI. Similarly, the Centers for Disease Control and Prevention (CDC) affirms that "eating a healthy diet and being physically active can help you reach and maintain a healthy weight" (CDC, 2023), highlighting the role of informed dietary choices and exercise in achieving balance. Registered Dietitian Joy Bauer adds, "when you combine smart eating with regular exercise, you're setting yourself up for success in maintaining a healthy weight. But if one piece of the puzzle is missing—like poor nutrition knowledge or low activity levels—you're more likely to struggle with weight gain or loss" (Bauer, 2019, in "Joy Bauer's Food Cures"), illustrating how disruptions in any factor can result in undesirable nutritional statuses. Collectively, these insights emphasize the importance of holistic health practices for BMI management. hus, the results of this study support the theory that nutritional status is the result of a complex interaction between eating behavior, activity level, and individual knowledge about health. The better a person's understanding of nutrition and the more active they are in exercising, the greater the chance of having an ideal body weight.

CONCLUSION

This study shows that there is a significant relationship between nutritional knowledge, physical activity, exercise intensity, and nutritional status (Body Mass Index/BMI) among high school students at Yasfi Bekasi. In general, respondents with good nutritional knowledge tend to have a BMI in the normal category and engage in moderate to high intensity physical activity and exercise.

First, nutritional knowledge has been proven to be an important factor in weight control. Students who understand the principles of balanced nutrition have a better ability to regulate their consumption patterns and maintain their body's energy balance. Second, the level of physical activity and exercise intensity plays a significant role in the stability of body composition, where regular and sufficiently intense physical activity helps maintain optimal fat and muscle mass proportions. Third, the balance between nutrient intake and energy expenditure is the primary determinant of ideal nutritional status.

Overall, a combination of good nutrition knowledge, active physical activity, and regular exercise intensity is key to maintaining a healthy body composition in adolescents. This study emphasizes the importance of a multidimensional approach to promoting adolescent health, by strengthening school-based nutrition education and consistent physical activity habits.

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