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The Relationship Physical Fitness with Learning Achievement of High School Students in Semarang

Hubungan Kebugaran Jasmani dengan Prestasi Belajar pada Siswa Sekolah Menengah Atas di Semarang

Indriana Rahma Nidya[1], Apoina Kartini[1], Suyatno Suyatno[1]*

[1]Department of Public Health Nutrition, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia

ABSTRACT

Background: Many parents encourage their children to take additional lessons to enhance their academic performance, while other important aspects, such as students' physical fitness, are often overlooked.

Objectives: This research investigates the relationship between physical fitness and learning achievement among high school students in Semarang.

Methods: This observational study employed a cross-sectional design and involved 396 high school students in Semarang, with 86 subjects selected randomly. The dependent variable was learning achievement, measured by the raw scores of the final semester exams. The independent variable was physical fitness, while the other confounding variables included nutritional status, food consumption, socioeconomic conditions, health status, and participation in private tutoring. Dietary intake was assessed using a 24-hour food recall method. Body Mass Index for age (BMI/A) was calculated using weight and height to evaluate nutritional status. The multistage fitness test was utilized to assess physical fitness. Additional data were collected through interviews. Data analysis was conducted using chi-square tests and multiple logistic regression.

Results: The results indicated that most subjects had inadequate nutrient intake, with low percentages for energy (55.8%), carbohydrates (76.7%), protein (45.3%), and iron (64%). In contrast, fat intake was predominantly categorized as excessive (39.5%). While most subjects exhibited good nutritional status (79.1%), their physical fitness levels were primarily poor (58.1%). Multivariate analysis revealed that good physical fitness and participation in additional lessons were positively correlated with learning achievement (p-value=0.025, p-value=0.017).

Conclusions: Enhancing physical fitness is essential for improving student learning outcomes. Participating in supplementary activities, such as attending additional lessons, is also necessary to improve student learning achievement.

INTRODUCTION

The advancement of a nation is significantly influenced by the quality of its human resources (HR), which encompasses achievements, health, mental well-being, and physical attributes[1]. The Human Development Index (HDI) is commonly used as a measure of HR quality, shaped by factors such as education, health, and economic conditions[2]. Among these factors, education plays a crucial role in nurturing individual potential, empowering individuals to contribute effectively to society and their environment[3].

In comparison to other countries, the quality of education in Indonesia is often considered inadequate. According to the 2023 rankings from Worldtop20.org, Indonesia is ranked 67th globally in terms of educational quality[4]. Within Southeast Asia, Indonesia also falls behind in educational performance due to disparities in access and regional variations in educational quality[5]. Addressing these challenges necessitates collaboration among the government, schools, parents, and the wider community to enhance learning outcomes[4].

Learning achievement reflects students' mastery of academic subjects and is influenced by various factors[6]. Internal factors include nutritional status, dietary intake, physical fitness, and psychological aspects such as attitudes, interests, talents, intelligence, and motivation[7–9]. External factors encompass the family environment, socioeconomic conditions, peer relationships, and school facilities[10–12].

Adolescence is a transitional stage from childhood to adulthood, characterized by significant physical and psychological changes in individuals[13]. Generally, teenagers aged 15 to 18 years are enrolled in high school. During this critical period, meeting nutritional needs is essential, as it directly impacts both their health and cognitive abilities[4]. Food serves as a fundamental necessity for teenagers, providing essential nutrients that support physical growth and development.

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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Regular consumption of nutrient-rich foods can help maintain health, enhance fitness, and positively influence academic achievement and overall human resource development[14]. The impact of food intake on cognitive development is profound, as the energy and nutrients derived from food play a vital role in supporting brain function[15]. The impact of food intake on cognitive development is profound, as the energy and nutrients derived from food play a vital role in supporting brain function. Furthermore, food intake indirectly affects the learning process and academic performance. Nutritional deficiencies in adolescents can lead to decreased motivation, increased susceptibility to illness, and reduced concentration, ultimately having a detrimental effect on academic outcomes[16].

To achieve optimal nutritional status, it is essential to pay careful attention to food intake to ensure that nutritional needs are met. This is crucial for supporting overall health and bodily development[17]. Nutritional status refers to the condition determined by the food consumed and how the body utilizes the nutrients. It reflects the balance of required nutrients and the body's physiological processes, which, in turn, influence health, physical growth, and cognitive function[18]. Optimal nutritional status is characterized by an adequate intake of both micronutrients and macronutrients, which the body efficiently uses to promote physical growth and optimal brain development[8].

The nutritional status of adolescents in Indonesia still requires increased attention. According to the 2018 Basic Health Research (*Riskesdas*), the nutritional status of adolescents aged 16 to 18 varies across the country. Nationally, 4.0% are classified as obese, 9.5% as overweight, 6.7% as underweight, 1.4% as severely underweight, and 78.3% as having a normal weight[19]. In Central Java, the nutritional status for the same age group indicates that 3.7% are obese, 7.9% are overweight, 8.1% are underweight, 1.6% are severely underweight, and 78.7% have a normal weight. Specifically, in Semarang, the figures are 6.92% obese, 12.2% overweight, 11.65% underweight, 0.43% severely underweight, and 68.8% with a normal weight[19].

Adolescents experiencing malnutrition may encounter significant challenges in their academic performance. Those with chronic nutritional deficiencies often exhibit a decline in school performance, which adversely affects their growth and development[20]. Proper nutritional status and adequate intake are essential for physical fitness, as they directly influence energy levels and stamina. Nutrient deficiencies can lead to diminished physical performance and impede other activities, including studying[21,22]. The 2022 Sport Development Index (SDI) report revealed that the physical fitness of children and adolescents in Indonesia remains suboptimal, with the majority categorized as "poor" or "very poor. This highlights the urgent need for more concerted efforts to enhance students' physical fitness, thereby supporting their overall health and academic success[24]. In the context of an educational curriculum that requires students to study for at least eight hours a day, optimal physical fitness becomes a critical factor. Physical fitness plays a vital role in facilitating sustained physical activity without excessive fatigue, reducing health risks, and improving concentration during study sessions. Consequently, this positively influences their academic achievements[25].

Based on the analysis of the Sport Development Index (SDI) data, community sports participation in Central Java and Semarang City is categorized as moderate and low, respectively. Additionally, the physical fitness index in these areas is also considered low[23]. These findings underscore the necessity of enhancing physical fitness and sports participation as vital components in promoting health and human resource development. A study conducted on high school students in Semarang identified several issues related to physical fitness, including students' complaints about their fitness levels, low attendance rates, and insufficient availability of food and beverages at schools that support physical fitness. These results highlight the importance of meeting nutritional requirements and providing facilities that promote student fitness, thereby creating an optimal environment to enhance their academic performance[26].

A preliminary study involving 30 high school students in Semarang revealed that 36.7% were classified as overweight, 6.7% as underweight, and 56.7% as having normal weight. The proportion of overweight students exceeded the data reported in the Riskesdas 2018 data for Semarang. Physical fitness assessments conducted using the Multistage Fitness Test indicated that all students demonstrated very low fitness levels. Specifically, 100% of the students exhibited very low fitness, with the Maximum Oxygen Volume (VO2max) recorded at ≤ 32 mL/kg/min for male students and ≤ 26 mL/kg/min for female students. Furthermore, 36.7% of the students performed poorly in biology, while 33.3% exhibited similar performance in economics, as determined through interviews and first-semester exam results.

This research aimed to explore the relationship between physical fitness and learning performance among high school students in Semarang, while also considering other influencing factors. Its novelty lies in its comprehensive approach to identifying the key determinants of students' learning achievements.

METHODS

This study utilized an observational approach with a cross-sectional design, conducted at SMA Negeri 9 in Semarang City from February to April 2024. Data collection took place in April 2024. The study population consisted of 396 students, with a sample size of 86 students determined using a formula based on the total population of 396, a confidence level (α) of 95% (Z=1.96), a margin of error of 10% (d=0.10), and a proportion estimate of 50% (p=0.5).

$$n = \frac{Z^2_{1-\alpha/2}\, p\,(1-p)\, N}{d^2(N-1) + Z^2_{1-\alpha/2}\, p\,(1-p)}$$

The sample was selected using simple random sampling, adhering to predetermined inclusion and exclusion criteria. The inclusion criteria required participants to be actively enrolled as Grade X students aged 15 to 18 at SMA Negeri 9 Semarang and to provide consent to participate in the study. Students were excluded if they were absent during the study, engaged in assignments outside of school, or following a special dietary regimen.

The primary variable of interest was learning performance, which was measured using raw scores from end-of-semester exams. Independent variables included physical fitness and various potential confounders, such as nutritional status, dietary intake, socioeconomic conditions, health status, and participation in additional learning activities. Primary data were collected through interviews utilizing questionnaires that captured demographic and household characteristics. Dietary intake was assessed using a 24-hour food recall method to document the consumption of food and beverages on both weekdays and weekends, supplemented by a food photo book for reference. Anthropometric and physical fitness data were also gathered through direct measurements. Weight was measured with a digital scale, height with a stadiometer, and physical fitness was evaluated using the Multistage Fitness Test (MFT), in which participants ran 20-meter laps at a pace dictated by the MFT guide[28].

Secondary data were drawn from students' raw scores in summative examinations for subjects including physics, chemistry, mathematics, biology, sociology, economics, geography, and history. Learning performance was categorized according to the Learning Outcome Achievement Criteria (KKTP) into two groups: "poor" (scores <71) and "good" (scores ≥71). Nutritional intake data, collected through a 24-hour food recall, were analyzed using Nutrisurvey software to determine the percentage of Recommended Dietary Allowance (RDA) fulfillment. Macronutrient intake was classified as "low" (<90% RDA), "adequate" (90–119% RDA), or "excess" (≥120% RDA), while micronutrient intake was classified as "low" (<77% RDA) or "adequate" (≥77% RDA)[27].

Nutritional status was assessed using anthropometric data processed with WHO AnthroPlus software to calculate BMI-for-age z-scores, which were categorized as "underweight" (<-2 SD), "normal" (-2 SD to +1 SD), or "overweight" (>+1 SD).

Physical fitness levels were classified using the results from the Multistage Fitness Test (MFT), with categories differing by gender. For males, fitness levels ranged from "very poor" (≤32 ml/kg/min) to "very good" (≥48 ml/kg/min). For females, the range was from "very poor" (≤26 ml/kg/min) to "very good" (≥42 ml/kg/min)[28]. Family income was calculated as the total income of both parents divided by the number of dependents and was categorized as "low" (below the City Minimum Wage) or "adequate" (at or above the City Minimum Wage). Health status was evaluated based on self-reported health over the past month and categorized as either "unhealthy" or "healthy". Participation in additional learning activities was recorded through interviews and categorized as either "participating" or "not participating".

Data analysis was conducted using SPSS software, following three distinct stages. First, univariate analysis was performed to describe each variable. Next, bivariate analysis utilizing the Chi-Square test assessed the relationship between independent and dependent variables. Finally, multivariate analysis was carried out using Multiple Logistic Regression with the Backward Stepwise (Conditional) method to identify the key variables associated with learning achievement, taking into account various complex factors. The Faculty of Public Health Ethics Committee at Diponegoro University in Semarang approved this study on March 28, 2024, under approval letter number 171/EA/KEPK-FKM/2024.

RESULTS AND DISCUSSIONS

The characteristics of the research subjects encompass several relevant aspects, including age, gender, learning achievement, nutrient intake, and nutritional status. Additionally, data were collected on physical fitness levels, socioeconomic status, health history, and participation in supplementary lessons. This information is comprehensively summarized in Table 1.

Table 1. Frequency Distribution of Subject Characteristics

Subject Characteristics	n	%
Age		
15 years	31	36.0
16 years	52	60.5
17 years	3	3.5
Gender		
Male	44	51.2
Female	42	48.8
Learning Achievement		
Poor (<71)	60	69.8
Good (≥71)	26	30.2

Subject Characteristics	n	%
Energy Sufficiency Level		
Low (<90% RDA)	48	55.8
Adequate (90–119% RDA)	29	33.7
High (≥120% RDA)	9	10.5
Carbohydrate Sufficiency		
Low (<90% RDA)	66	76.7
Adequate (90–119% RDA)	15	17.4
High (≥120% RDA)	5	5.8
Protein Sufficiency Level		
Low (<90% RDA)	39	45.3
Adequate (90–119% RDA)	23	26.7
High (≥120% RDA)	24	27.9
Fat Sufficiency Level		
Low (<90% RDA)	28	32.6
Adequate (90–119% RDA)	24	27.9
High (≥120% RDA)	34	39.5
Iron Sufficiency Level		
Low (<77% RDA)	64	64.0
Adequate (≥77% RDA)	36	36.0
Nutritional Status		
Underweight (<-2 SD)	6	7.0
Normal (-2 SD to +1 SD)	68	79.1
Overweight (>+1 SD)	12	14.0
Physical Fitness		
Very Poor	50	58.1
Poor	18	20.9
Average	16	18.6
Good	1	1.2
Excellent	1	1.2
Socioeconomic Status		
Low (<City Minimum Wage)	54	62.8
High (>City Minimum Wage)	32	37.2
Health History		
Unhealthy	35	40.7
Healthy	51	59.3
Participation in Tutoring		
Yes	17	19.8
No	69	80.2

RDA = Recommended Dietary Allowance; SD = Standard Deviation

Based on the data presented in Table 1, it is evident that the majority of the research subjects were male and 16 years old. Most exhibited poor academic performance, characterized by insufficient intake of energy, carbohydrates, protein, and iron. Conversely, a significant portion consumed fats in quantities that exceeded their dietary needs. Although most participants maintained a good nutritional status, their physical fitness levels were generally low. Additionally, many subjects hailed from disadvantaged socioeconomic backgrounds, despite reporting good physical health. Furthermore, most participants did not engage in extra lessons.

Table 2. Cross-tabulation results of variables and students' learning achievement

Variables	Learning Achievement		p-value[a]
	Poor	Good	
	n (%)	n (%)	
Energy Intake			
Insufficient (<90% RDA)	33 (68.8%)	15 (31.3%)	1.000
Sufficient (≥90% RDA)	27 (71.1%)	11 (28.9%)	
Carbohydrate Intake			
Insufficient (<90% RDA)	45 (68.2%)	21 (31.8%)	0.596
Sufficient (≥90% RDA)	15 (75.0%)	5 (25.0%)	
Protein Intake			
Insufficient (<90% RDA)	25 (64.1%)	14 (35.9%)	0.350
Sufficient (≥90% RDA)	35 (74.5%)	12 (25.5%)	
Fat Intake			
Insufficient (<90% RDA)	21 (75.0%)	7 (25.0%)	0.617
Sufficient (≥90% RDA)	39 (67.2%)	19 (32.8%)	
Iron Intake			
Insufficient (<77% RDA)	37 (67.3%)	18 (32.7%)	0.627
Sufficient (≥77% RDA)	23 (74.2%)	8 (25.8%)	
Nutritional Status			
Abnormal Nutrition	12 (66.7%)	6 (33.3%)	0.777
Normal Nutrition	48 (70.6%)	20 (29.4%)	
Physical Fitness			
Low Fitness	52 (76.5%)	16 (23.5%)	0.019*
High Fitness	8 (44.4%)	10 (55.6%)	
Socioeconomic Status			
Low	37 (68.5%)	17 (31.5%)	0.932
High	23 (71.9%)	9 (28.1%)	
Health Status			
Poor Health	23 (65.7%)	12 (34.3%)	0.661
Good Health	37 (72.5%)	14 (27.5%)	
Supplementary Lessons			
No	52 (75.4%)	17 (24.6%)	0.048*
Yes	8 (47.1%)	9 (52.9%)	

*RDA = Recommended Dietary Allowance; [a]Chi-Square Test; Significant (p-value<0.05)

From Table 2, it can be concluded that energy intake is not significantly associated with students' learning achievement (p-value=1.000). Although energy intake is essential for maintaining physical health and supporting bodily functions related to learning ability, energy deficiency can lead to fatigue, reduced concentration, and decreased motivation, ultimately harming academic performance[29,30]. Despite many students having insufficient energy intake, some still performed well academically, potentially due to supportive psychological factors such as intelligence, interest, or motivation. Conversely, students with adequate energy intake but poor academic performance may not be effectively absorbing or utilizing that energy. This finding aligns with a study conducted in Bekasi, which also reported no significant correlation between energy intake and academic performance (p-value=0.228)[31].

As illustrated in Table 2, carbohydrate intake does not have a significant relationship with students' learning achievement (p-value=0.596). Carbohydrates are the main source of energy for both the body and the brain, playing a crucial role in their optimal function. During digestion, carbohydrates serve as the primary source of energy for both the body and the brain, playing a crucial role in their optimal functioning. During digestion, carbohydrates are converted into glucose, which is essential for cognitive performance and may enhance learning outcomes. A deficiency in carbohydrates can lead to feelings of fatigue and low energy in students, as carbohydrates significantly influence brain function. Insufficient carbohydrate intake can also diminish

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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concentration and negatively affect cognitive abilities, which, in turn, impacts academic performance[32]. Some students with inadequate carbohydrate consumption may still excel academically, and conversely, some may struggle despite sufficient intake. This discrepancy could be attributed to habits such as skipping breakfast or maintaining irregular eating schedules. The lack of a significant correlation between carbohydrate intake and academic performance may also be influenced by the subjects' tendency to skip breakfast. Additionally, factors such as interest in learning and intelligence contribute to academic success. These findings are consistent with a study conducted in Bekasi, which reported no significant correlation between carbohydrate intake and academic performance (p-value=0.953)[31].

Similarly, as illustrated in Table 2, protein intake does not significantly correlate with students' learning achievement (p-value=0.350). Protein is an essential nutrient that supports the formation, growth, and maintenance of body cells and tissues, including brain tissue[33]. It also contributes to elevated levels of amino acids and choline, which serve as precursors for neurotransmitters. The secretion of these neurotransmitters has been associated with improved psychological health, thereby enhancing cognitive abilities[9]. Furthermore, protein plays a crucial role in the body's absorption of glucose. A protein deficiency can disrupt the nutrient supply to the brain, potentially impairing concentration[33]. On the other hand, students with low learning achievement but adequate protein intake may not absorb nutrients efficiently. Conversely, students with low learning achievement but adequate protein intake may not efficiently absorb nutrients. In contrast, students who excel academically despite low protein intake might be influenced by psychological factors such as motivation, interest, talent, and strong cognitive abilities. It is well-established that academic performance is influenced by a variety of factors, including psychological aspects like intelligence and motivation, as well as external factors such as teaching methods, school environment, and family support. These findings align with research conducted in Depok, which also indicated no significant relationship between protein intake and academic performance (p-value=0.704)[9].

As indicated in Table 2, fat intake does not have a significant relationship with students' learning achievement (p-value=0.617). Although fats are an important source of energy, cognitive brain function primarily relies on glucose as its main energy substrate. Therefore, fat intake may not significantly impact learning ability or concentration, provided that glucose requirements are adequately met[30]. A similar study conducted in Bekasi also found no significant correlation between fat intake and academic performance (p-value=0.779)[31].

The analysis concludes that iron intake does not significantly influence students' learning achievement (Table 2). Although iron plays a vital role in cognitive development—particularly in enhancing the brain's concentration and memory capacity—other factors may exert a more dominant effect on academic outcomes. One such factor is the body's absorption of iron, which is significantly influenced by the types of food consumed.

For instance, animal protein is easily absorbed, while inhibitors such as tannins and caffeine decrease absorption. Conversely, enhancers like vitamin C can improve iron absorption. This mechanism is reflected in serum ferritin concentration, which indicates the available iron in the body to support brain function[34]. Under normal circumstances, iron acts as a cofactor, activating the Monoamine Oxidase (MAO) enzyme in the brain, which is essential for improving concentration. However, iron deficiency can adversely affect the brain by disrupting neurotransmitter functions, leading to decreased sensitivity of dopamine receptors, which in turn diminishes concentration, memory, and learning abilities[8]. The lack of a significant relationship between iron intake and academic performance may be attributed to more influential factors such as talent, social environment, and motivation. Some students with iron deficiency may still perform well, possibly due to strong cognitive abilities. These findings are consistent with research conducted in Surakarta, which also indicated no significant relationship between iron intake and academic performance (p-value=0.627)[34].

As shown in Table 2, nutritional status does not significantly impact students' learning achievement (p-value=0.777). However, it plays a crucial role in children's growth and development, particularly during adolescence. Adequate and balanced nutrient intake supports daily activities, contributes to the educational process, enhances learning effectiveness, and influences optimal academic outcomes. Nutrient intake also affects physical growth and brain development, which in turn impacts intelligence and the quality of education, as measured by school exam results. Conversely, malnutrition can disrupt both physical and cognitive development, leading to poorer learning performance. These findings challenge the notion that nutritional status is the sole factor influencing learning performance. Other factors, such as psychological aspects—including interest and motivation to learn—learning strategies (methods and approaches), available resources, social environment, and family support, also play critical roles. These factors interact both directly and indirectly to determine students' learning performance in school. Similar conclusions were drawn from research conducted in Medan, which indicated no significant relationship between nutritional status and academic performance (p-value=0.209)[4].

According to Table 2, family socioeconomic status does not significantly correlate with students' learning achievement (p-value=0.932). While family socioeconomic status can influence learning performance through material support, such as learning resources provided by parents, adequate parental income facilitates the fulfillment of educational needs, thereby boosting students' confidence. Furthermore, favorable economic conditions can foster an environment conducive to the development of a child's potential. Families with higher socioeconomic status are more likely to provide a supportive learning environment, as demonstrated by several studies. Students are often able to leverage their parents' economic resources to enhance their academic outcomes[36,37]. However, the results of this study do not align with these findings. The

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e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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researchers suspect that students with adequate socioeconomic status may not always perform well academically. This might be due to students utilizing their family's economic status for activities that reduce study time. Therefore, socioeconomic status is not the only factor influencing academic performance; psychological factors, such as high learning motivation, are also important, regardless of family economic conditions. These results are consistent with research in Minahasa, which found no significant relationship between socioeconomic status and academic performance (p-value=0.303)[38].

The study found that health status does not significantly affect students' learning achievement (p-value=0.661) (see Table 2). According to established theory, physical health is regarded as one of the internal factors directly related to an individual's physical condition and plays a crucial role in influencing academic performance. Physical health significantly impacts learning outcomes. When a person is unwell, they often experience fatigue, lack of energy, dizziness, and increased sleepiness. For students, health issues can diminish stamina, leading to more frequent absences or requests for permission to miss learning activities. Consequently, students may fall behind in their lessons, which could adversely affect their academic performance[39]. In this study, several students reported experiencing health issues, such as colds, coughs, and fevers, lasting 1 to 3 days or more in the past month. However, these health issues did not significantly interfere with their learning activities. This suggests that health problems may not be the primary factor influencing learning outcomes, and other factors should be considered. This finding contrasts with a study conducted in Pontianak, which demonstrated a significant relationship between health issues and academic performance (p-value=0.025)[40].

Table 1. Dominant factors influencing students' learning achievement

Variables	OR (95% CI)	p-value[a]
Physical Fitness	3.806 (1.180 – 12.273)	0.025*
Additional Lessons	4.457 (1.313 – 15.131)	0.017*

OR=Odds Ratio; [a]Multiple Logistic Regression; *significant (p-value<0.05)

The research revealed a significant connection between physical fitness and students' learning achievement, as evidenced by the bivariate analysis (p-value=0.019) and multivariate analysis (p-value=0.025) presented in Tables 2 and 3. This indicates that students with better physical fitness are 3.806 times more likely to achieve favorable academic results. Physical fitness reflects the body's ability to engage in activities without experiencing excessive fatigue. With adequate physical fitness, students can enhance their physical condition, which supports their learning activities and may lead to improved academic performance[25]. Good physical fitness helps students maintain focus and engagement during learning, thereby boosting concentration, cognitive function, and memory. Additionally, regular physical activity can increase hemoglobin levels, improve oxygen intake, and enhance metabolism and concentration, all of which positively impact academic performance. Therefore, physical fitness is essential for students to possess sufficient energy for daily tasks and academic success. A study conducted in Mojosari also highlighted a correlation between physical fitness and students' academic performance (p-value=0.034)[42].

The results also indicated that additional tutoring can enhance students' learning achievement, as evidenced by a p-value of 0.048 in the bivariate analysis and a p-value of 0.017 in the multivariate analysis, as shown in Tables 2 and 3. The likelihood of improving learning achievement through tutoring is 4.457 times greater. Education is not confined to schools; tutoring outside of the classroom also plays a significant role. Tutoring helps students overcome learning challenges and supports their academic achievements. The government has implemented this program to assist students in maximizing their learning outcomes[43]. Every student possesses a unique learning style and varying abilities to comprehend new material, which influences their knowledge, attitudes, skills, and overall personal and character development. To facilitate this process, additional support, such as tutoring, is essential. Tutoring provides continuous assistance, helping students navigate their learning difficulties[44]. It benefits not only students with lower learning abilities but also those with average or above-average capabilities. These sessions help them refine and deepen their existing knowledge[45]. A study in Pemalang also found a correlation between tutoring and students' academic performance, with a p-value of 0.040[43].

This study has several limitations, as it only examined specific factors affecting learning achievement. Other important factors, such as psychological influences (including interest in learning, motivation, and talent) and external factors (such as school facilities, environment, family, and community support), were not included. Nevertheless, the study addressed several significant areas, including nutrition, nutritional status, physical fitness, and extra tutoring, all of which impact learning achievement. The findings provide a new perspective, emphasizing the necessity of a more comprehensive approach that not only focuses on academic aspects but also considers students' physical fitness to enhance academic performance.

CONCLUSIONS

This study found that a significant number of students' learning achievement were categorized as poor, based on their raw scores from the odd-semester final exam. The students' nutritional intake exhibited deficiencies in energy, carbohydrates, protein, and iron, while their fat intake exceeded the recommended levels.

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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Although most students maintained a satisfactory nutritional status, their physical fitness was predominantly classified as very poor. The analysis revealed no significant relationship between nutrient intake (energy, carbohydrates, protein, fats, and iron), nutritional status, family economic conditions, or physical health history and learning achievement. However, physical fitness and participation in extra lessons (tutoring) were found to significantly influence students' learning achievements. These findings suggest that good physical fitness and additional support through tutoring are crucial factors in promoting students' academic success.

ACKNOWLEDGEMENT

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

AUTHOR CONTRIBUTIONS

REFERENCES

1. Irnani, H. & Sinaga, T. Pengaruh pendidikan gizi terhadap pengetahuan praktik gizi seimbang, dan status gizi pada anak sekolah dasar. *J. Gizi Indones. The Indones. J. Nutr.* **6**, 58–64 (2017). https://doi.org/10.14710/jgi.6.1.58-64.

2. Sa'adah, R. H., Herman, R. B. & Sastri, S. Hubungan status gizi dengan prestasi belajar siswa Sekolah Dasar Negeri 01 Guguk Malintang Kota Padangpanjang. *J. Kesehat. Andalas* **3**, 460–465 (2014). http://dx.doi.org/10.25077/jka.v3i3.176.

3. Suwandaru, C. & Hidayat, T. Hubungan aktivitas fisik dengan prestasi belajar siswa SMK Negeri 1 Surabaya. *J. Pendidik. Olahraga dan Kesehat. V* **09**, 113–119 (2021). https://doi.org/10.31004/jrpp.v7i2.28340.

4. Sidabutar, H. A. Hubungan kebiasaan sarapan dan status gizi dengan prestasi belajar pada siswa SMA Negeri 17 Medan. *Nutr. Nutr. Res. Dev. J.* **03**, 1–11 (2023). Available at: http://lib.unnes.ac.id/id/eprint/65375.

5. Kemendikbudristek. Peringkat Indonesia pada PISA 2022 Naik 5-6 Posisi Dibanding 2018. (2023). Available at: https://www.kemdikbud.go.id/main/blog/2023/12/peringkat-indonesia-pada-pisa-2022-naik-56-posisi-dibanding-2018.

6. Qodri, A. Teori belajar humanistik dalam meningkatkan prestasi belajar siswa. *J. Pedagog.* **04**, 188–202 (2017). https://doi.org/10.33650/pjp.v4i2.17.

7. Salamah, M. S. & Setiawan, I. Tingkat kebugaran jasmani dan hasil belajar siswa dalam pembelajaran pendidikan jasmani olahraga dan kesehatan di SMP Negeri Kota Pekalongan. *Indones. J. Phys. Educ. Sport* **3**, 439–448 (2022). http://dx.doi.org/10.15294/inapes.v3i2.60760.

8. Wadhani, L. P. P. & Yogeswara, I. B. A. Tingkat konsumsi zat besi (Fe), seng (Zn) dan status gizi serta hubungannya dengan prestasi belajar anak sekolah dasar. *J. Gizi Indones. (The Indones. J. Nutr.* **5**, 82–87 (2017). https://doi.org/10.14710/jgi.5.2.82-87.

9. Mawarni, L. D. & Simanungkalit, S. F. Hubungan energi, protein, zat besi, dan pendapatan orang tua dengan prestasi belajar. *Indones. J. Heal. Dev.* **2**, 163–174 (2020). https://doi.org/10.52021/ijhd.v2i3.62.

10. Mario. Faktor pendorong prestasi belajar peserta didik SD Makassar. *J. Bhs. dan Pendidik.* **3**, 150–170 (2023). https://doi.org/10.47861/tuturan.v2i2.1072.

11. Erna, A., Natsir, M. S., Jailani, A. K., Wicaksono, Y. R. & Yusuf, P. N. Strategi analisis faktor - faktor penurunan prestasi belajar matematika dengan pendekatan data mining. *J. Stud. Inov.* **2**, 17–23 (2022). http://dx.doi.org/10.52000/jsi.v2i4.122.

12. Hafiz, M. Al, Zulbahri, Rosmawati & Wulandari, I. Hubungan kebugaran jasmani dengan hasil belajar PJOK siswa kelas XI usia 16-17 tahun SMA Pembangunan Laboratorium UNP Kota Padang. *J. Pendidik. dan Olahraga* **7**, 83–91 (2024). https://doi.org/10.24036/JPDO.7.2.2024.37.

13. Febriani, K. & Margawati, A. Hubungan asupan energi jajanan dengan prestasi belajar remaja di SMP PL Domenico Savio Semarang. *J. Nutr. Coll.* **2**, 491–497 (2013). https://doi.org/10.14710/jnc.v2i4.3731.

14. Wijayasari, E. Y. T. Hubungan asupan zat gizi makro dengan prestasi belajar anak usia 16 - 18 tahun. (Universitas Muhammadiyah Yogyakarta, 2019). Available at: http://repository.umy.ac.id/handle/123456789/27519.

15. Sari, M., Sitoayu, L., Gifari, N., Nadiyah, N. & Nuzrina, R. Analisis asupan energi, zat gizi makro, vitamin c, zat besi, seng, dan IMT/U berdasarkan tingkat kognitif siswa kelas 5 di SD Negeri Duri Kepa 13 Pagi Jakarta Barat. *Media Gizi Mikro Indones.* **12**, 39–52 (2020). https://doi.org/10.22435/MGMI.V12I1.2810.

16. Maku, A., Mendri, N. K. & Devianto, A. Hubungan antara status gizi dengan prestasi belajar anak sekolah dasar di SDN Ngringin Depok Sleman Yogyakarta. *Caring J. Keperawatan* **7**, 1–8 (2018).

http://dx.doi.org/10.29238/caring.v7i1.297.

17. Levina, A. & Sumarmi, S. Asupan zat gizi makro dan status gizi mahasiswa asing di Surabaya, Indonesia. *Media Gizi Indones.* **14**, 132–139 (2019). https://doi.org/10.20473/mgi.v14i2.132-139.

18. Nugraha, M. H. & Wibowo, S. Hubungan antara status gizi dengan kebugaran jasmani. *Pendidik. Jasm. Kesehat. Dan Rekreasi* **09**, 19–27 (2021). Available at: https://ejournal.unesa.ac.id/index.php/jurnal-pendidikan-jasmani/article/view/39782.

19. Kemenkes. Laporan Riskesdas 2018 Nasional.pdf. *Lembaga Penerbit Balitbangkes* hal 156 at (2018). Available at: https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/.

20. Sahid, M. H., Adisasmita, A. C. & Djuwita, R. Hubungan status gizi dengan prestasi belajar siswa kelas 1-3 sekolah dasar. *J. Epidemiol. Kesehat. Indones.* **5**, 75–82 (2021). https://doi.org/10.7454/epidkes.v5i2.2411.

21. Rizqi, H. & Ichwanudin. Hubungan asupan karbohidrat dan status gizi dengan tingkat kebugaran jasmani pada atlet basket remaja siswa sekolah menengah pertama. *Media Gizi Indones.* **11**, 182–188 (2016). http://dx.doi.org/10.20473/mgi.v11i2.182-188.

22. Sari, K. Q. M. & Nurhayati, F. Hubungan antara status gizi, kecukupan asupan energi, dan aktivitas fisik dengan kebugaran jasmani pada siswa kelas XI di SMAN 1 Batu. *J. Pendidik. Olahraga dan Kesehat.* **6**, 383–389 (2018). https://doi.org/10.14710/jnc.v10i3.30829.

23. Monzera, M. A., Ulfah, M. & Surahmi, F. Hubungan perilaku gaya hidup sehat terhadap kebugaran jasmani usia dewasa di fasilitas olahraga summit gym Kota Semarang. *J. Updat. Keperawatan* **2**, 12–24 (2022). http://dx.doi.org/10.31983/juk.v2i2.8810.

24. Gunarsa, S. D. & Wibowo, S. Hubungan kualitas tidur dengan kebugaran jasmani siswa. *J. Pendidik. Jasm.* **09**, 43–52 (2021). Available at: https://www.simantek.sciencemakarioz.org/index.php/JIK/article/view/495.

25. Aprilia, N. & Januarto, O. B. Hubungan kebugaran jasmani dengan prestasi belajar siswa SMP: literature review. *Sport Sci. Heal.* **4**, 495–507 (2022). https://doi.org/10.17977/um062v4i62022p495-507.

26. Albi, M. W. & Rustiadi, T. Perilaku hidup sehat terhadap tingkat kesegaran jasmani siswa kelas XI IPA 2 SMA Negeri 9 Semarang T/A 2019/2020. *Indones. J. Phys. Educ. Sport* **2**, 447–453 (2021). https://doi.org/10.31983/juk.v2i2.8810.

27. Gibson, R. . *Principles of Nutritional Assessment*. (Oxford University Press, 2005).

28. Muzakki, A. & Andrijanto, D. Survei tingkat kebugaran jasmani siswa saat pelajaran pendidikan jasmani olahraga dan kesehatan (PJOK) di SMP Daruttaqwa Gresik. *J. Pendidik. Olahraga dan Kesehat.* **09**, 39–43 (2021).

Available at: https://ejournal.unesa.ac.id/index.php/jurnal-pendidikan-jasmani/article/view/42704/36690.

29. Mulia, D. A., Amar, M. I., Sufyan, D. L. & Simanungkalit, S. F. Hubungan asupan energi dan protein, kualitas tidur, dan aktivitas fisik terhadap prestasi belajar di SMK Tunas Grafika Informatika 2020. *Ghidza J. Gizi dan Kesehat.* **5**, 197–210 (2021). http://dx.doi.org/10.22487/ghidza.v5i2.216.

30. Almatsier, S. *Prinsip dasar ilmu gizi*. (PT Gramedia Pustaka Utama, 2005).

31. Amalia, T. P., Fadhilah, T. M. & Sartika, A. N. Hubungan asupan gizi dan stunting dengan prestasi akademik pada anak usia sekolah dasar di SDSN Jati Rahayu V Kota Bekasi. *J. Gizi dan Pangan Soedirman* **3**, 90–98 (2019). https://doi.org/10.20884/1.jgps.2019.3.2.1652.

32. Fithria, Suhadi & Nelini. Hubungan kecukupan gizi sarapan dengan prestasi belajar siswa SMP Negeri 10 Kendari Kecamatan Kambu Kota Kendari tahun 2018. *Prev. J.* **3**, 1–8 (2018). http://dx.doi.org/10.37887/epj.v3i1.5437.

33. Wadhani, L. P. P. & Wijaya, S. M. Konsumsi protein, vitamin a, dan status gizi serta kaitannya dengan hasil belajar anak sekolah dasar. *J. Nutr. Coll.* **10**, 181–188 (2021). https://doi.org/10.14710/jnc.v10i3.30829.

34. Puspitasari, D. I., Hardiyanto, D. & Hamardika, N. A. Hubungan antara asupan zat besi dengan prestasi belajar siswa SMA Muhammadiyah 1 Surakarta. *Darussalam Nutr. J.* **5**, 121–128 (2021). https://doi.org/10.21111/dnj.v5i2.6564.

35. Pratama, D. A. & Winarno, M. E. Hubungan status gizi dan kebugaran jasmani terhadap hasil belajar penjas siswa SMA: literature review. *Sport Sci. Heal.* **4**, 238–249 (2022). http://dx.doi.org/10.17977/um062v4i32022p238-249.

36. Safitri, F. N. & Kustini, S. Pengaruh minat belajar, kondisi sosial ekonomi orang tua, dan lingkungan sekolah terhadap prestasi belajar ekonomi pada siswa kelas XI IPS SMA Negeri 4 Magelang tahun ajaran 2013/2014. *Econ. Educ. Anal. Journa* **3**, 249–256 (2014). Available at: https://journal.unnes.ac.id/sju/eeaj/article/view/3865.

37. Nugroho, T. A. & Sudarma, K. Pengaruh gaya belajar, motivasi belajar, dan kondisi sosial ekonomi orang tua pada hasil belajar. *Econ. Educ. Anal. J.* **6**, 188–201 (2017). http://dx.doi.org/10.31332/str.v26i2.2400.

38. Supit, D. & Gosal, N. M. Hubungan status sosial ekonomi orang tua dan prestasi belajar siswa. *J. Educ. FKIP UNMA* **9**, 177–182 (2023). http://dx.doi.org/10.31949/educatio.v9i1.4557.

39. Dewi, R. & Marwan. Pengaruh faktor fisiologis, lingkungan sekolah, dan motivasi terhadap hasil belajar ekonomi di SMAN 2 Painan. *EcoGen* **2**, 696–705 (2019). http://dx.doi.org/10.24036/jmpe.v2i4.7847.

40. Marlenywati, Hernawan, A. D. & Hardiyanti, A. D. Hubungan antara status gizi, kebiasaan sarapan

pagi, aktivitas fisik, dan gangguan kesehatan dengan prestasi belajar anak sekolah dasar. *Maj. Ilm. Al Ribaath* **12**, 16–23 (2015). http://dx.doi.org/10.29406/br.v12i2.82.

41. Amaliyah, M., Suardana, I. N. & Selamet, K. Analisis kesulitan belajar dan faktor-faktor penyebab kesulitan belajar IPA siswa SMP Negeri 4 Singaraja. *J. Pendidik. dan Pembelajaran Sains* **4**, 90–101 (2021). https://doi.org/10.23887/jppsi.v4i1.33868.

42. Achmat, F. & Wahyuni, S. E. Hubungan kebugaran jasmani terhadap prestasi akademik siswa (studi pada kelas XI MAN Mojosari). *J. Pendidik. Olahraga dan Kesehat.* **1**, 445–448 (2013).

43. Ristianti, A., Sukaesih, S. & Indriyanti, D. R. Hubungan bimbingan belajar swasta dengan hasil belajar biologi. *Unnes J. Biol. Educ.* **2**, 196–204 (2013). https://doi.org/10.31004/jrpp.v7i2.26713.

44. Tarkuni. Pengaruh bimbingan belajar terhadap prestasi belajar siswa kelas V di sekolah dasar. *Pedagog. J. Pendidik. dan Pembelajaran* **1**, 18–23 (2021). https://doi.org/10.56393/pedagogi.v1i1.78.

45. Subakti, H. & Handayani, E. S. Pengaruh bimbingan belajar terhadap hasil belajar bahasa indonesia siswa kelas tinggi di sekolah dasar. *J. Basicedu* **5**, 247–255 (2021). https://doi.org/10.31004/basicedu.v5i1.648.