

The Association Between Body Fat Percentage and Physical Activity and the Physical Fitness Level of Students at SMA IT Al-Madinah Cibinong

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Abstract: This study aims to examine the correlation between body fat percentage and physical activity with the physical fitness levels of students at SMA IT Al-Madinah Cibinong. The sampling technique used in this research was purposive sampling, with the inclusion criteria being male students from Grade 10 at SMA IT Al-Madinah Cibinong who were willing to participate in the physical fitness testing. Based on these criteria, 20 students were selected from a total population of 60 students. The correlation coefficient between body fat percentage and physical fitness was found to be $r = -0.822$. Meanwhile, the correlation between physical activity and physical fitness level was $r = 0.862$. Furthermore, the combined correlation of body fat percentage and physical activity with physical fitness level yielded a coefficient of $r = 0.948$. These findings can serve as valuable input for teachers and parents to promote physical activity and enhance students' physical fitness, aiming to maintain a healthy and normal body fat percentage.

Keywords: Physical Fitness, Body Fat Percentage, Physical Activity, Exercise

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INTRODUCTION

Physical fitness is a fundamental component of overall health, particularly during adolescence—a critical period marked by rapid physical, psychological, and social development. The World Health Organization (WHO) continues to advocate for the promotion of physical activity to combat sedentary lifestyles. A reduction in physical activity negatively impacts the functioning of body organs, which in turn reduces overall physical fitness (Hasan et al., 2020). Engaging in regular physical activity trains the body to perform daily tasks with greater efficiency and endurance, thereby reducing the risk of fatigue even during strenuous activities.

According to the 2022 Sport Development Index (SDI) report by the Ministry of Youth and Sports of the Republic of Indonesia, the physical fitness levels of Indonesian adolescents remain alarmingly low. The report revealed that 82.7% of elementary school students, 85.8% of junior high school students, and 83.9% of senior high school students were classified as having "Poor" or "Very Poor" levels of physical fitness. These statistics highlight a significant national concern regarding adolescent health and fitness.

In recent decades, technological advancements and lifestyle changes have contributed to a global decline in adolescent physical activity. The increased use of digital devices, long school hours, and limited access to open recreational spaces have collectively led to more sedentary behaviors among youth. This shift in daily habits not only reduces physical

activity but also contributes to unhealthy dietary patterns and excessive weight gain, both of which are key risk factors for decreased physical fitness levels in adolescents.

Physical fitness is a multidimensional concept that reflects the ability of an individual to perform physical tasks effectively and efficiently. It encompasses components such as cardiovascular endurance, muscular strength, flexibility, and body composition. Among these, body composition—particularly body fat percentage—plays a crucial role in determining how efficiently the body can function during physical exertion. An imbalance in body fat, whether in excess or deficiency, is often associated with impaired performance, increased fatigue, and susceptibility to health problems such as obesity-related illnesses or nutrient deficiencies.

Numerous studies have confirmed the importance of maintaining an active lifestyle during adolescence to support not only physical health but also cognitive performance, mental well-being, and social development. Schools serve as a vital setting for promoting physical activity and monitoring the health status of students. By identifying the relationship between body fat percentage, physical activity, and physical fitness, schools can implement more effective interventions and physical education programs. Therefore, research focused on these variables, particularly in a specific educational context such as SMA IT Al-Madinah Cibinong, is essential to generate evidence-based insights for improving adolescent health outcomes.

Obesity is closely linked to excessive body fat, which is visibly evident in individuals with increased body weight. While a certain amount of fat is essential for bodily function and energy storage, an excess of fat can pose serious health risks (Prayudho, 2021). Conversely, insufficient body fat may lead to compromised immune function, stunted growth, and developmental problems. Thus, maintaining a healthy range of body fat is critical for adolescents, particularly during a life stage that demands high energy for physical and cognitive activities.

Senior high school students, typically between the ages of 15 and 17, fall into the category of middle adolescence. At this stage, students often face heavy academic workloads, including formal classes, extracurricular activities, and additional lessons. Therefore, having a healthy and fit body is essential to support their daily routines and learning productivity siswa (Susanto, M., R., 2024). Both excessive and insufficient body fat can negatively affect adolescent health. Students with high levels of body fat are at increased risk for conditions such as cardiovascular disease, respiratory problems, and type 2 diabetes. On the other hand, students with very low fat levels may experience reduced immunity and developmental delays. Nutritional imbalance, especially among adolescents, remains a critical issue, as it not only affects their health but also impacts their daily performance and academic achievements.

This issue is also observed among students at SMA IT Al-Madinah Cibinong. Based on the researcher's preliminary observations, several students exhibited very low physical fitness levels. During physical education classes, some students showed signs of fatigue after mild exertion, while others remained energetic and capable of continuing with other activities even after intense physical tasks. These variations may be associated with differences in body composition—some students were overweight, underweight, tall, or short—each affecting how they responded to physical activity.

In response to these observations, this study aims to examine the relationship between body fat percentage and physical activity and their combined influence on the physical fitness levels of students at SMA IT Al-Madinah Cibinong.

METHODS

This study aims to explore the relationship between body fat percentage and physical fitness level, the relationship between physical activity and physical fitness level, as well as the combined relationship of body fat percentage and physical activity with physical fitness level among high school students. The research design employed in this study is a descriptive correlational method, which is used to analyze the association between multiple independent variables (predictors) and a dependent variable.

The research model is structured to evaluate two independent variables:

- X_1 = Body Fat Percentage
- X_2 = Physical Activity and their relationship with
- Y = Physical Fitness Level

This model allows for the analysis of both individual and combined contributions of the independent variables to the dependent variable. A conceptual framework illustrating the research model is presented below:

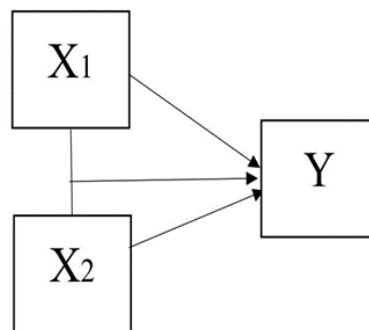


Figure 1. Research Design

The population of this study consisted of 60 male students enrolled in grade 10 at SMA IT Al-Madinah Cibinong. From this population, a sample of 20 students was selected based on specific inclusion criteria through the purposive sampling technique.

This non-random sampling approach was chosen to ensure that participants met the requirements necessary for valid data collection, which included being male, actively enrolled in the designated grade level, and willing to participate in all measurement procedures. This technique is particularly suitable for research requiring participants with specific characteristics that align with the objectives of the study.

To measure each variable in the study, the following instruments were used:

- Body Fat Percentage (X_1) was measured using the *Omron Body Fat Monitor*, a widely recognized bioelectrical impedance analysis device that provides non-invasive and relatively accurate measurements of body fat levels.
- Physical Activity (X_2) was assessed using the *International Physical Activity Questionnaire - Short Form (IPAQ-SF)*. This standardized questionnaire categorizes the frequency and duration of light, moderate, and vigorous physical activities over the past seven days and has been validated for use in adolescent populations.
- Physical Fitness Level (Y) was evaluated through the *Harvard Step Test*, a classical and widely used field test for assessing cardiovascular endurance. The test involves stepping up and down on a platform at a constant rate followed by a recovery heart rate count, which is then used to calculate a fitness index.

The data collected from the instruments were recorded, coded, and analyzed quantitatively. To determine the strength and direction of the relationships between variables, correlation coefficient tests (Pearson's r) were conducted. In addition, t-tests for significance were used to assess whether the observed correlations were statistically meaningful. These analyses were performed using appropriate statistical software to ensure precision and reliability of the results.

RESULT

Descriptive Statistics of Participant Characteristics

The general characteristics of the 20 study participants, including age, height, weight, body mass index (BMI), and body fat percentage, are presented in Table 1. The age range of the participants was 15 to 17 years, with a mean age of 16 ± 0.52 years, indicating that all subjects were within the middle adolescence stage. The average height was 176 ± 6.77 cm, while the weight ranged from 46 kg to 200.2 kg, with a mean of 73.05 ± 16.98 kg. The BMI values varied from 15.7 to 33.4 kg/m^2 , with a mean of 24.55 ± 5.84 kg/m^2 , suggesting a spread from underweight to obese categories among the students. The body fat percentage ranged between 14.5% and 32.6%, with a mean value of $23.17 \pm 6.47\%$, indicating considerable variability in body composition among the participants.

Table 1. Participant Characteristics (n = 20)

Variable	Minimum	Maximum	Mean \pm SD	Unit
Age	15.0	17.0	16 ± 0.52	Years
Height	162.0	190.0	176 ± 6.77	cm
Body Weight	46.0	200.2	73.05 ± 16.98	kg
Body Mass Index (BMI)	15.7	33.4	24.55 ± 5.84	kg/m^2
Body Fat Percentage	14.5	32.6	23.17 ± 6.47	%

Descriptive Statistics of Research Variables

Table 2. Descriptive Statistics of Main Research Variables

Variable	Min	Max	Mean \pm SD	Median	Mode	Unit
Body Fat Percentage (X_1)	14.5	32.6	23.17 ± 6.09	24.25	18.2	%
Physical Activity (X_2)	297.0	6034.0	1594 ± 1629	920.0	–	MET-min/week
Physical Fitness (Y)	12.79	67.76	34.10 ± 17.25	25.11	–	Fitness Index Score

Table 2 shows the descriptive statistics of the three main research variables: body fat percentage, physical activity, and physical fitness level. The body fat percentage (X_1) had a minimum of 14.5% and a maximum of 32.6%, with a mean of 23.17% and a standard deviation of 6.09. The median was 24.25%, and the most frequently occurring value (mode) was 18.2%.

Physical activity level (X_2), as measured in MET-minutes per week using the IPAQ-SF, ranged from 297 to 6034 METs. The average physical activity level was 1594 ± 1629 METs, with a median of 920 METs, indicating a right-skewed distribution where a few participants reported extremely high activity levels. No mode was identified for this variable.

Physical fitness (Y), assessed using the Harvard Step Test, yielded scores ranging from 12.79 to 67.76. The mean physical fitness index was 34.10 ± 17.25 , and the median value was 25.11, suggesting that half of the participants scored below this level. The data show a wide distribution of fitness performance among the students, with no clearly

dominant value.

These descriptive findings reflect a broad range of physical attributes, behaviors, and fitness levels, which will be further analyzed to identify correlations and determine the statistical significance of the relationships between body fat, physical activity, and physical fitness.

Table 3. Pearson Correlation Results

Variables	Correlation Coefficient (r)	Interpretation
Body Fat Percentage (X ₁) – Physical Fitness (Y)	-0.822	Strong negative correlation
Physical Activity (X ₂) – Physical Fitness (Y)	0.862	Strong positive correlation
Body Fat Percentage (X ₁) & Physical Activity (X ₂) – Physical Fitness (Y)	0.948	Very strong combined correlation

Table 3 shows the analysis revealed a strong negative correlation between body fat percentage and physical fitness level, with a Pearson correlation coefficient of $r = -0.822$. This indicates that higher body fat percentages are associated with lower levels of physical fitness. The result was statistically significant, suggesting that body fat percentage is an important factor influencing physical fitness in adolescents. The correlation between physical activity (measured in METs/week) and physical fitness level was found to be positive and strong, with a coefficient of $r = 0.862$. This suggests that students who engage in higher levels of physical activity tend to have better physical fitness scores. The relationship was statistically significant, supporting the role of physical activity in promoting cardiovascular and muscular endurance. A multiple correlation analysis was performed to examine the combined effect of body fat percentage and physical activity on physical fitness. The result yielded a very strong correlation coefficient of $r = 0.948$, indicating that the joint contribution of both predictors explains a substantial proportion of the variance in physical fitness levels. This underscores the importance of maintaining both a healthy body composition and regular physical activity for optimal adolescent fitness.

To further examine the combined effect of body fat percentage (X₁) and physical activity (X₂) on physical fitness (Y), a multiple linear regression analysis was conducted. The results are summarized in Table 4.

Table 4. Multiple Linear Regression Model Summary

Predictor	Unstandardized Coefficient (B)	Standard Error	t-value	p-value
Body Fat Percentage (X ₁)	-0.75	0.12	-6.25	< 0.001
Physical Activity (X ₂)	0.009	0.002	4.5	< 0.001

The results of the multiple linear regression analysis indicate that both body fat percentage (X₁) and physical activity (X₂) are statistically significant predictors of physical fitness (Y) among high school students.

The unstandardized coefficient for body fat percentage ($B = -0.75$) with a standard error of 0.12 and a t-value of -6.25 ($p < 0.001$) indicates a strong negative effect. Specifically, for each 1% increase in body fat percentage, the physical fitness index is predicted to decrease by 0.75 units, assuming physical activity remains constant. This

result is highly significant, suggesting that excess body fat negatively impacts cardiovascular endurance and overall fitness capacity.

The unstandardized coefficient for physical activity ($B = 0.009$) with a standard error of 0.002 and a t -value of 4.5 ($p < 0.001$) indicates a significant positive association. For every additional MET-minute per week of physical activity, the fitness index is predicted to increase by 0.009 units, controlling for body fat percentage. While the effect size per MET is small, it is meaningful when considering accumulated activity over time. Together, these findings emphasize that reducing body fat and increasing physical activity both play critical and complementary roles in improving adolescent physical fitness. The statistical significance of both predictors ($p < 0.001$) supports their inclusion in intervention programs aiming to enhance student health and performance.

DISCUSSION

The results of this study indicate a significant negative correlation between body fat percentage and physical fitness level among students of SMA IT Al-Madinah Cibinong, with a correlation coefficient of $r = -0.822$. This suggests that students with higher body fat percentages tend to have lower levels of physical fitness. This finding aligns with previous studies that also reported inverse relationships between body fat and physical fitness levels.

For instance, Pratiwi et al. (2022) found a negative correlation ($r = -0.330$) between body fat percentage and physical fitness in women aged 23–45 years. Similarly, Nastiti (2023) reported a correlation of $r = -0.635$ in a study involving female basketball athletes at Universitas Muhammadiyah Surakarta. Murbawani (2017) found a negative correlation of $r = -0.508$ between body fat and physical fitness among adolescent girls. These studies consistently show that increased body fat is associated with reduced fitness, likely due to the added mass impairing movement efficiency and increasing energy expenditure, which can lead to faster fatigue and elevated body temperature during activity (Putri, 2018).

This study also found a strong positive correlation between physical activity and physical fitness, with a correlation coefficient of $r = 0.862$. This implies that students who are more physically active tend to demonstrate better physical fitness levels. This result is consistent with previous studies, though the strength of the correlation in this study is higher than in earlier findings.

For example, Ardhianto et al. (2023) reported a positive correlation ($r = 0.244$) between physical activity and physical fitness among junior high school students. Alghozi (2021) found a correlation of $r = 0.352$ in upper-grade elementary students, while Sarosa et al. (2022) reported a correlation of $r = 0.200$ among members of a university karate club during the COVID-19 pandemic. Despite the differences in sample characteristics and contexts, these studies support the conclusion that physical activity is positively associated with better fitness levels. The relatively higher correlation in the current study may reflect the influence of consistent activity patterns among more physically active students, even though not all have structured exercise programs.

The combined correlation between body fat percentage and physical activity with physical fitness was found to be $r = 0.948$, indicating a very strong relationship. The results of the multiple regression analysis showed an F -value of 76.496, which is significantly greater than the critical value of F -table = 3.74, indicating that the regression model is statistically significant. These findings suggest that both variables together substantially influence physical fitness outcomes in students.

Despite 50% of the students reporting high levels of physical activity, it was observed that 75% of the students had poor physical fitness. This discrepancy may be attributed to the lack of consistent and structured exercise programs among the students. High activity levels without targeted training may not be sufficient to improve fitness, especially if not supported by adequate nutrition and body composition control.

The findings of this study reinforce the interdependent relationship between lifestyle behaviors and physiological outcomes in adolescent populations. Notably, the strong negative correlation between body fat percentage and physical fitness level suggests that excessive fat accumulation significantly impairs students' capacity to perform aerobic and muscular endurance tasks. This may be attributed to the increased metabolic cost of movement and the thermoregulatory strain placed on the body during exertion. As stated by Putri (2018), individuals with excess body fat experience a more rapid rise in body temperature and are prone to earlier onset of fatigue, which compromises overall physical performance.

The strong positive relationship between physical activity and physical fitness aligns with global public health recommendations by the World Health Organization (WHO, 2020), which advocate for at least 60 minutes of moderate-to-vigorous physical activity per day for adolescents. Active individuals benefit from improved cardiovascular efficiency, better oxygen utilization, and enhanced muscular strength, all of which contribute to higher fitness test outcomes. However, the present study also highlights that high physical activity alone does not always guarantee high physical fitness, as evidenced by the 75% of students with poor fitness despite 50% reporting high activity levels. This discrepancy points to the importance of quality, intensity, and structure of physical activity, rather than just volume.

Moreover, the combined predictive value of body fat percentage and physical activity, as shown by a multiple correlation of $r = 0.948$, indicates that these two variables synergistically influence fitness outcomes. This emphasizes the need for integrated school health programs that address both nutritional status and physical activity behaviors. In particular, consistent implementation of structured physical education curricula, nutritional counseling, and body composition monitoring could serve as early interventions to mitigate risks of chronic inactivity and obesity in adolescent populations.

From a policy perspective, the results support the incorporation of health education modules in the school system and the design of extracurricular programs aimed at promoting sustained physical engagement. Furthermore, schools should consider routine fitness assessments and personalized feedback to students as a strategy to raise awareness and motivate lifestyle improvements.

CONCLUSION

Based on the results of this study, it can be concluded that: there is a significant negative correlation between body fat percentage and physical fitness among students at SMA IT Al-Madinah Cibinong ($r = -0.822$). Higher body fat percentages are associated with lower physical fitness levels. There is a significant positive correlation between physical activity and physical fitness ($r = 0.862$). Students with higher levels of physical activity tend to have better physical fitness. The combination of body fat percentage and physical activity shows a very strong correlation with physical fitness ($r = 0.948$). These two factors together significantly influence the physical fitness outcomes of students. These findings highlight the importance of promoting both healthy body composition and regular physical activity to enhance the physical fitness of adolescents.

Based on the findings and conclusions of this study, the following recommendations are

proposed: schools should implement structured physical education programs that encourage regular and varied physical activity tailored to student needs. Health education should include components related to nutrition and the importance of maintaining a healthy body composition. Parents and teachers should collaboratively monitor students' activity levels and provide support for healthy lifestyle habits. Further research should be conducted with larger and more diverse samples to validate and extend the findings of this study.

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