



## Relationship Between Sleep Quality and Nutritional Status with Physical Fitness of Islamic Boarding School Students

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### Abstract

Physical fitness among Islamic boarding school (pesantren) students is influenced by multiple factors, notably sleep quality and nutritional status, both of which are in a suboptimal state due to the highly structured and demanding dormitory schedule. This study aimed to analyze the relationship between sleep quality and nutritional status with physical fitness among 10th grade students of MA Salafiyah Syafi'iyah Proto, Pekalongan Regency. A quantitative correlational cross-sectional design was employed. The sample consisted of 64 students (15 males and 49 females, aged 14–16 years) selected through purposive sampling. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), nutritional status via Body Mass Index (BMI), and physical fitness using the Multistage Fitness Test (MFT). Data were analyzed using Pearson Product-Moment correlation and multiple linear regression. Results indicated: (1) a significant negative relationship between sleep quality and physical fitness ( $r = -0.302$ ;  $p = 0.015$ ); (2) a significant positive relationship between nutritional status and physical fitness ( $r = +0.370$ ;  $p = 0.003$ ); and (3) both variables simultaneously had a significant relationship with physical fitness ( $F = 8.752$ ;  $p = 0.000$ ;  $R^2 = 0.223$ ). These findings recommend the need for sleep schedule reform and improved nutrition programs within the pesantren environment as integrated interventions to enhance students' physical fitness.

**Keywords:** islamic boarding school, MFT, nutritional status, physical fitness, PSQI, sleep quality



## Introduction

Physical fitness is the ability of the body to perform daily activities effectively and efficiently without excessive fatigue, while still retaining residual energy for leisure activities (Riyanto, 2020). Physical fitness is recognized as a fundamental factor in the growth, development, and productivity of individuals, particularly during adolescence. In an educational context, adequate physical fitness directly contributes to cognitive ability, learning concentration, and students' mental health (Chaeroni et al., 2021).

National data reveal an alarming condition: based on the Sport Development Index (SDI), 43.90% of the Indonesian population falls in the poor fitness category and 37.40% in the very poor category (Nadyya, 2021). Ironically, adolescence should represent the peak period of physical capacity, and failure to optimize it will have long-term consequences on quality of life and adult productivity.

At the local level, (Widya et al., 2022) reported that more than 50% of athletes in Pekalongan Regency demonstrated poor physical fitness based on MFT results, suggesting that suboptimal fitness levels are not limited to school populations but reflect a broader regional concern in the Pekalongan area. This finding provides a critical contextual baseline for the present study, indicating that the low MFT scores observed among pesantren students are consistent with a wider pattern of physical fitness deficiency among adolescents across the Pekalongan region.

Sleep quality is one of the most frequently overlooked determinants of physical fitness. Sleep is not merely a passive resting state; it is an active physiological process essential for muscle recovery, memory consolidation, hormonal regulation, and energy restoration (Wulansih et al., 2024). Scientific recommendations stipulate that adolescents require seven to nine hours of sleep per night (Ratnaningtyas & Fitriani, 2019). Chronic sleep deprivation disrupts growth hormone secretion, impairs glucose tolerance, inhibits muscle cell recovery, and increases the risk of cardiovascular disorders (Ferreira & Redondo-Tébar, 2025).

Beyond sleep quality, nutritional status plays a fundamental role in supporting adolescent physical fitness. Adequate nutritional status ensures a supply of energy and essential nutrients to maintain optimal physiological function, support muscle protein synthesis, and facilitate energy metabolism during physical activity (Mastuti, 2023). Conversely, poor nutritional status may lead to muscle weakness, reduced endurance, and growth disorders that negatively impact physical performance.

Salafiyah Syafi'iyah Proto Islamic Boarding School, Pekalongan Regency, implements a highly packed daily schedule that limits students' sleep to only approximately 4–5 hours per night (23:00–04:00 WIB), well below recommended standards. Preliminary observations indicated that many 10th grade MA students appeared lethargic, drowsy in class, and complained of fatigue during Physical Education (PE) lessons. This situation creates a critical research context in which two fundamental determinants of fitness sleep quality and nutritional status are simultaneously in a suboptimal state.

Research on the relationship between sleep quality and nutritional status with physical fitness in the pesantren student population remains very limited. (Rohmah & Santik, 2020) Confirmed the high prevalence of poor sleep quality in pesantren settings, yet did not examine its impact on physical fitness. Pratiwi et al. (2021) only investigated nutritional status and anemia in female pesantren students without including sleep quality, while Yunanda et al. (2025) examined all three variables but in elementary school students. No study simultaneously integrating sleep quality, nutritional status, and physical fitness in MA-level santri residing in a boarding pesantren has been found in the existing literature. This scientific gap constitutes the primary justification for the present study.

## Methods

### Research Design

This study employed a quantitative approach with a correlational cross-sectional design. The correlational design was selected to measure and analyze the relationship between the independent variables (sleep quality and nutritional status) and the dependent variable (physical fitness) without any experimental intervention (Creswell & Creswell, 2017).

### Participants

The population comprised all 10th grade students of MA Salafiyah Syafi'iyah Proto in the 2024/2025 academic year who resided in the boarding school (N = 176 students). Purposive sampling was applied based on inclusion criteria: (1) actively residing in the dormitory; (2) present and able to complete all data collection procedures; and (3) not experiencing any injury or medical condition that could affect test results. Exclusion criteria included: (1) students who were absent or refused to participate; (2) students with a history of physical disability preventing test completion; and (3) students with acute illness at the time of data collection. A total of 64 students met the inclusion criteria, consisting of 15 males (23.4%) and 49

females (76.6%), aged 14–16 years, with the majority aged 15 years (84.4%).

#### Instrument

Three instruments were utilized. First, sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), a globally validated instrument comprising 9 items across 7 component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Total PSQI scores range from 0–21; a score of  $\leq 5$  indicates good sleep quality and  $> 5$  indicates poor sleep quality (Antaroza et al., 2025). The instrument has a validity of 0.424–0.776 and Cronbach's alpha reliability of 0.602.

Second, nutritional status was assessed through Body Mass Index (BMI), calculated from body weight (kg) and height ( $m^2$ ) measured using a digital scale and stadiometer, respectively. WHO classification: underweight ( $< 18.5 \text{ kg}/m^2$ ), normal ( $18.5\text{--}25.0 \text{ kg}/m^2$ ), and overweight ( $> 25.0 \text{ kg}/m^2$ ). Third, physical fitness was assessed using the Multistage Fitness Test (MFT/Bleep Test), a 20-meter shuttle run test measuring aerobic capacity ( $VO_2\text{Max}$ ), with validity of 0.77 and reliability of 0.98 (Herry et al., 2025).

#### Procedure

This study received ethical exemption approval from the Ethics Committee of Universitas Muhammadiyah Pekajangan Pekalongan (No.065/KEP-UMPP/II/2026). Permission was also obtained from the leadership of MA Salafiyah Syafi'iyah Proto and the Pondok Pesantren administration. All participants provided informed assent, and parental/guardian consent was obtained prior to data collection. Data collection was conducted in three stages. Stage 1: students independently completed the PSQI questionnaire in a calm and conducive atmosphere under researcher supervision. Stage 2: anthropometric measurements including height (stadiometer, accuracy 0.1 cm) and body weight (digital scale, accuracy 0.1 kg) were taken individually. Stage 3: the MFT was administered on a flat outdoor field following an adequate warm-up. Each student's achieved level and shuttle were accurately recorded.

#### Data Analysis

Data were analyzed using SPSS v.25. Classical assumption tests were performed as prerequisites for multiple linear regression, including: normality test (One-Sample Kolmogorov-Smirnov), linearity

**Table 1**

*Descriptive Statistics and Category Distribution of Study Variables (N = 64)*

Variable	Min	Max	M	SD
PSQI Score	3.00	14.00	8.27	2.50
BMI ( $\text{kg}/m^2$ )	13.89	25.32	19.55	2.58
MFT ( $\text{ml}/\text{kg}/\text{min}$ )	20.00	38.50	25.20	3.87

#### Category Distribution

Variable	Category	n	%
Sleep Quality	Good ( $\leq 5$ )	10	15.6
	Poor ( $> 5$ )	54	84.4
Nutritional Status	Underweight	25	39.1
	Normal	38	59.4
	Overweight	1	1.6
Physical Fitness	Very Poor	39	60.9
	Poor	21	32.8
	Fair	4	6.3
	Good	0	0.0

Note. PSQI = Pittsburgh Sleep Quality Index; BMI = Body Mass Index; MFT = Multistage Fitness Test.

test (ANOVA Table), multicollinearity test (Tolerance and VIF), and heteroscedasticity test (Scatterplot). Hypothesis testing employed Pearson Product-Moment correlation for partial analysis (measuring the direction and strength of the relationship between each independent variable and the dependent variable individually) and multiple linear regression for simultaneous analysis ( $\alpha = 0.05$ ).

## Results

Table 1 presents the descriptive statistics and category distribution of the study variables. The mean Pittsburgh Sleep Quality Index (PSQI) score was 8.27 (SD = 2.50), indicating that, on average, students experienced poor sleep quality. The mean Body Mass Index (BMI) was 19.55 kg/m<sup>2</sup> (SD = 2.58), which was within the normal range. The mean Multistage Fitness Test (MFT) score was 25.20 ml/kg/min (SD = 3.87), indicating a relatively low level of physical fitness.

The category distribution further showed that 84.4% of students had poor sleep quality, while only 15.6% reported good sleep quality. Regarding nutritional status, 39.1% of students were

classified as underweight, 59.4% had normal BMI, and only 1.6% were categorized as overweight. In terms of physical fitness, most students were classified as having very poor (60.9%) or poor (32.8%) fitness levels, whereas only 6.3% reached the fair category. No students were categorized as having good physical fitness.

Prior to conducting multiple linear regression analysis, the classical assumptions were evaluated. As shown in Table 2, all assumptions were satisfied. The Kolmogorov–Smirnov test indicated that the residuals were normally distributed ( $p = .200$ ). Linearity tests demonstrated significant linear relationships between PSQI and MFT ( $p = .020$ ) as well as between BMI and MFT ( $p = .003$ ). In addition, no multicollinearity was detected (VIF = 1.00), and the scatterplot inspection indicated no evidence of heteroscedasticity. Therefore, the data met the requirements for multiple linear regression analysis.

Table 3 presents the Pearson correlation results between sleep quality, nutritional status, and physical fitness. Sleep quality was significantly negatively correlated with physical fitness ( $r = -.302, p = .015$ ), indicating that students

**Table 2**

*Summary of Assumption Tests for Multiple Linear Regression*

Assumption Test	Result	Interpretation
Normality (Kolmogorov–Smirnov)	$p = .200$	Normal distribution
Linearity (PSQI–MFT)	$p = .020$	Linear relationship
Linearity (BMI–MFT)	$p = .003$	Linear relationship
Multicollinearity	VIF = 1.00	No multicollinearity
Heteroscedasticity	Random scatterplot pattern	No heteroscedasticity

Note. All assumptions required for multiple linear regression were met.

**Table 3**

*Pearson Correlations Between Sleep Quality, Nutritional Status, and Physical Fitness*

Variables	r	p
PSQI and MFT	-.302	.015
BMI and MFT	.370	.003

Note. Negative values indicate inverse relationships, whereas positive values indicate direct relationships.

**Table 4***Multiple Linear Regression Predicting Physical Fitness (MFT)***Model Summary**

<b>R</b>	<b>R<sup>2</sup></b>	<b>Adjusted R<sup>2</sup></b>	<b>F</b>	<b>p</b>
<b>.472</b>	.223	.197	8.752	< .001

**Regression Coefficients**

<b>Predictor</b>	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
<b>Constant</b>	18.316	3.661	—	5.004	< .001
<b>PSQI</b>	-0.454	0.175	-.293	-2.599	.012
<b>BMI</b>	0.544	0.169	.363	3.220	.002

Note. Dependent variable = MFT score.

with poorer sleep quality tended to have lower MFT scores. Conversely, nutritional status was significantly positively correlated with physical fitness ( $r = .370, p = .003$ ), suggesting that students with higher BMI values within the normal range tended to demonstrate better physical fitness.

The simultaneous contribution of sleep quality and nutritional status to physical fitness was examined using multiple linear regression. As presented in [Table 4](#), the regression model was statistically significant,  $F(2, 61) = 8.752, p < .001$ , with an  $R^2$  value of .223. This finding indicates that sleep quality and nutritional status jointly explained 22.3% of the variance in physical fitness.

The regression coefficients further revealed that sleep quality significantly predicted physical fitness ( $\beta = -.293, p = .012$ ). Specifically, every one-point increase in PSQI score was associated with a decrease of 0.454 ml/kg/min in MFT performance. Nutritional status also emerged as a significant predictor ( $\beta = .363, p = .002$ ), indicating that every one-unit increase in BMI was associated with an increase of 0.544 ml/kg/min in MFT performance.

Overall, the findings suggest that poorer sleep quality and lower nutritional status were associated with reduced physical fitness among students.

## Discussion

### *Relationship Between Sleep Quality and Physical Fitness*

The present study found a significant negative relationship between sleep quality and physical fitness ( $r = -.302, p = .015$ ). This finding indicates that students with poorer sleep quality tended to demonstrate lower physical fitness levels. This result is particularly relevant considering that

84.4% of respondents in the present study were classified as having poor sleep quality.

Sleep plays an essential role in physical recovery and physiological adaptation. During deep sleep, growth hormone secretion increases and contributes to muscle repair, tissue regeneration, and energy restoration. Conversely, chronic sleep restriction may elevate cortisol levels, impair glucose metabolism, and reduce aerobic capacity, ultimately affecting cardiorespiratory fitness ([Ferreira & Redondo-Tébar, 2025](#)).

The findings are consistent with previous studies reporting significant associations between sleep quality and physical fitness among adolescents and young adults. [Ariwibowo et al. \(2023\)](#) found that better sleep quality was associated with higher physical fitness among volleyball extracurricular students, while [Putra and Ansyari \(2023\)](#) reported similar findings among medical students. Furthermore, a systematic review by [Paula and Maia \(2023\)](#) involving 5,797 participants from 11 countries concluded that longer sleep duration and better sleep quality were consistently associated with higher cardiorespiratory and muscular fitness among children and adolescents.

The high prevalence of poor sleep quality observed in this study is also comparable to findings among Indonesian adolescents. [Moeis et al. \(2023\)](#) reported that more than 70% of adolescents experienced poor sleep quality, primarily due to academic demands and restricted sleeping schedules. Within the pesantren environment, structured daily routines and limited sleep duration may further contribute to sleep disturbances, which may subsequently reduce physical fitness performance.

### *Relationship Between Nutritional Status and Physical Fitness*

The results also demonstrated a significant positive relationship between nutritional status and physical fitness ( $r = .370$ ,  $p = .003$ ). Students with BMI values closer to the normal range tended to achieve higher MFT scores.

Adequate nutritional status is fundamental for maintaining physical fitness because it supports energy availability, muscle protein synthesis, and aerobic metabolism. In the present study, 39.1% of students were classified as underweight, suggesting the presence of chronic energy deficits that may negatively affect physical performance. Insufficient energy intake can reduce muscle glycogen stores, accelerate fatigue, and limit cardiorespiratory endurance.

The present findings are in agreement with previous studies showing that adolescents with normal nutritional status generally demonstrate superior physical fitness compared to their underweight peers. Yunanda et al. (2025) reported a significant association between nutritional status and physical fitness among elementary school students, while Oukheda et al. (2023) found that normal-weight adolescents consistently achieved better fitness outcomes. Similar findings have also been reported among pesantren students, where adequate nutritional intake was associated with improved cardiorespiratory endurance (Pratiwi et al., 2021).

International evidence further supports these findings. Ferozi et al. (2024) demonstrated that adolescents with normal BMI performed significantly better on cardiorespiratory endurance and muscular fitness tests than underweight or overweight adolescents. Likewise, Wang (2022), in a large-scale study involving more than 32,000 high school students, reported that both underweight and obese adolescents showed lower physical fitness scores compared to students with normal BMI. Collectively, these findings highlight the importance of maintaining adequate nutritional status to support optimal physical fitness during adolescence.

#### *Simultaneous Relationship Between Sleep Quality, Nutritional Status, and Physical Fitness*

The multiple regression analysis revealed that sleep quality and nutritional status jointly predicted physical fitness,  $F(2, 61) = 8.752$ ,  $p < .001$ . The model explained 22.3% of the variance in physical fitness ( $R^2 = .223$ ), indicating a moderate contribution of these variables to students' fitness levels.

The regression coefficients further showed that both predictors contributed significantly to physical fitness. Sleep quality was negatively associated with MFT performance ( $\beta = -.293$ ,  $p = .012$ ), whereas nutritional status was positively associated with MFT performance ( $\beta = .363$ ,  $p = .002$ ). These findings suggest that improvements in

sleep quality and nutritional status may contribute to better physical fitness outcomes among students.

The observed relationship may be explained by the synergistic interaction between sleep and nutrition. Adequate sleep supports physiological recovery and metabolic regulation, whereas proper nutrition provides the energy and nutrients necessary for physical activity and adaptation. When both factors are compromised, as observed in the present study where poor sleep quality and underweight status were prevalent, physical fitness may be substantially affected.

Nevertheless, sleep quality and nutritional status accounted for only 22.3% of the variance in physical fitness, indicating that other factors also contribute to fitness outcomes. These factors may include habitual physical activity, exercise participation, genetic characteristics, psychological well-being, health status, and lifestyle behaviors (Lengkana & Muhtar, 2021; Surury et al., 2018). Future studies should incorporate these variables to develop a more comprehensive model of physical fitness among pesantren students.

From a practical perspective, the findings suggest that interventions aimed at improving physical fitness in pesantren settings should address both sleep management and nutritional adequacy simultaneously. Optimizing sleep schedules and improving dietary quality may provide meaningful benefits for students' overall physical fitness and health.

## Conclusions

Based on the findings, it is concluded that: (1) there is a significant negative relationship between sleep quality and physical fitness ( $r = -0.302$ ; Pearson  $p = 0.015$ ; regression  $p = 0.012$ ), meaning the worse the sleep quality, the lower the students' physical fitness; (2) there is a significant positive relationship between nutritional status and physical fitness ( $r = +0.370$ ; Pearson  $p = 0.003$ ; regression  $p = 0.002$ ), meaning the better the nutritional status, the higher the physical fitness; and (3) sleep quality and nutritional status simultaneously have a significant relationship with physical fitness among 10th grade students of MA Salafiyah Syafi'iyah Proto ( $F = 8.752$ ;  $p = 0.000$ ;  $R^2 = 0.223$ ).

Based on these findings, it is recommended that: (a) pesantren management review students' activity schedules to ensure a minimum of  $\geq 7$  hours of sleep per night; (b) the pesantren nutrition program be improved by ensuring availability of nutritious breakfast and varied meals; (c) PE teachers design adaptive learning programs that consider students' physical condition; and (d)

future researchers include variables of daily physical activity, actual dietary intake, and psychological factors to build a more comprehensive physical fitness prediction model.

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