



THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY, SLEEP QUALITY, AND PHYSICAL FITNESS AMONG SSB PERSISAC ATHLETES

Wiwit Bintang Permatasari¹, Maftukin Hudah¹, Bertika Kusuma Prastiwi¹

¹Universitas PGRI Semarang, Physical Education Health and Recreation, Semarang, Indonesia

*Coresponding Author. Email: wiwitbp29@gmail.com

*Email Author: wiwitbp29@gmail.com, maftukinhudah10@upgris.ac.id,
bertikakusumaprastiwi@upgris.ac.id

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Abstract

Physical fitness is a key component of athletic performance, particularly among soccer players who require endurance, recovery, and optimal physical condition. Previous research has reported inconsistent findings regarding the relationship between physical activity, sleep quality, and physical fitness. Some studies have found significant associations, while others have reported non-significant results. Furthermore, evidence focusing on adolescent soccer players in local soccer schools remains limited, particularly in the Indonesian context. Therefore, this study aimed to examine the relationship between physical activity, sleep quality, and physical fitness, as well as changes in these variables over a two-week observation period among athletes at SSB Persisac Semarang. This study employed a quantitative correlational design with pre-test and post-test measurements involving 25 athletes selected through purposive sampling. Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ), sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), and physical fitness was evaluated using the Nusantara Student Fitness Test (TKPN). Data were analyzed using descriptive statistics, the Shapiro–Wilk normality test, Spearman’s rank correlation, and the Wilcoxon signed-rank test. Spearman’s correlation was used to determine the relationship between variables, while the Wilcoxon test was used to compare pre-test and post-test measurements. The results showed that physical activity had a weak positive correlation with physical fitness ($r = 0.176$; $p = 0.399$), while sleep quality had a weak negative correlation with physical fitness ($r = -0.162$; $p = 0.439$), with both relationships being statistically insignificant. The Wilcoxon test revealed significant changes in sleep quality ($p = 0.006$) and physical fitness ($p = 0.001$), while physical activity did not undergo a significant change ($p = 0.145$). These findings suggest that physical activity and sleep quality were not significantly associated with physical fitness among athletes at SSB Persisac Semarang; however, significant changes in sleep quality and physical fitness were observed during the two-week observation period.

Keywords: Physical Activity; Sleep Quality; Physical Fitness; Soccer Athletes



INTRODUCTION

Physical fitness is an essential component in supporting athletes' performance, especially in soccer, which requires optimal endurance, strength, flexibility, and recovery ability. Physical fitness can be defined as the ability of an individual to perform daily physical activities and sport without experiencing excessive fatigue while still maintaining sufficient energy for other activities (Wulandari & Jariono, 2022). Good physical fitness is closely related to the body's physiological functions, including cardiorespiratory endurance, muscular strength, flexibility, balance, and coordination (Abadi & Sartika, 2021). For athletes, maintaining physical fitness is important because it influences performance, recovery processes, and injury prevention during training and competition (Charest & Grandner, 2020).

One of the factors influencing physical fitness is physical activity. Regular physical activity with moderate to vigorous intensity contributes to improved cardiovascular endurance, muscle strength, and overall physical performance (Antara et al., 2023). Adequate physical activity helps soccer athletes maintain optimal body composition, improve aerobic capacity, enhance muscular endurance, and support overall physical performance during training sessions and competitive matches. Regular and structured physical activity also contributes to physiological adaptation, cardiovascular efficiency, and recovery processes, which are essential for athletes who are exposed to high training intensity and competitive demands throughout the season (Silva et al., 2022).

In addition to physical activity, sleep quality also plays an important role in supporting athletes' physical condition and recovery. Sleep is a biological process that contributes to tissue repair, hormone regulation, energy restoration, and cognitive recovery (Yang et al., 2019). Athletes who experience poor sleep quality may have decreased physical performance, impaired concentration, slower recovery, and increased risk of injury (Fullagar et al., 2015). Previous studies reported that athletes with better sleep quality tend to demonstrate higher aerobic capacity and better sports performance compared to athletes with inadequate sleep quality (O & O, 2018).

Several studies have examined the relationship between physical activity, sleep quality, and physical fitness among adolescents and athletes. Dewi et al. 2024 found a significant relationship between physical activity and sleep quality among adolescents, indicating that individuals with higher levels of physical activity tend to have better sleep quality (Dewi et al., 2024). Furthermore, Hong et al. reported that sleep quality was positively associated with cardiorespiratory fitness and working memory among adolescents (Hong et al., 2025). Research conducted by Clemente et al. also explained that poor sleep quality among soccer players negatively affected recovery, training adaptation, and physical performance (Clemente et al., 2021). These findings indicate that both physical activity and sleep quality contribute to athletes' physical fitness and overall performance.



Despite these findings, evidence regarding the relationship between physical activity, sleep quality, and physical fitness remains inconsistent. While several studies have reported significant associations among these variables, other studies found weak or non-significant relationships depending on training load, age, and assessment methods (Brand et al., 2010; Carbonell-Escalas et al., 2025; Suppiah et al., 2016). These inconsistencies suggest that the contribution of physical activity and sleep quality to physical fitness may vary across different athletic populations, particularly among adolescent soccer athletes.

Furthermore, most previous studies assessed physical fitness using VO₂max test, bleep tests, or cardiorespiratory fitness indicators, which primarily focus on aerobic capacity. Such measurements may not fully represent the multidimensional nature of physical fitness, including strength, flexibility, balance, agility, and coordination. In addition, studies involving adolescent soccer athletes in Indonesia remain limited. Therefore, this study addresses both theoretical and methodological gaps by examining the relationship between physical activity, sleep quality, and physical fitness among adolescent soccer athletes using the Tes Kebugaran Pelajar Nusantara (TKPN), a nationally standardized and multidimensional physical fitness assessment instrument (Utomo et al., 2025).

This study was conducted at SSB Persisac Semarang because adolescent soccer athletes experience intensive training loads and competitive demands that may affect their physical condition and sleep patterns. Understanding the relationship between physical activity, sleep quality, and physical fitness is expected to provide practical contributions for coaches, athletes, and sports institutions in designing effective training and recovery programs. In addition, the findings of this study are expected to contribute to the development of sports science research related to adolescent athlete health and performance.

The purpose of this study was to analyze the relationship between physical activity, sleep quality, and physical fitness among athletes of SSB Persisac Semarang. This study is also expected to provide scientific evidence regarding the importance of maintaining balanced physical activity and adequate sleep quality to optimize athletes' physical fitness and performance.

METHODOLOGY

This study employed a quantitative correlational design with pre-test and post-test measurements. The research was conducted at SSB Persisac Semarang over a two-week period. A total of 25 adolescent soccer athletes were selected through purposive sampling, consisting of 20 males and 5 females aged between 13 and 16 years. Participants were required to be active athletes, regularly attend training sessions, and voluntarily agree to participate in the study. All participants



provided informed consent prior to data collection, and the confidentiality of participant data was maintained throughout the study.

Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ), sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and physical fitness was evaluated using the Tes Kebugaran Pelajar Nusantara (TKPN). The GPAQ and PSQI instruments used in this study were adapted from previous research (Utomo et al., 2025). The TKPN is a multidimensional physical fitness assessment instrument that is widely used to evaluate the physical fitness of Indonesian students and adolescent athletes. Data collection took place during pre-test and post-test sessions over a two-week observation period. Participants completed the GPAQ and PSQI questionnaires under researcher supervision, while physical fitness was assessed using standardized TKPN procedures.

Data were analyzed using descriptive statistics, the Shapiro–Wilk normality test, Spearman’s rank correlation, and the Wilcoxon Signed-Rank Test. Descriptive statistics were used to summarize the mean, standard deviation, minimum, and maximum values of each variable. Because several variables were not normally distributed, the Wilcoxon Signed-Rank Test was used to compare pre-test and post-test measurements, whereas Spearman’s rank correlation was employed to determine the relationship between physical activity, sleep quality, and physical fitness. Statistical significance was set at $p < .05$.

RESULTS

Descriptive statistical analysis was used to describe the scores of physical activity, sleep quality, and physical fitness. The results showed that physical activity and physical fitness scores increased from pre-test to post-test after the two-week observation period. The sleep quality score decreased, which indicates better sleep quality because a lower PSQI score represents better.

Table 1. Descriptive Statistics

Statistic	Physical Activity	Physical Activity	Sleep Quality	Sleep Quality	Physical Fitness	Physical Fitness
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Mean	3288.16	3816.32	7.04	5.68	3.64	4.06
SD	2864.29	2816.95	1.64	1.14	0.68	0.70
Min	400	600	4	4	2.3	2.6
Max	10740	12480	10	8	4.8	5.0



Based on Table 1, the mean physical activity score increased from 3288.16 to 3816.32. The mean sleep quality score decreased from 7.04 to 5.68, indicating better sleep quality after the observation period. Physical fitness also increased from 3.64 to 4.06. The minimum and maximum scores showed that there were variations among athletes in all variables.

Table 2. Normality Result

Variables	Shapiro-Wilk Sig.	Interpretation
AF_PRE	0.000	Not Normal
AF_POST	0.000	Not Normal
KT_PRE	0.346	Normal
KT_POST	0.027	Not Normal
KJ_PRE	0.259	Normal
KJ_POST	0.142	Normal

Based on Table 2, the Shapiro–Wilk test was used to assess data normality because the sample size was fewer than 50 participants ($n = 25$). Therefore, the Wilcoxon Signed-Rank Test was used to compare pre-test and post-test scores, while Spearman's rank correlation was used to examine the relationship between physical activity, sleep quality, and physical fitness.

Table 3. Wilcoxon Result

Variables	Z	Sig. (2-tailed)	Interpretation
Physical Activity	-1.457	0.145	Not Significant Difference
Sleep Quality	-2.743	0.006	Significant Difference
Physical Fitness	-3.364	0.001	Significant Difference

The Wilcoxon Signed Rank Test showed that sleep quality and physical fitness had significant differences between pre-test and post-test measurements ($p < 0.05$). Meanwhile, physical activity did not show a significant difference because the significance value was greater than 0.05.

Table 4. Spearman Correlation Result

Variables	Correlation Coefficient (r)	Sig. (2-tailed)	Interpretation
Physical Activity - Physical Fitness	0.176	0.399	Weak Positive, Not Significant
Sleep Quality - Physical Fitness	-0.162	0.439	Weak Negative, Not Significant



Spearman correlation analysis showed that physical activity had a weak positive correlation with physical fitness ($r = 0.176$; $p = 0.399$). Sleep quality had a weak negative correlation with physical fitness ($r = -0.162$; $p = 0.439$). Both relationships were not statistically significant because the significance values were greater than 0.05.

DISCUSSION

The results indicated that physical activity was positively correlated with physical fitness; however, the relationship was weak and not statistically significant ($r = 0.176$; $p = 0.399$). This finding suggests that higher levels of physical activity did not necessarily correspond to better physical fitness among the athletes in this study. Physical fitness is influenced by various factors, including training intensity, training frequency, nutritional status, recovery strategies, and individual physiological characteristics. Similar findings were reported (Brand et al., 2010; Suppiah et al., 2016). Who found that physical activity and lifestyle-related factors were not always significantly associated with physical fitness among adolescent athletes. The non-significant relationship may also be influenced by the relatively small sample size and the short observation period of two weeks.

Sleep quality was negatively correlated with physical fitness, but the relationship was also weak and statistically non-significant ($r = -0.162$; $p = 0.439$). Although sleep plays an important role in recovery, hormonal regulation, and physical performance, sleep quality alone may not be sufficient to explain variations in physical fitness. This finding differs from Hong et al. (2025), who reported a positive association between sleep quality and cardiorespiratory fitness among adolescents. Differences in participant characteristics, fitness assessment methods, and training conditions may explain these inconsistent findings. Furthermore, the athletes involved in this study participated in regular training programs, which may have contributed more substantially to physical fitness than sleep quality alone.

Despite the absence of significant correlations, physical fitness improved significantly during the observation period ($p = 0.001$). This result suggests that factors other than physical activity and sleep quality may have contributed to the improvement in fitness levels. Regular soccer training, coaching programs, adaptation to training loads, and recovery practices may have played important roles in enhancing athletes' physical condition. Therefore, coaches should consider multiple aspects of athlete development, including training management, recovery strategies, nutrition, and healthy lifestyle behaviors, to optimize physical fitness among adolescent soccer athletes.

This study has several limitations that should be considered when interpreting the findings.



First, the sample size was relatively small and drawn from a single soccer school, which may limit the generalizability of the results to other athletic populations. Second, the observation period was limited to two weeks, which may not have been sufficient to capture substantial changes in physical activity, sleep quality, and physical fitness. Third, physical activity and sleep quality were assessed using self-reported questionnaires, which may be subject to recall bias and response bias. Therefore, future studies are recommended to involve larger samples, longer observation periods, and additional objective measurements to provide a more comprehensive understanding of the factors associated with physical fitness among adolescent athletes.

CONCLUSION

Based on the findings of this study, physical activity showed a weak positive correlation with physical fitness, while sleep quality showed a weak negative correlation with physical fitness among athletes of SSB Persisac Semarang. However, neither relationship was statistically significant. The results also indicated significant changes in sleep quality and physical fitness during the two-week observation period, whereas physical activity did not change significantly. These findings suggest that physical fitness among adolescent soccer athletes may be influenced by multiple factors beyond physical activity and sleep quality alone. This study contributes to the growing body of research on adolescent athletes in Indonesia by examining physical activity, sleep quality, and physical fitness using the Tes Kebugaran Pelajar Nusantara (TKPN) as a multidimensional fitness assessment instrument. Practically, the findings highlight the importance of considering various aspects of athlete development, including training programs, recovery management, and lifestyle factors. Future studies involving larger samples, longer observation periods, and additional physiological variables are recommended to provide a more comprehensive understanding of factors associated with physical fitness among adolescent athletes.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research.

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