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The relationship between physical activity intensity, sleep quality and stress levels in adolescent physical fitness

Muchammad Kasmadi[abc1], Suhadi[def2].

[1]Department of Post Graduate, Faculty of Sports and Health Sciences, Universitas Negeri Yogyakarta, Indonesia.
[2]Department of Sports Education, Faculty of Sports and Health Sciences, Universitas Negeri Yogyakarta, Indonesia.

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Abstract

Physical activity, sleep quality, and stress levels on physical fitness in adolescence can increase the positive value of adolescent students' development in doing all activities. At the same time, previous research has shown that physical activity, stress levels and sleep quality strongly influence each of these activities in the context of positive influences. Because adolescent activity is so high, the study examined this relationship in everyday life. The design and method used in this study were correlational, with 200 adolescent students involved in this study who selected purposive sampling. Data collection techniques are questionnaires, among which IPAQ is a questionnaire with a physical activity measurement scale. Sleep quality using PSQI (Pittsburgh Sleep Quality Index). Stress rating scale using DASS (Depression Anxiety Stress Scales). Physical fitness is measured using the Indonesian Physical Fitness Test for 16-19 years. Data analysis using Spearman's rho correlation test using SPSS application version 26. This study found that in physical activity with adolescent physical fitness, Sig. 0.714 > 0.05 was obtained, which shows a significant relationship between physical activity and physical fitness. Sleep quality with physical fitness in adolescents obtained Sig. Value 0.826 > 0.05, so there is a significant relationship between sleep quality and physical fitness in adolescents. At the level of stress related to physical fitness, they obtained Sig. Values of 0.000 < 0.05 mean that no significant relationship exists between adolescents' stress levels and physical fitness.

Keywords: Physical activity, sleep quality, stress level, physical fitness, adolescent.

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INTRODUCTION

Physical fitness significantly affects physical activity. Each activity has a stable level if the activity is carried out regularly so that it can affect physical fitness. Cardiorespiratory fitness in children and adolescents has a relationship with physical activity (World Health Organization, 2021).

Correspondence author: Muchammad Kasmadi, Universitas Negeri Yogyakarta, Indonesia.
Email: muchkasmadi.2021@student.uny.ac.id

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Physical fitness is a person's ability to carry out daily activities easily without feeling easily tired and can carry out activities using energy reserves (Destriana et al., 2022). Physical fitness owned by each individual varies, this depends on how the individual performs physical activity. Everyone's physical fitness can be developed through a sports activity that intends to increase endurance and physical fitness (Panggraita et al., 2020). Physical fitness gives a person the ability to carry out daily work productively without feeling excessive fatigue and has additional energy reserves to carry out sudden activities to enjoy leisure time. Physical fitness becomes one of the physical aspects of overall freshness. Physical education has an orientation towards a healthy lifestyle that has the potential to develop character in social interactions. Physical education is considered to be a place to channel skills in the field of sports (Lleixà et al., 2016). A healthy lifestyle in the educational environment has been given by physical education, and this aims to determine the effects obtained by each class regarding the level of fitness that has a close relationship with health on the application of physical education (Liu et al., 2017). Currently, physical fitness can be improved through sports activities carried out in the study of physical education (Ayu et al., 2023). This sport is a program to improve students' physical fitness. In addition to being cheap and easy, it is very interesting and fun, and the training load significantly improves endurance, strength, speed, and other components of physical fitness.

Physical fitness in a person will decrease if one is wrong in applying lifestyle and carrying out daily activities. Someone with good sleep quality is likely to have good physical fitness because sleep can restore body stamina and maintain mental condition to carry out daily activities. During sleep, the body recovers, an important part of activity. The recovery period here is an effort to increase the body's working power, so during sleep, the body improves fatigue experienced by muscles during activity. So, quality sleep is important because it has a positive impact not only on the muscles but also on the brain.

Sleep quality is the need for adequate sleep, which is determined by the number of hours of sleep (quantity of sleep) and the depth of sleep (quality of sleep). Sleep quality includes quantitative and qualitative aspects of sleep, such as the length of sleep, the time it takes to fall asleep, the frequency of awakenings, and subjective aspects, such as depth and sleep satisfaction. Sleep quality is said to be good if it does not show signs of sleep deprivation and does not experience problems in sleep, poor sleep quality is a risk factor for physical and psychological problems (Dany & Kusuma, 2022). Good sleep quality has benefits in the physical education process, which can improve students' performance in the learning process. Students with good sleep quality can do every activity they do at school (Safaringga & Herpandika, 2018). According to Jalali et al. (2020), If the body's energy alone has weakened, a person cannot carry out his activities in shape and maximum. Further statement of sleep conditions in adolescents by Gupta et al. (2017) affirm that in sleep conditions, the body recovers to restore body stamina to optimal condition.

Someone with good body fitness possesses optimal thinking and performance quality. Physical fitness can affect his physical and mental readiness to bear the burden he receives. Physical fitness is the ability of the body to adapt to the physical load given to it without feeling excessive fatigue and still enjoy its leisure time comfortably (Januarianto & Warthadi, 2023). The stress level among adolescents needs to be a concern; adolescents in an advanced stage of child development are very bad if they have poor stress levels (Hastuti & Baiti, 2019). Teenagers can reduce stress levels in every activity, especially in school activities, because in addition to learning activities, students can meet with friends, which can make students' moods happy. In physical fitness, if students have a stable level of stress, then the student can do all activities in the learning process (Tarigan et al., 2022).

Studies conducted by Shokibi and Nuryanto (2015) show that in physical fitness, 2 important factors can influence: internal and external factors. Internal factors are things that are contained in the human body

and are sedentary, such as genetic factors, age, and gender. External factors include physical activity, nutritional status and health, haemoglobin levels, adequate rest, and smoking habits (Siefken et al., 2021). Stress is found in genetic factors, which put the brain's work under pressure and significantly affect physical fitness. Various ways to maintain physical fitness include regulating your diet, getting adequate rest, and exercising regularly. Efforts to maintain physical fitness can also be made through physical activity.

The various explanations above explain that physical fitness is thought to have a close relationship with several factors, such as physical activity, sleep quality, and stress levels. Humans have different physical activity, sleep quality, and stress levels, so their physical fitness is different. The more physical activity performed, the quality of sleep maintained, and the level of stress maintained, the higher the level of physical fitness. This is in accordance with research conducted by (Sepdanius et al., 2023), which suggests an interrelated correlation between physical activity, stress, and sleep quality on physical fitness. However, there was no significant correlation between physical activity and sleep quality. Therefore, it is advisable to maintain the quality of physical activity to avoid stress so as to get good quality sleep and maintain physical fitness.

The selection of subjects among adolescents is very important because, at this level, it is a group that is a mass development at the stage of children. The choice of physical activity in adolescents is because currently, the quality of physical activity carried out in adolescents is feared to be very low because life behaviour is sedentary with the rapid development of the times. This is worrying because physical activity is very influential in physical fitness, and good physical activity can improve physical fitness (Waluyo, 2023). Good quality sleep must be provided by every teenager in order to maintain a healthy body. Moreover, the quality of adolescent sleep, which is very important today, is increasingly worrying because of the many activities carried out by adolescents at night, such as

activities that provide benefits or problems behind. If adolescents do not care about sleep quality, it is believed that all activities can be disrupted, especially teaching and learning activities (Mustafaoğlu et al., 2018). Students with poor sleep quality will fall asleep in class and easily get tired of learning activities at school (Waluyo, 2023).

This study aims to determine whether there is a relationship between physical activity, stress, and sleep quality on physical fitness. Similar studies have been conducted by (Moonti et al., 2023; Pangestika et al., 2018), But the study concluded that there was a significant relationship between sports activities, sleep quality, stress levels, and physical fitness. This research is a development of previous research to answer with certainty whether there is a relationship between physical fitness and sleep quality. The results of this study are expected to be positive and used as an insight into the importance of physical activity, sleep quality, and stress levels as physical fitness support. So, by looking at the role of physical activity levels, sleep quality, and stress levels in adolescents, we can see their contribution to students' physical fitness, which can be used as energy in doing all activities. The research study that will be carried out can show the impact of physical activity, sleep quality, and stress levels in adolescents today, which are associated with physical fitness and positively impact adolescent activities in the school environment or activities at home.

METHOD

The research method that will be used in this study is correlated with quantitative research approach techniques. The subjects in this study were adolescent students aged 16-19 years, high school students who were in good spiritual and physical health, had no history of illness or injury or were under the supervision of a doctor. The technique of taking research subjects uses purposive sampling by applying health track records, willingness to participate in research activities voluntarily, and allowed by teachers in their respective schools. The study participants were male and female, with 200 adolescent students. Data collection

techniques are questionnaires, including IPAQ, which is a questionnaire with a physical activity measurement scale based on MET (Metabolic Equivalent) values used to determine the degree of physical activity. IPAQ has a moderate level of validity (r = 0.48). The questionnaire for sleep quality is PSQI (Pittsburgh Sleep Quality Index), developed by Busyee, Reynolds, Monk, et al., where the reliability value is (Cronbach's) 0.83.

Table 1. Sleep quality assessment (Gupta et al., 2017)

No.	Dimension	Item Number
1.	Subjective sleep quality	6
2.	Sleep latency	2;5a
3.	Sleep duration	4
4.	Habits of Sleep Efficiency	4. 3. 1
5.	Sleep disturbance	5b; 5c; 5d; 5e; 5f; 5g; 5h; 5i; 5h
6.	Use of sleeping pills	7
7.	Dysfunction during the day	8; 9

The PSQI questionnaire consists of 19 questions, each with 7 components: subjective sleep quality, sleep latency, sleep duration, sleep disturbance, sleep efficiency, use of sleeping pills, and daytime sleep dysfunction (Table 1).

The respondent's answers to the 19 questions were added according to the criteria contained in the PSQI questionnaire. The scores of the seven components are then added to become an overall score with a range of values from 0 – 21. A Global score of 5 indicates good sleep quality, and a score of > 5 is considered to have poor sleep quality. The validity of the PSQI questionnaire was tested for r count (0.410-0.831) > r table (0.361), so this questionnaire is suitable for measuring sleep quality.

The self-assessment scale used to measure a person's negative emotions for stress is DASS (Depression Anxiety Stress Scale) (Sharma et al., 2018). Because the stress level was sought in this study, the measured questionnaire was a stress scale consisting of 14 questions. Table 1 shows that there are four rating scales, ranging from never with a value of 0 to always with a value of 3. The following Table 1 is shown. The 14 questions have been declared valid and reliable with a Cronbach Alpha coefficient of 0.880. Physical fitness is measured using the Indonesian Physical Fitness Test for the age range of 16-19 years. The analysis used

for this study was the Spearman Rank (Rho) correlation test using the SPSS application version 26.

RESULT

This study consisted of 200 respondents who obtained data correlating physical activity, sleep quality, and stress levels in adolescent physical fitness.

Table 2. Description of the value of physical activity, sleep quality, and stress levels on physical fitness of adolescents

	Physical activity	Sleep Quality	Stress levels	Physical fitness
N	200	200	200	200
Mean	3.0200	2.3500	2.6900	3.0400
median	3.0000	3.0000	3.0000	3.0000
Mode	3.00	3.00	3.00	3.00
SD	.52052	.71224	.59674	.71143
Variance	.318	.456	.410	.432
Min	2.00	2.00	2.00	1.00
Max	4.00	4.00	4.00	3.00
Sum	208.00	210.00	201.00	202.00

Table 2 shows descriptive data from four variables. It can be seen from the data that the variance of adolescent physical activity variance value is 0.212, adolescent sleep quality variance value is 0.313, adolescent stress level variance value is 0.373, and adolescent fitness variance value is 0.333.

Table 3. Results of Spearman's Rho correlation test data analysis

Correlation		
		Physical fitness
Physical activity	Correlation Coefficient	0.177
	Sig. (2-tailed)	0.714
	N	200
Sleep Quality	Correlation Coefficient	0.044
	Sig. (2-tailed)	0.826
	N	200
Stress levels	Correlation Coefficient	0.411
	Sig. (2-tailed)	0.000
	N	200

Based on Spearman's rho correlation test results, Table 3 shows the results in physical activity with adolescent physical fitness, Sig. 0.714 > 0.05 values were obtained, showing a significant relationship between physical activity and physical fitness. In the quality of sleep with physical fitness in adolescents, Sig. 0.826 > 0.05 was obtained, showing a significant relationship between adolescents' sleep quality and physical fitness. At the level of stress related to physical fitness, they obtained Sig. Values of 0.000 < 0.05 mean no significant relationship exists between stress levels and physical fitness in adolescents.

DISCUSSION

The results showed a significant relationship between physical fitness, physical activity, and sleep quality in adolescents aged 16 to 19. However, the value of stress levels did not have a significant relationship. Since the beginning of physical fitness is highly correlated with the level of physical activity, it is marked by the frequent exercise of adolescents on the sidelines of their activities to support energy needs in each activity. In addition to exercise, nutritional fulfilment is also a factor in improving physical fitness. The better the level of physical activity, the better physical fitness possessed in adolescents. Physical activity is any activity that involves movement in the body and causes an increase in caloric needs.

Physical activity carried out regularly and continuously according to the intensity and duration recommended according to age and ability can improve the degree of physical or psychological health (Merchán-Sanmartín et al., 2022). In addition, the better the implementation of physical activity, the better the capabilities of a person's body

(Sadacharan, 2021). Students who often do physical activity are better able to adapt to their environment, understand themselves, recognize their emotions, motivate themselves and recognize the emotions, and this is a form of high physical fitness. It is emphasized that demographics correlate with emotional abilities (Sharma et al., 2018). In line with previous research using between-person designs (Kapteyn et al., 2018; Klaperski et al., 2013), physical activity was lower shortly after stressful times. As physical activity can be seen as an effortful activity, less self-regulatory resources, time constraints, or low motivation during stressful times might account for this effect (Kanning et al., 2013; Kanning & Schlicht, 2010).

Physical fitness is the body's ability to perform all movement-related activities. Good physical fitness in adolescents is needed to support all activities, and adolescents have many activities that must be supported by physical fitness (Al-Jamil et al., 2018). Based on the results of the correlation analysis between sleep quality and physical fitness in adolescents, a significant positive correlation was obtained between sleep quality and physical fitness in adolescents. This means that the better the sleep quality, the higher the level of physical fitness. Sleep quality is an individual's ability to meet sleep needs in accordance with maximum sleep needs (Simpatik et al., 2023).

Individuals with poor sleep quality will negatively impact the body, including being susceptible to disease, often feeling tired, unfocused, and often sleepy. Sleep deprivation can interfere with a person's emotional health, resulting in anxiety, stress, and decreased performance (Arasy et al., 2023). In addition, quality sleep is a necessary resource for professionals to manage stressful situations and moods (Nugroho & Natalya, 2021). A person is required to have good sleep quality so that a person can have ideal physical fitness. Good sleep quality can be achieved by always maintaining sleep patterns and having an age-appropriate amount of sleep. Teenagers with good sleep quality tend to be more energetic and enthusiastic about daily activities. Furthermore, this will give adolescents more time to do activities well, communicate well with

others, pursue targets, and complete tasks on time (Medic et al., 2017). Sleep quality is influenced by sleep patterns and emotional stress factors that affect students' sleep quality (Stiglic & Viner, 2019).

Based on the analysis that has been done, the following is a detailed exposure to the relationship between stress levels and physical activity and physical fitness. In accordance with the data analysis that has been done, it was found that the level of stress with physical fitness does not correlate. From the results obtained, stress level with physical fitness obtained Sig. Value 0.000 < 0.05 means no significant relationship exists between stress level and physical fitness in adolescents. The value shows that the form of the correlation relationship is negative, which means that the relationship between stress levels is inversely proportional to physical fitness. Alternatively, the lower the stress level, the higher the physical fitness, and vice versa. Studies examining composite scores of collective health behaviours, including physical activity, find that stress predicts negative health behaviours. In fact, stress accounts for a substantial proportion of variance in collective health behaviours. Stress and Behaviour in Adolescents Tucker et al. (2012) Considering the multifarious relationships between stress and behaviour, it is plausible that stress is related to both PA and exercise as well. Physical activity is any activity that involves movement in the body and causes an increase in calorie needs. Physical activity carried out regularly and continuously in accordance with the recommended intensity and duration according to age and ability can improve the degree of physical or psychological health (Klaperski et al., 2013). On the other hand, good emotional and physical activity can help one survive in unfavourable conditions (Kanning & Schlicht, 2010).

The results of this study are in accordance with research (Praveena & Shashikala, 2022), which states that physical activity and sleep quality impact health and physical fitness. At the stress level, there is a considerable effect on an object or system, either to damage or change its shape (Østerås et al., 2017). Stress is related to changes in body physiology, psychological conditions, and environmental pressures.

Severe stress can cause a very high temporary rise in blood pressure. If periods of stress often occur, it will experience damage to blood vessels, the heart, and kidneys; then, to avoid the negative impact of stress, it is recommended to start a healthy lifestyle to get healthy and physical fitness.

This study's results align with previous research (Vecenane & Vazne, 2022). They conducted a study on 220 college students and concluded that those who engage in regular physical activity have better levels of physical fitness and reduced levels of mental stress compared to their peers who do not exercise. Physical fitness in adolescents Linnan et al. (2020) found an inversely significant correlation between physical fitness and mental stress, which means an increase in the fitness index leads to decreased stress levels. The study of Stoliarova et al. (2021) obtained the results that there is a statistically significant relationship between physical activity and psychological stress. Furthermore, the study of Aryantara et al. (2023) obtained results that showed greater stress levels applicable to the low physically active group, while lower stress levels were found in the medium and high active groups. They have found that students who engage in physical activity have lower stress levels than those who are not physically active (Schultchen et al., 2019).

One of the strengths of this study is the inclusion of variables such as stress levels for physical fitness in adolescents. Another strength of the study is the recent validation of the included stress instrument (PSQ) in adolescents, providing support for four-factor models and cross-gender measurement invariants. However, we also acknowledge some limitations. Neither design used correlation analysis has the right to determine causal relationships between variables. In addition, the number of subjects is limited, and the time of recruitment and research has been done. The sample size was manageable (N = 200), and further studies may need to confirm the findings. To cope with stress, several other factors and variables are also relevant, such as adverse childhood experiences, coping strategies, and disasters. However, they are outside the prescribed

scope of the study. All limitations should be considered to enhance future studies.

CONCLUSION

Based on the data processing and analysis results, the authors concluded that a relationship exists between physical fitness, physical activity, and sleep quality in adolescents. However, adolescents had no significant relationship in the analysis of physical fitness and stress levels. It is recommended for future research to be able to compare physical fitness with several other factors, both internal and external. From the limitations of research that has been carried out in the future, it must increase the number of subjects and larger objects to obtain findings that can be significant.

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