Relationship between physical activity and student cognitive function

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Abstract

Physical activity positively impacts cognitive function and can help avoid cognitive impairment. The study aimed to investigate the association between cognitive function and physical activity in junior high school students in Bandung. This research is quantitative research with a correlation analytic design. The instrument used in this study is a questionnaire. The sampling technique used is a random sample, the sample is 1870 respondents. The questionnaire used in this study is a closed questionnaire, which is a questionnaire whose answers have been provided so that respondents only need to choose. The study found that half of the respondents with less activity experienced less cognitive function (71,8%). Almost half of the respondents had a physical activity with good cognitive function (21.6%), and a small proportion of physical activity experienced quite a number of cognitive functions (8.6%). There is a relationship between physical activity and function cognitive in students. The results of this study are expected to be taken into consideration for further research by examining other factors related to cognitive function and other factors related to physical activity, such as gender, socioeconomic, and family factors.

Keywords: Physical activity, cognitive function, students.

INTRODUCTION

Physical activity is one of the variables known to impact cognitive performance (Hostinar et al., 2012). According to a lot of research, people who are physically inactive or have trouble moving around will have different cognitive function scores (Lundgren et al., 2016). Physical activity has a beneficial effect on cognitive function as well as preventing cognitive impairment and dementia (Loprinzi, 2019). It is believed that exercise stimulates neuron growth, which could prevent students' cognitive loss (Lundgren et al., 2016). According to Singh & Staines (2015), when engaging in physical exercise, the brain is engaged, which causes it to produce more Brain-Derived Neurotrophic Factor (BDNF). This BDNF protein is crucial for maintaining the health and fitness of nerve cells (Ploughman, 2008). If BDNF levels are low, it will cause senile disease (Loprinzi, 2019). Most students even reduce physical activity because of current technology plus living habits during the pandemic, although some students are aware of the benefits of exercising. The broad influence of several factors on cognitive function includes smoking, alcohol consumption, depression, lack of social support, impaired physical

function, and lack of physical activity (Gomes da Silva & Arida, 2015). Physical activity is a body movement that requires energy to do it, such as walking, doing housework, gardening, cycling and also gymnastics (Irwin et al., 2018). Physical activity can inhibit or slow down the decline in body function caused by increasing age (Gastin et al., 2017). The frequency and physical exercise performed can reduce the risk of cognitive impairment (Holfelder et al., 2020). Physical activity levels that are high and sustained over time are linked to both high cognitive function and cognitive decline (Lundgren et al., 2016). The benefits of physical activity will be evident when you will look 3 years younger than his age (Irwin et al., 2018). In general, cognitive performance will naturally deteriorate as we age. Additionally, there are risk factors that can influence the deterioration of cognitive function, such as hereditary familial conditions, educational attainment, brain injuries, pollutants, a lack of physical exercise, and long-term conditions like Parkinson's, heart disease, stroke, and diabetes (Kraft, 2012).

School-age can predict how a person will live the next life, including their health condition (Felez-Nobrega et al., 2020). Physical activity is a critical non-drug exercise that improves cognitive function and lowers the risk of cognitive deterioration. Amazingly, even a little physical activity, particularly outside the home, can boost moods, lessen loneliness and stress, enhance sleep quality, and stave off depression. However, excessive physical activity will impair cognitive function (McCarthy et al., 2021). Previous research has explained a lot about the relationship between physical activity and cognitive function in the elderly, but very little has been explained at school age. Even though we all know that school age is the most appropriate age to prepare a person's healthy living habits (Díez et al., 2021). Therefore, researchers feel the need to try to explain this phenomenon from the school age so that preparation for the next life can be maintained.

METHOD

This study uses a correlational analytic design that examines the relationship between variables. The design of this study used a cross-sectional design, namely research by measuring or observing at the same time. This research was conducted in March - June 2022. This research was conducted in the city of Bandung. In this study, the population used was Bandung City Junior High School students, amounting to 98,289. Due to lack of time, the researcher used simple random sampling so that the sample in this study only amounted to 1870 students. The instrument used in this study was a questionnaire. The questionnaire used in this study is a closed questionnaire, which is a questionnaire whose answers have been provided so that the respondents just have to choose. The physical activity instrument was a student questionnaire (PAQ-C questionnaire). The cognitive function instrument is a questionnaire related to cognitive function, with a checklist of 10, score yes: 1, no: 0 with good cognitive function criteria: 76-100%, enough: 56-75%, less: <56. Univariate analysis was carried out on each variable from the research results. This analysis only produces the distribution and percentage of each variable, namely physical activity. The analysis was carried out on two variables thought to be related or correlated, namely, the criteria for physical activity and cognitive function.

Equation and formula

The analysis was carried out on two variables thought to be related or correlated, namely, the criteria for physical activity and cognitive function. Analyzed using the formula:

$$r_{xy} = \frac{n\sum X_i Y_i - (\sum X_i)(\sum Y_i)}{\sqrt{\left\{n\sum X_1^{\,2} - (\sum X_1)^2\right\}\left\{n\sum Y_1^{\,2} - (\sum Y_1)^2\right\}}} \qquad (1)$$

Knowing the relationship between two variables, whether the significance or not, with a significance of 0.05, using the Spearman rank test with SPSS software.

RESULT

In this section, the research results conducted on junior high school students in Bandung will be described with a total of 1870 respondents. The research was carried out from March 2022 to June 2022. The results of the research are as follows:

Physical Activity

Students' physical activity levels were measured using data from the PAQ-C questionnaire submitted through a customized Google form junior high school. The findings of these tests were divided into five categories: (1) very high, (2) high, (3) moderate, (4) low, and (5) very low. The information based on the answers to the PAQ-C questionnaire results is shown in greater detail in table 1 below:

Table 1. Physical activity measurement results

No	Physical Activity Category	Frequency	
		f	%
1	Very Low	23	1.23%
2	Low	1137	60.80%
3	Moderate	677	36.20%
4	High	33	1.76%
5	Very High	0	0%
Total		**1870**	**100%**

(Primary data of physical activity, 2022)

According to table 1, Up to 60.80% of students fit this description of low physical activity. More details can be seen in the image below:

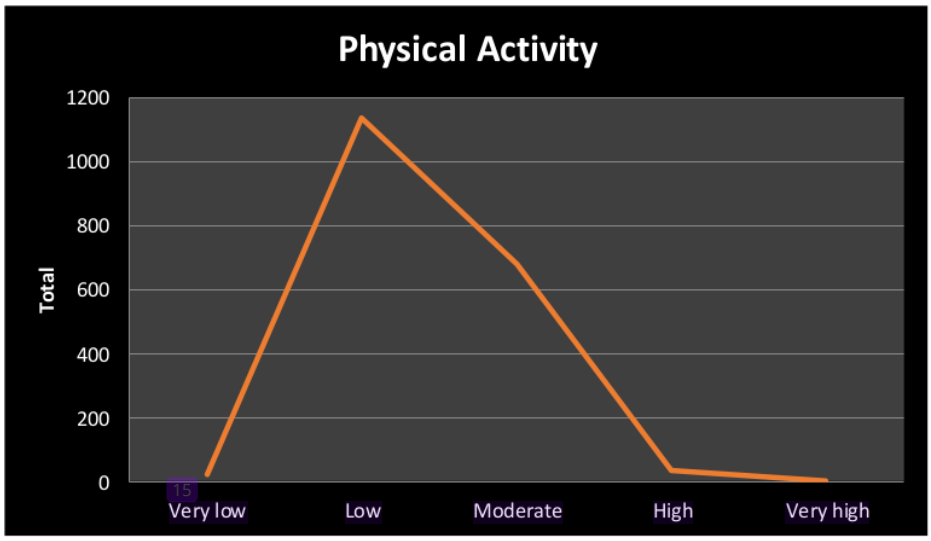

Figure 1. Physical Activity of students

Cognitive Function

The data obtained from filling out the google form cognitive function questionnaire that has been modified for junior high school is intended to determine the level of students' cognitive function, and the measurement results are categorized into three, namely: (1) good, (2) moderate, (3) less. For more details, the results of filling out the questionnaire can be seen in table 2 below:

Table 2. Cognitive function results

No	Cognitive Function Category	Frequency	
		f	%
1	Good	47	2.51%
2	Moderate	368	19.68%
3	Less	1455	77.81%
Total		**1870**	**100%**

(Data of Cognitive Function, 2022)

Overall, the students' average cognitive function results are in the less category with a percentage of 77.81%. More details can be seen in the image below:

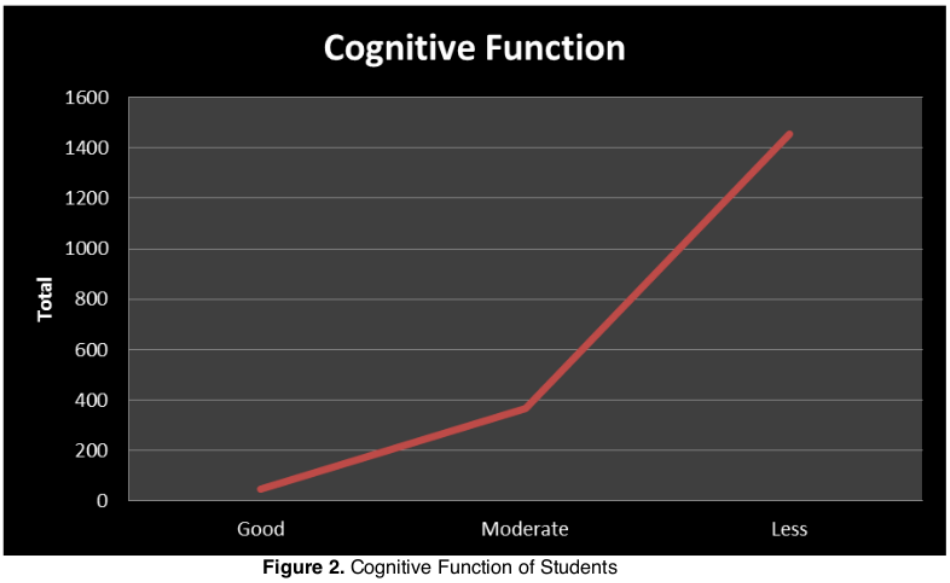

Figure 2. Cognitive Function of Students

Table 3. Correlations test result

			Physical activity	Cognitive Function
Spearman's rho	Physical activity	Correlation Coefficient	1.000	.650*
		Sig. (2-tailed)	.	.001
		N	1870	1870
	Cognitive Function	Correlation Coefficient	.650*	1.000
		Sig. (2-tailed)	.001	.
		N	1870	1870

*. Correlation is significant at the 0.05 level (2-tailed).

The results of the study using Spearman's Rho test showed that the probability value or error level (p: 0.001) was smaller than the standard significantly (0: 0.05), so what was accepted meant that there was a relationship between physical activity and cognitive function in junior high school students in Bandung, West Java Province.

DISCUSSION

The study's results on physical activity showed that almost half of the respondents had less physical activity, a total of 1137(60.80%), and for some respondents whose physical activity was moderate, several 677 (36.20%). The results showed that most Bandung City Junior High School students did not do physical activity. According to the researcher, based on the questionnaire filled in by the respondents, almost all of the

respondents did less activity, for example, walking in the morning every day, because engaging in regular physical activity can keep blood flowing optimally and bring nutrients to the brain. The results of the cognitive function study showed that almost half of the respondents' cognitive function was less than 1455 students (77.81%), and some respondents had moderate cognitive function 368 (19.68%). The results show that almost all junior high school students in Bandung City, West Java Province said they had a decline in cognitive function. Based on the results of the questionnaires filled out by the respondents according to the researchers, Many survey participants reported cognitive function was deteriorating, this was due to a lack of physical activity.

According to Rolving et al., (2019), high cognitive function scores are correlated with routine and high amounts of physical activity. However, low or moderate exercise levels among students are linked to a decline in cognitive performance. Studies conducted by Moen et al., (2018) demonstrate how activity can enhance one's executive function, attention, thinking speed, working memory, and long/short-term memory. The frequency and physical exercise performed can reduce the risk of cognitive impairment (Schnider et al., 2021). Strong levels of sustained and ongoing physical activity are associated with both high cognitive function and cognitive decline (Meijer et al., 2020). Basically, cognitive function will normally decline with age. The benefits of physical activity will be apparent when it looks 3 years younger than its age, and 20% can reduce the risk of impaired cognitive function (BenOunis et al., 2013). Additionally, there are risk factors that can influence the deterioration of cognitive function, including a family history of diseases like Parkinson's, heart disease, stroke, and diabetes, as well as education level, brain injury, pollutants, lack of physical exercise, and chronic illnesses like these (Gomes da Silva & Arida, 2015).

Based on the results Keeley & Fox, (2009), researchers and decision-makers have focused on the possibility that Children's academic achievement, learning, and cognitive function can all be improved through

physical activity and fitness. To find research that used physical activity or fitness measures to evaluate the degree of relationship with or effect on a) academic achievement and b) cognitive performance, a three-step search methodology was used. Data extraction involved 18 studies in all, including 11 correlational studies, 6 quasi-experimental studies, and 1 randomized control trial. Any research did not meet the criteria for examining the connections between physical activity and cognitive function. Although there were discovered to be positive relationships between physical activity, fitness, academic achievement, and cognitive function components, the intervention did not support these findings. The relationship between physical activity and cognitive function is a positive relationship. There is a relationship between physical activity and the students' cognitive function. The higher the physical activity, the higher the cognitive function score. The results of this study are expected to be taken into consideration for further research by examining other factors related to cognitive function and other factors related to physical activity, such as gender, socioeconomic, and family factors.

CONCLUSION

Considering the goals of the study and the analysis of the connection between physical activity and cognitive performance in junior high school students in Bandung City, West Java Province, it can be concluded that almost half of the respondents have less physical activity, then almost half of the respondents' cognitive function is also in the poor category, and there is a relationship between physical activity and function cognitive in students.

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