International Journal of
Disabilities Sports and Health Sciences
e-ISSN: 2645-9094

RESEARCH ARTICLE

Association Between Physical Fitness, Body Fat, BMI, and Physical Activity Level with Learning Outcomes in Elementary School Students

Sapto ADI[*1], Yulingga Nanda HANIEF[2], Prisca WIDIAWATI[3], Teejay D. PANGANİBAN[4] and Budi Ariyanto MUSLİM[5]

[1]Universitas Negeri Malang, Faculty of Sports Science, Department of Sports Science, Malang / Indonesia
[2,3]Universitas Negeri Malang, Faculty of Sports Science, Department of Sports Coaching Education, Malang / Indonesia
[4]Batangas State University, College of Teacher and Education, JPLPC-Malvar / Phillipines
[5]Ministry of Youth and Sports of the Republic of Indonesia / Indonesıa
*Corresponding author: sapto.adi.fik@um.ac.id

Abstract
The main problem in achieving learning outcomes in physical subjects at the primary school level is very complex. This study aimed to investigate the relationship between physical fitness, body fat, BMI, and physical activity levels with physical education learning outcome in elementary school students. A cross-sectional study was conducted to answer the research questions. This study involved 27 students (Aged 10.82±0.79) from elementary schools in Malang City, Indonesia. Instruments to determine physical fitness include endurance (PACER Test), flexibility (V sit and reach), and strength (sit-ups and squat thrust), the Indonesian Physical Fitness Test was used to determine body fat and Body Mass Index (BMI), and Physical Activity Questionnaire for Children (PAQ-C) was used to determine physical activity levels. The research result showed that physical fitness, body fat, BMI, and physical activity level were closely related to learning outcomes (R of 0.821), but only physical fitness influences physical fitness (Sig. < 0.05), while body fat, BMI, and physical activity level had no effect. In conclusion, students with good physical fitness tend to get good learning outcomes, so the physical education curriculum must accommodate physical activities that can increase the physical fitness level of students. Future research on academic success factors needs to be investigated, especially schools need to promote movement-based activities to support academic success.

Keywords
Physical fitness, Pacer test, Physical activity, Obesity, Physical education, Learning outcomes

INTRODUCTION

Education is anticipated to have a significant influence on learning outcomes, particularly in terms of how students behave. This behavior change should encompass all the untapped potential within children that can be nurtured through education. Physical education, which is an important component of holistic education, is one part of this (Cereda, 2023). Through carefully organised physical, sports, and health activities, the goal is to promote physical fitness, motor skills, critical thinking abilities, social skills, logical reasoning, emotional stability, moral action, a healthy lifestyle, and an introduction to environmental consciousness (Bailey et al., 2009; Erfle & Gamble, 2015; Goudas & Magotsiou, 2009; Meyer et al., 2013; Özkan & Kale, 2023; Starc & Strel, 2012). Physical education holds great importance within the education system. Therefore, it is offered to foster the development of motor skills, physical capabilities, knowledge, reasoning abilities, appreciation for values (including mental, emotional, spiritual, and social attitudes), and the cultivation of habits that promote a healthy lifestyle, ultimately leading to

Received: 29 October 2023 ; **Revised** ; 22 February 2024 ; **Accepted:** 08 March 2024; **Published:** 25 March 2024

How to cite this article: Adi, S., Hanief, Y.N., Widiawati, P., Panganiban, T.D., and Muslim, B.A. (2024). Association Between Physical Fitness, Body Fat, BMI, and Physical Activity Level with Learning Outcomes in Elementary School Students. *Int J Disabil Sports Health Sci*;7(2):335-341. https://doi.org/10.33438/ijdshs.1382608

well-rounded and comprehensive growth and development (Randall, 2013).

Learning outcomes are an indicator of students' success in participating in physical education lessons. Many studies report that learning outcomes can be achieved by students because of the success of the learning methods applied by teachers (Yu et al., 2021; Zacharis, 2011), students' motivation (Rafiola et al., 2020; Tella, 2007), and use of technology in learning (Khasanah & Hariyoko, 2023; Lee & Lee, 2021). Factors in achieving learning outcomes need to be explored so teachers, students, and parents can know clearly about the factors to further develop strategies based on the identified factors. This is important considering that each child has a different character and each learning method will produce a different impact on each student. Another research also revealed that physical activity, learning environment, and learning motivation are important factors in improving learning outcomes (Hasbullah et al., 2021). Firdaus et al. (2023) also reported that students who have a good body mass index (BMI) and physical fitness are not enough to get optimal learning results without high learning motivation.

Physical education develops cognitive, affective, and movement-based psychomotor aspects (McLennan & Thompson, 2015). The cognitive domain is concerned with how humans acquire, process, and apply knowledge. This is known as the "thinking" domain. Our attitudes, values, and emotions are all part of the affective domain. This is known as the "valuing" domain. The psychomotor domain is concerned with manual or physical abilities. This is the domain of "doing". All three must be addressed if unmotivated pupils who lack the motivation or ability to learn are to overcome barriers to learning and academic achievement (Dudley & Burden, 2020).

This study attempts to identify several variables that are assumed to have a close relationship to learning success in physical education subjects. Physical fitness, Body Fat, BMI, and Physical Activity Level are considered as several determining factors for learning success. Although several studies report that good physical fitness can influence the achievement of good learning outcomes (Nanda & Sari, 2021), however, it cannot be denied that other aspects can encourage students to improve their learning outcomes. A teacher who has limited information regarding the factors that cause student learning outcomes will not have a strategy to improve their learning outcomes. A student who has a good level of physical activity may not necessarily be able to complete the tasks given by the physical education teacher, nor do students with a tendency to be obese find it difficult to perform movement skills. It has been recommended that the treatment of obesity in young people should focus on environmental factors such as diet and physical activity that can be modified (Barlow & Committee, 2007), rather than focusing on excess weight and weight control.

Physical inactivity among children and adolescents is becoming a rising public health issue (Baldonado et al., 2022; Wyszyńska et al., 2020). In 2018, only between 20 and 40% of children aged 5 to 17 years in Europe met the WHO recommendation of 60 minutes of moderate to vigorous intensity physical activity every day (Aubert et al., 2018). Therefore, children with lack physical activity also have the potential to become overweight (Aquino & Reyes, 2022).

The studies that have been reported are only limited to factors that influence the achievement of student learning outcomes in Physical Education subjects which include aspects of movement skills (Aziz, 2014), cognitive, affective, and psychomotor aspects (Mirzeoğlu, 2014), and physical fitness (Agustin et al., 2021), yet there are still limited studies linking whether overweight, physical activity, and body mass index affect student learning outcomes in physical education.

So, this study seeks to investigate whether physical fitness Body Fat, BMI, and Physical Activity Level are considered closely related and contribute to the achievement of student learning outcomes in physical education subjects. This study involved elementary school students aged 9-12 years. These findings can be a key driver for teachers and schools in promoting fit, active, and healthy living in achieving student learning outcomes.

MATERIALS AND METHODS

Participants

This study was a cross-sectional study. This study involved an elementary school in Malang City, Indonesia, totaling 41 students, of which 14 students were not involved in data analysis because each student did not complete one of the tests, resulting in 27 students as participants (male = 12, female = 14). Participant categories are shown in Table 1.

This study was approved by the Research Ethics Committee of the State University of Malang with reference number No (LB.01.02/9/KE.114/2023), and all procedures and protocol complied with the Helsinki World Medical Association Declaration on the ethical conduct of research involving human subjects. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Table 1. Participant characteristics

Variable	Total (n=27)			
	M	SD	Minimum	Maximum
Age	10.82	0.79	9	13
Body mass (kg)	37.10	9.53	24	62.3
Body height (m)	1.42	0.07	1.28	1.52
Body Mass Index (kg/m2)	18.32	4.66	13.64	31.79

Mean (M); Standard Deviation (SD)

This research seeks to measure physical fitness, body fat, body mass index (BMI), physical activity levels, and learning outcomes in elementary school students. Instruments used to measure physical fitness include endurance (PACER Test), flexibility (V sit and reach), and strength (sit-ups and squat thrust).

Body mass index and body fat using the Indonesian Student Fitness Test (Ministry of Youth and Sport, 2022). To determine the level of physical activity with the Physical Activity Questionnaire for Children (PAQ-C) (Kowalski et al, 2004). Physical fitness tests that refer to the Indonesian Student Fitness Test include the V-Sit Reach Test, Sit-ups for 60 seconds, Squat Thrust for 30 seconds, and Pacer Test.

Meanwhile, learning outcome data comes from physical education subject grades in the current semester. The measurement activities were carried out over 2 days in August 2023. On the first day, all participants filled out a form willing to take a series of tests. Next, all participants took a physical fitness test. On the second day, all participants filled out the PAQ-C questionnaire and measured Height, Weight, and Age.

Statistical analysis

The study seeks to determine the relationship between physical fitness, body fat, body mass index, level of physical activity, and learning outcomes in physical education subjects, so the data is analyzed using multiple linear regression to determine the relationship between variables both partially and simultaneously. In addition, normality test data was also carried out. The Statistical Package for Social Sciences (SPSS) software programme version 23.0 was used to analyse all data.

RESULTS

Table 2 presents the test results for physical fitness, body fat, body mass index, and physical education subject grades during the semester. The Physical Fitness Score was the result of a combined analysis of the V-Sit Reach Test, Sit-ups for 60 seconds, Squat Thrust for 30 seconds, and Pacer Test.

Table 2 showed that the average physical fitness score of number 2, which when translated based on the Indonesian Student Fitness Test guidelines, was included in the Fair category. The average body fat value of 0.66 showed that most were in the Normal category.

Meanwhile, the average Body Mass Index value was 18.32, which means that the majority of

participants were in the good (normal) nutrition category. Physical activity level data also showed interesting information, namely that students with moderate and low physical activity had the same composition (n=12) (Table 3).

Table 4 showed that the Adjusted R-value was 0.616, which meant that (physical fitness, physical activity, body fat, BMI, and physical activity level) affected the learning outcomes of PE subjects by 61.6%. Meanwhile, the rest (100-61.6=38.4%) was influenced by other variables besides physical fitness, physical activity, body fat, BMI, and level of physical activity. To find out whether physical fitness, physical activity, body fat, BMI, and level of physical activity partially influence learning outcomes in Physical Education subjects, it could be seen in Table 5.

Table 2. Data on physical fitness, body fat, body mass index, and physical education subject grades

Variable	Total (n=27)			
	M	SD	Minimum	Maximum
Physical Fitness	2	0.5	1.3	3.1
Body Fat	0.66	0.10	0.5	0.93
Body Mass Index (kg/m2)	18.32	4.66	13.64	31.79
Physical Education Subject Grade learning outcomes	84.6	2.6	80	89

Mean (M); Standard Deviation (SD)

Table 3. Data of physical activity level

Category	Frequency	Percentage (%)
Very high	0	0
High	3	11.12
Medium	12	44.44
Low	12	44.44
Very low	0	0
Total	27	100

Table 4. Coefficient of determination value

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.821[a]	.675	.616	1.635

a. Predictors: (Constant), Physical Activity, Body fat, Physical Fitness, BMI

Table 5. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	78.899	3.905		20.207	.000
	Body Mass Index	.460	.755	.140	.609	.549
	Bodyfat	.860	.647	.318	1.330	.197
	Physical Fitness	3.644	.634	.802	5.747	.000
	Physical Activity	-.890	.508	-.229	-1.753	.093

a. Dependent Variable: Learning Outcomes

Based on Table 5, the only significance value < 0.05 was physical fitness, so only physical fitness influenced learning outcomes in physical education lessons. Meanwhile, BMI, body fat and physical activity did not have a significant effect. Table 6 showed that there is no difference in learning outcomes between male and female students.

Tabel 6. Independent Sampels T-Test

	t	df	p
Male - Female	-0.757	25	0.456

Note. Student's t-test

DISCUSSION

This research seeks to investigate the relationship between physical fitness Body Fat, BMI, and Physical Activity Level with student learning outcomes in physical education. The findings showed that physical fitness Body Fat, BMI, and Physical Activity Level had an influence on achieving learning outcomes, but partially, only physical fitness influenced students' achievement of learning outcomes.

The connection between physical fitness and overall health is well-established. Maintaining physical fitness can lower the chances of developing cardiovascular diseases, type II diabetes, and obesity (Hillman et al., 2008). Furthermore, it has been shown to positively impact mental health by reducing symptoms of depression, anxiety, and stress (Eveland-Sayers et al., 2009). The well-being of children and adolescents is greatly influenced by their physical fitness levels. Not only does it contribute to better brain function, cognitive abilities, and academic performance (Tomporowski et al., 2008), but it also raises concerns about the overall development of individuals worldwide.

Participating in numerous sports requires maintaining and increasing health-related physical fitness, which includes cardiovascular endurance, muscle strength and endurance, flexibility, and body composition (Chen et al., 2016; Ni & Yu, 2023), therefore the students who had good physical fitness, they would be able to follow the movement learning assigned by the teacher. Legarra-Gorgoon et al. (2023) conducted research in preschool children in Spain to investigate the relationship between basic motor competence (BMC) and physical fitness. Higher BMC was associated with better physical fitness in Spanish preschool children, according to his research. These findings highlight the critical role of basic motor skills in increasing physical activity in preschool children.

The thing that needed attention were students with a high Body Mass Index (BMI), which means being overweight can harm physical fitness, as in a study reported by Liu et al. (2023) on children aged 4-9 years in China. Schools must be promoters of healthy living through physical activity as outlined in the physical education curriculum. Physical activity has many health benefits, including better cardiovascular endurance, blood pressure, and reduced risk of future depression and heart attacks (Bushman, 2019). Schools are the main place to reach the majority of Indonesian children and provide them with physical opportunities. Some schools provide arenas for playing amidst the narrowing of empty land in urban areas.

Although the findings in this study showed that physical activity, BMI, and Body fat were not closely related to learning outcomes, other studies reported different results (Aziz, 2014; Firdaus et al., 2023; Hasbullah et al., 2021; Liu et al., 2023; Meyer et al., 2013; Rodriguez et al., 2020). This was caused by many factors, including part of the limitations of this study. This study did not observe the tests given to all students to achieve student learning outcomes. The learning outcomes obtained from the students could be in the form of physical fitness tests, working on questions, or even structured assignments. This needed to be observed further and to find out the indicators of student success in taking physical education lessons.

The conclusion of this study was the physical fitness indicators were very closely related to student learning outcomes in physical education lessons. The physical education curriculum must accommodate the needs of elementary school students to be more physically active and have ideal body composition. This was a major challenge for physical education subjects amidst the issue of physical activity in free time which most teenagers use to look at gadgets, television, and also to just lie down.

Conflict of Interest

The authors have declared no conflicts of interest.

Ethisc Committee

This study received permission from the Ethics Commission of the State University of Malang No 101/KEPK/2023

Author Contributions

Study design, SA, YNH; Data Collection, YNH, PW; Statistical Analysis, TDP, YNH, BAM, PD; Manuscript preparation, YNH, PW, TDP; Literature review, SA, YNH. All authors have read and agreed to the published version of the Manuscript.

ACKNOWLEDMENT

The research team would like to thank the State University of Malang for providing funding so that this research can be completed. This research is a faculty superior research scheme with research contract number 5.4.135/UN32.20.1/LT/2023.

REFERENCES

Agustin, W. W., Hartati, H., & Aryanti, S. (2021). Physical Fitness Analysis of Student Learning Outcomes. *Journal Physical Education, Health and Recreation*, *5*(2), 162–168. [CrossRef]

Aquino, J. . M., & Reyes, M. G. (2022). The Relationship of Sports Participation in Academic Performance among College of Arts and Sciences Varsity Players. *Physical Education and Sports: Studies and Research*, *1*(2), 107-122. [CrossRef]

Aubert, S., Barnes, J. D., Abdeta, C., Abi Nader, P., Adeniyi, A. F., Aguilar-Farias, N., Tenesaca, D. S. A., Bhawra, J., Brazo-Sayavera, J., & Cardon, G. (2018). Global matrix 3.0 physical activity report card grades for children and youth: results and analysis from 49 countries. *Journal of Physical Activity and Health*, *15*(s2), S251–S273. [CrossRef]

Aziz, I. (2014). Evaluating Learning Outcomes of Sports Skill through Observation. *Asian Social Science*, *10*(5), 130–135. [CrossRef]

Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R., & Education, B. P. (2009). The educational benefits claimed for physical education and school sport: an academic review. *Research Papers in Education*, *24*(1), 1–27. [CrossRef]

Baldonado, N. N., Demot, A. M. L., Villaflores, P. J. A., Dayag, G. G., Buado, E. L., Ramos, C. V., Cruz, G. V. T. D., & Martinez, R. G. (2022). Physical Activity Participation of Persons Deprived of Liberty in Santiago City District Jail, Philippines. *Physical Education and Sports: Studies and Research*, *1*(2), 91-106. [CrossRef]

Barlow, S. E., & Committee, E. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*, *120*(Supplement_4), S164–S192. [CrossRef]

Bushman, B. A. (2019). Physical activity guidelines for Americans: The relationship between physical activity and health. *ACSM's Health & Fitness Journal*, *23*(3), 5–9. [CrossRef]

Cereda, F. (2023). A Modern Pedagogical Approach in The Subject of Physical Education. *Physical Education and Sports: Studies and Research*, *2*(2), 126-141. [CrossRef]

Chen, W., Mason, S., Hammond-Bennett, A., & Zalmout, S. (2016). Manipulative skill competency and health-related physical fitness in elementary school students. *Journal of Sport and Health Science*, *5*(4), 491–499. [CrossRef]

Dudley, D., & Burden, R. (2020). What effect on learning does increasing the proportion of curriculum time allocated to physical education have? A systematic review and meta-analysis. *European Physical Education Review*, *26*(1), 85–100. [CrossRef]

Erfle, S. E., & Gamble, A. (2015). Effects of daily physical education on physical fitness and weight status in middle school adolescents. *Journal of School Health*, *85*(1), 27–35. [CrossRef]

Eveland-Sayers, B. M., Farley, R. S., Fuller, D. K., Morgan, D. W., & Caputo, J. L. (2009). Physical fitness and academic achievement in elementary school children. *Journal of Physical Activity and Health*, *6*(1), 99–104. [CrossRef]

Firdaus, K., Hartoto, S., Hariyanto, A., Subagya, I., & Mario, D. T. (2023). Evaluation of Several Factors that Affect the Learning Outcomes of Physical Education. *International Journal of Human Movement and Sports Sciences*, *11*(1), 27–36. [CrossRef]

Goudas, M., & Magotsiou, E. (2009). The effects of a cooperative physical education program on students' social skills. *Journal of Applied Sport Psychology*, *21*(3), 356–364. [CrossRef]

Hasbullah, A., Hanif, A. S., Setiakarnawijaya, Y., & Pelana, R. (2021). Learnıng Outcomes Of Physıcal Educatıon For Eleventh Grade Students Of Senıor Hıgh School. *Gladi: Jurnal Ilmu Keolahragaan*, *12*(02), 115–127. [CrossRef]

Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nature Reviews Neuroscience*, *9*(1), 58–65. [CrossRef]

Kementerian Pemuda dan Olahraga. (2022). *Pedoman Pelaksanaan Tes kebugaran Pelajar Nusantara*. Kementerian Pemuda dan Olahraga. [CrossRef]

Khasanah, R. N., & Hariyoko, H. (2023). Development of learning media for physical education, sports, and health on basic football techniques based on articulate storyline application. *Indonesian Journal of Research in Physical Education, Sport, and Health (IJRPESH)*, *1*(1), 8–14. Retrieved from [CrossRef]

Lee, H. S., & Lee, J. (2021). Applying artificial intelligence in physical education and future perspectives. *Sustainability*, *13*(1), 351. [CrossRef]

Legarra-Gorgoñon, G., García-Alonso, Y., Ramírez-Vélez, R., Erice-Echegaray, B., Izquierdo, M., & Alonso-Martínez, A. M. (2023). Associations between basic motor competencies and physical fitness in Spanish

pre-schoolers: a cross-sectional study. *Italian Journal of Pediatrics*, *49*(1). [CrossRef]

Liu, G., Hao, R., Li, X., Gao, Y., Li, W., & Zhang, M. (2023). Body Mass Index and Physical Fitness among Chinese Adolescents Aged 15–18: A Cross-Sectional Study of Gender Differences. *Children*, *10*(7), 1204. [CrossRef]

McLennan, N., & Thompson, J. (2015). *Quality physical education (QPE): Guidelines for policymakers*. Unesco Publishing. [CrossRef]

Meyer, U., Roth, R., Zahner, L., Gerber, M., Puder, J. J., Hebestreit, H., & Kriemler, S. (2013). Contribution of physical education to overall physical activity. *Scandinavian Journal of Medicine & Science in Sports*, *23*(5), 600–606. [CrossRef]

Mirzeoğlu, A. D. (2014). The effects of peer teaching on the university students achievements in cognitive, affective, psychomotor domains and game performances in volleyball courses. *Educational Research and Reviews*, *9*(9), 262–271. [CrossRef]

Nanda, G. R., & Sari, M. (2021, February). Relationship of Physical Fitness to Physical Education Learning Outcomes of Class VIII Students of Junior High School Negeri 6 Siak Hulu. In *1st International Conference on Sport Sciences, Health and Tourism (ICSSHT 2019)* (pp. 109-112). Atlantis Press. [CrossRef]

Ni, R., & Yu, Y. (2023). A study on the factors of barriers to female university students' sports participation from an environmental perspective. *Indonesian Journal of Research in Physical Education, Sport, and Health (IJRPESH)*, *1*(2), 87–97. Retrieved from [CrossRef]

Özkan, Z., & Kale, R. (2023). Investigation of the effects of physical education activities on motor skills and quality of life in children with intellectual disability. *International Journal of Developmental Disabilities*, *69*(4), 578–592. [CrossRef]

Rafiola, R., Setyosari, P., Radjah, C., & Ramli, M. (2020). The effect of learning motivation, self-efficacy, and blended learning on students' achievement in the industrial revolution 4.0. *International Journal of Emerging Technologies in Learning (IJET)*, *15*(8), 71–82. [CrossRef]

Randall, L. (2013). Physical Education's Contribution to Health and Wellness: Part 1. *Antistasis*. [CrossRef]

Rodriguez, C. C., Camargo, E. M. de, Rodriguez-Añez, C. R., & Reis, R. S. (2020). Physical activity, physical fitness and academic achievement in adolescents: A systematic review. *Revista Brasileira de Medicina Do Esporte*, *26*, 441–448. [CrossRef]

Starc, G., & Strel, J. (2012). Influence of the quality implementation of a physical education curriculum on the physical development and physical fitness of children. *BMC Public Health*, *12*, 1–7. [CrossRef]

Tella, A. (2007). The impact of motivation on student's academic achievement and learning outcomes in mathematics among secondary school students in Nigeria. *Eurasia Journal of Mathematics, Science and Technology Education*, *3*(2), 149–156. [CrossRef]

Tomporowski, P. D., Davis, C. L., Miller, P. H., & Naglieri, J. A. (2008). Exercise and children's intelligence, cognition, and academic achievement. *Educational Psychology Review*, *20*, 111–131. [CrossRef]

Wyszyńska, J., Ring-Dimitriou, S., Thivel, D., Weghuber, D., Hadjipanayis, A., Grossman, Z., Ross-Russell, R., Dereń, K., & Mazur, A. (2020). Physical activity in the prevention of childhood obesity: the position of the European childhood obesity group and the European academy of pediatrics. *Frontiers in Pediatrics*, *8*, 662. [CrossRef]

Yu, Z., Gao, M., & Wang, L. (2021). The effect of educational games on learning outcomes, student motivation, engagement and satisfaction. *Journal of Educational Computing Research*, *59*(3), 522–546. [CrossRef]

Zacharis, N. Z. (2011). The effect of learning style on preference for web- based courses and learning outcomes. *British Journal of Educational Technology*, *42*(5), 790–800. [CrossRef]