

The relationship between physical fitness and student learning outcomes in Indonesia: A meta-analysis study

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Abstract

Physical fitness plays an important role in supporting student learning outcomes. Therefore, this study aims to analyze the effect of physical fitness on student learning outcomes through a meta-analysis approach. This study uses a meta-analysis method, a statistical analysis technique that combines the results of various similar studies to obtain a more comprehensive quantitative picture. The data analyzed were obtained from scientific articles published on Google Scholar with the keywords "physical fitness" and "student learning outcomes". The population in this study consisted of 873 articles published from 2020 to 2025. The sampling technique used was purposive sampling with specific inclusion and exclusion criteria, namely: (1) discussing the relationship between physical fitness and student learning outcomes, (2) published in the 2020–2025 period, (3) using a quantitative research design with a correlational approach, and (4) limited by the author's institution of origin from Indonesia. From the selection process, 34 articles met the requirements for further analysis. Data were analyzed using the effect size test with the help of JASP software. The Random Effects model analysis showed a significant positive relationship between physical fitness and student learning outcomes ($z = 5.015$; $p < 0.001$; 95% CI: 0.315–0.718). The Rank Correlation results showed a Kendall's value of 0.151, and Egger's test produced a p-value of 0.186, indicating no publication bias. Forest plot analysis showed that the combined effect size was in the medium category, with a value of 0.52 (-1.79; 2.08). There was a significant relationship between physical fitness and student learning outcomes. These findings strengthen empirical evidence that good physical fitness can support academic achievement and is the basis for planning holistic and integrative educational programs.

Received:
May 15, 2025

Accepted:
July 17, 2025

Online Published:
July 26, 2025

Keywords:
Learning outcomes,
physical fitness,
students.

Introduction

Education is the primary means of developing the quality of human resources. Through education, humans increasingly realize the importance of thinking in determining the quality of their future (Atmaja et al., 2025; Rahman et al., 2024). Education allows humans to plan their future from school age (Castellví et al., 2022; Nopiyanto et al., 2025). Many believe that education and knowledge are the keys to survival and competition in a competitive global era in every country (Barrichello et al., 2020). Physical education is integral to general education, influencing students' cognitive, affective, and psychomotor potential through physical activity (Hasan et al., 2024). Physical education provides valuable life experiences for students, such as the development of

agility, motor intelligence, teamwork, and social skills. Through structured physical activities, students learn motor skills and character values such as discipline, sportsmanship, responsibility, and empathy (Abadi et al., 2024; Hidayat et al., 2025). This process directly strengthens students' mental, emotional, and social aspects, essential to educational goals (Gulo et al., 2024; Meetei, 2023).

Physical fitness can be defined as a person's ability to perform daily activities easily without experiencing excessive fatigue and still having energy reserves for other activities (Kardiawan et al., 2025). Physical fitness is an important element that supports optimizing school student learning processes (Burhaein & Rozak,

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To Cite: Islam, S., Awaliyyah, U. A., Sanjaya, H. F., Husein, M., Abadi, A. K., Kapitarau, R., Dewi, I. S., & Muti, G. G. (2025). The relationship between physical fitness and student learning outcomes in Indonesia: A meta-analysis study. *Adv Health Exerc*, 5(2), 87-98.

2024; Rusli et al., 2022). This aligns with Pulido & Ramírez Ortega's (2020) research, which shows that physical fitness is a critical component in supporting student academic achievement, especially from neuroeducation and cognitive neuroscience perspectives.

Regular physical activity can stimulate neuroplasticity, the brain's ability to form and reorganize connections between neurons. This process is crucial for students, supporting learning, memory strengthening, and overall cognitive development (Achiron & Kalron, 2008; Moiniafshari et al., 2023). With increased neuroplasticity, students become more adaptable to constantly changing experiences and learning environments, thus strengthening their capacity to absorb and process new information (Budde et al., 2016; Spytka, 2024). Physical activity has increased the production and balance of neurotransmitters such as dopamine and Serotonin, which are vital in regulating mood, motivation, and attention levels (Sieniawska et al., 2024).

Dopamine contributes to the brain's nervous system, which can increase enthusiasm and intrinsic drive to learn, while Serotonin plays a role in stabilizing emotions and helping reduce anxiety levels. Combining these two neurotransmitters creates a more stable and positive psychological state, thus supporting an optimal internal environment for effective learning (Boyle et al., 2024; Olveracortes et al., 2008). In addition, good physical fitness also has a positive impact on students' physiological and psychological aspects during learning activities. Fit students tend to have stable energy, strong endurance, and higher concentration abilities, so they do not tire easily, rarely get sick, and stay focused on learning. As a result, students can maximize their potential (Sidik et al., 2024).

Learning outcomes are behavioral changes after participating in learning activities by educational objectives in the cognitive, affective, and psychomotor domains (Darfin et al., 2024). Student learning outcomes in this academic field can be observed through a recapitulation of learning outcomes, commonly called a report card. In the report card, student learning outcomes can be observed during one semester of study at school. Each report card lists the grades for the subjects that students have taken each day. Report card grades are grades given by teachers based on the student's activity and ability in participating and implementing the learning that has been given (Milenković et al., 2024). In addition, report

card grades also reflect the academic achievements that students can achieve. A visible indicator is that each student can enjoy the benefits of exercise in general through an improved level of physical fitness that impacts the enthusiasm, motivation, and health of the students concerned so that they can carry out learning activities optimally (April Yesaya Sipayung & Aliman, 2024).

In recent years, several studies in Indonesia have analyzed the relationship between physical fitness and student learning outcomes using a *literature review approach* (Aprilia & Januarto, 2022; Kapti & Winarno, 2022; Pratama & Winarno, 2022). However, this approach has not been able to fully demonstrate the magnitude of the influence of physical fitness on learning outcomes quantitatively. Therefore, it is important to use a *meta-analysis approach* to determine the extent of the influence of physical fitness on student learning outcomes in schools in Indonesia in a more objective, measurable, and comprehensive manner. Starting from this problem, this study was conducted to examine the extent of the contribution of physical fitness to student learning outcomes in Indonesia using a meta-analysis approach.

Methods

The method used in this study is meta-analysis. Meta-analysis is a statistical analysis technique used to summarize the results of various studies, producing findings that attempt to integrate the latest findings. Meta-analysis plays an important role in research as a method for evaluating various previous studies that discuss similar themes but with a level of data validity that has not been fully verified (Reinebo et al., 2024). In this analysis, the effect size value is used as a parameter to determine the significance of the research results (Maulana et al., 2025). The effect size can be expressed in raw form or a standardized r value, representing the correlation and average difference between the two analyzed variables (Cohen, 2013).

Research Procedures

The implementation of meta-analysis research includes several stages, namely: (1) selecting and reviewing the research topic to be used, (2) collecting research results with titles relevant to the topic, (3) assessing the quality of the articles obtained and (4) calculating the effect size of the selected research results (Cohen, 2013). (5) analyzing the heterogeneity of the effect size, (6)

interpreting the research results and drawing conclusions (Shipley & van Riper, 2022).

In the article search and selection process, this study used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach as a guideline for systematically, transparently, and structured data identification, screening, and inclusion (Page et al., 2021). The PRISMA process began with article identification through online databases, primarily Google Scholar. The data used in the analysis were obtained from published scientific articles and accessed online through the official websites of each journal. The literature search was conducted using keywords such as "Physical Fitness," "School Students," and "Learning Outcomes," with publication years between 2020 and 2025.

Exclusion and inclusion criteria

Inclusion criteria for this study included quantitative studies that explicitly examined the relationship between physical fitness and learning outcomes in school students. Selected studies must involve participants who are school students, whether at the elementary, junior high, or high school level. The research must be conducted in Indonesia. Furthermore, only studies using standardized and validated measurement instruments to assess physical fitness and student learning outcomes will be included. Articles published between 2020 and 2025 must have an ISBN, be in Indonesian or English, and present sufficient statistical data for analysis.

Exclusion criteria included articles that were not empirical research, such as editorials, opinion pieces, or non-systematic *literature reviews*. Studies that did not

involve school students or directly examine the relationship between physical fitness and student learning outcomes were also excluded. Studies that used unreliable measurement tools or did not provide sufficient quantitative data for analysis were excluded. Additionally, duplicate articles from the same study and studies for which data could not be accessed or verified were eliminated from the selection process.

Assessment of the Quality of Each Study to Be Analyzed

After an identification and selection process based on inclusion and exclusion criteria, the articles that were obtained were evaluated for methodological quality using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies developed by The Joanna Briggs Institute

(2017). This assessment instrument consists of 8 questions designed to assess the internal validity of each study included in the meta-analysis. The assessment focused on important aspects such as the clarity of the inclusion criteria, the reliability and validity of variable measurements, the appropriateness of statistical analysis, and the extent to which the study identified and controlled for biases that may arise in cross-sectional research designs.

Data Analysis

Study selection was conducted by identifying references extracted into an Excel database to facilitate

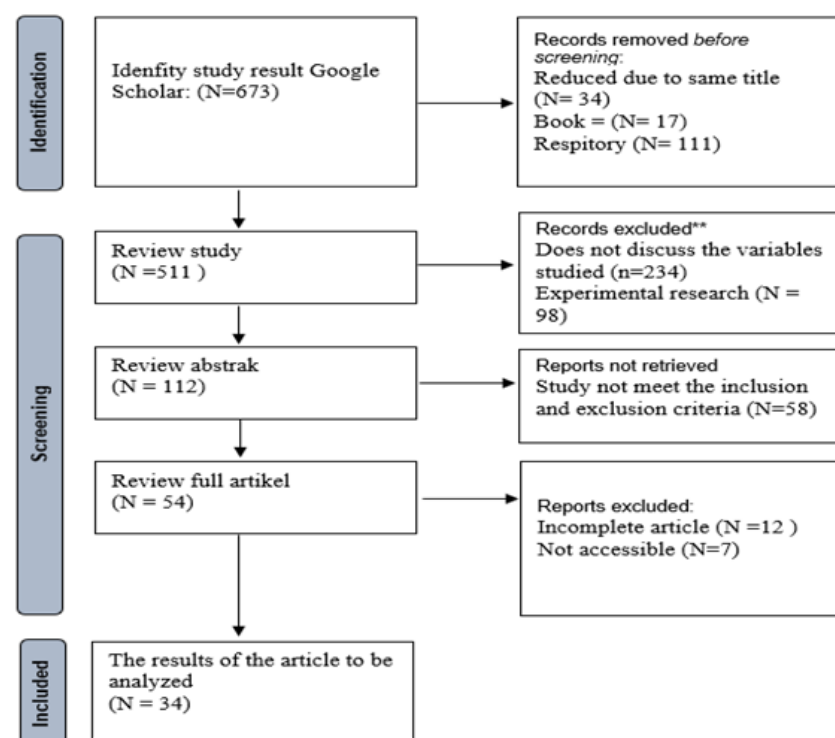


Figure 1. Diagram of the flow of search strategies to identify the study data.

Analysis

Using keywords entered into the Google Scholar search engine, 673 scientific articles discussing the relationship between mental toughness and anxiety in athletes were retrieved. After carefully screening based on established inclusion and exclusion criteria, 34 articles were deemed suitable for in-depth analysis.

management and removal of duplicate articles. Researchers reviewed the abstracts of the studies found using a search strategy to identify studies that met the criteria for physical fitness and learning outcomes. Physical fitness is an essential component that students must possess to support their learning process. The data obtained will undergo a series of systematic analysis stages: Identify research variables by entering the obtained variables into the appropriate columns and identify correlation values in each article to be analyzed. If a research article only presents certain values, then these values must be converted using a predetermined formula.

$$F = t^2$$

$$t = \sqrt{Fr} = t / \sqrt{(t^2 + df)}$$

The risk of bias was analyzed to determine the effect size (Z) and standard error effect size (SEz), and then

the data were analyzed using JASP software. The effect size and standard error effect size were calculated using the following formula:

$$Z = 0.5 \times \ln \frac{1+r}{1-r}$$

Effect Size Equation

$$V2 = \frac{1}{n-3}$$

$$SE_z = \sqrt{V2}$$

The Effect Size test data were interpreted using JASP software to obtain information on the presence or absence of publication bias. Publication data related to the relationship between physical fitness and student learning outcomes were categorized based on correlation values: $r = 0.1$ (low), $r = 0.3$ (moderate), and $r = 0.5$ (high) (Cohen, 2013; Husein et al., 2025).

Table 1

JBI assessment for cross-sectional research methods.

Author	Item								Σ
	1	2	3	4	5	6	7	8	
Fahrudi, (2025)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	7
Khairi et al., (2025)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Peristiwanto & Ansori, (2024)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	7
Wahab et al., (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Sidik et al., (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Iqbal et al., (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Efendi et al., (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Hanna et al., (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Sipayung & Aliman, (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Fadila et al., (2024)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	8
Yulifri et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Abrilian & Maksum, (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Al Hafiz et al., (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Sepriani et al., (2024)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Sutriawan et al., (2024)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	7
Lovita et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Adrian et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Maidarisa et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Hidayat et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Defril et al., (2023) Study 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Defril et al., (2023) Study 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Ramadhan et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Putra et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Rayhan et al., (2023)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Supariyadi et al., (2022)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Destriana et al., (2022)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Salamah & Setiawan, (2022)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Fadilla & Pudjijuniarto, (2022)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	7
Idham et al., (2022)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Putra et al., (2022)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Damrah & Pitnawati, (2021)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Riyanto, (2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	7
Sari, (2020)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Sobarna et al., (2020)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	7
Aryadi, (2020)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6

Hypothesis testing

The research findings are presented in narrative form. Information regarding the study sample, effect size, standard error, heterogeneity test, and publication bias test is presented in tables and graphs. The meta-analysis in this study used a random effects model to calculate the level of heterogeneity and estimate the average effect size of variables influencing student learning outcomes based on their physical fitness. This approach was chosen to accommodate variation across the studies analyzed.

Visualization in the form of a forest plot is used to illustrate the extent to which physical fitness influences learning outcomes, based on correlation categories, namely $r = 0.1$ (low), $r = 0.3$ (moderate), and $r = 0.5$ (high) (Cohen, 2013).

Publication bias testing was conducted using rank correlation analysis and regression methods. The

analysis results indicated no publication bias if the significance value (p-value) was greater than 0.05. In addition, further testing using a funnel plot and Egger's test also produced a p-value > 0.05 , which indicates the absence of publication bias in the studies analyzed.

Results

The research results and discussion were compiled using a systematic method based on a review of previous research findings, using correlational studies to select articles discussing physical fitness and student learning outcomes. Data testing in the meta-analysis was conducted by classifying correlation studies between physical fitness and learning outcomes, then analyzing the number of subjects used and the correlation results of each study that met the criteria.

Table 2

Results of conversion of effect size (Z) and standard error (SE) values.

No	Writer	Sample	N	R	SE	ICE
1	Fahrudi, (2025)	Junior High School	28	0.300	0.31	0.20
2	Khairi et al., (2025)	Elementary School	45	0.560	0.63	0.15
3	Peristiwanto & Ansori, (2024)	Elementary school	122	0.335	0.35	0.09
4	Wahab et al., (2024)	Junior High School	30	0.332	0.35	0.19
5	Sidik et al., (2024)	Junior High School	31	0.432	0.46	0.19
6	Iqbal et al., (2024)	Junior High School	15	0.562	0.64	0.29
7	Efendi et al., (2024)	High School	65	0.357	0.37	0.13
8	Hanna et al., (2024)	Junior High School	30	0.400	0.42	0.19
9	Sipayung & Aliman, (2024)	Junior High School	40	0.898	1.46	0.16
10	Fadila et al., (2024)	Junior High School	25	0.598	0.69	0.21
11	Yulifri et al., (2023)	High school	27	0.969	2.08	0.20
12	Abrilian & Maksu, (2024)	High School	108	-0.121	-0.12	0.10
13	Al Hafiz et al., (2024)	High School	26	0.588	0.67	0.21
14	Sepriani et al., (2024)	Junior High School	58	0.228	0.23	0.13
15	Sutriawan et al., (2024)	Junior High School	50	0.747	0.97	0.15
16	Lovita et al., (2023)	High School	22	0.724	0.92	0.23
17	Adrian et al., (2023)	Junior High School	18	0.652	0.78	0.26
18	Maidarisa et al., (2023)	High School	26	0.495	0.54	0.21
19	Hidayat et al., (2023)	High School	36	-0.936	-1.70	0.17
20	Defril et al., (2023) Study 1	High School	19	0.544	0.61	0.25
	Defril et al., (2023) Study 2	High School	15	0.569	0.65	0.29
21	Ramadhan et al., (2023)	elementary school	32	0.650	0.78	0.19
22	Putra et al., (2023)	Junior High School	31	0.411	0.44	0.19
23	Rayhan et al., (2023)	Junior High School	53	0.611	0.71	0.14
24	Supariyadi et al., (2022)	High School	24	0.464	0.50	0.22
25	Destriana et al., (2022)	Junior High School	60	0.751	0.98	0.13
26	Salamah & Setiawan, (2022)	Junior High School	82	0.547	0.61	0.11
27	Fadilla & Pudjijuniarto, (2022)	High School	27	0.416	0.44	0.20
28	Idham et al., (2022)	Elementary School	56	0.180	0.18	0.14
29	Putra et al., (2022)	High School	52	0.264	0.27	0.14
30	Damrah & Pitnawati, (2021)	Junior High School	29	0.220	0.22	0.20
31	Riyanto, (2020)	Junior High School	36	0.617	0.72	0.17
32	Sari, (2020)	Junior High School	32	0.830	1.19	0.19
33	Sobarna et al., (2020)	High school	75	-0.656	-0.79	0.12
34	Aryadi, (2020)	Junior High School	91	0.620	0.73	0.11

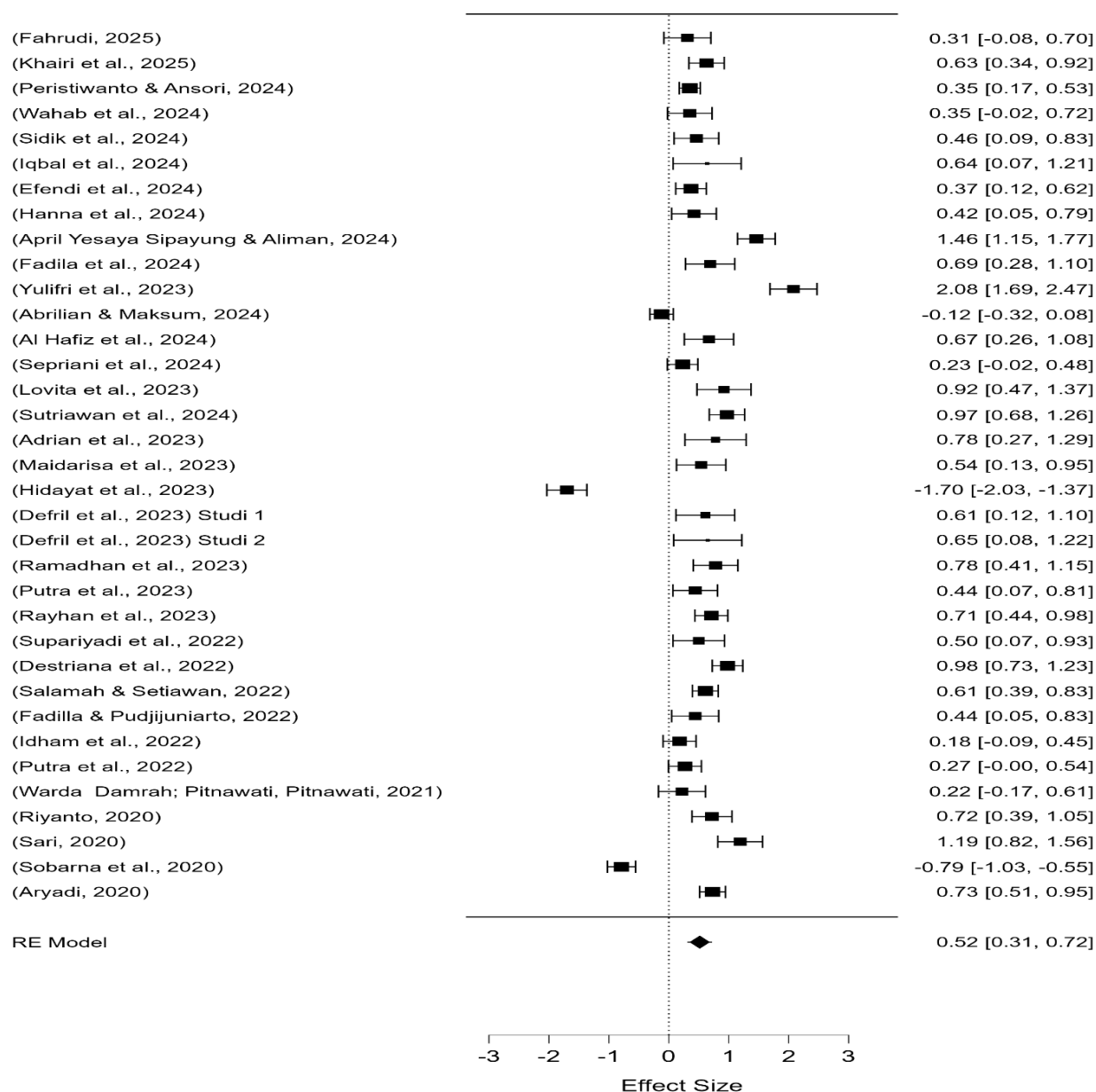


Figure 2. Forest.

Based on the results of the forest plot, it can be observed that the results of the analyzed research articles show variations in influence values ranging from -1.79 to 2.08. In addition, an average effect value of 0.52 was obtained. This value explains that the average influence of physical fitness on student learning outcomes is 52%, which is included in the moderate category. Based on the effect size classification, namely $r = 0.1$ (low), $r = 0.3$ (moderate), and $r = 0.5$ (high) (Cohen, 2013). Meanwhile, other factors influence 48% of the population.

1. Heterogeneity test

The fixed and random effects table analysis results indicate that the results of the 33 study effect sizes analyzed are heterogeneous ($Q = 489.803$; $0.01 < 0.05$).

Thus, the random effects model is more suitable for estimating the average effect size of the 34 studies to be analyzed.

Table 2
Fixed and random effects.

	Q_e	df	P
Omnibus Test of Model Coefficients	25,155	1	< .001
Residual Heterogeneity Test	489,803	33	< .001

The heterogeneity test results in this meta-analysis indicate a high variation between the studies analyzed. The tau-squared (τ^2) value of 0.337 with a 95% confidence interval of 0.208 to 0.591 indicates significant variance in effect sizes between studies that cannot be explained by sampling error alone. The tau (T) value, the square root of τ^2 , was recorded at 0.581

(95% CI: 0.456–0.769), reflecting the standard deviation of the actual effect between studies. Furthermore, the I^2 value of 93.092% (95% CI: 89.241–96.933) indicates that more than 93% of the variation in study results is due to actual heterogeneity, not random variation. This value is considered very high, thus reinforcing the need to use a random effects model *in* the analysis. In addition, the H^2 value of 14.476 (95% CI: 9.295–24.586) indicates a considerable ratio of total variance to random variance, further confirming substantial inhomogeneity between studies.

Table 3

Estimation of residual heterogeneity.

	Estimate	95% Confidence Interval	
		Lower	Upper
τ^2	0.337	0.208	0.591
T	0.581	0.456	0.769
I^2 (%)	93,092	89,241	96,933
H^2	14,476	9,295	24,586

2. Test hypothesis

The results of the interval coefficient table with a random effects model show a significant positive correlation between physical fitness and learning outcomes ($z = 5.015$; $p < 0.001$, 95%CI (0.315; 0.718).

Table 4

Test of the effect measurement model.

	Estimate	95% Confidence Interval				
		SE	Z	P	Lower	Upper
Intercept	0.516	0.103	5.015	< .001	0.315	0.718

3. Publication bias test

A publication bias test was conducted to assess whether the published data used in this study represented the population as a whole. The presence of publication bias can be identified by examining the values generated by the Rank Correlation and Regression methods.

Table 5

Rank correlation test for funnel plot asymmetry.

	τ Kendall	P
Ranking test	0.151	0.214

Based on Table 5, Rank Correlation Test for Funnel Plot Asymmetry, it can be seen that the Kendall value of 0.151 indicates that the correlation coefficient between the magnitude of the effect and the variance is not equal to 0 (Saradela et al., 2021). The p-value of 0.214 is greater than 0.05, which means there is no publication bias.

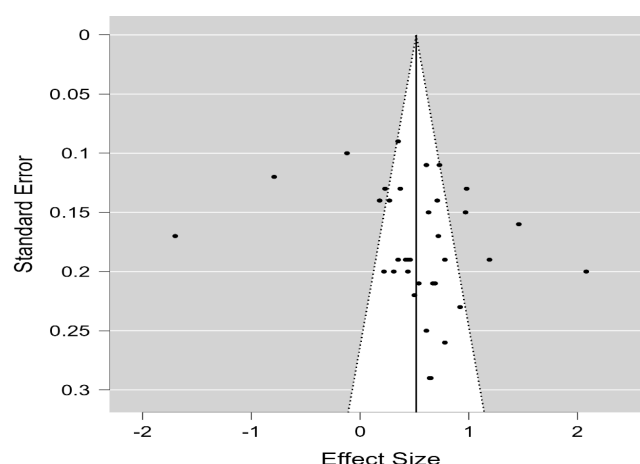
**Figure 3.** Regression test for funnel plot.

Figure 3 presents a regression test for the funnel plot, which indicates an imbalance in the data distribution, thus providing no firm evidence of symmetry in the results. This result requires further analysis using Egger's test to evaluate the degree of symmetry and confirm the validity of the findings regarding potential publication bias (Husein et al., 2025). The results of the Egger's test analysis, which provides a more in-depth look at this potential bias, are presented in Table 5.

Table 6

Regression test for funnel plot asymmetry ("Egger's Test").

	Z	P
Sei	1,323	0.186

The results in Table 6 show that the Egger test showed a p-value of 0.186, well above the 0.05 threshold. This indicates that the meta-analysis was free from publication bias (Sultan et al., 2023). To improve the accuracy and validity of the results, the data distribution trend was further analyzed using the Drawer Record Test analysis, better known as Fail-safe N, as shown in Table 6.

Table 7

Drawer record test.

	Fail-safe N	Significant Target	Observed Significant
Rosenthal	3839,000	0.050	< .001

The record drawer test analysis was used to estimate the number of articles with insignificant results that have not been published (Marks-Anglin & Chen, 2020). The results in the table show a fail-safe value of 3839,000. The analysis formula used is $5k + 10$, with k representing the number of data points analyzed. $K =$

34, so $5k + 10 = 5(34) + 10 = 180$. There is no publication bias in meta-analysis research if the record drawer test value is greater (Azzahrah et al., 2021). Thus, it can be concluded that the fail-safe N value of $3839,000 > 180$ indicates no publication bias in this study.

Discussion

Data were analyzed using an effect size test with the help of JASP software. Analysis with the Random Effects model showed a significant positive relationship between physical fitness and student learning outcomes ($z = 5.015$; $p < 0.001$; 95% CI: 0.315–0.718). The Rank Correlation results showed a Kendall's value of 0.151, and Egger's test produced a p value of 0.186, indicating no publication bias. Forest plot analysis showed that the combined effect size was in the medium category, with a value of 0.52 (-1.79; 2.08). There is a significant relationship between physical fitness and student learning outcomes.

Based on a systematic analysis of 34 scientific articles published between 2020 and 2025, consistent and significant evidence indicates a positive correlation between physical fitness and student learning outcomes. Maintaining physical fitness for school students is crucial because it can reduce the risk of cardiovascular disease and excess weight (Islam et al., 2023; Orłowski et al., 2011; Vasquez et al., 2025). Furthermore, physical fitness also positively impacts mental health, such as reducing symptoms of depression, anxiety, and stress (Elshaer & Zayed, 2022; Zheng et al., 2021).

Good physical fitness can play a significant role in normalizing blood pressure and improving lymphatic circulation, thus strengthening the body's physiological responses (Baruki et al., 2022; Silverman & Deuster, 2014). This increased circulation can benefit the brain, as it ensures an adequate supply of oxygen and nutrients, ultimately supporting students' concentration, memory, and critical thinking skills, especially for those who maintain a consistent level of physical fitness (Gu et al., 2016; Orłowski et al., 2011; Wenggaard et al., 2017). Furthermore, students with good levels of physical fitness tend to exhibit more optimal physiological responses. This condition provides various benefits, including supporting smooth blood flow throughout the body, including to the brain, which plays a vital role in supporting the learning process and cognitive function (Zavalishina et al., 2021).

The results of this study are in line with findings from various countries, which show that good physical fitness contributes positively to cognitive function, concentration, memory, and learning motivation of students (Andersen et al., 2016; Centeio et al., 2023; Fedewa & Ahn, 2011; Gu et al., 2016; Sasayama et al., 2019).

Students with reasonable fitness levels have a higher capacity to cope with academic pressure, demonstrate stronger mental resilience, and have the ability to maintain focus and attention for more extended periods. This also indirectly impacts the quality of the teaching and learning process in the school environment (Muratbayevich, 2024; Pérez-Maldonado et al., 2020; Santana et al., 2017). In the long term, physical fitness is also believed to shape the character of discipline, cooperation, and responsibility, which are important aspects in developing a holistic and competitive student profile (Gulo et al., 2024).

Therefore, implementing a physical fitness improvement program in the educational curriculum, particularly through the subject of Physical Education, Sports, and Health, is crucial. This program aims to improve physical aspects and serves as a strategic tool for developing students' cognitive and affective potential. This effort is increasingly relevant in the challenges of 21st-century education, where students are required to possess critical, collaborative, and adaptive thinking skills, all of which are significantly influenced by physical fitness and health (Zulpahmiri et al., 2024).

Physical fitness can be an effective strategy to support improved learning abilities, especially in the school-age population. Physical fitness is a goal in physical education and an integral part of the overall learning process. Therefore, every educational institution in Indonesia needs to view physical activity not merely as a supplement but as a crucial component in supporting students' maximum academic achievement.

Conclusion

There is a significant relationship between physical fitness and student learning outcomes. For further research, it is recommended to test other variables that may influence student learning outcomes. The limitation of this study lies in the focus of the analysis, which only covers the components of the relationship between physical fitness and student learning outcomes in schools in Indonesia. Therefore, further research will also analyze non-physical aspects. In addition, the data source used in this study only comes from Google

Scholar, and the scope of the research location is limited to Indonesia. Adding other databases and expanding the research area is hoped to result in new, more diverse and representative findings.

Acknowledgments

The researcher would like to thank the Faculty of Sport Science, Semarang State University, and colleagues for their assistance completing this article and the facilities supporting this research. Furthermore, the researcher would like to thank the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia for its support through the Unggulan Scholarship program, which made this research possible.

Authors' Contribution

Study Design: SI, UAA, HFS, MH; Data Collection: SI, UAA, HFS, MH, AKA, RK; Manuscript Preparation: SI, ISD, GGM.

Ethics Approval and Consent to Participate

Not applicable

Funding

No author has any financial interest or received any financial benefit from this research.

Conflict of Interest

The authors state no conflict of interest.

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