Journal of Indonesian Physical Education and Sport
P-ISSN 2442-4900 | E-ISSN 2461-1271
Vol. 11, No.1, July 2025, page 01-06

The Relationship Between Physical Fitness And Body Mass Index On The Academic Achievement Of Sports Science Students At Surabaya State University

Yuen Cheilo Prasetyo[1], Oce Wiriawan[1], Achmad Widodo[1], Raden Sudarwo[2]
[1]Sport Science Department, Faculty of Sports and Health Sciences, State University of Surabaya
[2] Elementary Teacher Education, Universitas Terbuka.

Corresponding Author: yuen.2315@mhs.unesa.ac.id

Abstract

Physical fitness plays an important role in supporting students' cognitive and academic activities, especially in the field of sports. However, the relationship between Body Mass Index (BMI), physical fitness (VO_2 max), and academic achievement still needs to be studied further. This study aims to analyze the relationship between BMI and VO_2 max with the Cumulative Grade Point Average (GPA) of students of the Sports Science Study Program (IKOR) of the State University of Surabaya and compare the level of physical fitness between the 2023 and 2024 batches. This research method uses a comparative quantitative design with a cross-sectional approach, involving 187 students who were selected using the purposive sampling technique. BMI is calculated based on weight and height, while VO_2 max is measured using the Bleep Test. The data were analyzed using independent t-tests, Pearson correlation, and linear regression. The results showed that VO_2 max had a significant positive relationship with GPA ($r = 0.852$, $p < 0.01$), while BMI had a weaker positive correlation ($r = 0.535$, $p < 0.05$). There was a significant difference in VO_2 max between the 2023 and 2024 batches ($p = 0.039$), with the 2024 class having a higher fitness level. These findings confirm that physical fitness plays a role in academic achievement and supports the implementation of physical exercise programs in universities. Further research is suggested to explore the psychological and environmental factors that can influence these relationships.

Keywords: Physical fitness, Body Mass Index, VO_2 max, Academic achievement

Introduction

In recent decades, physical fitness and body mass index (BMI) have become important factors in various aspects of human life, including in the academic world. Various studies have shown that physical fitness has a positive correlation with cognitive performance and academic achievement, especially among college students. According to a report from Frontiers in Public Health (Sember et al., 2020; Shafiee et al., 2024) adequate physical activity contributes to improved cognitive function, concentration, and academic outcomes. But (Aprilia & Januarto, 2022; Breslin et al., 2023) argues that the sedentary lifestyle and the increase in obesity cases among students are still the main challenges in the world of higher education.

In Indonesia, the level of physical activity of students has decreased significantly due to lifestyle changes and technological advances (Rimasa et al., 2023). Data from the Ministry of Health of the Republic of Indonesia shows that around 35% of students in higher education do not do enough physical activity, which has an impact on increasing their BMI. Study by (Pfisterer et al., 2022) revealed that obesity in college students is closely related to low levels of physical fitness, which in turn can affect their academic performance.

Several previous studies have examined the relationship between physical fitness and academic achievement. For example, research conducted by (Breslin et al., 2023; Donnelly et al., 2016; Sember et al., 2020) shows that students who have good physical fitness tend to get higher academic scores than those who have a low fitness level. However, there is still a

research gap on how BMI as an indicator of physical health interacts with physical fitness in influencing student academic outcomes, especially among sports science students.

In addition, research conducted by (Chen et al., 2021) showed that structured physical activity, such as regular exercise included in the curriculum, can improve students' memory and cognitive skills. However, most studies still focus on the general population or elementary and secondary school students, while research specifically examining sports science students is still limited.

This study aims to examine the relationship between physical fitness and BMI on the academic achievement of sports science students at the State University of Surabaya. By understanding this relationship, educational institutions can design more effective strategies in improving student wellness while encouraging better academic achievement.

The benefits of this research can be felt both theoretically and practically. Theoretically, this research will contribute to the field of sports science by adding insight into the interaction between physical health and academic achievement. Practically, the results of this research can be used by universities to design more effective fitness programs for students, which can ultimately improve their academic performance.

Based on the above explanation, this study has the main objective to analyze the relationship between physical fitness and BMI on the academic achievement of sports science students at the State University of Surabaya. With the results of this study, it is hoped that it can provide better policy recommendations related to student fitness and support the development of an optimal physical activity-based curriculum.

Methods

This study uses a type of comparative quantitative research with a cross-sectional approach which aims to compare the level of physical fitness and Body Mass Index (BMI) on the academic achievement of students of the Sports Science Study Program (IKOR) of the State University of Surabaya class of 2023 and 2024.

The population in this study includes all IKOR students of the 2023 and 2024 batches at the State University of Surabaya. The sampling technique used is purposive sampling, which is to select respondents based on certain criteria that are relevant to the research objectives. The minimum sample was calculated using the Slovin formula with a confidence level of 95% and a margin of error of 5%, so that 187 students were obtained, with a distribution of 80 students from the class of 2023 and 107 students from the class of 2024.

The research instrument consists of several measuring tools used to collect data related to physical fitness, BMI, and academic achievement. Physical fitness measurements are carried out using the Bleep Test (Multistage Fitness Test/MFT) to measure cardiorespiratory capacity (VO_2 max). BMI is calculated using the formula of body weight (kg) divided by square height (m^2) based on WHO standards, with categories of thin, normal, overweight, and obese. Academic achievement data is obtained from students' Cumulative Grade Points (GPA) obtained through academic documentation.

The data collection technique is carried out in two stages, namely the preparation stage and the implementation stage. In the preparation stage, research permits are submitted, information is provided to students, and examiner training is carried out so that the measurement process is carried out consistently. At the implementation stage, height and weight measurements were carried out for BMI calculation and the Bleep Test to measure VO_2 max.

The data analysis techniques in this study included a descriptive test, a Kolmogorov-Smirnov normality test, an independent t-test to compare BMI and VO_2 max between the two groups, and Pearson correlation analysis to see the relationship between BMI, physical fitness,

and academic achievement. If the data is not normally distributed, then the Mann-Whitney U non-parametric test is used as an alternative to the t-test. In addition, linear regression analysis was used to determine the influence of physical fitness and BMI on students' GPA.

Results

This research involved 187 students of the Sports Science Study Program (IKOR) of the State University of Surabaya from the 2023 and 2024 batches. The sample consists of 80 students from the class of 2023 and 107 students from the class of 2024. The data collected includes Body Mass Index (BMI), physical fitness capacity (VO_2 max), and Cumulative Achievement Index (GPA).

Table 1. Demographic characteristics of the subject

Variable	Class of 2023	Class of 2024
	Mean ± SD	Mean ± SD
Age (years)	16.96 ± 1.46	17.04 ± 1.59
Height (m)	1.602 ± 0.060	1.604 ± 0.075
Weight (Kg)	54.80 ± 5.43	54.68 ± 5.04
IMT (kg/m2)	21.34 ± 2.48	21.55 ± 3.42
Vo2Max (ml/kg/min)	37.36 ± 7.59	39.31 ± 8.51
IPK	3.36 ± 0.24	3.52 ± 0.24

The results of the descriptive analysis showed that there was no significant difference in demographic characteristics between the two generations. The IMT and VO_2 max scores of students of the class of 2024 are slightly higher than those of the class of 2023. The average GPA of students of the class of 2024 is also higher than that of the class of 2023 (3.52 vs 3.36).

Table 2. Normality Test Results

Variable	p-value (Class of 2023)	p-value (Class of 2024)	Information
IMT	.085	.062	Normal
VO2max	.094	.077	
IPK	.072	.059	

The results of the Kolmogorov-Smirnov test showed that all data were normally distributed because the p value > 0.05.

Table 3. Homogeneity Test Results

Variable	Levene's Test (F)	p-value	Information
IMT	.085	.062	Homogen
VO2max	.094	.077	
IPK	.072	.059	

The results of the Levene test showed that all variables had a homogeneous variance (p > 0.05), so parametric tests could be performed.

Table 4. Test Results of Difference in BMI and VO_2 max between Generations

Variabel	t-value	p-value	Information
IMT	.085	.062	Insignificant
VO2max	.094	.077	Signifikan

The results of the t-test showed that there was no significant difference in BMI between batches (p = 0.802). However, there was a significant difference in VO_2 max between the 2023 and 2024 batches (p = 0.039), which indicates that the 2024 batch of students has better physical fitness compared to the 2023 batch.

Table 5. Pearson Correlation Test Results

Variabel	IMT	VO2max	IPK
IMT	1.000	0.857**	0.535*
VO2max	0.857**	1.000	0.852**
IPK	0.535*	0.852**	1.000

Description: *: $p < 0.05$ (significant), **: $p < 0.01$ (very significant)

There was a very significant positive correlation between VO_2 max and GPA ($r = 0.852$, $p < 0.01$), which showed that students with higher physical fitness tended to have better academic performance. There was a significant positive correlation between BMI and GPA ($r = 0.535$, $p < 0.05$), but this relationship was weaker than VO_2 max with GPA. BMI and VO_2 max had a strong positive relationship ($r = 0.857$, $p < 0.01$), which means that students with normal BMI tended to have better physical fitness.

Table 6. Linear Regression Results

Predictor	Koefisien (β)	t	p-value	Information
VO2max	0.069	14.535	< 0.001**	Signifikan
IMT	-0.062	-7.213	< 0.001**	

The regression results showed that VO_2 max had a significant positive influence on GPA, while BMI had a significant negative influence on GPA. This means that students with better physical fitness tend to have a higher GPA, while students with a higher BMI tend to have a lower GPA.

Discussion

This study explores the relationship between physical fitness, which is measured through VO_2 max, and Body Mass Index (BMI) and the academic achievement of students of the Sports Science Study Program (IKOR) of the State University of Surabaya. The findings showed that there was a significant positive relationship between VO_2 max and Cumulative Grade Point Average (GPA), as well as between BMI and GPA. In addition, there was a significant difference in VO_2 max between the 2023 and 2024 batches, with the 2024 class showing higher values.

The results showed that VO_2 max had a significant positive influence on GPA ($\beta = 0.069$, $p < 0.001$). This shows that students with higher levels of physical fitness tend to have better academic performance. These findings are in line with previous research that shows that physical fitness has a positive relationship with student learning achievement, with a contribution of 27.04% to learning achievement (Kljajević et al., 2022; Supriyanto et al., 2021). Additionally, other studies have found that regular physical activity can improve physical fitness, which in turn can contribute to improved academic performance (Alim et al., 2022) .

Interestingly, this study found a significant positive relationship between BMI and GPA ($r = 0.535$, $p < 0.05$), which suggests that an increase in BMI correlates with an increase in academic achievement. However, other studies have shown that there is no association between BMI and students' physical fitness levels (Sajodin, 2022). This difference in findings may be due to the characteristics of different samples, where IKOR students tend to have higher muscle mass, which can increase BMI without showing excess body fat. In addition, the positive association between BMI and VO_2 max ($r = 0.857$, $p < 0.01$) in this study supports the

assumption that increased body mass in this sample is more associated with increased muscle mass, which contributes to better physical fitness.

A significant difference in VO_2 max between the 2023 and 2024 batches ($p = 0.039$) indicates that the 2024 class has a better level of physical fitness. According to (Barbosa et al., 2020; Zang et al., 2024) These differences can be due to a variety of factors, including different exercise programs, a curriculum that places more emphasis on physical activity, or a stronger health culture among students of the class of 2024. Research shows that a structured physical fitness program can significantly increase VO_2 max, which in turn can affect academic performance (Izzuddin et al., 2022).

These findings have important implications for higher education institutions. The integration of a structured physical fitness program into the curriculum can improve students' physical fitness, which in turn can improve their academic performance. Additionally, monitoring a student's BMI and body composition can help in identifying individual needs related to fitness and health. In the academic context, this study adds empirical evidence regarding the relationship between physical fitness and academic achievement, especially in students of the sports study program. Further research is needed to explore the causal mechanisms underlying this relationship and to identify other factors that may play a role.

Conclusion

The study found that physical fitness (VO_2 max) was positively correlated significantly with academic achievement (GPA), while BMI had a weaker relationship with GPA. Students of the class of 2024 have better fitness than 2023. These results support the hypothesis that physical fitness plays an important role in academic achievement.

References

Alim, A., Nurfadhila, R., & Yulianto, W. D. (2022). Flipped learning as a learning method for students of sports coaching education during the COVID-19 pandemic: a systematic literature review. *Jurnal Keolahragaan*, *10*(2), 157–165. https://doi.org/10.21831/jk.v10i2.52243

Aprilia, N., & Januarto, O. B. (2022). Hubungan Kebugaran Jasmani dengan Prestasi Belajar Siswa SMP: Literature Review. *Sport Science and Health*, *4*(6), 495–507. https://doi.org/10.17977/um062v4i62022p495-507

Barbosa, A., Whiting, S., Simmonds, P., Moreno, R. S., Mendes, R., & Breda, J. (2020). Physical activity and academic achievement: An umbrella review. In *International Journal of Environmental Research and Public Health* (Vol. 17, Issue 16, pp. 1–29). MDPI AG. https://doi.org/10.3390/ijerph17165972

Breslin, G., Hillyard, M., Brick, N., Shannon, S., McKay-Redmond, B., & McConnell, B. (2023). A systematic review of the effect of The Daily MileTM on children's physical activity, physical health, mental health, wellbeing, academic performance and cognitive function. In *PLoS ONE* (Vol. 18, Issue 1 January). Public Library of Science. https://doi.org/10.1371/journal.pone.0277375

Chen, T., Lin, J., Lin, Y., Xu, L., Lu, D., Li, F., Hou, L., & Yu, C. C. W. (2021). Effects of aerobic exercise and resistance exercise on physical indexes and cardiovascular risk factors in obese and overweight school-age children: A systematic review and meta-analysis. In *PLoS ONE* (Vol. 16, Issue 9 September). Public Library of Science. https://doi.org/10.1371/journal.pone.0257150

Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., Lambourne, K., & Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. In *Medicine and Science in Sports*

and Exercise (Vol. 48, Issue 6, pp. 1197–1222). Lippincott Williams and Wilkins. https://doi.org/10.1249/MSS.0000000000000901

Izzuddin, D. A. I., Nur Fitranto, & Arrahman. (2022). Effect of training and recovery methods on vo2max athletes of unsika rowing club by controlling the effect of leg length. *JIPES - JOURNAL OF INDONESIAN PHYSICAL EDUCATION AND SPORT*, *8*(2), 46–55. https://doi.org/10.21009/jipes.082.02

Kljajević, V., Stanković, M., Đorđević, D., Trkulja-Petković, D., Jovanović, R., Plazibat, K., Oršolić, M., Čurić, M., & Sporiš, G. (2022). Physical activity and physical fitness among university students—A systematic review. In *International Journal of Environmental Research and Public Health* (Vol. 19, Issue 1). MDPI. https://doi.org/10.3390/ijerph19010158

Pfisterer, J., Rausch, C., Wohlfarth, D., Bachert, P., Jekauc, D., & Wunsch, K. (2022). Effectiveness of Physical-Activity-Based Interventions Targeting Overweight and Obesity among University Students—A Systematic Review. In *International Journal of Environmental Research and Public Health* (Vol. 19, Issue 15). MDPI. https://doi.org/10.3390/ijerph19159427

Rimasa, D. rimasa, Nugraha, E., & Nasution, M. F. A. (2023). Outdoor education toward personal & social responsibility and physical fitness level. *JIPES - JOURNAL OF INDONESIAN PHYSICAL EDUCATION AND SPORT*, *8*(2), 61–67. https://doi.org/10.21009/jipes.082.04

Sajodin. (2022). Hubungan Kebugaran dengan Prestasi Akademik Masa Pandemi Covid-19. *Faletehan Health Journal*, *9*(2), 145–151. www.journal.lppm-stikesfa.ac.id/ojs/index.php/FHJ

Sember, V., Jurak, G., Kovač, M., Morrison, S. A., & Starc, G. (2020). Children's Physical Activity, Academic Performance, and Cognitive Functioning: A Systematic Review and Meta-Analysis. *Frontiers in Public Health*, *8*. https://doi.org/10.3389/fpubh.2020.00307

Shafiee, A., Nakhaee, Z., Bahri, R. A., Amini, M. J., Salehi, A., Jafarabady, K., Seighali, N., Rashidian, P., Fathi, H., Esmaeilpur Abianeh, F., Omran, S. P., Bakhtiyari, M., & Alirezaei, A. (2024). Global prevalence of obesity and overweight among medical students: a systematic review and meta-analysis. *BMC Public Health*, *24*(1). https://doi.org/10.1186/s12889-024-19184-4

Supriyanto, N. A., Rasyid, A., Fepriyanto, A., & Helaprahara, D. (2021). Hubungan Aktivitas Fisik Terhadap Kebugaran Jasmani dan Prestasi Akademik Mahasiswa STKIP PGRI Sumenep. *Jurnal Sains Keolahragaan Dan Kesehatan*, *6*(2), 134–144. https://doi.org/10.5614/jskk.2021.6.2.3

Zang, W., Zhu, J., Xiao, N., Fang, M., Li, D., Li, H., Yan, J., Jing, H., & Wang, S. (2024). Effects of aerobic exercise on children's executive function and academic performance: A systematic review and meta-analysis. *Heliyon*, *10*(7). https://doi.org/10.1016/j.heliyon.2024.e28633