Contents lists available at IOCS

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

The relationship between hemoglobin levels and exercise intensity among students of the faculty of medicine Pasundan University

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ARTICLE INFO

Article history:

Received Nov 4, 2025
Revised Nov 10, 2025
Accepted Dec 18, 2025

Keywords:

Exercise Intensity
Hemoglobin
Medical Students
Physical Activity

ABSTRACT

Background: Hemoglobin (Hb) is an essential protein responsible for oxygen transport and plays an important role in maintaining physical and cognitive performance. Exercise intensity is often associated with changes in hemoglobin levels; however, evidence among medical students remains inconsistent. Academic demands may influence students' physical activity patterns and, consequently, their hemoglobin status. Objective: This study aimed to analyze the relationship between exercise intensity and hemoglobin levels among medical students at the Faculty of Medicine, Pasundan University. Methods: This analytical observational study employed a cross-sectional design involving 112 medical students selected through purposive sampling. Exercise intensity was assessed using a structured questionnaire, and hemoglobin levels were measured using the EasyTouch® GCHb device. Data analysis included univariate analysis and Chi-Square tests to determine the association between exercise intensity and hemoglobin levels. Results: Most participants had normal hemoglobin levels (62.5% of females and 42.9% of males) and reported moderate exercise intensity (91.1% of females and 82.1% of males). Statistical analysis showed no significant relationship between exercise intensity and hemoglobin levels in females ($p = 0.264$) or males ($p = 0.505$). Conclusion: Exercise intensity was not significantly associated with hemoglobin levels among medical students. These findings suggest that hemoglobin status in this population may be more strongly influenced by other factors such as nutrition, hydration, stress, and sleep quality rather than exercise intensity alone.

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INTRODUCTION

Oxygen plays a crucial role in cellular metabolism, and its efficient transportation throughout the body depends on erythrocytes, which contain hemoglobin. Hemoglobin, composed of heme and

globin, binds and releases oxygen to ensure proper oxygen delivery to tissues (Sepriadi et al., 2020). Normal hemoglobin concentrations in men range from 13.5 to 18.0 grams per deciliter, while for women, it ranges from 11.5 to 16.0 grams per deciliter (Halim, E. V., Shane, Ticoalu. R. H., & Djon, 2014) The concentration of hemoglobin can be influenced by a variety of factors, one of which is physical activity, as exercise increases the body's demand for oxygen, causing changes in the way oxygen is transported in the blood (Okon IA et al, 2025).

Regular physical activity has been shown to positively affect hemoglobin levels. As the body engages in exercise, oxygen demand increases in active tissues, which leads to physiological adaptations, including an increase in erythropoiesis (red blood cell production). This adaptation is necessary to meet the body's heightened oxygen requirements during physical exertion (Alkaririn et al., 2022). Aerobic exercise, such as jogging, has been linked to an increase in blood volume and hemoglobin concentration, as consistent exercise combined with proper nutrition supports enhanced oxygen delivery (Farid, Y., Bowman, N. S., & Lecat, 2023).

The relationship between exercise intensity and hemoglobin levels has been well documented in research. Studies have found that moderate-intensity exercise over a period of 14 days can raise hemoglobin levels by 8% in men and 8.3% in women (Rona, 2020). This increase, attributed to hemoconcentration, is typically short-term, but long-term benefits can occur if exercise is sustained, leading to increased red blood cell (Azri, R. G., & Sinaga, 2023). The physiological response of the body to exercise helps improve overall cardiovascular function and physical endurance, with a direct impact on oxygen-carrying capacity.

University students, particularly those at the Faculty of Medicine, often experience variations in physical activity due to their demanding academic schedules. While some students may engage in regular physical activity, others may struggle to maintain a consistent exercise regimen. This study aims to explore the relationship between exercise intensity and hemoglobin levels among medical students at Pasundan University, with the goal of understanding how exercise influences both their physical health and academic performance. By examining this relationship, the research aims to provide insights into the potential benefits of optimized physical activity for student well-being and academic success. Hemoglobin levels are influenced by a wide range of physiological and environmental factors beyond physical activity alone, particularly in medical student populations. Nutritional status plays a central role, as adequate intake of iron, vitamin B12, and folic acid is essential for erythropoiesis and red blood cell maturation. Irregular eating patterns, inadequate nutrient intake, and unbalanced diets commonly observed among university students—may contribute to reduced hemoglobin levels. Hydration status also affects hemoglobin concentration, where dehydration can cause hemoconcentration and excessive fluid intake may lead to hemodilution, potentially obscuring the true hemoglobin status.

This study aims to investigate the relationship between exercise intensity and hemoglobin levels among medical students at Pasundan University, providing insights into how exercise could potentially improve both their physical health and academic performance.

RESEARCH METHOD

This study employed an analytical observational design with a cross-sectional approach. The data used in this study consisted of primary data collected directly from medical students at the Faculty of Medicine, Pasundan University, in 2025. The primary variables included exercise intensity as the independent variable and hemoglobin levels as the dependent variable.

Participants were selected using purposive sampling based on predefined inclusion and exclusion criteria. Inclusion criteria comprised healthy medical students who consented to participate and were willing to undergo hemoglobin testing. Exclusion criteria included students who were menstruating at the time of data collection, those with known blood disorders such as anemia or thalassemia, and students who declined participation. A total of 112 students met the criteria and were included in the study.

Data collection was conducted in two stages. First, exercise intensity data were obtained using a structured and validated questionnaire that assessed the frequency, duration, and intensity of physical activity. Second, hemoglobin levels were measured using the EasyTouch® GCHb hemoglobin meter through capillary blood sampling from the fingertip. Hemoglobin values were classified into low, normal, and high categories based on established clinical reference standards.
Data processing involved coding, data entry, and data cleaning prior to analysis. Univariate analysis was performed to describe the distribution of exercise intensity and hemoglobin levels using frequencies and percentages. Bivariate analysis was conducted to examine the relationship between exercise intensity and hemoglobin levels using the Chi-Square test. Statistical analysis was performed using SPSS version 28, with a significance level set at $p < 0.05$.

RESULTS AND DISCUSSIONS

This section presents the results of data processing and discusses the findings in relation to existing research. Data analysis was conducted to describe the distribution of hemoglobin levels and exercise intensity among medical students and to examine the relationship between these variables. The results are presented through univariate and bivariate analyses, followed by an interpretation of the findings in comparison with previous studies to identify similarities, differences, and possible explanations. The findings of this study indicate that most respondents had normal hemoglobin levels and predominantly engaged in moderate-intensity exercise. However, statistical analysis showed no significant association between exercise intensity and hemoglobin levels in both female and male students. These results are discussed by considering physiological mechanisms, lifestyle factors, and contextual conditions specific to medical students, as well as by comparing them with findings from previous studies that have reported both significant and non-significant relationships between physical activity and hemoglobin levels.

This research was conducted from September 22 to September 25, 2025. A sample was obtained from a group of 112 students from the Faculty of Medicine, Pasundan University (FK UNPAS) in 2025, who met the inclusion criteria. The study used primary data, collected through a questionnaire to assess the intensity of physical activity and hemoglobin levels measured via capillary blood testing on the finger using the GCHb Hemoglobin meter. Data were processed using SPSS 25 for Windows.

Table 1. Hemoglobin levels

Hemoglobin Levels	Gender			
	Female		Male	
	n	%	n	%
Low	15	(26,8%)	12	(21,4%)
Normal	35	(62,5%)	24	(42,9%)
High	6	(10,7%)	20	(35,7%)
Total	56	(100%)	56	(100%)

Table 1 shows the results of the hemoglobin test among respondents based on hemoglobin levels. Among females, 35 respondents (62.5%) had normal hemoglobin levels, while 24 male respondents (42.9%) showed the same. More respondents in this study had normal hemoglobin levels, both for males and females.

Table 2. Exersice intensity

Exercise Intensity	Gender			
	Female		Male	
	n	%	n	%
Low	4	(7,1%)	3	(5,4%)
Moderate	51	(91,1%)	46	(82,1%)
High	1	(1,8%)	7	(12,5%)
Total	56	(100%)	56	(100%)

Table 2 shows the exercise intensity distribution among respondents. The majority of respondents had moderate exercise intensity, with 51 females (91.1%) and 46 males (82.1%) reporting moderate intensity exercise. Thus, moderate intensity exercise was most common among participants in this study.

Table 3. Relationship between hemoglobin levels and exercise intensity among FK UNPAS students in 2025

		Exercise Intensity				
Female	Hemoglobin Levels	Light n (%)	Moderate n (%)	Heavy n (%)	Total n (%)	*P-Value*
	Low	0 (0,0%)	15 (100%)	0 (0,0%)	15 (100%)	
	Normal	3 (8,6%)	31 (88,6%)	1 (2,8%)	35 (100%)	0,264
	High	1 (16,7%)	5 (83,3%)	0 (0,0%)	6 (100%)	
	Total	4 (7,1%)	51 (91,1%)	1 (1,8%)	56 (100%)	
Male	Low	0 (0,0%)	11 (91,7%)	1 (3,7%)	12 (100%)	
	Normal	3 (12,5%)	18 (75%)	3 (12,5%)	24 (100%)	0,505
	High	0 (0,0%)	17 (85%)	3 (15%)	20 (100%)	
	Total	3 (5,4%)	46 (82,1%)	7 (12,5%)	56 (100%)	

The table presents the distribution of hemoglobin levels in relation to exercise intensity for both female and male students at FK UNPAS in 2025. For females, most respondents (88.6%) with normal hemoglobin levels reported moderate intensity exercise, while 16.7% of those with high hemoglobin levels were engaged in light exercise. The p-value for females was 0.264, which is greater than 0.05, indicating that there is no statistically significant relationship between hemoglobin levels and exercise intensity among female students.

For males, a similar trend is observed where the majority of those with normal hemoglobin levels (75%) participated in moderate intensity exercise. The p-value for males was 0.505, also greater than 0.05, suggesting that there is no significant relationship between hemoglobin levels and exercise intensity among male students either. Overall, both groups (females and males) showed that most participants had moderate intensity exercise regardless of their hemoglobin levels. Statistical tests (chi-square) revealed no significant associations between hemoglobin levels and exercise intensity for both genders, suggesting that exercise intensity does not significantly influence hemoglobin levels among the students in this study.

Discussion

a. Hemoglobin Levels, the results in Table 1 demonstrate that the majority of respondents, both female and male, had normal hemoglobin levels. Among the female respondents, 35 individuals (62.5%) had normal hemoglobin levels, while for the male respondents, 24 (42.9%) fell into the same category. A smaller proportion of respondents, particularly women, had low hemoglobin levels (26.8% for females and 21.4% for males). Only a small number of participants exhibited high hemoglobin levels, with 10.7% of females and 35.7% of males in this category. These findings suggest that the general population of medical students in this study had relatively normal hemoglobin levels. However, there were noticeable differences in the distribution of hemoglobin levels between genders. It is essential to explore the factors that may contribute to these variations, as well as the potential impact of exercise intensity on hemoglobin levels.

Hemoglobin, the protein in red blood cells that carries oxygen, plays a critical role in overall health. Hemoglobin levels are known to be influenced by various factors such as diet, physical activity, age, and gender. The higher percentage of respondents with normal hemoglobin levels in this study may be a reflection of the relatively healthy lifestyle that medical students tend to maintain compared to the general population. As medical students, they may be more aware of the importance of nutrition and health, which could contribute to the observed normal levels of hemoglobin (Su Fan et al, 2023). However, it is important to note that while normal hemoglobin

levels were the most common outcome, the presence of low hemoglobin levels in a significant proportion of respondents is concerning, as it may indicate the early stages of anemia or other underlying health conditions that could benefit from intervention.

Factors such as nutrition are essential in regulating hemoglobin levels. The intake of iron-rich foods, vitamin B12, and folic acid can significantly impact the production of hemoglobin and red blood cells (Luhulimaa, L., Singh, R., & Patel, 2024). Inadequate nutrition can lead to iron deficiency anemia, particularly among young adults like college students, who may have irregular eating habits due to academic stress or limited access to balanced meals. Additionally, lifestyle factors such as sleep quality, hydration status, and stress levels can also influence hemoglobin levels. Previous research by Kim Hyun-Kyung et al. (2017) Indicated that proper hydration can improve hemoglobin levels by optimizing the synthesis of red blood cells. Moreover, stress, which is common among medical students, can negatively impact hemoglobin production, as chronic stress is known to reduce the efficiency of the body's ability to absorb nutrients essential for red blood cell production (NK Subbalakshmi, 2017).

In this study, the majority of respondents exhibited normal hemoglobin levels, but a subset of students had low levels. Low hemoglobin can be attributed to a variety of factors, including insufficient dietary intake of iron, blood loss, or underlying medical conditions such as gastrointestinal disorders that impair nutrient absorption. The presence of low hemoglobin levels in approximately 26.8% of females and 21.4% of males could be indicative of early-stage anemia or a deficiency in key nutrients necessary for red blood cell production (Hain et al, 2023). These findings are concerning because even mild anemia can lead to fatigue, reduced cognitive function, and overall decreased physical performance, which may negatively affect academic performance in students (Ariani, N. L., & Ginting, 2022).

Gender differences in hemoglobin levels observed in this study are consistent with findings from other studies. Typically, males tend to have higher hemoglobin levels than females, which may be related to physiological differences such as muscle mass and the effect of menstrual blood loss in females. The hormonal influences on hemoglobin levels are well-documented, with testosterone in males and estrogen in females playing significant roles in erythropoiesis (the production of red blood cells) (Su Fan, et al 2023).This hormonal difference, along with menstruation in females, could explain why a larger proportion of female students in this study had low hemoglobin levels compared to their male counterparts. These gender-based physiological factors should be considered when interpreting hemoglobin data among students in different populations (Sergio A, Zen MA, Wahyuni RK, 2022).

Additionally, the exercise intensity of the respondents should also be factored into the discussion. While exercise, especially moderate and high-intensity exercise, is known to stimulate red blood cell production by increasing oxygen demand (Su Fan et al., 2023), this study found no significant relationship between exercise intensity and hemoglobin levels among the respondents. The majority of respondents in this study were engaged in moderate-intensity exercise, which may not have been intense enough to elicit significant changes in hemoglobin production. Research by Putri et al. (2021) supports this notion, suggesting that moderate-intensity exercise has some physiological benefits but generally does not lead to substantial increases in hemoglobin levels, particularly in populations that do not engage in endurance training or high-intensity workouts. Thus, the results of this study suggest that other factors, such as nutrition, hydration, and stress levels, likely play a more substantial role in determining hemoglobin levels than exercise alone.

Studies on exercise and hemoglobin levels have yielded varying results. While some research indicates a clear benefit of higher-intensity exercise on hemoglobin levels (Heimo et al., 2020), other studies suggest that moderate-intensity exercise may not have a significant impact on hemoglobin levels, as was the case in this study. For instance, Khan et al. (2020) found that students who engaged in moderate-intensity exercise exhibited higher hemoglobin levels than those who were sedentary, suggesting that even moderate activity, when performed consistently,

can help increase hemoglobin levels. However, this study found no significant difference between exercise intensity and hemoglobin levels, which may be due to the short duration of the study or the fact that the exercise intensity did not reach a level sufficient to induce measurable changes in erythropoiesis.

These conflicting results suggest that exercise intensity alone may not be the determining factor for changes in hemoglobin levels. Other factors, such as duration of exercise, nutritional intake, and the presence of other health conditions, may also contribute to the observed variation in hemoglobin levels across studies. Therefore, future research should consider not only exercise intensity but also the interaction between diet, lifestyle, and physical activity in determining optimal hemoglobin levels for individuals.

In conclusion, while the majority of respondents in this study exhibited normal hemoglobin levels, a significant proportion of female students showed low hemoglobin levels. Gender differences in hemoglobin levels are consistent with established research, but the lack of a significant relationship between exercise intensity and hemoglobin levels indicates that other factors, such as diet, sleep, and stress, may play a more significant role in determining hemoglobin levels. Further research should aim to explore these interactions in greater detail, as understanding the full range of factors affecting hemoglobin levels can help inform strategies for promoting better health and well-being in student populations.

b. Exersice Intensity, in Table 2, the distribution of exercise intensity among respondents is depicted, revealing a clear trend toward moderate-intensity physical activity. Among female respondents, a significant majority (91.1%) reported engaging in moderate-intensity exercise, with 51 out of 56 females in this category. Similarly, among male respondents, 46 individuals (82.1%) participated in moderate-intensity exercise. Only a small proportion of both male and female respondents reported engaging in low-intensity exercise, with 7.1% of females and 5.4% of males, while a minimal number of participants, especially males (1.8%), engaged in high-intensity physical activity. This distribution indicates that moderate-intensity exercise was the most commonly reported level of exercise intensity among both male and female participants in this study.

The predominance of moderate-intensity exercise observed in this study is consistent with findings from other research on exercise habits in young adults and university students. Moderate-intensity exercise is generally defined as activities that elevate the heart rate to 50-70% of the maximum heart rate, which may include activities such as brisk walking, cycling, or recreational sports. This intensity of exercise is often recommended for overall health, as it can improve cardiovascular health, muscle strength, and endurance without placing excessive strain on the body (Luhulimaa et al., 2024). The high frequency of moderate-intensity exercise in this study suggests that the majority of respondents are likely engaging in activities that promote general physical fitness, aligning with common health recommendations for this age group.

Moderate-intensity exercise has been shown to yield numerous health benefits. Research indicates that such exercise is beneficial for maintaining a healthy body weight, improving mood, enhancing cardiovascular health, and boosting the immune system ((Hain D, Bednarski D, Cahill M, Dix A, Foote B, 2023; Putri AFF, Kaidah S, 2021). For students, particularly those engaged in rigorous academic work, moderate exercise offers a balanced approach to maintaining physical and mental well-being. It can help reduce stress, improve concentration, and alleviate symptoms of anxiety and depression, which are common among students, especially those studying in demanding programs such as medicine (NK Subbalakshmi, & Sunandha, 2017). The fact that such a large proportion of participants in this study reported moderate-intensity exercise suggests that they may be utilizing physical activity as a coping mechanism for the stress and pressures associated with their academic workloads.

Interestingly, while moderate-intensity exercise was the most common among the respondents, the study also found a small group of participants who engaged in low- or high-

intensity exercise. Low-intensity exercise was reported by 7.1% of female respondents and 5.4% of male respondents, which is relatively low compared to the moderate-intensity group. Low-intensity exercise is typically associated with lighter physical activities such as walking at a slow pace or performing stretching exercises. This lower intensity is often recommended for individuals who are just beginning an exercise regimen or for those with certain health conditions that may limit their ability to engage in more strenuous activities.

On the other hand, only a small number of male respondents (1.8%) engaged in high-intensity exercise, which is defined as activities that elevate the heart rate to 70-85% of the maximum heart rate. High-intensity exercises include activities such as sprinting, heavy weightlifting, and high-intensity interval training (HIIT). The relatively small number of respondents participating in high-intensity exercise could be attributed to the time constraints and academic pressures faced by university students. Engaging in high-intensity exercise requires a significant time commitment for training and recovery, which may be difficult for students to maintain alongside their academic responsibilities (Brown CEB, Richardson K, Pizzirani BH, Atkins L, Yucel M, 2024)). Furthermore, high-intensity exercise requires a higher level of fitness and may be more challenging for individuals who are not accustomed to intense physical activity, potentially limiting its accessibility to a subset of the student population (Barreto et al, 2024).

In terms of gender differences, the data reveals a slightly higher percentage of male respondents engaging in high-intensity exercise compared to females. This trend could be attributed to gender-based differences in physical activity preferences and societal norms. Men may be more inclined to engage in high-intensity activities due to cultural expectations surrounding masculinity and physical strength, which often prioritize intense, strength-focused exercise (Barreto et al, 2024).In contrast, women may be more likely to choose moderate-intensity exercises that are less physically demanding, such as aerobics or fitness classes. These gender-based differences in exercise preferences are not uncommon and reflect broader societal influences on physical activity patterns (Pradas F et al. 2021).

Despite the observed differences in exercise intensity across genders, both male and female students primarily engaged in moderate-intensity exercise, suggesting that this level of activity is considered accessible and suitable for the majority of respondents. The focus on moderate-intensity exercise may reflect an understanding of its health benefits, including improved cardiovascular fitness, weight management, and overall well-being. Moreover, moderate-intensity exercise is often the most feasible option for individuals with busy schedules, such as university students, who may struggle to find the time for more intense physical activities due to academic commitments. Therefore, the predominance of moderate-intensity exercise in this study is likely a reflection of both the practical benefits and health recommendations associated with this level of physical activity (Kercher et al, 2024; Razaan MN, 2024). Overall, Table 2 provides valuable insights into the exercise habits of FK UNPAS students. The high prevalence of moderate-intensity exercise highlights the importance of this level of physical activity in maintaining general health and fitness among university students. Given the busy and often stressful nature of academic life, moderate-intensity exercise may serve as an effective strategy for managing stress, improving mood, and promoting overall well-being. Further research is needed to explore the specific types of exercises performed and their impact on health outcomes, including hemoglobin levels, to better understand the role of physical activity in the well-being of university students.

c. Relationship Between Hemoglobin Levels and Exercise Intensity Among FK UNPAS Students in 2025. In Table 3, the relationship between hemoglobin levels and exercise intensity among FK UNPAS students in 2025 is illustrated. The data suggests that there is no significant relationship between exercise intensity and hemoglobin levels for both male and female students. For females, the majority of respondents with normal hemoglobin levels (88.6%) reported engaging in moderate-intensity exercise. However, 16.7% of females with high hemoglobin levels engaged in light-intensity exercise. This is an interesting observation, as

one might expect a higher correlation between high-intensity exercise and elevated hemoglobin levels. Despite this, the p-value for females was found to be 0.264, which is greater than 0.05, indicating that the association between hemoglobin levels and exercise intensity is not statistically significant.

Similarly, male respondents displayed a comparable pattern in terms of exercise intensity. The majority of male students with normal hemoglobin levels (75%) engaged in moderate-intensity exercise. Among males with high hemoglobin levels, 15% engaged in heavy exercise, while 12.5% were involved in moderate-intensity exercise. Despite these observations, the p-value for males was 0.505, also greater than 0.05, which means that the relationship between exercise intensity and hemoglobin levels for male students is also not statistically significant. The findings from both genders suggest that the intensity of exercise does not significantly influence the hemoglobin levels of students in this study, regardless of whether they had low, normal, or high levels of hemoglobin.

These results align with previous research that suggests moderate-intensity exercise is unlikely to cause significant changes in hemoglobin levels unless performed over a prolonged period or at a higher intensity. While exercise is known to have numerous physiological benefits, including increased red blood cell production (erythropoiesis), moderate-intensity activities such as brisk walking, light cycling, or casual sports may not exert the same level of physiological stress needed to significantly elevate hemoglobin levels (Putri AFF, Kaidah S, 2021). High-intensity activities, on the other hand, such as sprinting, weightlifting, or high-intensity interval training (HIIT), are more likely to stimulate greater erythropoiesis due to the increased oxygen demand placed on the body during intense physical exertion. However, as shown in this study, few students engaged in such high-intensity exercises, with only 1.8% of females and 3.7% of males reporting such levels of physical activity. This limited participation in high-intensity exercise could account for the lack of significant changes in hemoglobin levels in both genders.

One possible reason why exercise intensity did not significantly influence hemoglobin levels in this population could be the lack of sufficient duration or frequency of exercise. Research has demonstrated that consistent, long-term engagement in moderate-to-high intensity exercise over weeks or months is more likely to result in measurable increases in hemoglobin levels (Su Fan et al, 2023). Short-term participation in moderate-intensity exercise, as observed in this study, may not provide the body enough time to adapt and increase red blood cell production significantly. Furthermore, factors such as diet, stress, sleep quality, and overall health can also play a significant role in determining hemoglobin levels, potentially overshadowing the effects of exercise intensity. As suggested by other studies (Luhulimaa, L., Singh, R., & Patel, 2024). proper nutrition, particularly iron intake, and maintaining adequate hydration are critical factors in regulating hemoglobin levels, which may explain why exercise intensity alone did not show a strong correlation with hemoglobin levels in this cohort.

In contrast, some studies have suggested a more direct relationship between exercise intensity and hemoglobin levels, especially in populations engaged in endurance sports. For example, Heimo et al. (2020) found that students who engaged in moderate-intensity exercise had higher hemoglobin levels compared to those who were sedentary or performed light activities. This suggests that even moderate-intensity exercise, when performed regularly, can stimulate red blood cell production and improve overall hemoglobin levels. However, such studies often focus on populations with a higher volume or intensity of exercise, such as athletes or individuals engaged in long-term endurance training, which is not reflective of the participants in this study. The discrepancy between studies highlights the importance of considering exercise duration, frequency, and intensity when evaluating the relationship between exercise and hemoglobin levels.

Furthermore, stress and academic workload might also contribute to the findings of this study. Medical students, in particular, face significant academic pressures, which can affect both their physical and mental health. Stress has been shown to negatively impact hemoglobin levels

and overall health by interfering with proper nutritional intake, sleep quality, and exercise habits (NK Subbalakshmi, & Sunandha, 2017). It is possible that the relatively high levels of stress experienced by the participants in this study may have influenced their ability to engage in higher-intensity exercise or to maintain a balanced diet, both of which are essential for optimal hemoglobin production. Thus, future studies could benefit from exploring the potential impact of stress and lifestyle factors on hemoglobin levels in university students.

In conclusion, this study provides important insights into the relationship between exercise intensity and hemoglobin levels among FK UNPAS students. While moderate-intensity exercise was the most common form of physical activity reported by the participants, there was no significant association between exercise intensity and hemoglobin levels. The findings suggest that other factors, such as diet, sleep quality, and stress, may play a more significant role in determining hemoglobin levels than exercise intensity alone. Given the limited participation in high-intensity exercise and the potential influence of other lifestyle factors, future research should explore the role of these factors in regulating hemoglobin levels and overall health among university students.

CONCLUSION

This study demonstrates that exercise intensity was not significantly associated with hemoglobin levels among medical students at the Faculty of Medicine, Pasundan University. Statistical analysis showed no significant relationship between exercise intensity and hemoglobin levels in female students ($p = 0.264$) or male students ($p = 0.505$). Although the majority of respondents reported moderate-intensity exercise (91.1% of females and 82.1% of males), a considerable proportion of students still exhibited low hemoglobin levels (26.8% of females and 21.4% of males). These findings indicate that regular moderate exercise alone may not be sufficient to maintain optimal hemoglobin status in this population.

The practical implication of these findings for student health programs is that physical activity guidelines in medical education settings should not focus solely on increasing exercise intensity. Instead, programs should emphasize balanced health strategies that integrate consistent moderate physical activity with nutritional support, hydration management, stress reduction, and adequate sleep. This approach is particularly relevant given that most students already engage in moderate-intensity exercise, yet variations in hemoglobin levels persist.

Furthermore, the results provide opportunities to support healthy lifestyle interventions for students with low activity levels or suboptimal hemoglobin status. Targeted interventions such as moderate-intensity exercise programs, routine hemoglobin screening, and nutrition education focusing on iron intake may help address the identified proportion of students with low hemoglobin levels. By grounding health policies in these data-driven findings, medical faculties can develop evidence-based student health programs that support both academic performance and long-term well-being.

ACKNOWLEDGMENT

e would like to express our sincere gratitude to all the participants of this study, the students of FK UNPAS, whose valuable contributions made this research possible. Special thanks to the Faculty of Medicine, Universitas Pasundan, for their support in providing the necessary resources and facilities for data collection. We also appreciate the assistance of the research team, particularly those who helped with data collection and analysis. Our deepest gratitude goes to our mentors and colleagues for their invaluable feedback and guidance throughout this research. Lastly, we thank our families for their unwavering support and encouragement. Authors' note the authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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