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Effects of high-intensity interval training ratios on physical fitness in junior high students

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Abstract

Most Indonesian students continue to exhibit low levels of physical fitness, with 77.12% of children aged 10–15 classified in the low or very low category. This condition highlights the need for effective interventions to improve students' physical fitness. This study aims to analyze the effects of HIIT with 1:2 and 1:5 ratios on junior high school students' physical fitness, as well as to examine the moderating roles of gender and self-efficacy in their training responses. A quantitative approach with a 2 × 2 × 2 factorial design was employed, involving 100 junior high school students in the East AmabiOefeto Subdistrict, Kupang Regency. The intervention lasted for eight weeks, consisting of 16 sessions conducted three times per week. The instruments used were the National Physical Fitness Test (Tes Kebugaran Jasmani Nasional, TKPN) and the Generalised Self-Efficacy Scale. The data were analysed using ANCOVA statistical procedures. Results revealed that HIIT ratio, gender, and their interaction significantly influenced physical fitness ($p < 0.05$). Conversely, self-efficacy alone did not show a significant effect ($p > 0.05$), although it contributed to the three-way interaction. Overall, this study confirms that both 1:2 and 1:5 HIIT ratios effectively improve students' physical fitness, with the 1:2 ratio being slightly more effective. Teachers can implement short HIIT sessions (10–15 minutes) every week, adjusting the ratios and intensity according to students' individual characteristics and needs. Future research should expand the sample size, include additional psychological variables, and explore variations in HIIT duration and frequency to develop a more comprehensive and practical school-based training model.

Keywords: HIIT, physical fitness, self-efficacy, 1:2 vs 1:5 ratio, gender.

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INTRODUCTION

Physical fitness refers to the body's capacity to carry out daily activities efficiently and in a balanced manner without undue fatigue, while also encompassing the ability to move effectively, master motor skills, and maintain a healthy physical condition over the long term (Muhtar, 2021; Zou,

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2016). Physical fitness is not solely a requirement for athletes; it is equally important for school-aged children, as health and fitness form the foundation for developing a generation that is both intellectually capable and physically healthy (Hidasari, 2023). Declining fitness levels are closely associated with reduced functional capacity and long-term health risks, making physical fitness a crucial component of lifelong well-being.

Evidence from international and national contexts indicates a worrying decline in youth fitness levels. A systematic review involving 14 countries reported that contemporary adolescents are less physically fit than previous generations, particularly in strength, endurance, and flexibility. This global trend is reflected in Indonesia, where data from the 2023 Sport Development Index (SDI) show that only 6.79% of children aged 10–15 years and 5.04% of adolescents aged 16–30 years have good or excellent physical fitness levels, while the majority 77.12% of children and 83.55% of adolescents fall into low or very low fitness categories (Mutohir, 2023). These figures indicate a national fitness crisis, reflecting declining activity levels and the limited effectiveness of existing school-based physical activity programs.

Low compliance with physical activity recommendations further reinforces this concern. According to WHO guidelines, children and adolescents should engage in at least 60 minutes of moderate-to-vigorous physical activity daily, including aerobic activities throughout the week and muscle and bone-strengthening exercises on at least three days per week (Bull FC, 2020). However, national data indicate that only 34% of children and 35.7% of adolescents regularly participate in physical activity at least three times per week, suggesting that approximately 65% of young people have not met the recommended activity levels needed to achieve optimal fitness (Mutohir, 2023). This gap highlights the need for innovation in school-based physical education programs.

The consequences of low physical fitness are clearly observable in children and adolescents. Unfit students often experience fatigue, daytime sleepiness, discomfort during light activities, and emotional disturbances,

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such as anxiety, irritability, and sadness, all of which directly interfere with learning, concentration, and academic engagement (Agus, 2021). These conditions underscore the importance of early intervention, as low physical activity and poor fitness habits established during childhood may persist into adolescence and adulthood if not adequately addressed (Wolfe, 2020; Karuc, 2020).

Despite the recognized importance of physical fitness, many schools have not yet implemented structured, sustainable, and evidence-based physical activity programs. Existing interventions are often unmeasurable, insufficiently varied, and not aligned with students' developmental characteristics, resulting in limited effectiveness. This situation emphasizes the urgency of introducing innovative, systematic, and contextually relevant interventions that can enhance motivation, regulate exercise intensity according to student characteristics, and support improvements in physical health, cognitive function, and academic performance (Donnelly, 2017; Alamsyah, 2017; Singh, 2019).

High-intensity interval training (HIIT) has emerged as a promising alternative for addressing these challenges. HIIT involves short bouts of high-intensity exercise interspersed with recovery periods and has been shown to improve cardiorespiratory capacity, cardiac function, oxidative capacity, and overall physical performance, even when implemented within limited time frames (Hidayatullah, 2022; Martin-Smith, 2020; Zhao, 2022; Ribeiro, 2015; Deka, 2022). This method is recognized for its time efficiency, safety, high acceptability, and better adherence compared to longer-duration continuous exercise, making it particularly suitable for school settings with limited facilities and instructional time (Zhao, 2022).

For junior high school students in Indonesia, HIIT is highly relevant due to its adaptability to students' active characteristics, its ability to reduce boredom, and its minimal requirements for space and equipment. International studies have demonstrated that school-based HIIT programs can improve cardiorespiratory endurance, reduce body weight, and enhance speed and agility among adolescents, regardless of body

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composition (Martin-Smith, 2020). These findings support the potential of HIIT as an effective and feasible intervention within Indonesian school contexts.

However, empirical research on HIIT implementation in Indonesian junior high schools remains limited, particularly studies examining variations in work-to-rest ratios and the moderating roles of gender and self-efficacy. Anthropometric and physiological differences between males and females may influence exercise performance and adaptation, suggesting that HIIT protocols should be tailored according to gender (Schmitz B, 2020). Additionally, self-efficacy has been identified as a key predictor of physical activity engagement and exercise adherence across different populations (Sheng, 2025). Understanding how these factors interact with HIIT is essential for developing more precise and effective school-based fitness interventions.

Therefore, this study aims to analyze the effects of HIIT training with 1:2 and 1:5 work-to-rest ratios on students' physical fitness, considering gender and self-efficacy as moderating variables. By examining these interactions, the study seeks to provide evidence-based guidance for designing physical education programs that are more effective, efficient, and responsive to student characteristics, while contributing to the growing literature on HIIT implementation in school settings with limited time and facilities.

METHOD

This study employed a quantitative experimental approach using a 2 × 2 × 2 factorial design to examine the effects of High-Intensity Interval Training (HIIT) with work-to-rest ratios of 1:2 and 1:5 on students' physical fitness, while considering gender (male/female) and self-efficacy level (high/low). This design allowed the simultaneous analysis of both main effects and interaction effects among the three variables. The study was conducted at SMP Negeri 1 AmabiOefeto Timur and SMP Negeri 6 AmabiOefeto Timur, located in the AmabiOefeto Timur Subdistrict, Kupang Regency, East Nusa Tenggara, Indonesia. The intervention lasted for eight

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weeks, from January 13 to March 10, 2025, and consisted of 16 training sessions conducted three times per week.

The study population comprised 871 junior high school students in the AmabiOefeto Timur Subdistrict. The sample size was determined using the Slovin formula with a margin of error of 0.1, resulting in 89 participants, which was supplemented by 11 eligible volunteers, yielding a total sample of 100 students aged 13–15 years. The inclusion criteria required participants to be physically and mentally healthy and willing to participate in the training program. Participants were assigned to eight groups based on the combination of HIIT ratio, gender, and self-efficacy level.

Physical fitness was assessed using the TesKebugaranPelajar Nusantara (TKPN) (Kemenpora, 2022), which includes Body Mass Index (BMI), V-sit and reach, 60-second sit-ups, 30-second squat thrusts, and the pacer test. TKPN is a nationally validated instrument developed by the Indonesian Ministry of Youth and Sports Affairs, and reliability confirmation in this study produced a Cronbach's alpha of 0.85, indicating good internal consistency. Self-efficacy was measured using the 10-item Generalized Self-Efficacy Scale (GSES). Previous studies have demonstrated its validity and reliability in adolescent populations, and internal reliability testing in the present study yielded a Cronbach's alpha of 0.84, confirming its suitability for the research context.

Participants completed a structured HIIT program according to their assigned work–rest ratios. The 1:2 group performed 10 seconds of exercise followed by 20 seconds of rest, whereas the 1:5 group performed 15 seconds of exercise followed by 75 seconds of rest. Each training session consisted of a 5-minute warm-up, a main HIIT phase (4 minutes for the 1:2 ratio and 12 minutes for the 1:5 ratio), and a 5-minute cool-down. The exercises included zig-zag running, burpees, push-ups or knee push-ups, half squat jumps, squat thrusts, sit-ups, lunges, and high knees. Training intensity and adherence were monitored directly by the researcher to ensure consistency with the intervention protocol. After the intervention was completed, a post-test using TKPN was administered.

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Data analysis was performed using IBM SPSS version 25. Normality and homogeneity assumptions were tested using the Kolmogorov–Smirnov test and Levene's test. Group differences were analyzed using ANCOVA, with pretest TKPN scores treated as covariates to control for baseline differences in physical fitness. Statistical significance was set at $p < 0.05$.

RESULT

Before the HIIT intervention was administered, a baseline measurement of physical fitness (pretest) was conducted on all 100 student participants. The assessment was carried out using the *Tes*t of National Physical Fitness Test for Indonesian Students (TKPN), which includes four components: V-sit and reach, 60-second sit-up, 30-second squat thrust, and the PACER test. The pretest results indicated that the participants' average physical fitness score fell into the 'Low' category, with a mean score of 1,4.

Table 1. TKPN pretest results

N = 100	Mean = 1,4
Category	Percentage (%)
Very poor	19,8 %
Poor	68,3 %
Fair	11, 89 %
Good	0,0 %
Very good	0,0 %

The pretest results using the TesKebugaranPelajar Nusantara (TKPN) showed that the majority of students had low physical fitness levels, with 19.8% classified as "very poor," 68.3% as "poor," and only 11.89% as "fair." No students reached "good" or "very good" categories. These findings confirm that Indonesian students aged 13–15 years generally exhibit low fitness levels, highlighting the urgent need for evidence-based interventions.

Following the 8-week HIIT intervention, which consisted of a total of 16 training sessions, a post-test was conducted to reassess the students' physical fitness. The post-test results showed a notable improvement, with the average fitness category increasing to 'Fair' and a mean score of 2.0

Table 2. TKPN post-test results

N = 100	Mean = 2,0
Category	Percentage (%)
Very poor	0 %

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Poor	50,98 %
Fair	49,02 %
Good	0,0 %
Very good	0,0 %

The TKPN post-test results indicate that out of 100 students, none remained in the "Very Poor" category (0%), and 49.02% of students reached the "Fair" category—an increase from 11.89% in the pretest. Although the "Poor" category still dominated at 50.98%, these results demonstrate that nearly half of the participants successfully moved out of the low fitness category to a more favorable level. The substantial increase from the "Very Poor" to the "Fair" category indicates that the rise in the proportion of students is consistent with the effectiveness of HIIT.

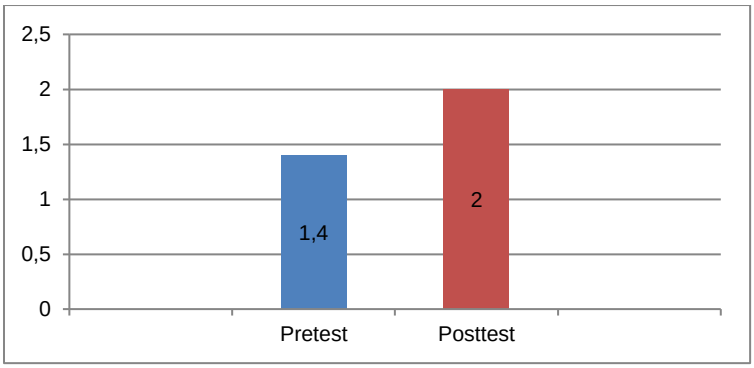

Figure 1. An increase in physical fitness category scores from pretest to post-test, indicating an improvement in students' fitness levels.

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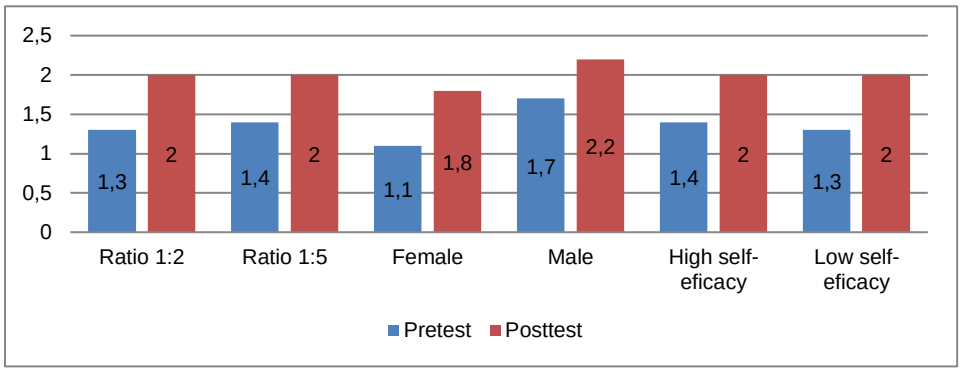

Figure 2. Comparison of pretest and post-test scores between groups (1:2 and 1:5 ratios)

Based on these results, there was an improvement in physical fitness after students participated in the HIIT program with 1:2 and 1:5 ratios. Fitness scores increased from 1.4 in the pretest to 2.0 in the post-test, with a difference of 0.6 points, representing a 42.86% improvement. However, this increase cannot be definitively categorized, as fitness improvements (e.g., VO_2max) depend on multiple factors such as HIIT intensity, duration, frequency, and the characteristics of the population (students vs. athletes), meaning there is no single universal standard applicable to all contexts. Therefore, to determine whether this increase is statistically significant, further inferential analysis is required.

The next stage of data analysis involved assumption testing, where the data were considered normally distributed based on the Kolmogorov-Smirnov test, which yielded a p-value of 0.168 (> 0.05). The data were also considered homogeneous as indicated by Levene's test, which produced a p-value of 0.175 (> 0.05). Since all prerequisite assumptions were met, the data were further analyzed using a two-way ANCOVA model, and the results are presented as follows :

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Table 3. Physical fitness assessment before (pretest) and after HIIT training post-test)

Variable		Preetest	Post-testt	Difference	Improvement (%)	Adjusted mean	*P - Value*	*Partial eta squared*	Interpretation
HIIT	Ratio 1:5	1,4 ± 0,4550	2,0 ± 0,2671	0,6	40,49%	1,985	000	0,505	medium
	Ratio 1:2	1,3 ± 0,7675	2,0 ± 0,2390	0,7	49,78%	2,023			
Gender	Female	1,1 ± 0,2763	1,8 ± 0,1141	0,7	64,00%	1,919	000	0,926	large
	Male	1,7 ± 0,4350	2,2 ± 0,1877	0,5	32,17%	2,089			
Self-efficacy	High	1,4 ± 0,5126	2,0 ± 0,3030	0,6	42,17%	2,002	0,442	0,007	small
	Low	1,3 ± 0,4047	2,0 ± 0,1920	0,6	47,63%	2,005			
Interaction	-	-	-	-	-	-	000	0,87	Large

Table 3 shows that, after controlling for baseline physical fitness, ANCOVA revealed a significant difference between HIIT with 1:2 and 1:5 ratios on post-test TKPN scores (p = 0.000; partial eta squared = 0.505, indicating a moderate effect. This suggests that the choice of HIIT ratio influences improvements in physical fitness. Gender also had a significant effect (p = 0.000; partial eta squared = 0.926, significant effect), highlighting the need to tailor training according to sex. In contrast, self-efficacy was not significant (p = 0.442; partial eta squared = 0.007, small effect). The interaction between HIIT, self-efficacy, and gender was significant with a large effect (p = 0.000; partial eta squared = 0.870), emphasizing the importance of adjusting training programs according to the combination of individual factors to achieve optimal fitness outcomes.

Table 5. ANCOVA results of the research variables

Variable	P - Value	Partial eta squared
HIIT	0,000	0,505
Gender	0,000	0,926
Self-efficacy	0,442	0,007
Interaction	0,000	0,87

The analysis shows that HIIT and gender have significant effects on students' physical fitness ($p < 0.05$), with a strong effect size for HIIT ($\eta^2 = 0.505$) and a very strong effect size for gender ($\eta^2 = 0.926$). The interaction among HIIT, gender, and self-efficacy is also significant ($p < 0.05$; $\eta^2 = 0.87$), indicating substantial differences in responses based on the variable

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combinations. In contrast, self-efficacy is not significant (p = 0.442; η^2 = 0.007), suggesting a negligible influence on fitness outcomes.

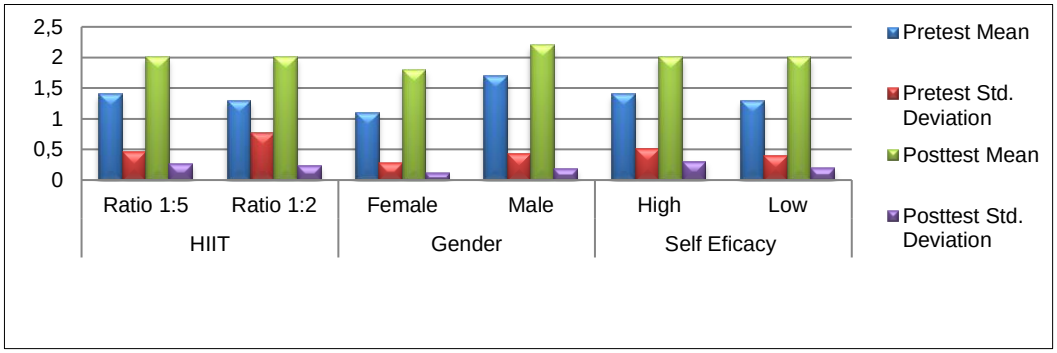

Figure 3. Diagram of the improvement in research variables

The analysis indicated that HIIT had a significant effect on students' physical fitness, with a partial eta squared of 0.505, reflecting a strong effect. At the same time, gender also showed a significant influence with a very high partial eta squared (0.926), suggesting that biological or physiological differences affect responses to training. In contrast, self-efficacy did not have a significant independent effect, indicating that motivation or self-belief does not directly modify physical fitness outcomes. Furthermore, the interaction among HIIT, gender, and self-efficacy had a highly significant effect with a partial eta squared of 0.870, indicating that the combination of these three variables produces substantial variation in fitness improvement. This suggests that the effectiveness of HIIT can be maximized by designing training programs that simultaneously consider training ratio, gender characteristics, and students' levels of self-efficacy.

DISCUSSION

This study aimed to compare two HIIT training ratios, namely 1:2 and 1:5, in relation to gender and levels of self-efficacy (an experimental study on junior high school students in the AmabiOefeto Timur sub-district). The findings revealed a significant difference in the effects between the HIIT 1:2 and 1:5 training ratios, with a p-value of 0.00 < 0.05 and a partial eta squared value of 0.505, indicating a large effect size of 50.5%. These results are consistent with a study by Deng (2024), which found that engaging in HIIT

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consistently for over 10 weeks, three times per week, with a short rest-to-work ratio (1:1), significantly improved cardiorespiratory fitness in overweight or obese children and adolescents.

Statistical evidence also indicates that HIIT with a 1:2 ratio is more effective in improving students' physical fitness. The difference between pretest and post-test scores was 0.7, with a percentage increase of 49.78%, and a corrected mean of 2.023. In comparison, the 1:5 ratio showed a pretest-posttest difference of 0.6, representing a 40.49% increase in percentage, and a corrected mean of 1.985. This suggests that the most significant improvement occurred in the 1:2 group compared to the 1:5 group. The finding that a 1:2 work-to-rest ratio is more effective than 1:5 aligns with physiological principles, indicating that shorter recovery periods create a stronger training stimulus by increasing stress on the aerobic and glycolytic systems, thereby enhancing strength, endurance, and cardiorespiratory capacity. Zhang (2024) explained that the greater improvement observed under the 1:2 ratio is attributable to denser cardiovascular stimulation resulting from shorter rest intervals, which lead to higher oxygen turnover, increased lactate clearance demands, and greater myocardial workload, thereby supporting stronger VO_2max adaptations, particularly in adolescents. In line with these findings, de Menezes-Junior (2020) reported that shorter rest intervals are more effective in reducing body fat indicators among youth populations.

Physiologically, the effects of High-Intensity Interval Training (HIIT) provide significant benefits for improving physical fitness. As demonstrated in the study by Wibowo (2019) on children aged 13–15 years, HIIT was found to induce physiological thickening of the left ventricular myocardium, which enhances the heart's strength and its capacity to pump blood with each contraction. This adaptation leads to a decrease in resting heart rate and an improvement in cardiorespiratory fitness. The broader efficacy of HIIT observed in this study also reflects evidence that HIIT improves agility, speed, cardiovascular endurance, and anaerobic capacity while inducing key physiological adaptations such as left ventricular myocardial thickening,

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increased VO_2max, and heightened cardiovascular responses during exercise (Wibowo, 2019; Windiastoni, 2019; Susilo, 2019). Collectively, these studies support the present findings, reinforcing that optimized HIIT ratios particularly shorter recovery intervals can enhance fitness outcomes in school contexts and offer meaningful long-term health benefits.

Bauer (2022) reported that HIIT programs implemented both during and outside physical education class hours in school settings led to greater improvements in neuromuscular and anaerobic performance, as well as reductions in fasting blood glucose levels among school-aged children. Furthermore, Visier-Alfonso (2021) explained that the relationship between physical activity and academic achievement is not direct, but is mediated by cardiorespiratory fitness (CRF), cognitive flexibility, and inhibitory control. Therefore, physical activity interventions aimed at enhancing academic performance should primarily focus on improving cardiorespiratory fitness and executive function. High-Intensity Interval Training (HIIT) is not only physiologically effective but can also be pedagogically integrated into school physical education (PE) classes. Strong evidence supporting this comes from a study by Jurić P (2023), which implemented a 12-week HIIT program for students aged 10–15 years within PE classes. Several PE-based HIIT frameworks (Bauer, 2022; Jurić, 2023) demonstrate that HIIT can be integrated into 2×35–40 minute PE sessions weekly, making it realistic and policy-aligned for Indonesian junior high schools.

Another finding of this study revealed a significant difference in the effect of HIIT training on physical fitness between male and female students. The ANCOVA test showed a p-value of 0.00 (< 0.05) with a partial eta squared value of 0.926, indicating a large effect size of 92.6%. Statistical evidence also showed that the female group experienced faster improvement, while male students achieved higher final performance levels after adjusting for the covariate values. This gap is attributed to the higher initial pretest scores among male students, which made female students appear greater; however, after covariate adjustment, male students exhibited a larger increase. This aligns with Waldo (2023), who reported that

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male students experienced greater improvements in physical fitness than females, and is consistent with Jovanović R (2024), who found that HIIT can be implemented in schools as an alternative physical education strategy because it provides substantial fitness benefits within a relatively short training duration, particularly for female students. These findings suggest that physiological responses to HIIT may vary depending on sample characteristics, training design, and the research context. Age and sex influence VO_2max, with boys generally showing increases until around 18 years of age and girls remaining relatively stable between 14 and 18 years; additionally, females typically have VO_2max values approximately 20% lower than males due to differences in hormones, haemoglobin levels, body fat, and muscle mass (Az Zahra, 2025). These findings emphasize the importance for teachers and coaches to design training programs that consider gender differences, ensuring that each student receives an appropriate training load and achieves optimal fitness improvements. Teachers may implement HIIT twice a week for 12–15 minutes per session, using a 1:2 ratio for higher-fit students and a 1:5 ratio for beginners, while monitoring intensity through perceived exertion cues and modifying impact-based movements for lower fitness groups.

On the other hand, this study found that differences in self-efficacy levels (high and low) did not have a significant effect on physical fitness, with a p-value = 0.442 > 0.05 and a partial eta squared value of 0.007, indicating a very small effect size (0.07%). Conversely, this study indicates that differences in self-efficacy levels do not have a significant effect on physical fitness, with only a small effect size, likely due to the dominant influence of physical and biological factors. As reported by Raghuveer G. H. (2020), physical activity is the primary determinant of cardiorespiratory fitness; thus, self-efficacy that is not mediated by actual physical activity does not lead to meaningful improvements in fitness. Furthermore, the non-significant findings may be attributed to two factors: the limitations of the self-efficacy instrument, which measured students' general self-efficacy rather than task-specific self-efficacy related to exercise or training, and the

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relatively short intervention duration, which may have been insufficient to produce meaningful psychological changes. Therefore, it is crucial for teachers and coaches to effectively address students' psychological aspects through structured physical activities or training programs to achieve optimal fitness improvements, create a safe learning environment, and support the development of both physical abilities and overall fitness. The practical implication for teachers and coaches is that HIIT programs should be designed with appropriate frequency, duration, and intensity tailored to students' characteristics and individual capacities. Additionally, structured activities and consistent guidance can help maintain students' motivation and adherence, thereby maximizing fitness outcomes without relying heavily on psychological factors such as self-efficacy.

At the point of interaction among the HIIT, self-efficacy, and sex variables, a significant effect was found on the improvement of physical fitness, with a p-value = 0.000 < 0.05 and a partial eta squared value of 0.870, indicating a large effect size (87%). The interaction among HIIT, self-efficacy, and gender has a significant effect on improvements in physical fitness, with the observed effect size categorized as large. Li (2025) reported that HIIT training significantly enhances physical capacity while also providing psychological benefits, including reductions in anxiety and depression as well as increases in self-confidence among adolescents. Furthermore, Sheng (2025) demonstrated that self-efficacy plays an important mediating role between exercise motivation and physical activity, indicating that higher motivation can promote participation in physical activity through strengthened self-efficacy. Moreover, Ghayour Baghbani S. M. (2023) concluded, in a literature review, that physical exercise interventions can improve self-efficacy and have a positive influence on long-term commitment to physical activity and overall mental health.

Furthermore, Peng B. (2025) investigated the influence of physical activity on adolescents' self-efficacy, examining the mediating role of psychological resilience and considering gender differences. The results showed that physical activity significantly enhances self-efficacy both

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directly and indirectly through improved psychological resilience, with multi-group analysis confirming that the structural relationships are consistent between male and female adolescents despite potential variations in effect pathways, highlighting the importance of designing physical activity interventions that take into account psychological characteristics and gender to maximize improvements in self-efficacy among adolescents. These findings provide an important scientific basis for teachers and coaches to utilize all aspects of their students psychological, biological, and physiologicalto maximize the effects of training and learning programs aimed at improving students' physical fitness, and support the use of HIIT as an alternative strategy with wider benefits beyond fitness outcomes.

This study has several limitations that should be considered as references for future research. First, the limitation of subjects was due to constraints in budget, time, and the distance between schools, resulting in the sample being drawn from only two public junior high schools within the AmabiOefeto Timur sub-district, limiting generalizability. Second, the self-efficacy measurement instrument had a limitation in that it assessed general self-efficacy without specifically targeting self-efficacy related to physical activity. Additionally, the researcher encountered challenges in providing clear instructions and supervising a large number of students during the implementation of the intervention. Third, the randomisation process may have been subject to potential bias because it was conducted directly by the researcher in the field, making it difficult to avoid imbalances in participant characteristics across groups fully. Based on the existing limitations, future researchers are advised to expand the sample size, use a self-efficacy instrument that is more specific to physical activity, and establish inter-school collaborations to produce more representative and applicable research findings. Future studies should employ longitudinal tracking to examine the sustainability of effects, test varied HIIT durations and weekly frequencies, and evaluate curricular integration models in PJOK to generate long-term implementation standards.

CONCLUSION

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This study reinforces that High-Intensity Interval Training (HIIT) is a highly effective method for improving physical fitness in junior high school students, with the 1:2 work-to-rest ratio delivering the most optimal benefits and producing the most significant improvement compared to the 1:5 ratio. The overall findings highlight that students respond positively to structured high-intensity training due to combined biological and physiological adaptations that enhance endurance, strength, and cardiorespiratory function. The interaction between the HIIT method, self-efficacy, and sex also shows a significant effect on fitness outcomes, although self-efficacy levels alone do not have a significant impact. Therefore, implementing HIIT programs that consider students' biological and psychological characteristics is recommended as an effective strategy to enhance physical fitness in school settings. For practical application, physical education teachers are encouraged to integrate HIIT into evidence-based instruction and curriculum development by designing regular, time-efficient training sessions that match students' readiness and capacity. Implementing HIIT systematically in school programs enables teachers to optimize fitness improvements for all students while supporting a more engaging and outcome-oriented learning environment. For future research, it is recommended to include a larger sample, consider additional psychological variables such as motivation or interest in exercise, and utilise a self-efficacy instrument that is more specific to physical activity contexts to obtain more comprehensive findings.

REFERENCES

Agus, A., &Sepriadi. (2021). *ManajemenKebugaran*. *Sukabina Press* (pp. 1–206). ISBN 978-602-8124-96-6.

Alamsyah, D. A. N., Hestiningsih, R., & Saraswati, L. D. (2017). Faktor-faktor yang berhubungandengankebugaranjasmani pada remajasiswakelas xi smk negeri 11 semarang. *Jurnal Kesehatan Masyarakat (e-Journal)*, *5*(3), 77–86. Retrieved fromhttps://ejournal3.undip.ac.id/index.php/jkm/article/view/17169

Az Zahra Anindya Putri Setyawan Zahra, Triyana, &Fendy Nugroho. (2025). Pengaruh High Intensity Interval Training (Hiit) Terhadap Peningkatan Vo_2 Max Pada Pemain Hockey. *Jurnal Nasional*

Fisioterapi (Jurnafisio), *3*(1), 9–15. Retrieved from https://jurnafisio.com/index.php/JF/article/view/60

Bauer, N., Sperlich, B., Holmberg, HC. *et al.* (2022). Effects of High-Intensity Interval Training in School on the Physical Performance and Health of Children and Adolescents: A Systematic Review with Meta-Analysis. *Sports Med - Open* 8, 50. https://doi.org/10.1186/s40798-022-00437-8

Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., ... &Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British journal of sports medicine*, *54*(24), 1451-1462.https://doi.org/10.1136/bjsports-2020-102955

de Menezes-Junior, F. J., de Jesus, Í. C., Ferreira, V. L., Wiens, A., Mota, J., &Leite, N. (2020). Effect Of Different Interval Training Protocols On Adiposity Indicators In Overweight-Obese Children And Adolescents: A Systematic Review And Meta-Analysis. *Journal of Physical Education (Maringa)*. UniversidadeEstadual de Maringa.https://doi.org/10.4025/jphyseduc.v31i1.3161

Deka, P., Pathak, D., Klompstra, L., Sempere-Rubio, N., Querol-Giner, F., & Marques-Sule, E. (2022). High-intensity interval and resistance training improve health outcomes in older adults with coronary disease. *Journal of the American Medical Directors Association*, *23*(1), 60–65.https://doi.org/10.1016/j.jamda.2021.05.034

Deng, Y., & Wang, X. (2024). Effect of high-intensity interval training on cardiorespiratory in children and adolescents with overweight or obesity: a meta-analysis of randomized controlled trials. *Frontiers in Public Health*. Frontiers Media SA.https://doi.org/10.3389/fpubh.2024.1269508

Donnelly, J. E., Ed, D., Co-chair, F., Hillman, C. H., Co-chair, P. D., PhD, … PhD (2017). Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. *Medicine and Science in Sports and Exercise* (Vol. 48, pp. 1197–1222).https://doi.org/10.1249/MSS.0000000000000901

Fitriana Puspa Hidasari. (2023). Measurment Of Youth Physical Fitness In Pontianak City Using TKPN Instruments. *Journal Physical Health Recreation*, *3*(2), 76–83. https://doi.org/10.55081/jphr.v3i2.987

Ghayour Baghbani, S. M., Arabshahi, M., &Saatchian, V. (2023). The impact of exercise interventions on perceived self-efficacy and other psychological outcomes in adults: A systematic review and meta-analysis. *European Journal of Integrative Medicine*. https://doi.org/10.1016/j.eujim.2023.102281

Hidayatullah, M. F., &Ellyas, I. S. (2022). *MenjagaKebugarandengan HIIT*. (F. Umar, Ed.) (pp. 1–109). Cakra Wijaya. ISBN 978-602-17083-6-1.

Jovanović, R., Živković, M., Stanković, M., & Giustino, V. (2024). Effects of school-based high-intensity interval training on health-related fitness in adolescents. *Frontiers in Physiology*, *15*(November), 1–8. https://doi.org/10.3389/fphys.2024.1487572

Jurić P, Dudley DA, Petocz P. (2023). Does incorporating high intensity interval training in physical education classes improve fitness outcomes of students? A cluster randomized controlled trial. Prev Med Rep. 4;32. 102127. https://doi.org/10.1016/j.pmedr.2023.102127

Karuc, J., Sorić, M., Radman, I., &Mišigoj-Duraković, M. (2020). Moderators of change in physical activity levels during restrictions due to COVID-19 pandemic in young urban adults. *Sustainability (Switzerland)*, *12*(16). https://doi.org/10.3390/su12166392

Kemenpora. (2022). PedomanTesKebugaranPelajar Nusantara.

Li, Y. T., & Zhou, Y. (2025). Experimental research of impact on psychological state for adolescents with high-intensity interval training intervention. *Frontiers in Psychology*, *16*, 1567003. https://doi.org/10.3389/fpsyg.2025.1567003

Martin-Smith, R., Cox, A., Buchan, D. S., Baker, J. S., Grace, F., & Sculthorpe, N. (2020). High intensity interval training (HIIT) improves cardiorespiratory fitness (CRF) in healthy, overweight and obese adolescents: A systematic review and meta-analysis of controlled studies. *International Journal of Environmental Research and Public Health*. https://doi.org/10.3390/ijerph17082955

Muhtar, T., &Lengkana, A. S. (2021). *KESEHATAN DALAM PENDIDIKAN JASMANI* (p. 99). CV Salam InsanMulia. ISBN 978-623-7938-12-5.

Mutohir, T. C., Lutan, R., Maksum, A., Kristiyanto, A., & Akbar, R. (2023). *KebugaranJasmani dan GenerasiEmas 2045*. DeputiBidangPembudayaanOlahraga Kementerian Pemuda dan OlahragaRepublik Indonesia.

Peng B, Chen W, Wang H, Yu T. (2025). How does physical exercise influence self-efficacy in adolescents? A study based on the mediating role of psychological resilience. BMC Psychol. 21;13(1):285. https://doi.org/10.1186/s40359-025-02529-y

Raghuveer, G., Hartz, J., Lubans, D. R., Takken, T., Wiltz, J. L., Mietus-Snyder, M. (2020). ... & American Heart Association Young Hearts Athero, Hypertension and Obesity in the Young Committee of the Council on Lifelong Congenital Heart Disease and Heart Health in the Young. Cardiorespiratory fitness in youth: an important marker of health: a scientific statement from the American Heart Association. *Circulation*, *142*(7), e101-e118. https://doi.org/10.1161/CIR.0000000000000866

Ribeiro, R., Oliveira Silva, J. Í., Dantas, M. G. B., Menezes, E. S., Pereira Arruda, A. C., &Schwingel, P. A. (2015). High-intensity interval

training applied in Brazilian Jiu-jitsu is more effective to improve athletic performance and body composition. *Journal of Combat Sports and Martial Arts*, *6*(1), 1–5. https://doi.org/10.5604/20815735.1166073

Schmitz B, Niehues H, Thorwesten L, Klose A, Krüger M, Brand SM. (2020). Sex Differences in High-Intensity Interval Training-Are HIIT Protocols Interchangeable Between Females and Males? Front Physiol. 11-38. https://doi.org/10.3389/fphys.2020.00038

Sheng, J., Ariffin, I. A. B., &Tham, J. (2025). The influence of exercise self-efficacy and gender on the relationship between exercise motivation and physical activity in college students. *Scientific Reports*, *15*(1), 11888.https://doi.org/10.1038/s41598-025-95704-5

Singh, A. S., Saliasi, E., Van Den Berg, V., Uijtdewilligen, L., De Groot, R. H. M., Jolles, J., … Chinapaw, M. J. M. (2019). Effects of physical activity interventions on cognitive and academic performance in children and adolescents: A novel combination of a systematic review and recommendations from an expert panel. *British Journal of Sports Medicine*. https://doi.org/10.1136/bjsports-2017-098136

Susilo, E. A. (2019). Pengaruh High Intensity Interval Training Kettlebell Workout TerhadapPeningkatan Daya TahanAnaerobik. *Briliant: JurnalRiset Dan Konseptual*, *4*(4), 410. https://doi.org/10.28926/briliant.v4i4.362

Visier-Alfonso, M. E., Álvarez-Bueno, C., Sánchez-López, M., Cavero-Redondo, I., Martínez-Hortelano, J. A., Nieto-López, M., & Martínez-Vizcaíno, V. (2021). Fitness and executive function as mediators between physical activity and academic achievement: Mediators between physical activity and academic achievement. *Journal of Sports Sciences*, *39*(14), 1576–1584. https://doi.org/10.1080/02640414.2021.1886665

Waldo, K., Indra Bayu, W., & Sriwijaya, U. (2023). The Effect of Aerobic General and Sex on Physical Fitness. *JurnalIlmuKeolahragaan*, *6*(1), 89–98. http://dx.doi.org/10.31851/hon.v6i1.8178

Wibowo, S. P. K. (2019). Pengaruh High Intensity Interval Training terhadap Daya TahanKardiovaskuler, Kecepatan dan Kelincahan pada Usia 13-15 Tahun. *JOSSAE (Journal of Sport Science and Education)*, *4*(2), 79–84. https://doi.org/10.26740/jossae.v4n2.p79-84

Windiastoni, Y. H., &Haritsah, N. F. (2019). Pengaruh High Intensity Interval Training Terhadap Cardiorespiratory Pada Remaja. *Interest :JurnalIlmu Kesehatan*, *8*(2), 169–176. https://doi.org/10.37341/interest.v8i2.172

Wolfe, A. M., Lee, J. A., &Laurson, K. R. (2020). Socioeconomic status and physical fitness in youth: Findings from the NHANES National Youth

Fitness Survey. *Journal of Sports Sciences*, *38*(5), 534–541. https://doi.org/10.1080/02640414.2020.1713688

Zhang, Z., Xie, L., Ji, H., Chen, L., Gao, C., He, J., … Li, D. (2024). Effects of different work-to-rest ratios of high-intensity interval training on physical performance and physiological responses in male college judo athletes. *Journal of Exercise Science and Fitness*, *22*(3), 245–253. https://doi.org/10.1016/j.jesf.2024.03.009

Zhao, K., Hu, Z., Wang, T., Tian, L., Wang, M., Liu, R., ... &Jihua, W. (2022). Acute effects of two different work-to-rest ratio of high-intensity interval training on brain-derived neurotrophic factor in untrained young men. *Frontiers in Physiology*, *13*, 988773., https://doi.org/10.3389/fphys.2022.988773

Zou, L. (2016). Relationship between Functional Movement Screening and Skill-Related Fitness in College Students. *International Journal of Sports Science*, *6*(1), 11–18. https://doi.org/10.5923/j.sports.20160601.03