

# The Influence of Circuit Training and Interval Training Techniques on the Physical Well-Being of Elementary School Students Analysed from A Gender Perspective

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**Abstract** Every student needs physical fitness to gain agility, ability, and high learning ability and achievement. The study investigates the influence of circuit and interval training on the physical fitness of fifth-grade elementary school students, considering gender differences. The research was conducted using a 2x2 factorial design experimental method. A total sample strategy was applied, with 62 participants in total (32 males and 30 females). The physical fitness of 10-12-year-olds was evaluated using the TKJI (Indonesian Physical Fitness Test). The results indicated a notable disparity in the impact of circuit and interval training techniques on physical fitness. Additionally, gender-based differences were observed, suggesting that physical fitness varied between male and female students, with a significance level of Sig. <0.05. The research also explored the interaction between training methods and gender. Results indicated no significant interaction, implying that the effectiveness of circuit and interval training did not depend on gender. However, male and female participants demonstrated better physical fitness when subjected to the circuit training method. To summarise, the study underscores the beneficial influence of circuit training on the physical condition of primary school pupils. It underscores the importance of taking gender into account when implementing fitness interventions.

**Keywords** Circuit Training, Interval Training, Physical Fitness, Elementary School Students, Gender

## 1. Introduction

Everyone expects a healthy and fit body [1]. Some experts argue that physical fitness refers to the body's capacity to adapt the functioning of its organs to specific physical tasks or environmental conditions, ensuring efficient performance without excessive tiredness and allowing for proper recovery before engaging in subsequent activities [2]. Another opinion by Chen et al. [3] is that physical fitness is a sign of health for the entire population and has a critical role in human life. Physical fitness will support the ability to carry out daily activities [4]. Every student needs physical fitness to gain dexterity, knowledge and high learning ability [5].

As technology becomes increasingly advanced, it tends to induce lethargy or a lack of motivation among young individuals to engage in physical activity [6]. The statement made clear that today's technology is more fun to fill their free time, especially for children and teenagers; they can watch interesting videos on YouTube for hours, watch the latest movies, and even play games only through

their cellphones or laptops very quickly. Allocating a minimum of 15 minutes each week for exercise seems challenging. Research from López-Gil et al. [7] strengthens the quote, which explains that the number of hours in front of the screen that is too long can result in less time for activities, increased food consumption, and reduced time for rest which can lead to obesity. Another study conducted by Kim et al. [8] found that being overweight will cause a person to increase the time he is not moving, causing obstacles to physical activity such as exercising. Therefore a healthy lifestyle to maintain physical fitness will decrease.

Elementary school children are synonymous with late childhood children around 6-12 years old or school-age who are known always to want to move [9]. Primary school children have physical growth characterized by becoming taller, heavier, and stronger than children in preschool/ kindergarten. In elementary school, children will be more active and vital to physical activities such as running, climbing, jumping, swimming and other outdoor activities. Children carry out this physical activity to train coordination, motor skills, body stability and the distribution of accumulated energy [10]. At the age of elementary school, children's gross and fine motor skills become better [11]. According to Sabrina et al. [12], the physical fitness of women in elementary school, specifically those aged 10-12 years or in grades IV and V, is nearly equivalent to that of men before puberty.

In children or elementary school students, good physical fitness can also reduce the risk of metabolic diseases and malignancy diseases to reduce the mortality rate three times [13]. Students' physical performance is an important aspect that can increase mobility in achieving maximum academic achievement [14]–[16]. Physical fitness significantly correlates with student learning achievement [17], [18].

Physical fitness is intricately linked to physical exercise. On the other hand, physical activity is commonly described as any movement of the body generated by the muscles. It increases energy expenditure compared to when the body is at rest. Physical activity is a complex phenomenon that may be categorised and measured based on varying intensity levels [19]. Physical fitness is intricately linked to engagement in physical exercise. On the other hand, physical activity is commonly described as any movement of the body generated by the skeletal muscles and results in an increase in energy expenditure compared to resting levels. Physical activity is a complex phenomenon that may be categorised and measured based on varying intensity levels [20]. Consequently, primary school kids must uphold and enhance their physical health by adhering to a well-designed exercise regimen [5].

Based on the results of field observations conducted by researchers in the form of interviews with physical education teachers, students were less enthusiastic in sports lessons, lazy, and tired quickly in sports. According to the findings of field observations carried out by researchers through interviews with physical education teachers, pupils exhibited less enthusiasm, lethargy, and rapid fatigue

during sports lessons. Also, during sports lessons, students instead went to the school cafeteria to buy food and then brought them to watch their friends exercise. It was followed by interviews with the class teacher, who said that several children at school were still experiencing lethargy and a lack of enthusiasm for taking lessons. Students were sleepy during morning lessons; their heads lay on the table, and some even fell asleep when given a repeat assignment; this was made possible because of the physical fitness of students who are still very low and the state of the body that is not fit. Therefore, fitness can be a factor in achieving learning objectives. Thus, a student in a state with a high or good fitness level will find it easier to carry out activities or work. Conversely, with a low level of physical fitness, students will need help carrying out all daily activities. On the other hand, achieving optimal physical fitness requires engaging in accurate, consistent, and quantifiable physical activity.

Sport is a form of physical exercise undertaken to preserve and enhance one's health or physical fitness [21]. *Sport* is a methodical and repetitive physical activity that is organised and goal-oriented, intending to improve physical fitness and maintain overall health [22]. Physical activity plays a crucial role in enhancing physical fitness as it improves various aspects of the body's functionality, including maximum oxygen consumption (VO<sub>2</sub>max), body composition, muscle strength and endurance, and flexibility [23]–[25]. Physical activity refers to the engagement in exercises or activities that promote health and fitness [26]–[29]. The study conducted by Li & Zhang [30] demonstrates that engaging in physical activity positively influences academic attainment, including participation in extracurricular activities.

Circuit training is a training model divided into several areas with different variations in each area with a specific purpose. These exercises are programmed systematically from the start of training to the rest of the training in set sessions or training repetitions [31]. *Circuit training* is an aerobic exercise arranged sequentially and carefully from various posts, carried out by moving from one post to another [32]. According to Kundu [33], circuit training is considered interval training that integrates aerobic strength and endurance training. It includes the advantages of both cardiovascular and strength training. In his journal [34], he asserts that circuit training is very efficient due to its time-saving nature, requiring approximately 30 minutes to complete. Additionally, this sport only necessitates a small area for its execution.

Interval training is an exercise that is done repeatedly with specific rest periods [21]. Interval training positively impacts the development of endurance and stamina [35]. Interval training has characteristics like having rest periods interspersed during exercise [36].

To ensure the maintenance of physical fitness, enhancing students' exercise awareness is necessary based on the findings from field observations and literacy. Hence, the researcher intends to conduct a study titled "The Impact of

Circuit Training and Interval Training Techniques on the Physical Well-being of Elementary School Students Analysed from a Gender Perspective".

## 2. Materials and Methods

This study employed an experimental approach utilising a 2x2 factorial design. The factorial design is an adaptation of the conventional experimental design that considers the potential impact of moderator factors on the relationship between the independent and dependent variables [37]. Assessing the treatment results between factors A and B and searching for the influence of the interaction between factors A and B yields the effect of the treatment [38]. The research was carried out at Tanjung Sari 1 Public Elementary School, South Lampung Regency, 2020/2021 Academic Year.

Researchers used sampling to ascertain a portion of the population by evaluating the representation of population aspects to gather research data and information [39]. The sampling method employed is total sampling. Total sampling is a method in which the number of samples equals the population size. This approach is preferable when the population is smaller than 100, ensuring that the research sample represents the entire study population [40]. The study focused on fifth-grade pupils at SD Negeri 1 Tanjung Sari, South Lampung Regency. The study consisted of a total population of 62 individuals, comprising 32 males and 30 females. Therefore, the complete population served as the research sample. The research sample was categorized based on gender using ordinal pairing to obtain two groups based on gender. From the results of gender categorization, it was stated that each training method consisted of 16 male subjects in both circuit and interval training. Apart from that, the female gender consisted of 15 female subjects for each training method given. So, four category groups were obtained. It is based on giving all items an equal opportunity to be included in each category. After being divided into four groups, each group of individuals of the same sex underwent a pretest using the TKJI (Indonesian Physical Fitness Test) test instrument on individuals aged 10-12 years before receiving any therapy. The TKJI instrument, the Indonesian Physical Fitness Test, has a validity value of 0.884 for boys and 0.897 for girls aged 10-12 years. The reliability value is 0.911 for boys and 0.942 for girls [41].

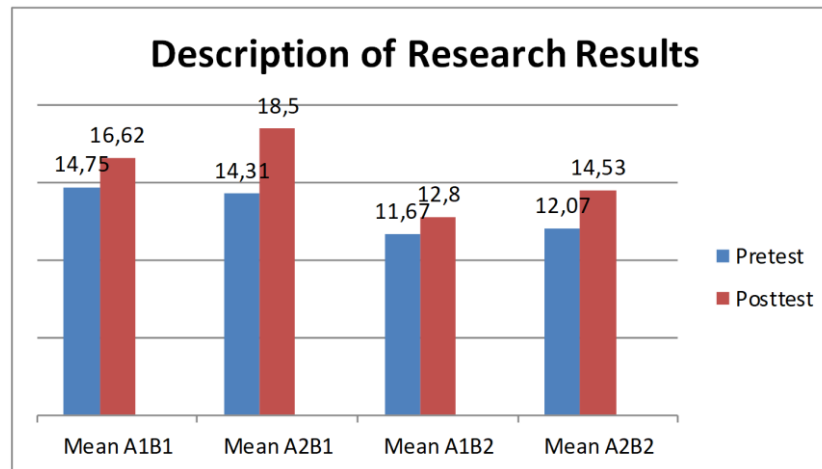
The training program is designed to conduct research.

The training program provided is in the form of circuit training consisting of 5 posts, including post 1 (running back and forth with a distance of 5 meters), post 2 (push-ups), post 3 (jumping rope), post 4 (going up and down stairs), and post 5 (20-meter run) one post is done for 30 seconds and between posts rest 30 seconds. At the same time, the interval training program by running at a distance of 50 meters with a time of 8 seconds and an interval period of 30 seconds is carried out in 3 sets of 5 repetitions. Before starting the training program, the subject is first given an initial test and then a treatment program. After the treatment program is given, data collection is continued by conducting a final test. The TKJI (Physical Fitness Test) for ages 10-12 consists of 5 tests: the 40-meter run, the elbow hanging test, lying down for 30 seconds, jumping straight up, and running 600 meters.

Data analysis used in this study was carried out with the help of SPSS version 25 software, namely by using two-way ANOVA (two-way ANOVA) at a significance level = 0.05. Before testing the hypothesis, the first to do is the prerequisite test, namely the normality test and homogeneity test. The normality test in this study used the Kolmogorov-Smirnov test using the Monte Carlo exact test, which aims to determine whether or not a data distribution is normal and as one of the prerequisites using the two-way ANOVA test. The homogeneity test uses the Levene test, which aims to determine each data group's variance.

## 3. Results

The results of the research will be explained coherently, including (1) a description of the results of the study, (2) prerequisite tests in the form of normality and homogeneity tests, and (3) hypothesis testing. The hypothesis testing will be explained sequentially according to the research objectives, namely: (a) a comparison of the effect of the circuit training method and interval training on the physical fitness of fifth-grade students at SD Negeri 1 Tanjung Sari, South Lampung Regency, (b) a comparison of the effect of male and female sex on the physical fitness of class V elementary school students 1 Tanjung Sari, South Lampung Regency, and (c) Interaction of circuit training methods and interval training and gender on the physical fitness of class V elementary school students 1 Tanjung Sari, South Lampung Regency. In full, it will be presented as follows.



Information:

A1B1: Male Gender Interval Training Method

A2B1: Male Gender Circuit Training Method

A1B2: Female Gender Interval Training Method

A2B2: Female Gender Circuit Training Method

Figure 1. Description of Research Results

Figure 1 shows that the pretest score of the A1B1 group was 14.75 and experienced an increase in the posttest to 16.62. Group A2B1 had an average pretest value of 14.31 and experienced an increase in the posttest to 18.5. Group A1B2 pretest score was 11.67 and increased in the posttest to 12.8. In the A2B2 group, the pretest score was 12.07, and the posttest increased to 14.53.

The normality test in this study used the Kolmogorov-Smirnov test by looking at the Sig. Monte Carlo with the help of SPSS 25 software with a significance level of 5% or 0.05. The following normality test results can be seen in the following table:

Table 1. Normality Test Results

One-Sample Kolmogorov-Smirnov Test		
		Standardized Residual for Posttest
N		62
Normal Parameters <sup>a,b</sup>	Mean	.0000
	Std. Deviation	1.00000
Most Extreme Differences	Absolute	.135
	Positive	.135
	Negative	-.075
Test Statistic		.135
Asymp. Sig. (2-tailed)		.007 <sup>c</sup>
Monte Carlo Sig. (2-tailed)	Sig.	.190 <sup>d</sup>
95% Confidence Interval	Lower Bound	.182
	Upper Bound	.197

Based on Table 1, the value of sig. Normality of  $0.190 > 0.05$ , the research data shows a normal distribution.

In this study, the homogeneity test used the Levene test to find out the variance of the data with the help of SPSS 25 software with a sig. 5% or 0.05. Following are the results of homogeneity testing.

Table 2. Homogeneity Test Result

		Levene Statistic	df1	df2	Sig.
Physical Fitness	Based on Mean	2.089	3	58	.112
	Based on Median	1.958	3	58	.130
	Based on Median and with adjusted df	1.958	3	55.325	.131
	Based on trimmed mean	2.130	3	58	.106

Based on Table 2, the value of sig. Homogeneity of  $0.112 > 0.05$ , the results show that the research data shows the same or homogeneous variance.

Testing the research hypothesis was attempted based on the results of information analysis and interpretation of 2-way ANOVA analysis. The order of the results of hypothesis testing, adjusted for the hypotheses that have been formulated previously, is as follows.

Analyzing the data shown in Table 3, whereas the exercise technique column achieved a significance level of 0.012, which is less than 0.05, we may infer that circuit and interval training had different impacts on the physical fitness of fifth-grade students at SD Negeri 1 Tanjung Sari, South Lampung Regency. The mean value for the circuit

training strategy is 16.52, which is 1.84 higher than the mean value for the interval training method, which is 14.68.

**Table 3.** Hypothesis Test Result

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	239.045	1	239.045	30.782	.000
Training Method	52.280	1	52.280	6.732	.012
Gender * Training Method	.022	1	.022	.003	.958

Based on Table 3, it can be seen in the gender column that the sig value is obtained.  $0.000 < 0.05$ , it can be concluded that there are differences in the effect of male and female gender on the physical fitness of fifth-grade students at SD Negeri 1 Tanjung Sari, South Lampung Regency. Based on the analysis results, the male sex group is more significant, with an average value of 17.65, compared to the female sex of 13.63, with a difference of 4.02.

Based on the results of the ANOVA test in Table 3. In the column gender\* training method, the sig.  $0.958 > 0.05$ , it can be concluded that there is no interaction between the circuit training method and interval training and gender on the physical fitness of class V elementary school students in Tanjung Sari, South Lampung Regency. However, based on the statistical analysis results, the mean value for the male sexes who received circuit training was higher (18.50) than the male sexes who received interval training (average value 16.63). Likewise, the female group who received the circuit training method (14.53) performed better than the female group who received the interval training method (12.73).

## 4. Discussion

An analysis of the study's findings offers insight into the conclusions of the data analysis offered. Hypothesis testing yields three distinct categories of analytical conclusions: 1) There is a notable comparison of the main study components. 2) The effect of student gender on the physical fitness of fifth-grade primary school kids is being compared. 3) There is no substantial interaction between the main elements in the interaction of two aspects. The outcomes of the additional analysis can be summarised as follows.

1. Analysis of the effect of the circuit training method and interval training on the physical fitness of fifth-grade students at SD Negeri 1 Tanjung Sari, South Lampung Regency

In this study, training with 12 sessions a month and a frequency of 3 times a week, which is done repeatedly, can

improve physical fitness. This is supported by training theory, which states that training is a physical movement carried out systematically and repeatedly over a long period to improve the body's physiological and psychological systems and functions in order to experience an increase in achieving optimal performance [48].

Based on the hypothesis test results, the two training methods significantly affect the physical fitness of fifth-grade students at Public Elementary School 1 Tanjung Sari, South Lampung Regency. The results of this study agree with research conducted by Gokulkrishnan [42] that there is a significant increase in Vital capacity and VO<sub>2</sub> max due to circuit training and interval training, which will improve physical fitness. In this study, both exercises had an effect. However, the results indicated that circuit training had a more significant impact on the physical fitness of fifth-grade kids than interval training since the interval training group performed activities with rest or recovery time between sessions. In contrast, the circuit training group had rest periods. Alternatively, recovery is carried out at the time of transfer from post to post [43]. Research conducted by Martin & George [44] explains that circuit training exercises body conditioning and endurance in a short rest period between posts. The results of this study also agree with Taufik et al. [45] who explain that the circuit training method has a better effect than the interval training method on physical fitness in terms of VO<sub>2</sub>Max. According to Ninzar [46], VO<sub>2</sub>Max can be used as a parameter of a person's physical fitness. The results of this research were also confirmed by Jariono et al., who found that circuit training significantly influenced the physical fitness of elementary school students [47].

The advantages of the circuit training method in improving physical fitness are explained by Jany & Vairavasundaram [49] circuit training is an effective and structured physical exercise aimed at developing and improving physical fitness in terms of flexibility, endurance, and muscle strength; it is easy to do with or without equipment. Another opinion expressed by Malawade et al. [50] was that circuit training significantly increases positive well-being and reduces psychological stress and fatigue to a certain extent. Circuit training is given weekly for 12 weeks, effectively improving body composition and physical fitness factors, muscle strength, and endurance [51]. Another opinion expressed by Elias et al. [53], Septia [52] is that circuit training requires individuals to continue to move at each post with or without rest (15-30 seconds) between posts so that it is efficient to improve cardiorespiratory fitness and muscle endurance through high-intensity aerobic exercise. However, this circuit training also starts from an easy to difficult level to improve performance and is a training method that is not boring [54]. Another opinion is that regularly implementing circuit training can improve individual performance and concentration and is also an effective way to increase lean mass and lose weight.

The advantage of the interval training method is that

there are passive and active rest breaks between training intervals [55]. Another advantage gained after interval training is that it will help lose weight and thus prevent obesity [56]. Another opinion of Busyairi & Ray [57] is that interval training can improve VO<sub>2</sub>Max abilities. Another statement expressed by Atakan et al. [58] is that the interval training method has advantages such as complete control of the resulting tension, as a systematic approach, allows easy to monitor daily progress, and increases potential energy faster than other conditioning exercises, as well as this training program. It can be done anywhere and does not require special equipment.

## 2. Analysis of the effect of male and female gender on the physical fitness of fifth-grade students at SD Negeri 1 Tanjung Sari, South Lampung Regency

The results of the data analysis show that there is an effect of gender on physical fitness. Students with the male gender have better fitness than students with the female gender. The results of this study reinforced by research of Tittlbach et al. [59] found differences in the level of physical fitness between men and women in each age range (male physical fitness scores were higher than women). This can be caused by various things, such as differences in the physical activity carried out [60], differences in lifestyle, hormones, biological organs, and differences in muscle strength between men and women [61]. Another opinion was expressed by Handelsman et al. [62] that the difference in physical fitness between men and women is determined by the secretion of the hormones testosterone and estrogen, in which testosterone will increase the number and size of muscle fibres and also increase mitochondria in cells so that tissues are active. In cells, that can increase, and the ATP produced is even more in men, unlike women with lower testosterone. However, in women, the hormone estrogen is higher than in men, which increases the distribution of body fat so that inactive tissue is more in the body and reduces the level of physical fitness. A lot of ATP will produce more energy so that it can increase the level of physical fitness. However, the results of this study are also different from previous studies conducted by Hambali et al. [63], and Hartati et al. [64], that women's physical fitness is better than men, and there is no difference in the effect of gender on physical fitness.

Thus in this study, it is the novelty that the male sex has higher physical fitness because men have a higher testosterone hormone than women. This statement can be seen during recess at school. Male students play more physical games, such as playing basketball, playing volleyball and chasing each other, while female students sit more [65].

## 3. Interaction of circuit training methods and interval training and gender on the physical fitness of fifth-grade students at SD Negeri 1 Tanjung Sari, South Lampung Regency

The ANOVA examination indicated no significant

interaction between the circuit training method, the interval training method, and gender. Hence, we have determined that gender does not substantially impact the physical fitness of fifth-grade students at SD Negeri 1 Lampung, Tanjung Sari, South Lampung Regency, regardless of whether the circuit training method or the interval training method is employed. Hence, doing a posthoc or follow-up test was superfluous in this investigation.

## 5. Conclusions

After one month with a frequency of 3 times a week following the circuit training and interval training program, the physical fitness of male and female students significantly increased. However, circuit training improves physical fitness in male and female students more than interval training. Apart from that, the research results also show that this study's type of exercise method does not depend on gender.

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