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The effect of interval training on 100-meter running speed in club tub jar aru female sprinter athletes

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Abstract
This study aims to determine the effect of interval training on 100-meter running speed in female sprinter athletes Club Tub Jar Aru. The method used by the experiment was to determine the effect of the independent variable (interval training) against the dependent variable (100-meter running speed) under controlled conditions. The entire population of 15 people was also sampled (Census research). The data sources in this study were collected through 100-meter running test data before and after treatment. The test results from the table "t" with DF = n-1, i.e., = 15-1 = 14, show that with df of 14 at a significant level of 5% obtained, t-table. = 1,761 and 1% = 2,624. Because t-observation.is greater than the t-table. Thus, significant levels of 5% and 1% of the alternative hypothesis are accepted, while the null hypothesis is rejected. This means that at a significant level of 5% and 1%, there is a positive influence between the independent and dependent variables in the form of a significant increase in running speed in Club Tub Jar Aru female sprinter athletes.

Keywords: Interval training, speed, 100-meter run, women's sprinter

Introduction
Interval training involves repeated circuits between high-intensity periods and active rest or lower recovery. In the context of athletics, particularly sprinting, such as the 100-meter run, interval training has been the subject of exciting research to understand its impact on improving the speed and performance of athletes (Kesumawati *et al*., 2022) [16]. One background to the problem is that researchers and coaches constantly look for ways to improve athletes' performance quickly without sacrificing health or increasing the risk of injury (Zeng *et al*., 2017) [20]. Interval training promises the potential to increase the speed of a 100-meter run by utilizing the principles of the body's physiological adaptation to regular interval training.

It is essential to understand the variables that affect the effectiveness of training intervals on 100-meter running speed. For example, proper training interval design, such as interval duration, intensity, and rest duration, are important factors that must be considered to achieve optimal results (Benda *et al*., 2021) [3]. In addition, individual differences in physiological responses to exercise are also factors to be considered when developing effective interval training programs. Therefore, the background to the issue includes in-depth research into how variations in interval training design can affect increases in 100-meter running speed among athletes (Firdiansyah, 2023) [6].

Interval training effectively increases the speed of a 100-meter run, and scientific research backs up this claim. Scientific studies highlight the benefits of interval training in improving the strength, speed, and endurance needed to achieve optimal results in sprinting. The high intensity of interval training helps optimize the body's physiological adaptations, including increased aerobic and anaerobic capacity, which are critical factors in improving the performance of athletes in the 100-meter run. Interval training allows athletes to target specific aspects of the 100-meter sprint, such as initial acceleration, maximum speed, and quick recovery between sprints. By designing appropriate interval training, athletes can strengthen the muscles involved in sprinting movements and improve movement coordination to achieve better efficiency. This is important because the 100-meter run involves a short period, where every second and movement is critical to the athlete's success (Firdiansyah & Hary, 2023) [6]. Interval training provides flexibility in exercise design, allowing adjustments according to the individual needs and abilities of the athlete.

This allows the trainer to adjust the intensity, duration, and frequency of intervals according to the athlete's fitness level and specific goals. With this customizable approach, athletes can optimize their workouts to maximize results relatively quickly. The benefits of interval training are not only limited to improving the performance of athletes but also allow for improved overall health. Interval training improves cardiorespiratory function, reduces cardiovascular disease risk, and improves body composition. Thus, interval training provides clear benefits in an athletic context and can improve overall quality of life.

Field facts reveal that it is also necessary to consider athletes' psychological and motivational aspects in interval training programs. Although interval training can be an effective tool for improving the speed of a 100-meter run, psychological factors such as motivation, consistency, and the support of the coaching team can play an essential role in the successful implementation and outcome of an training program (Ztella Rumawatine, Taufik Rihatno, Sri Nuraini, 2017) [21]. Therefore, the background of the problem also includes research on how this psychological aspect can be managed and improved to improve the effectiveness of interval training in increasing the speed of the 100-meter run.

Sports are essential to maintaining health and achieving physical fitness. Efforts to socialize in sports must start from an early age, and it is very appropriate if this effort starts from learning physical education at every level of education. Sports are also considered, such as knowledge and ability in athletics. Athletic sports are easy to do and develop theoretically and practically. Poor training makes people who should create athletes but do not know what training exactly is given to get an athlete who excels, not because they do not know that providing an exercise is arbitrary or not planned, regular, or programmed. Thus, the result is not satisfactory. Therefore, athletes should ignore their training efforts and have a speed development program. According to Poerwanto and Firdiansyah (2019) [12], speed is the ability of individuals to perform the same movement over and over again in the shortest possible time. Any effort to improve performance and efforts to improve physical condition must develop everything contained in these components. Just like in the 100-meter running number after being seen in training and observation in the field, the most crucial role is the footwork step to go faster, so when viewed in terms of the role of physical condition through interval training in terms of doing 100-meter running movements is very important.

The 100-meter sprinter involves understanding how interval training affects body mechanics during the sprint phase. Well-designed interval training can help improve the strength, speed, and efficiency of movements involved in sprinting, such as stride, quick recovery between steps, and overall body position. Increased strength and coordination of the major muscles involved in sprint, such as leg and core muscles, can improve thrust when launching the body forward, thereby speeding up overall movement. In addition, interval training targeting aerobic and anaerobic capacity development can improve endurance and aerobic efficiency, potentially reducing fatigue-induced performance degradation during a 100-meter sprint.

The (Kilic *et al*., 2022) [10] research systematically analyzed and meta-analyzed various studies that have been conducted previously to evaluate the effect of interval training on 100-meter sprint performance. The results showed that high-intensity interval training significantly increased the speed of the 100-meter run compared to other training methods. That same research by Akyol and Pektas (2018) [1] provided relevant insights by focusing on professional soccer players. The study highlighted the positive effect of interval training on sprint performance, which directly impacts 100-meter running speed. The results showed that interval training programs focused on sprints improved the speed and performance of sprints in a relatively short period. Retnanto & Firdiansyah (2023) [15] offers an additional understanding of the impact of interval training on running performance. Despite its focus on intermediate running distances, the study remains relevant as it investigates general principles and effects of interval training on running performance. The results show that interval training consistently improves running performance in various contexts, including running speed, which can positively impact the speed of -meter run (Firdiansyah, 2022) [5].

This study aimed to get an idea of the effect of interval training on 100-meter running speed in Club Tub Jar Aru female sprinter athletes. The benefit of this study is to develop interval training programs to develop and improve athlete performance in athletics. It is expected to help athletes improve their ability to run 100 meters to achieve more optimal speed and results. Based on the above problems, researchers want to research the effect of interval training on 100-meter running speed in Club Tub Jar Aru female sprinter athletes.

Method

The method used is an experiment to determine the effect of treatment variables/actions) on dependent variables (Results) under controlled conditions (Malliari & Togia, 2016) [11]. This study was a one-group pretest-posttest design; this study was carried out in Karey Aru Selatan Timur Village, and this research was carried out for three months. This study's population was Club Tub Jar Aru female athletes, totaling 15 people. The sample used by the entire population of Club Tub Jub Jar Aru female athletes amounted to 15. Thus, this study is a census study. In census research, every entity or individual in the population is researched or data taken. That is, there is no random selection or taking of a specific subset of the population since the entire population is considered in the study (Retnanto & Firdiansyah, 2022) [14].

This study's independent variable (X) is interval training, and its implementation is training in and out and speed. In-out exercise is performed repeatedly between periods of high intensity (in) and periods of active recovery or lower rest (out). During periods of high intensity, athletes will perform high-intensity exercises or movements that require maximum effort, such as sprints or strength training. After that, the athlete will move on to a lighter recovery period, a brisk walk, or a light jog to allow for muscle recovery and the cardiorespiratory system. In-out workouts help improve endurance, speed, and muscle strength by combining hard work and recovery. Speed training involves short-distance sprints (20 to 60 meters), acceleration, or starting reaction exercises. Speed training improves muscle strength, movement coordination, and mental speed in response to starter signals or race situations. Thus, speed training helps improve the performance of athletes in activities that require speed and quick reactions, such as running a 100-meter sprint.

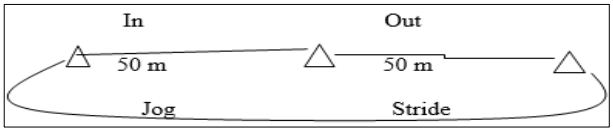

Fig 1: In-Out Exercise (Syaranamual, 2022)

The dependent variable (Y) is the speed of the 100-meter distance running assessed by the 100-meter distance running test instrument (r-value = 0.731 with height criteria). The data obtained will be analyzed using the t-test formula.

Results and Discussion

The data presented are conditioned to look for D (difference) between variable I and variable II scores. If variable I is denoted by X while variable II we give the symbol Y, then D = X – Y. Thus D = 497.23 - 317.07 = 180.16. Next, add D so that we get ∑D = 180.16 and determine the mean of the difference using the formula (∑D)/N. (180.16/15) = 12.011.

Table 1: X and Y Data Result

Sample	X	Y	D(X-Y)	$D^2(X-Y)^2$
1	31.05	19.15	11.9	141.61
2	36.1	20.06	16.04	257.2816
3	34.08	22.45	11.63	135.2569
4	28.08	20.09	7.99	63.8401
5	30.08	20.28	9.8	96.04
6	29.09	21.3	7.79	60.6841
7	30.08	18.46	11.62	135.0244
8	41.09	20.44	20.65	426.4225
9	28.08	21.21	6.87	47.1969
10	40.08	22.3	17.78	316.1284
11	29.08	18.45	10.63	112.9969
12	39.08	20.15	18.93	358.3449
13	39.08	31.15	7.93	62.8849
14	34.1	19.28	14.82	219.6324
15	28.08	22.3	5.78	33.4084
	497.23	317.07	180.16	2466.7524

Based on the table of "t" values, it can be seen that with df / db of 14 obtained t values at a significant level of 0.05 = 1.761 and 0.01 = 2.624, or in other words, it can be concluded that 1.761<10,000 > 2.624. Rejection, H-o.; If it turns out, t-count.>, t-table. Then, H-o. Rejected. As for the rejection criteria, H-o. When t >, t-a, df. =, t-o.05, df.= 1.761 and,t-o.01,df. While the result is t-count. = 10,000 then, t-calculate > t-table., then the result, H-a. Accepted. It can be explained that interval training affects the speed of running 100 meters in Club Tub Jar Aru sprinter female athletes.

The calculation results can be known to calculate = 10,00, then consulted with the data criticism figures table both at the level of significance of 5% and 1% by first determining the db or df where db or df = N-1 = 15-1 = 14. Thus, for the significance level of 5%, it is known that the value of t-table = 1.761, While for the significant level of 1%, it is known that the value of table = 2.623. That means that at a substantial level, 5% is smaller than the count, more remarkable than the significant level of 1% or < t >, t-table, or in other words, it can be concluded that 1.761 < 10.000 > 2.623. Based on the hypothesis testing criteria, if calculate> table, the alternative hypothesis or Ha is accepted, and vice versa rejects the null hypothesis. Based on the above tests, it can be concluded that the training interval affects the speed of running 100 meters in female athletes' sprinter club tub jar aru. That means the alternative hypothesis (H-a.) is accepted, and the null hypothesis is rejected (H-o.).

Interval training in Club Tub Jar Aru female sprinter athletes revealed that In Out and Speed Training influence the 100-meter running speed of Club Tub Jar Aru female sprinter athletes. Many beginner athletes have not maximized their speed, even though they train every day, but their speed has not maximized the speed of running 100 meters. Because most of the arm swings when running are not optimally swung forward, in addition, the step speed and stride length were not carried out optimally; the Club Tub Jar Aru, a women's sprinter, did not have the maximum speed to increase after interval training in out and speed training was carried out; this can be seen in the initial test data and the final test by doing a 100-meter running speed test, it can be seen that the final test data has increased from the initial test data. Research written by Ayan (2018) [2] that interval training programs focused on increasing speed and aerobic endurance significantly increase the speed of 100-meter running in female athletes. The study suggests that interval training with variations in intensity can effectively improve female athletes' performance in sprints. Research published in the International Journal of Sports Physiology and Performance found that interval training programs involving a combination of short sprints and passive rest or lighter recovery significantly increased 100-meter running speed in female athletes. The results of this study show that interval training can be an effective method for improving sprint performance in female athletes. Geri (2021) [8] research published in the Scandinavian Journal of Medicine & Science in Sports highlights that high-intensity interval training can result in a significant increase in 100-meter running speed in female athletes. The study shows that interval training designed to increase speed can significantly benefit female athletes in achieving better results in sprinting. A meta-analysis by Canli (2019) [4] published in Sports Medicine concluded that interval training programs consistently resulted in significant improvements in sprint speed in female athletes. Although the focus was not specifically on the 100-meter run, the findings support that interval training can positively affect running speed in female athletes in general.

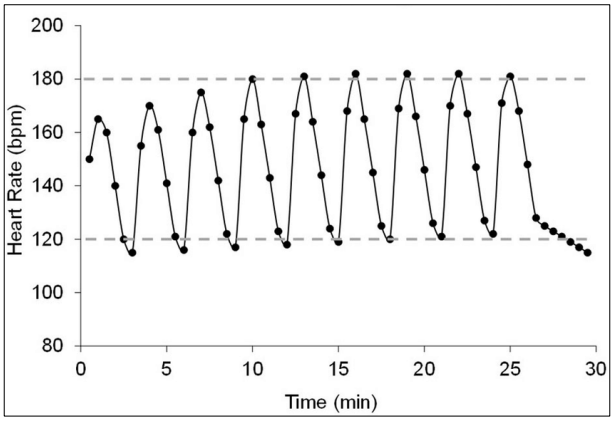

Fig 2: Interval Training Scheme

The interval training scheme emphasizing interval training in-out, also known as interval training with intensity variations, has become an exciting research focus in conjunction with increased 100-meter sprint speed. This method involves repeating circuitry between periods of high intensity (In) and periods of active recovery or lower rest (Out) (Retnanto & Firdiansyah, 2022) [14]. The discussion on the effect of the in-out training interval on the 100-meter sprint covers several important aspects. In-out interval training provides an adequate stimulus to increase the strength and endurance of the muscles involved in sprint (Ramadan *et al*., 2023) [13]. High-intensity periods increase muscle strength and explosiveness, while recovery periods (Outs) aid in rapid muscle recovery and reduce excessive fatigue accumulation. Thus, this pattern can increase movement efficiency and allow athletes to maintain high speed during the 100-meter sprint.

Interval speed training helps increase the athlete's maximum speed through exercises designed to speed up movement and increase step frequency. By integrating short-distance maximum sprints and acceleration exercises, athletes can improve their ability to reach top speed in less time. This is important in the 100-meter sprint, where the starting speed and initial acceleration are critical determining factors in achieving good performance (Sugihartini & Yudiana, 2018) [19]. Speed training intervals also help improve quick recovery between successive sprints. By incorporating short rest periods between sprints, athletes can exercise their ability to recover quickly after maximum effort (Subagio *et al*., 2020) [18] (Rumawatine, Taufik, Sri, 2017) [21]. This improvement in recovery ability can allow athletes to maintain speed and intensity during the entire 100-meter run, thereby improving overall performance. Thus, interval speed training becomes an effective method in preparing athletes to better face the challenges of the 100-meter sprint.

Interval training has a significant physiological impact on increasing the speed of the 100-meter sprint in athletes. High-intensity interval training allows for increased aerobic and anaerobic capacity of athletes. During high-intensity intervals, the body needs more oxygen to meet high energy demands, which triggers an increase in aerobic capacity by improving the performance of the cardiorespiratory system. Interval training also triggers anaerobic adaptation, increasing the body's capacity to produce energy without oxygen, which is essential for increasing explosive power and speed in sprints.

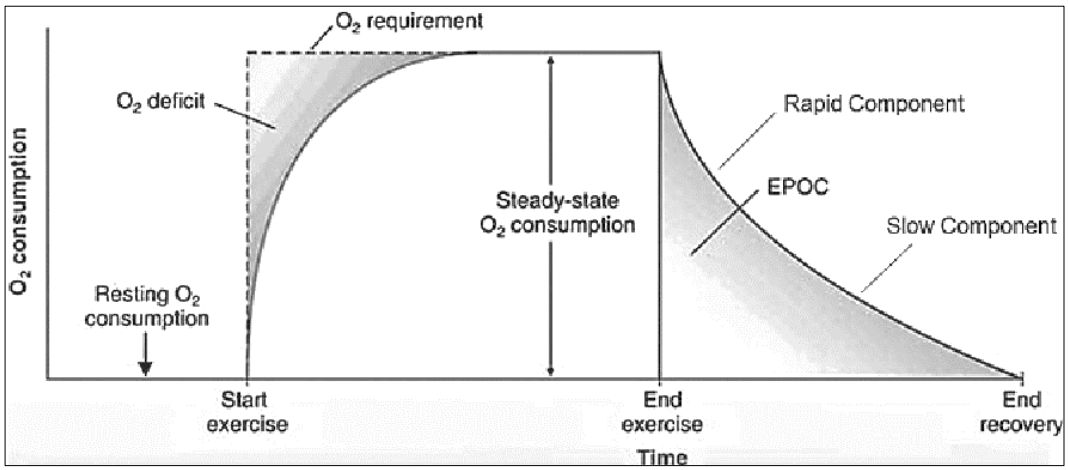

Fig 3: Interval Training Sprint Guide

The above scheme suggests that interval training helps increase the strength and efficiency of the muscles involved in sprint running. During high-intensity intervals, the muscles are maximally activated to produce robust and fast movements (Zulfahmi, 2018) [22]. This triggers physiological adaptations in the muscles, such as an increase.

In the size of muscle fibers and an increase in the strength of muscle contractions, increasing the athlete's ability to generate the power required for a 100-meter sprint at maximum speed. Interval training helps improve an athlete's ability to cope with fatigue and speeds recovery between sprints. By designing short rest periods between high-intensity intervals, athletes can train their body's recovery system to recover faster after maximum effort. This is important because a 100-meter sprint requires the athlete's ability to maintain high speed over the entire race distance, and the ability to recover quickly between sprints can help maintain optimal performance (Hary & Firdiansyah, 2019) [9].

Theoretically, interval training affects the athlete's central nervous system, improving the coordination of movements and reactions necessary to achieve maximum sprint speed. Interval training strengthens nerve pathways that regulate muscle contraction and movement coordination, increasing movement efficiency and precision. This lets the athlete respond quickly to the start signal and produce coherent and effective movement during the 100-meter sprint. Thus, through these diverse physiological effects, interval training can help increase the speed of the 100-meter sprint in athletes.

When athletes do 100-meter sprints, they should also consider the potential risk of injury due to training intervals that are too intensive or unsuitable for individual needs. Excessive training loads or lack of adequate recovery between intervals can increase the risk of injury to the muscle structures, tendons, and joints involved in sprinting. Therefore, it is essential to pay attention to the selection of interval training appropriate to the individual's fitness level and strength and monitor recovery and signs of excessive fatigue to reduce the risk of injury (Shingjer, 2018) [17].

Conclusion

This research resulted in interval training in the form of out-and-speed training. It was influential and proven to show its effectiveness as an alternative to increasing the 100-meter running speed of Club Tub Jar Aru female sprinter athletes.

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