

The Improvement of Power Endurance and Aerobic through Interval Method by Using Vest Jackets

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Abstract Vest jacket is a training tool that attaches an external load to the jacket pocket which aims to provide resistance to the body during exercise. This research aims to improve power endurance and aerobic through the interval method by using vest jackets. The method used in this research was an experiment with One-Group Pretest-Posttest design. The sample was 17 futsal players who joined the Pro Futsal League in 2020. The research instruments were in the form of power endurance ability test through a Multistage Hurdle Jump Test and aerobic test through a Bleep Test. The data analysis t-test with a significant level of 5% uses SPSS 18 software. The results show that interval method training using a vest or weighted jacket has a significant effect on increasing power endurance and aerobic abilities. The conclusion in this study is that the increase in aerobic capacity is influenced by interval method training using a resistance vest jacket and the increase in the ability of power endurance is progressively greater because the elements of the training material are more dominant with heavy work muscles. For further research, it is suggested that the scientific development in coaching should be more effective and efficient. Therefore, in this research, it can be developed through other forms of training or method to sports that are more specifically dominant in physical abilities, such as sports that are dominant power endurance and dominant endurance.

Keywords Interval Method, Vest Jacket, Power Endurance, Aerobic, Futsal

1. Introduction

Futsal player needs physical abilities in the form of power endurance and aerobic which according to [1], the leg muscle power is very important to jump and run in intermittent sports. Maintaining and increasing leg power are important for futsal athletes who do a lot of sprints during trainings and matches which will cause muscle fatigue. Then, according to [2], if we take a look at the characteristics of the futsal sport that is played for 20x2 times, high aerobic abilities are supported by good anaerobic abilities. Aerobic capacity is the ability to maintain high work output for long periods of time [3]. VO_2max is also expressed as the total volume of oxygen used per minute (ml/kg/min) [4].

To improve physical abilities, many training methods are used. One of them is High Intensity Interval Training method or commonly called as HIIT. Interval training involves repetition and recovery exercises [5, 6]. It involves a repetition duration of 10-30 seconds and with recovery done actively or passively [7, 8]. HIIT training is 90% to 100% of vo_2max [9, 10]. According to [11] the distance of high intensity interval training using an aerobic energy system is more than 30 seconds while the training interval using anaerobic energy system is between 10 to 30 seconds. Moreover, the time span for high and low intensity interval trainings is between 10 seconds to 4 minutes. To sum up, HIIT training from the beginning of the initial warming up, core, and cooling down can take place within thirty minutes based on the intensity of the exercise. Interval training consists of the duration and

intensity of work intervals, the duration and intensity of rest intervals, and the total work duration. This can be manipulated to suppress the energy designed in the interval training [12] by changing the running distance, the running time, the number of repetitions, and the duration of recovery. Then, interval training can be carried out at high intensity in large quantities with the same fatigue [13].

The aim of HIIT training method, according to [14], is to repeatedly emphasize the physiological system during certain endurance exercises to a greater extent than they actually are; also, to produce difficult adaptations and increase efficiency and energy metabolism efficiency [15]. The advantages of HIIT is that high intensity exercise is more efficient than moderate intensity exercise which can improve anaerobic and aerobic fitness, burn fat during exercise, improve cardiovascular health, and increase muscle mass [16]. Even peripheral vascular structure and function can be improved by conducting sprint interval training [6]. [17] showed a large improvement in high-intensity anaerobic energy systems. Besides, a higher training intensity provides greater cardio-protective benefits [18].

In some research on HIIT, the results of two training groups (interval and continuous run methods) have a significant relationship with power endurance [19]. HIIT can increase anaerobic capacity by 28% and increase aerobic capacity. This is in line with research which states that aerobic training with HIIT method conducted for 6 weeks with moderate intensity does not have an effect on anaerobic capacity, but aerobic training conducted for 6 weeks with high intensity (20 seconds of exercise, 10 seconds of rest with an intensity of 170% VO_2max) can increase anaerobic and aerobic capacity simultaneously [20]. Furthermore, HIIT significantly improved the performance of trained rowers [21]. Significant aerobic improvement in runners, swimmers with the HIIT method [22]. In addition, relatively short but intense sprint training can result in improved oxidative muscle tone [23] glycolytic enzyme activity, short-term maximum power output, and VO_2max [24]. HIIT may be more time-efficient to improve fitness, maximal oxygen consumption (VO_2max) [25, 26].

Interval training is commonly done to improve anaerobic and aerobic. The increase of training load for anaerobic and aerobic capacity can be done in several ways, including by adding reps, sets, duration, load (weight), and so forth. In connection with the training model in this research, weight vest or vest weighted jackets were applied to add weight. The function of the vest jackets is as an external load which aims to provide resistance to the body when they are doing trainings. Moreover, the vest jackets can also be used for dynamic training. Adding training load using a vest weighted jacket is included as one form of resisted training. In a research conducted by [27], it found that the forms of training were generally divided into three: resistance-based training, resisted running and plyometrics. In line with this research, [28] found that the methods used

to improve acceleration include assisted resisted sprinting techniques, weight training, and plyometric training. In resisted running and plyometrics, the most widely used tools are weight vests, weight jackets, running on climbs, plyometric bounding and variations, tools to add weight to the arms, weighted sledge, parachutes, running in sand, and resisted towing [27, 28, 29]. In addition, [30] also suggested the use of weight vests in resisted training exercises.

This research aims to determine the improvement of power endurance and aerobic through the interval method by using vest or weighted jackets. Based on the description above, some studies have suggested that there is an effect of training by using a weighted vest on the basic movement (kihon) of karate dachi Zenkutsu [31]. Then, [32] revealed that the provision of foot training by using a weighted vest turned out to affect the agility of PB Bintang Timur abadi Surabaya badminton athletes. Some studies also provided a positive impact in improving performance by using loads of 5, 7, 8, 11, and 12.5% of body mass [33, 34, 35, 36]. With the results of the research above, researchers feel interested to study more deeply in improving power endurance and aerobic through the application of the interval method by using vest weighted jackets.

2. Methods

The population in this study were 17 futsal players. The sample used in this study was the entire population or 17 futsal players. After receiving the detailed explanation of the objectives, potential benefits, and risks associated with participating in this research, each student gave her written approval. In the implementation of the first research, conducted initial testing as initial data to find out where the athlete's abilities, then after knowing the results of the initial ability and finally given with interval training method using a vest jacket with a form of training tailored to the characters of futsal, the treatment is carried out 3 times a week. After the treatment is given, the researcher takes the final measurement to find out the results of the given process. The steps taken for the data collection were preparing test instruments and the data collection was taken by four experts who carried out according to the test procedure. The type data taken is the type of quantitative data. The data collection schedule consisted of two stages; the first stage was the initial test to determine the initial conditions of the subject and the second stage was the final test to see the improvement of the results of the training treatment. The method used in this research was the true experimental method with one group pre-test-post-test design [37]. The research steps can be seen in Figure 1.

The research instruments was in the form of an interval training program using a vest jacket as a process in data collection and some test items to determine the ability of power endurance by Multi Stage Hurdle Jump Test [38] and the ability of aerobic by Bleep Test [39].

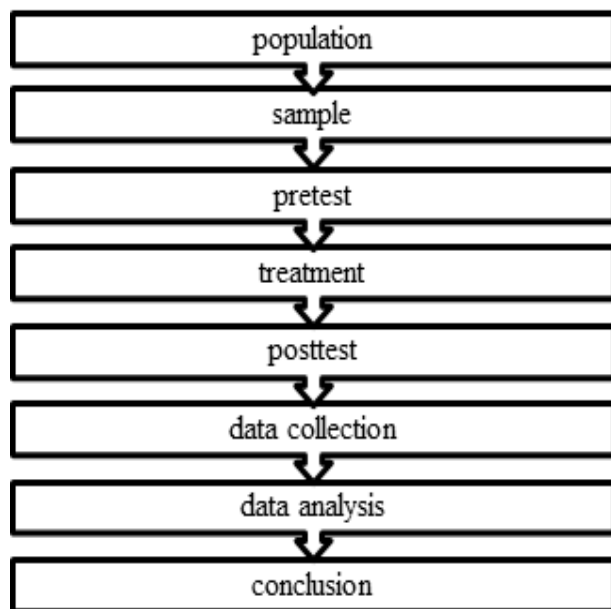


Figure 1. The Research Design

3. Results

The data obtained from the samples in conducting pre-test and post-test were analyzed by using SPSS software. The analysis technique was paired sample t-test. This test was used to test whether there were differences or effects. The first step to see the impact in increasing aerobic with the interval method using a vest jacket is to do a normality test by the Kolmogorov-Smirnov One-Sample Test. Because the subject has a normal distribution so the proceed with the descriptive data test used Paired Samples Statistics, and the correlation test used Paired Samples Correlations.

The average value of power endurance pretest is 87.76 <posttest 102.47, and the average value of aerobic is 42.57 <44.02. Therefore, there are differences in the average results of the training between the pretest and posttest, the power endurance correlation coefficient value of 0.667

with a significance value of 0.003, and the aerobic correlation coefficient value of 0.895 with a significance value of 0.000. Because the Sig. value <probability is 0.05, it can be said that there is a relationship between the pretest and the posttest variables. To prove whether the difference is really significant or not, we need to interpret the results of the paired sample T test as contained in Table II.

Table 1. The results of the average test and the correlation of the power endurance and aerobic

Component	The interval method using vest jackets			
	Mean		Correlation	Sign
	before	After		
Power Endurance	87.76	102.47	0.667	0.03
Aerobic	42.57	44.02	0.895	0.000

Table 2. The results of paired sample t-test

Components of		The Interval Training Method using vest (weighted) jackets		
		Results	Sig.	Significance Test of
Power Endurance		Improved	0,000	Significant
Aerobic		Improved	0.001	Significant

Based on the test table above, the Sig. value (2-tailed) of power endurance is 0,000 <0.05, it can be concluded that there is an average difference between pretest and posttest, which means that there is an influence of the interval training method using vest jackets to improve the ability of power endurance. Then, the Sig. value (2-tailed) of aerobic is 0.001 <0.05, and it showed that there is an average difference between pretest and posttest. It means that there is an influence of interval training method by using vest jackets to improve aerobic ability. For more detail improvement presented in the Figures 2 and 3.

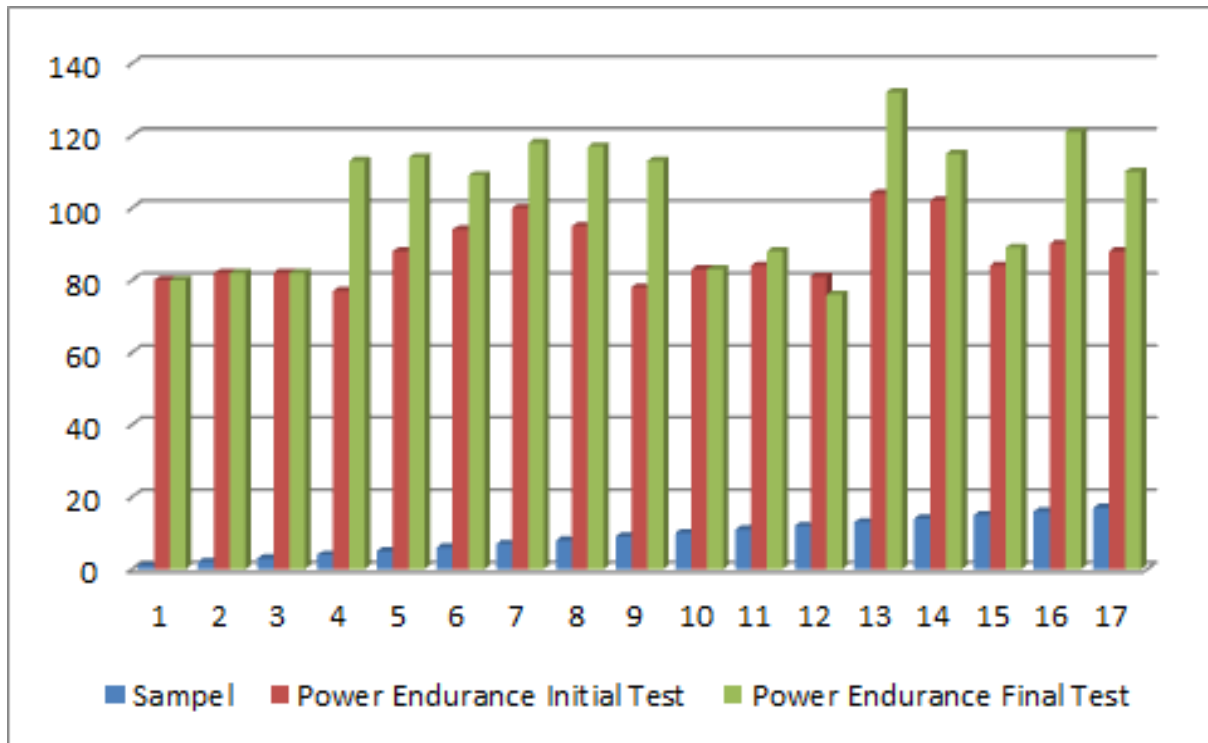


Figure 2. The percentage of initial test and final test of power endurance ability improvement influenced by interval training method by using vest or weighted jacket.

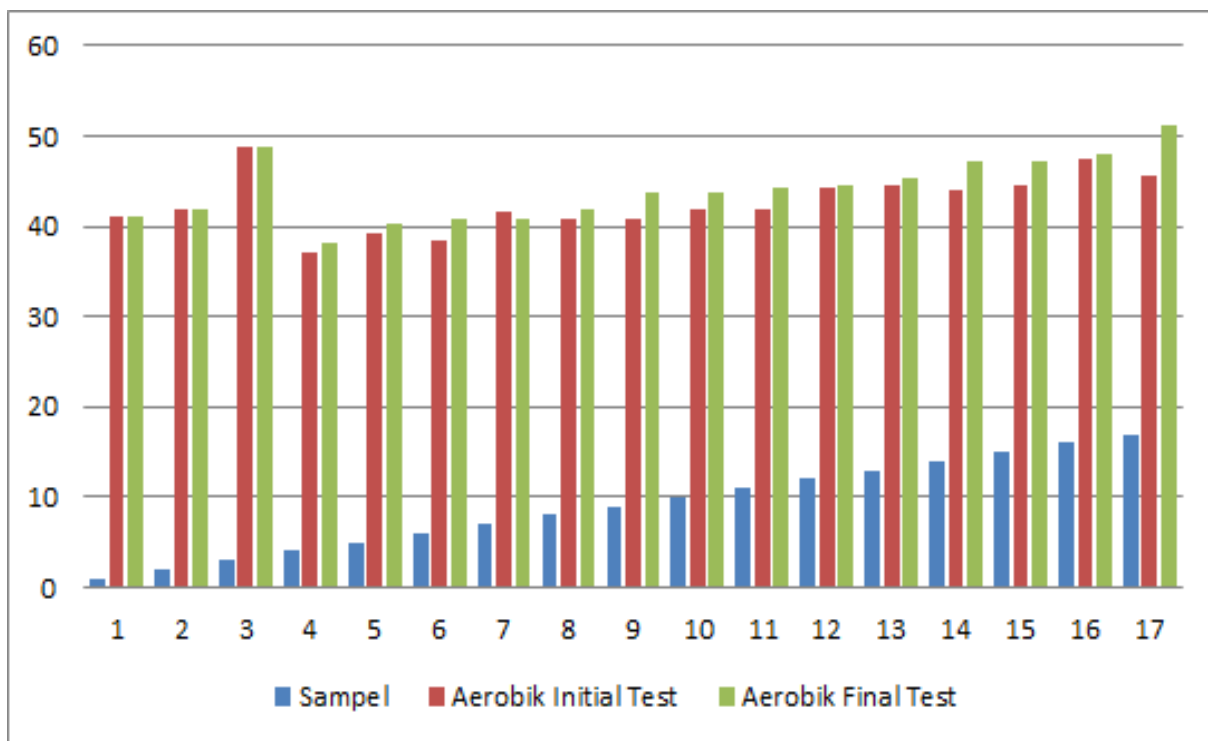


Figure 3. The percentage of initial test and final test of aerobic ability improvement influenced by interval training method by using vest or weighted jacket.

4. Discussions

Some findings in this research greatly help researchers to discuss not only in conceptual physiological but also its

implementation in the field. The ability of power endurance is speed strength maintained for a long time [40] and power endurance in physiological concept acts as one of the abilities in which its energy source comes from the

anaerobe lactacid. As can be seen from the results of the training, and as it is known, the results of interval method training using a vest or weight jacket have a significant effect on power endurance and aerobic. This is in accordance with the research of [19] that interval training is effective in increasing power endurance abilities. According to [41] that interval training has a significant impact on increasing cardiovascular and muscle isokinetic strength. Then [42] media weighted jackets and weighted belts can increase the leg strength of water polo athletes. The increase in the results of this study is due to the structure of the exercises that are designed and arranged based on individual abilities, such as frequency or repetition when doing agility, speed, and jumping forms, and / or form of running in a longer distance in an interrupted manner because it is applied to the interval method with the duration of lactacid, namely: 25 seconds to 120 seconds. Because futsal is a high-intensity sport that requires the players to sprint much more [43] to do some specific movements, such as quickly doing acceleration, doing deceleration, jumping or changing direction [44]. [27, 30, 45] the use of weight vests is highly recommended in training with the form of running, jumping and other expansive movements without limiting the space for movement.

A weighted jacket is a resistance training which certainly stimulates the muscles to respond when they are moving so the weight and lightness of the training appear to each individual in performing repetitions (reps) of a different amount. This is in line with the opinion of [27] One form of resisted training, namely by adding training loads using a weighted jacket. It depends on the ability of muscle recovery movement and muscle recovery after completion of a series of motion. The increase number of movements for each workout in some period causes the quality of muscle contraction to accelerate. This indication shows that a significant impact is felt by the players when the endurance power is needed and demanded. This is in line with [46] that power endurance really needs to be trained so that there is a repetition of basic techniques that must exert maximum strength in a fairly short time with a long work duration because they do it repeatedly in one match. The real condition in the field seems that each player has a better movement speed from match to match. The ability of aerobic capacity affected by interval training method by using these weighted jackets resistance is in accordance with the physiological principle that the increasing number of repetitions, the longer duration of doing, and the increasing distance traveled will give a better adaptation effect. According to [16], exercise with high intensity causes increased anaerobic and aerobic fitness, and can burn fat, improve cardiovascular health and increase muscle mass. This was shown by the players after training and also after the match. Each of them experienced a recovery that was willing to show progress. And time recovery became shorter, -because in a research conducted by [47] it was mentioned that during a match,

each player could do around 26 sprints (e.g., $\geq 18.4\text{km} \cdot \text{h}^{-1}$), with a short recovery (i.e., 15 seconds) among them. This is because in playing futsal, the player must repeat the run with a quick recovery [48]. [49] states that this interval method is highly recommended by coaches because it has a very positive impact on the development of endurance athletes.

Progressively, the improvement of the training results indicates that the quality of power endurance greatly improves in each individual element of the training material caused by the more dominant muscle weight compared to cardio work. For some players whose aerobic quality has improved, they only show a slight improvement because the limit of maximum ability is almost reached in accordance with the demands and needs of a futsal player.

5. Conclusion

The conclusion in this study is the interval training method using a vest or weighted jacket has a significant effect on increasing power endurance and aerobic abilities. The increase in the ability of power endurance is progressively greater because the elements of the training material are more dominant with heavy work muscles. The implication of the results shows that in order to get the maximum training impact as stated in the laws of physiology and pedagogy, the training methods applied by a coach or trainer must adapt to various physical components without ignoring the principles and the norms of the training. For further research, researchers suggest that the scientific development in coaching should be more effective and efficient. Therefore, in this research, it can be developed through other forms of training or application to sports that are more specifically dominant in physical abilities, such as sports that are dominant power endurance and dominant endurance.

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