Impact of HIIT Exercise Methods on Improving the Ability of Anaerobic and Aerobic Capacities of Female Futsal

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Abstract: HIIT stands for High Intensity Interval Training and is a model of aerobic conditioning performed with maximum intensity of exercise, which is equal to or greater than 90% of VO2max, the problem that arises is how much impact is given to anaerobic and aerobic dynamic enhancement capabilities. The purpose of this study was to determine the impact of the use of HIIT training methods on enhancing the dynamic capability of anaerobic and aerobic capacity. The method used is one group experimental method pre-test-post-test design. In the implementation, the researcher perform the testing and the initial measurement and then give the exercise treatment with HIIT training method, after finishing the treatment then testing and final stage measurement were done. The analytical technique used is to use two-sided equality tests to determine whether there is an increase in anaerobic and aerobic ability. This study shows that there is a significant effect between the results of the initial test and the final test results on anaerobic dynamic ability, as well as indicating that there is a significant influence between the preliminary test results and the final test results on aerobic dynamic ability. The implications of the research results indicate that in physical training, the training method must adapt to the various elements of the physical component to be trained in accordance with the principles and practice norms in physiological and pedagogical law in order to gain meaningful impact on maximal training.

1 INTRODUCTION

The phenomenon that occurs in the field is some weaknesses that are still experienced by the coach is a variety of methods and forms of exercise for each physical component. Physical ability is one factor that is very important if you want to get maximum performance in every sport. The key to achievement success is the presence of determinants of achievement, both internally and externally.

High Intensity Interval Training (HIIT) has become increasingly popular in recent years. HIIT is an efficient time-training method to increase aerobic capacity and maintain an index of speed and strength (Cathal J. Cregg, 2013), HIIT training can be easily modified for people of all fitness levels and special conditions, such as overweight and diabetes. HIIT exercises can be done on all ways of exercising, including cycling, walking, swimming, water exercises, and in many other exercise groups. The HIIT exercise provides the same fitness benefits as endurance exercise continuously, but in shorter periods of time. This is because the HIIT exercise tends to burn more calories than traditional exercise, especially after practice. The study compared moderate intensity training in 70% of maximal oxygen consumption (VO2max) for 60 min, with HIIT performed in 170% of maximal oxygen consumption (VO2max).

When developing the HIIT program, consider the duration, intensity, and frequency of the work interval and the length of the recovery interval. Intensity during high intensity work intervals should range from ≥ 80% of the estimated maximum heart rate. As a good subjective indicator, the working interval should feel like we are exercising "hard" to "very hard". By using sound as a guide, it's like having a conversation, with difficulty. The intensity of the recovery interval should be 40-50% of the estimated maximum heart rate. It will be a very comfortable physical activity to help with recovery and prepare for the next exercise. The relationship of exercise and the recovery interval is important. Many studies use specific recovery ratios to improve different body energy systems. For example, a 1: 1 ratio may be a 3-minute hard work (or high intensity) followed by a 3 minute (or low intensity). This 1: 1 interval exercise often revolves around 3, 4, or 5 minutes followed by

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the same time in recovery. The HIIT training protocol is popular with this type of program, the athletes perform about 30 seconds 'sprint or near full out effort', followed by 4 to 4.5 minutes of recovery. The combination of these exercises can be repeated 3 to 5 times. This high intensity work effort is usually shorter (30 seconds with sprint interval training).

In research on HIIT can be increased by using 4 weeks on trained athletes (Matthew, et al., 2009). The study found that HIIT can increase aerobic capacity to the same extent as moderate intensity training sustainability, but also produce 28% anaerobic capacity increase. Other findings led to the development of various HIIT programs. Although there are many different ways to perform HIIT, all programs marked with high intensity combined with rest or brief recovery intensity. This is consistent with research that resulted in training with HIIT method for 6 weeks of moderate intensity exercise did not give effect to anaerobic capacity but 6 weeks of moderate exercise with high intensity (20 seconds of exercise, 10 seconds rest with intensity of 170% VO2max) anaerobic capacity and VO2max simultaneously (tabata, et al., 1996). But there is research showing that HIIT training has no effect on anaerobic ability in relatively adult-trained adult population, the results show no benefit to the HIIT exercise method as it has been done in tabata research even in this study the tabata protocol is less favorable (Foster, et al., 2015). While the practice with relative intensity and physiological response to steady state exercises are well documented. Therefore, the purpose of this study was to determine the impact of the use of the Tabata protocol exercise method on enhancing the dynamic capacity of anaerobic and aerobic capacity.

HIIT training has been shown to increase aerobic and anaerobic fitness, maintain blood pressure, heart health, insulin sensitivity (which helps muscles exercise more easily using glucose for fuel to generate energy), cholesterol profiles and belly fat and weight while maintaining muscle mass according to studies showing that HIIT exercises can be used for body fat loss (Trapp, dkk. 2008), and even lower six skinfolds (Tremblay and Simoneau, 1994) and weight loss (Jan Helgerud, dkk., 2007).

Aerobic capacity is the ability to maintain long-term high-performance output, HIIT training performed 4-5 times per week for 5 weeks, resulting in increased uptake oxygen inhale, 2,000 m and peak performance (Sperlich, dkk., 2010) while anaerobic capacity is ability to perform very high workload repeatedly. This is important, because by providing exercise to people who have high aerobic ability, it will be more capable to withstand fatigue and have a rapid recovery process (Cochram, 2006; Smith, 2012). Aerobic capacity is often termed as VO2max (Torrance, 2013, Phil, 2013), as an indicator of aerobic capacity then passes VO2max measurements. The focus of research is directed to the impact of protocol tabata method exercises on anaerobic dynamic enhancement capabilities comprising the physical capabilities included in an anaerobic work system ability of speed of motion, both in the form of Speed, Agility, and Quickness.

Many sports that require these components either alone need only Speed, or Agility only, but many sports require a combination of these abilities. In addition to the ability of the speed of motion, other capabilities that the system works based on anaerobic energy sources are the ability of fast power or power (Seagrave, 1992), power maintained in long duration or in the number of repetitions that many are also called Power Endurance, or Speed which is maintained in a relatively long duration or speed endurance (Seagrave, 1992).

Given the results of the above studies, researchers feel interested in deeper reviews of HIIT, through research studies on the impact of HIIT training methods on anerobic and aerobic capacity building.

2 METHODS

2.1 Subject

Students who are members of University Futsal Puteri student activity unit consisting of 14 people. After receiving a detailed explanation of the objectives, potential benefits, and risks associated with participating in this study, each student gave her written approval.

2.2 Protocol

In the execution, the researcher perform the testing and the initial measurement and then give the exercise treatment with HIIT training method, after finishing the treatment then testing and final stage measurement were done. The steps taken for data collection is to prepare the test instrument carry out testing and measurement according to the test procedure by a number of personnel testers (4 people who are experts in data retrieval). The collected data is a type of quantitative data. The data collection schedule consists of two stages, the first stage is a preliminary test to determine the initial condition of

the subject, and the second stage is the final test to see the progress of the training treatment results.

The method used is one group pre experimental method pre-test-post-test design (Fraenkel and Wellen, 1993). Research instruments used to carry out the process and collect data in the form of a protocol tabata training program with a form of internal resistance training for 28 days or 4 weeks and several test items to determine the ability of Anaerob and Aerob, ie the Aerob ability is measured through Bleep Test (Leger and Lambert, 1982), an Anaerobic ability consisting of speed test in the form of Speed, 20 m dash sprint test (Wood, 2008), speed in the form of Agility ie shuttle run 4m x 5 rep (Keinze, 2005), leg power that is Single Leg Triple Hop for Distance Test (Williams, et al., 2017), Power Endurance is Multi Stage Hurdle Jump Test (Kristopher, 2010) and Speed Endurance is a 150 m sprint test (Keinze, 2005).

3 STATISTICAL ANALYSIS AND RESULTS

Analytical technique used is to use correlation test which continued with test of determination to know how big influence given method of HIIT training to increase anaerobic and aerobic dynamic ability.

In looking at the impact of aerobic enhancement with the HIIT training method, the first step is to test through normality test by using One-Sample Kolmogorov-Smirnov Test, due to normal subject distribution, followed by descriptive data test using Paired Samples Statistics, correlation using Paired Samples Correlations.

Tabel 1**:** Paired samples correlations.

	N	correlation	signification
Pair anaerobic 1 & anaerobic 2	14	.904	.000

Tabel 2: Paired samples test.

t-count	t-table (0.975)	signification
6,15	2,16	Significant

The correlation between the two variables was 0.904, p = 0.000 <0.05, then there was a significant correlation between aerobic and aerobic end tests. Then proceed with Paired Sample t Test can be seen that t-count = 6.15 with t-table at significance level α = 0.05 with dk (n-1) = 17, t = (1- α) = (1- 0.025) = 0.975 is 2.16. From the results of the above data can be obtained conclusion that Ho is rejected means H1 accepted. Thus HIIT training can significantly improve aerobic ability. Thus, further testing is required by using the test of determination.

Table 3: Determination test.

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	.904	.818	.807	1.61855

a.Predictor (constant), v02max2

Since R = 0.904, Coefficient of Determination R2 (R Square) = 0.818, this means the increase from the initial test and the final test of HIIT-affected aerobic ability is 82% while 18% is influenced by other factors.

In anaerobic capability with HIIT training method, the first step tested by normality test by using One-Sample Kolmogorov-Smirnov Test, due to normal subject distribution, then followed by descriptive data test using Paired Samples Statistics, after which the correlation test using Paired Samples Correlations.

Table 4: Paired samples correlations.

	N	correlation	signification
Pair anaerobic 1 & anaerobic 2	14	.931	.000

The correlation between the two variables was 0.931, p = 0.000 <0.05, then there was a significant correlation between anaerobic and anaerobic final test. Then proceed with Paired Sample Test.

Table 5: Paired samples test.

t-count	t-table (0.975)	signification
3.74	2.16	significant

Tabel 6: Determination test.

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	.931	.867	.852	1.61855

b. Dependent variable: anaerobic 1

Since t = 3.74, p = 0.000> 2.16, there is a significant difference between anaerobic and anaerobic end test. Thus, further testing is required by using the test of determination. Since R = 0.931, Coefficient of Determination R2 (R Square) = 0.867, this means the increase from the initial test and the final test of anaerobic ability affected by HIIT is 87% while 13% is influenced by other factors.

4 DISCUSSION

Below we will describe the findings that can be discussed further, after seeing there are some physical components that are influenced HIIT training method with the form of internal stabilization resistance training.

From Figure 1, it can be seen that aerobic physical component influenced HIIT exercise method by 82% with 18% influenced by other factors, while the physical component speed is affected by the protocol tabata method of 65.5% with 34.5% influenced by other factors, while agility is only affected by 65.5% by HIIT training method and limb power were affected by 75.8% influenced by HIIT exercise method with 17% influenced by other factors, from both limbs affected by 75.4% while left limb 72.7% by HIIT training method, this indicated that the volume and the intensity for both parts of the leg requires special treatment. Of the three physical components are included into the category Anaerobic Alactacid, which when combined it has 71.6% influenced by the method of exercise tabata protocol, while 28.4% influenced by other factors.

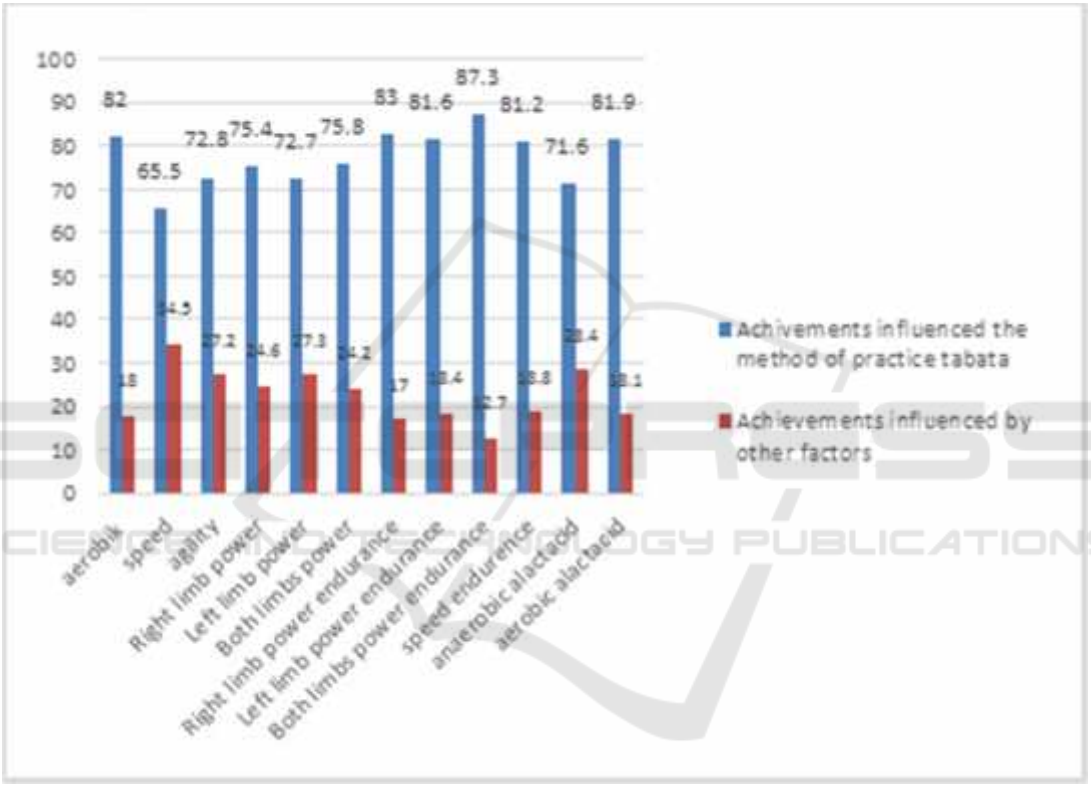

Figure 1: Increase percentage of initial test and end test anaerobic ability affected by tabata protocol exercise method and affected by other factors.

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In the Anaerobic Lactacid category, 81.9% were affected by the protocol tabula method, while 18.1% were influenced by other factors. Physical component of endurance power is influenced 87.3% and Speed endurance is 83% influenced by HIIT training method. This study shows that there is a very good relationship between the results of the initial test and the final test results on anaerobic dynamic ability, so there is a significant difference with the high increase is influenced by the HIIT exercise method while the other is influenced by other factors is low, and indicates that there is a very strong results between preliminary and final test results on aerobic dynamic capability, so there is a significant difference with the high increases affected by the HIIT exercise method.

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5 CONCLUSIONS

The implications of the research results indicate that in physical training, the training method must adapt to the various elements of the physical component to be trained in accordance with the principles and practice norms in physiological and pedagogical law in order to gain meaningful impact on the maximum training.

Because of the application of HIIT training methods that have an impact on increasing the average anaerobic and aerobic capabilities, it is recommended that each trainer is able to design a program with HIIT method with a varied form of exercise as it is important that the training needs become more secure and the target of the exercise becomes directed. A trainer must be aware of the requirements before the HIIT training program is given, so that the implementation of the exercise with the HIIT training method can be applied. Adequate exercise implementation with proper training methods, practice patterns, principles and practice norms is an important key to overcompensation (Exercise Effect).

For further research it is suggested that scientific development in coaching more effective and efficient then in this research can be developed through other forms of exercise or application on sports that more specific dominant physical ability, such as sports dominance of the speed (sport speed), dominant power endurance (sport power), or dominant endurance (sport endurance).

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