Advances in Social Science, Education and Humanities Research, volume 278 2nd Yogyakarta International Seminar on Health, Physical Education, and Sport Science (YISHPESS 2018) 1st Conference on Interdisciplinary Approach in Sports (CoIS 2018)

# The Effects of Training Method and Aerobic Capacity on the Anaerobic Endurance of Taekwondo Athletes in Dojang Lampung Barat

Guntur Yuli Satria Program Pascasarjan Universitas Negeri Yogyakarta Yogyakarta, Indonesia gysatria@gmail.com

TLANTIS

Abstract—the aim of this study is to examine the different significant effects between (1) interval training and HIIT methods in anaerobic, (2) athletes having high and low aerobic capacity of anaerobic, and (3) Interaction between training methods (Interval Training and HIIT) and aerobic capacity (high and low) on anaerobic of Taekwondo athletes in Dojang Lampung Barat .The method of this study was experimented on a factorial design with the measurement 2 x 2. 20 Taekwondo athletes were used as sample of the study in Dojang Lampung Barat; they were selected randomly from the original population of 38 athletes. The test undergone to measure aerobic capacity is the Multistage Fitness Test. The test undergone to measure anaerobic endurance is a 300 meter run test. The data analysis technique used is a two way ANAVA at a significance level  $\alpha = 0.05$ . The results of the study are as follows. (1) There are different significant effects on training methods of Interval Training and HIIT on anaerobic of Taekwondo athletes in Dojang Lampung Barat, which is proven from F = 14.850 and p = 0.001 < 0.05. The HIIT training method is better than the interval training method with a posttest average difference of (-) 0.791 sec. (2) There are different significant effects of athletes having a high or low aerobic capacity on anaerobic Taekwondo in Dojang Lampung Barat, which is proven from F = 22.934 and p =0.000 <0.05, athletes who have high aerobic capacity are better than those with low aerobic capacity with difference value of (-) 0.983 seconds. (3) There is a significant interaction between the training method (Interval Training and HIIT) and aerobic (high and low) on anaerobic endurance of Taekwondo athletes in Dojang Lampung Barat, which is proven from F = 27.428 and **p** = 0.000 < 0.05.

Keywords—interval training, HIIT, aerobic capacity, anaerobic

#### I. INTRODUCTION

Taekwondo is one of the most popular martial arts circles among teenagers and children, and is said to be the most popular marital art sports among all others. In martial arts taekwondo the dominant foot is used to attack, so it's said that taekwondo is a martial art that uses the foot to attack. Taekwondo is said to be successfully learnt when one has successfully mastered the various aspects contained in it. The fundamentals of taekwondo are formed from various attack and defense techniques that make use of the body parts to confront the opponent. Maintaining a good physical condition is very important in helping the athlete follow his or her trainings perfectly. Hari Amirullah Rachman Program Pascasarjan Universitas Negeri Yogyakarta Yogyakarta, Indonesia hari\_amirullah@uny.ac.id

The martial arts taekwondo is a battle sport whose basic character is a free-handed fight whose objective is to repulse an opponent. The martial arts taekwondo is a sport that uses anaerobic predominant energy, it is a sports branch that demands high intensity physical activity with relatively short time, and its predominant energy system is anaerobic. To increase anaerobic endurance, regular physical exercise measured with enough dosage of time is required of the athlete.

West Lampung is one of the residencies in Lampung province, the district was formally established in 1991. The martial arts taekwondo was first introduced to the public in 1966.

Based on the result of several observations, researchers found the problems that exist in the dojang taekwondo west Lampung. The initial results of observation of the researchers show that taekwondo exercise in west Lampung is more focused on exercise techniques, physical exercise training especially those that increases anaerobic endurance is given less attention.

Endurance exercise is the body's ability to fight fatigue in order for it to perform activities or work within a space of time in order to get back in shape.

Aerobic capacity is related to the ability of individuals to perform dynamic physical activities involving large group of muscles at high intensity and performed over a long period of time. It also represents the ability of the cardiovascular and respiratory system to provide oxygen for muscle cells that perform long activities and also the muscle's ability to obtain energy through aerobic system.

By looking at the phenomenon of phenomena in the field, researchers are eager to do researches on how to increase endurance in athletes' especially anaerobic endurance. One of the physical training that can be used to improve anaerobic endurance is the interval training method; interval training means a series of repetitions of the activities of training spaces by rest periods, during this period of rest, a mild form of exercise is usually done.

Based on the description above, the researcher is interested in conducting a research with title "The effect of training method (interval training and HIIT) and aerobic capacity on the anaerobic endurance of taekwondo athletes in dojang Lampung Barat."

Based on the background, identification and limitations of the problems that have been stated above, the researchers the formulated the problems to be studied as follows; (1) how big is the influence of training methods (Interval Training and HIIT) on anaerobic taekwondo athlete in Dojang Lampung Barat? (2) Is there any difference in the effect of athletes having high and low aerobic capacity on anaerobic endurance at taekwondo in Dojang Lampung Barat? (3) Is there an interaction between the training methods (Interval Training and HIIT) and aerobic capacity (high and low) to anaerobic endurance of taekwondo athletes in Dojang Lampung Barat?

Based on the formulation of the problems stated above, the objectives to be achieved in this research are: (1) to know the difference between the influence of training methods (Interval Training and HIIT) and aerobic capacity to anaerobic endurance of taekwondo athletes in Dojang Lampung Barat. (2) To know the difference between influence of athlete having high aerobic capacity and low anaerobic endurance of a taekwondo athlete in Dojang Lampung Barat. (3) Interaction between training method (Interval Training and HIIT) and aerobic capacity (high and low) on anaerobic resistance of taekwondo athletes in Dojang Lampung Barat.

The results of this study are expected to benefit various parties both theoretically and practically, the benefits are as follows: (1) As one of the references, (2) As one of the information materials and further research studies, (3) As one of the guidance of a trainer's development in practice and training. (4) Increasing anaerobic endurance for athletes. (5) The trainer may utilize and further optimize the performance of his athlete.

#### II. METHOD

This research use the experimental method, using this method helps to reveal the relationship between two or more variables or look for the influence of a variable on another variable.

## A. Types of Research

This research uses 2 x 2 factorial designs.

#### B. Time and Place of Study

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

# C. Target / Research Subject

The population of taekwondo athletes in Dojang Lampung Barat in this study is as many as 38 athletes; the

number of samples taken in this study using the random sampling technique amounted to 20 athletes.

### D. Procedure

The first procedure in this study is to conduct aerobic capacity test using the Multistage Fitness Test, this test is used to determine the aerobic capacity of athletes. After the aerobic capacity data is collected, an analysis is conducted to identify athletes with high and low aerobic capacity, analysis is done by looking at the overall test score, after the test scores are obtained, the ranking then begins. From that rank, a high aerobic capacity score of 27% and a low aerobic capacity score of 27% of the data was taken. Based on this 10 athletes who have high aerobic capacity and 10 athletes who have low aerobic capacity Each data is then divided into two groups at random and 5 athletes with high aerobic capacity are treated by interval training and HIIT training methods, the same is done for the group of athletes having low aerobic capacity.

## E. Data Collection and Instrument Engineering

Data collection techniques conducted in this study is tests and measurements. Prior to the pretest and posttest measurements, samples are first measured to determine high and low aerobic capacity. The instruments used in this research are: (1) Aerobic Capacity Test: the test involved in measuring the aerobic capacity is a multistage fitness test. (2) Anaerobic Endurance Test: the test involved in measuring aerobic resistance in this study is a 300 meter test run.

## F. Data Analysis Technique

Data analysis techniques used in this study using SPSS 20 i.e. using two-way ANAVA (ANAVA two-way) at significance level = 0.05. Also, to compare the pair treatment average you make use of the Tukey test. Prior to the use of two-way ANAVA (ANAVA two-way) the prerequisites that needs to be tested includes: (1) Normality test, the technique used here is the Kolmogorov Smirnov normality test, normality Test is taken to determine whether the sample used in the study is normally distributed or not. (2) Variance homogeneity and hypothesis test, variance homogeneity test uses the Levene test, the levene test is taken to determine if both treatment groups result from populations having homogeneous variance or not. After the normality and variance homogeneity test, the data is recorded in the parametric statistical category and thus the requirements for two-way ANAVA (ANAVA two-way) usage in data analysis are been met. Testing the the hypothesis is done by using two-way ANAVA (ANAVA two-way) and if the interaction is proven, it will then continue been tested using Tukey test by using software program SPSS version 20.0 for windows with significance level 5% or 0.05.

## **III. RESULTS AND DISCUSSION**

The results of this research are recorded in form of pretest and posttest data which is the general description of each related variables in research. This research was conducted at GOR Aji Saka Lampung Barat. Pretest data retrieval began on Thursday, February 2, 2017 while posttest data retrieval took place on Thursday, April 13, 2017.

When imputing the pretest and posttest data samples we use the 20 taekwondo athletes with an average age of 15-18 years who have been selected previously. The treatment is done 16 times, with the frequency of 2 (two) meetings in one week before Sunday, i.e. every Thursday and Saturday.

The pretest and posttest data of anaerobic test results in taekwondo athletes in Dojang Lampung Barat are represented in the following table.

	Kelompok Kapasitas Aerobik Tinggi								
No	Interva	Training (A	181)	HIIT (A2B1)					
	Pretest	Postlest	Selisih	Pretest	Posttest	Selisih			
1	48.47	48.01	0,40	46.25	45.12	1,13			
2	48.04	47.32	0.72	47.43	46.09	1.34			
3	48.31	47,54	0.77	47.36	46,34	1.02			
4	48.52	48,12	0.4	46:45	45.20	1,19			
5	48.56	47.36	1.2	47.47	46.21	1.26			
*	1.47 %			2.53%					
	Kelompok Kapasitas Aerobik Rendah								
No	Interval Training (A1B2)			HIIT (A2B2)					
	Pretest	Posttest	Selisih	Pretest	Posttest	Selisth			
1	48.19	47.26	0.93	48.57	48.24	0.33			
2	48.05	47.04	1.01	48.59	48,09	0.5			
3	48.55	48.02	8.53	48.26	47.56	0.7			
4	48.47	48.11	0.36	48.53	48.1	0.43			
5	48.23	47 46	0.77	48.17	47.32	0.85			
%	-	1.49%		-	1.16%				

The descriptive statistics of pretest and posttest anaerobic test results of taekwondo athletes in Dojang Lampung Barat are presented in the table below.

TABLE II. DESCRIPTIVE STATISTICS OF PRETEST AND POSTTEST ANAEROBIC

Metode	Koordinasi	Statistik	Pretest	Posttest
	Timoni	Jumlah	241,90	238,35
	inggi	Rerata	48,3800	47,6700
Interval	(AIBI)	SD	,21249	,37202
Training	10002000	Jumlah	241,49	237,89
	Rendah	Rerata	48,2980	47,5780
	(A1B2)	SD	,20669	,46981
	Tinggi (A2B1)	Jumlah	234,96	229,02
		Rerata	46,9920	45,8040
		SD	,59162	,56959
HIIT	Rendah	Jumlah	242,12	239,31
		Rerata	48,4240	47,8620
	(A2B2)	SD	,19463	,39890

If shown diagrammatically, the anaerobic pretest and posttest data of taekwondo athletes in Dojang Lampung Barat are presented in the following figure.



Fig. 1. Pretest and Bar charts Posttest Anaerobic

Information:

A1B1: A group of athletes trained using an interval training method with high aerobic capacity

A2B1: Group of athletes trained using method with high aerobic capacity

A1B2: Group of athletes trained using interval training methods with low aerobic capacity A2B2: A group of athletes trained using a hiit method with low aerobic capacity.

## A. Normality Test

The normality test in this data is studied using the Kolmogorov Smirnov method. The results of normality test data performed on each group of analysis recorded with software program SPSS version 20.0 for windows with a significance level of 5% or 0.05. The summary of the data is represented in the table below:

Data	P	Signifikansi	Keterangan
Pretest A181	0,877		Normal
Posttest A1B1	0,942		Normal
Pretest A281	0.536	1 mm	Normal
Posttest A2B1	0,787	0.05	Normai
Freetest A182	0,956		Normal
Postfost A1B2	0,960		Normal
Pretest A282	0.734		Normal
Posttest AZB2	0.699	{	Normal

TABLE III. NORMALITY TEST

Based on the statistical analysis of normality test that has been done by using Kolmogorov Smirnov Z test, shows that all pretest and posttest data obtained from normality test has a data value p > 0,05, which implies normal data distribution.

#### B. Homogeneity Test

Homogeneity test is taken to test if the equation of several samples are homogeneous or not . Homogeneity test is meant to test the similarity of variance between pretest and posttest. The homogeneity test in this research is Levene Test. Homogeneity test results are presented in the following table.

TABLE IV. HOMOGENEITY TEST

Kelompok	Levene Statistic	df1	df2	Sig	Keterangan
Pretest	6,759	1	18	0,524	Hemogen
Postlest	12,277	1	18	0,676	Homogen

Based on the statistical analysis that has been done by using Levene Test, the pretest value of significance obtained is equal to  $0.524 \ge 0.05$ . This means that the data group has a homogeneous variant. Likewise, the results of calculations on the posttest obtained significance value of  $0.616 \ge$ 

## C. Hypothesis Test Results

The first hypothesis reads "There is a significant difference between the influence of training methods (Interval Training and HIIT) and anaerobic endurance of taekwondo athletes in Dojang Lampung Barat". If the results of the analysis show a significant influence, the exercise method then gives effect to the anaerobic taekwondo at Dojang Lampung Barat. Based on the results of the analysis obtained, the data are as follows.

TABLE V. RESULTS OF ANAVA EXPERIMENTAL GROUPS USING INTERVAL TRAINING AND HIIT METHODS

Source	Type III Sum of Squares	đť	Mean Square	F	Sig
Metode Latihan	3.128	1	3.128	14.850	.001

From the results of the ANAVA test above, it can be seen that the significance p value is 0.001. Because the significance value of p is equal to 0.001 <0.05, it means Ho is rejected. Thus, there is a significant difference between the training method (Interval Training and HIIT) and anaerobic endurance of taekwondo athletes in Dojang Lampung Barat. Based on the results of the analysis, the HIIT method is better with an average posttest score of 46.833 compared to the Interval Training method with an average posttest score of 47.624. Thus, the saying that "There is a significant influence between the training methods (Interval Training and HIIT) and anaerobic endurance of taekwondo athletes in Dojang Lampung Barat" has been proven.

The second hypothesis states that "There is a significant difference in the effect of having high aerobic capacity and low anaerobic resistance in taekwondo athletes of Dojang Lampung Barat". Since the results of the analysis show a significant difference, it can be said that there is a difference in the influence of high aerobic capacity and low resistance to anaerobic taekwondo of athletes in Dojang Lampung Barat. The calculated results are presented in the table as follows.

 
 TABLE VI.
 Results ANAVA DIFFERENCES OF AEROBIC CAPACITY HIGH AND LOW ON ANAEROBIC

Source	Type III Sum of Squares	đť	Mean Square	F	Sig
Kapasitas_Aerobik	4.831	1	4.831	22.934	.000

From the results of the ANAVA test in the table above, it can be seen that the significance of p value is 0.000. Since the significance value of p is 0.000 <0.05, it means that Ho is rejected. Based on this, there is significant difference between having high aerobic capacity and low anaerobic endurance of taekwondo athlete in Dojang Lampung Barat. Based on the analysis, athletes with high aerobic capacity are better with an average posttest score of 46.737 compared with athletes with low aerobic capacity with an average posttest score of 47.72. This means that the hypothesis which states that "There are significant differences in the effect high aerobic capacity and low to anaerobic resistance in taekwondo athletes of Dojang Lampung Barat", has been proven.

The third hypothesis reads "There is a significant interaction between training methods (Interval Training and HIIT) and aerobic capacity (high and low) of anaerobic athletes in Dojang Lampung Barat". The calculation results are presented in the table as follows.

 TABLE VII.
 AN INTERACTION RESULTS BETWEEN EXERCISE METHOD

 (INTERVAL TRAINING ANDHIIT) AND AEROBIC CAPACITY (HIGH AND LOW)

Source	Type III Sum of Squares	đľ	Mean Square	F	Sig
Metode_Latihan * Kapasitas_Aerobik	5.778	1	5.778	27.428	.000

From the results of the ANAVA test in the table above, it can be seen that the significance value of p is 0.000. Since the significance value of p is 0.000 <0.05, it means that Ho is rejected. This means that the hypothesis "There is a significant interaction between training methods (Interval Training and HIIT) and aerobic capacity (high and low) of anaerobic endurance athletes taekwondo in Dojang Lampung Barat", has proven Diagram of interaction result between training method (Interval Training and HIIT) and aerobic capacities (high and low) of anaerobic resistance taekwondo athlete in Dojang Lampung Barat can be seen in the picture as follows.



Fig. 2. Interaction Result between Training Method (Interval Training and Hiit) and Aerobic Capacity (High and Low)

After proving there is an interaction between training methods (Interval Training and HIIT) and aerobic capacity (high and low) against anaerobic endurance athletes in taekwondo Dojang West Lampung, it is necessary to further the test using Tukey test, the results of the furthered test can be seen in the table below.

TABLE VIII. SUMMARY OF TUKEY TEST RESULTS

Kelompok	Interaksi	Mean Difference	Stid Error	sig
	A281	1.8660	29029	.000
ATBT	A182	0920	.29029	.989
	A282	- 1920	29029	.970
	A181	-1.8660	.29029	.000
A281	A182	-1.7740	.29029	.000
	A282	-2.0580	.29029	.000
	A181	0920	.29029	.989
A182	A281	1.7740	.29029	.008
	A282	- 2840	29029	763
	A181	1920	.29029	.910
A282	A281	2.0580	.29029	.000
	A1B2	.2840	,29029	.763

Based on the calculated Tukey results with asterisk marks (\*) on the table, it shows that the pairs have different interactions, pairs are: (1) A1B1-A2B1, (2) A2B1-A1B1, (3) A2B1-A1B2, (4) A2B1-A2B2, (5) A1B2-A2B1, (6) A2B2-A2B1.

## D. Discussion of Research Results

Discussion of the results of this study provides further interpretation of the results of data analysis that have been proposed. The hypothesis test yielded two groups of conclusion analysis that is: (1) there is a significant difference between the main factors of research: and (2) there is a meaningful interaction between the main factors in the form of two-factor interaction. Discussion of the results of the analysis can be further described as follows.

a) Differences in the influence of Interval Training and HIIT training methods on anaerobic endurance.

Based on hypothesis testing, the training methods and HIIT Interval Training has a significant difference on anaerobic endurance athletes in taekwondo Dojang West Lampung. HIIT training methods are better than the Interval Training methods on anaerobic endurance athletes. HIIT exercise has effects on the body, particularly on the blood pressure, hormones, blood glucose, lactate levels, and the autonomic nervous system. HIIT can increase the max VO2 and cause myocardial thickening of the left ventricle of the heart strengthening the ability of the heart to pump blood at every contraction and decreases the number of pulses per minute.

Based on the results, it can be seen that the HIIT exercise method has several advantages over the interval training method. In workout method HIIT adapt the advantage of time spent where there is a turn movement from jogging to a sprint and jog again in other words there is no monotonous movement. High intensity interval training method has several advantages such as a shorter training time, flexible, and the effect reduces injuries on the musculoskeletal system.

b) The effect of high and low aerobic capacity on anaerobic endurance

The results show that athletes with high aerobic capacity are better than those with low aerobic capacity for anaerobic resistance in taekwondo athletes in Dojang Lampung Barat. Aerobic capacity has a significant relationship to anaerobic endurance and contributes to it. This study shows that athletes with good aerobic capacity got better results than athletes with low aerobic capacity. It also shows that there is a difference of effect between the aerobic capacity of athletes of good category and less on anaerobic endurance. This is because athletes on the good category aerobic capacity have plenty of oxygen that can be accommodated by the lungs that will be able to meet the oxygen needs in cells and organs while performing the exercise program, while for athletes in the bad category have less oxygen capacity that can be accommodated by the lungs - lungs not much or less maximal.

c) Interaction between training methods (Interval Training and HIIT) and aerobic capacity (high and low) to anaerobic endurance.

The results in this study show that there is a significant interaction between the training method (Interval Training and HIIT) and aerobic capacity (high and low) to anaerobic taekwondo athletes in Dojang Lampung Barat. The results show that the HIIT training method is the most effective method used for athletes who have high aerobic capacity and training methods. Training interval is more effective for athletes who have low aerobic capacity. From the interaction results, it appears that the main factor of research in the form of two factors indicates an interaction which is significant. The results of this study show that in each group there are differences in influences between them.



#### **IV. CONCLUSIONS AND SUGGESTIONS**

### A. Conclusion

There is significant difference of influence between training method (Interval raining and HIIT) and anaerobic endurance of taekwondo athlete in Dojang Lampung Barat. Higher (good) HI training methods compared to Interval Training methods is seen between athletes who have high aerobic capacity and low to the anaerobic resistance of taekwondo athletes in Dojang Lampung Barat. Athletes with high aerobic capacity are better than athletes with low aerobic capacity. There is an interaction between training methods with aerobic capacity and anaerobic resistance of taekwondo athletes in Dojang Lampung Barat.

#### B. Suggestion

Based on the results of research that has been done to prove that the HIIT training method is more effectively used than the Interval Training method, it is therefore suggested to the trainer, to use the HIIT training method in enhancing anaerobic endurance. For researchers who intend to continue or replicate this study it is advisable to exercise more rigorous control throughout the experimental series. These controls are performed to avoid threats from external and internal validity.

#### REFERENCES

- R. N. Andika, & N. B. Khairun, "Pengaruh high intensity interval training (HIIT) terhadap kebugaran kardiorespirasi," Jurnal UNILA. 6. 1. 2. 2017.
- [2] K. N. Berawi, & A. R. Nugraha, "Pengaruh high intensity interval training (HIIT) terhadap kebugaran kardiorespirasi," Jurnal Majority, 6, 1, 1-5. 2017.
- [3] D. Tirtawirya. Sistem energi dominan taekwondo (kyorugi). Artikel: http://universologi.blogspot.co.id/2012/12/sistem-energi-dominantaekwondo kyorugi.html, 2012.
- [4] Gumelar, M, I. Hamidie, R, D, R. & Surdiniaty, U. (2017). "Pengembangan software aerobic capacity dengan menggunakan bleep test berbasis aplikasi android," Jurnal terapan ilmu keolahragaan. 2. 1. 25
- [5] J. Hairy, Fisiologi olahraga jilid I. Jakarta: Depdikbud Derektorat Jendral Perguruan Tinggi. 2010.
- [6] Harsono. Kepelatihan olahraga (teori dan metodologi). Bandung: Remaja Rosdakarya. 2015.
- [7] Harsuki. Perkembangan olahraga terkini. Jakarta: PT. Raja Grafindo Persada. 2003.
- [8] R. Hadi, Ilmu kepelatihan dasar. Semarang: Rumah Indonesia. 2007.
- [9] B. Indrayana, Perbedaan pengaruh latihan interval training dan fartlek terhadap daya tahan kordiovaskuler pada atlet junior putra teakwondo wild club Medan 2006/2007. Jurmal Cerdas Sifa, Edisi No.1. 1-11. 2012.
- [10] J. Katralli, V. Itagi, S. S. Goudar, "Assessment of aerobic capacity and muscle strength in indian judokas," International Journal of Physical Education, Sports and Health.1, 3, 8-35. 2015.
- [11] Nana, Sudjana, M. A. Ibrahim, Penelitian dan penilaian pendidikan. Bandung: Sinar Baru Algesindo, 2012.
- [12] Suryadi, Y. Taekwondo poomse taeguek. Jakarta: PT Gramedia Pustaka Utama, 2003.
- [13] M. F. Ulum, "Pengaruh latihan interval pendek terhadap peningkatan daya tahan anaerobik pada pemain hoki SMA Negeri 16 Semarang," E-Journal Kesehatan Olahraga FIK UNESA, 2, 1, 2013.