



The Effect of Interval Training on Increasing VO₂. Max in Pencak Silat Athletes Fostered by ASBD Bengkulu

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Abstract:

Background: This study aims to determine the effect of Interval Training on VO₂Max ability in pencak silat athletes fostered by Al-Azhar Martial Arts Bengkulu Branch. Improving VO₂Max is essential for achieving optimal performance, especially in endurance-demanding martial arts such as pencak silat.

Methods: This research employed a pre-experimental design with one group pretest–posttest. The population consisted of pencak silat athletes fostered by the Al-Azhar Martial Arts Bengkulu Branch, and 26 pre-teen athletes were selected as the sample. Data were collected using the Multistage Fitness Test. Statistical analysis included normality test, homogeneity test, and paired t-test.

Result: The findings revealed that the calculated t-value (11.38) was greater than the t-table value (1.708) at a significance level of $\alpha = 0.05$, indicating a significant effect. After 16 training sessions, the VO₂Max of athletes increased by 22.58%.

Conclusion: Interval Training significantly improves VO₂Max ability in pencak silat athletes fostered by Al-Azhar Martial Arts Bengkulu Branch. Therefore, interval training can be considered an effective program to enhance aerobic endurance and support athletic performance in pencak silat.

Keywords: Athlete, Interval, Training, VO₂Max

1. INTRODUCTION

Pencak Silat, as the cultural heritage of the Indonesian nation, has become an inseparable part of people's lives. This martial art not only trains the physical, but also shapes the character of the younger generation. The unique blend of sport and art in Pencak Silat makes it a valuable asset that needs to be preserved. Physical fitness is one of the important aspects of mastering Pencak Silat, and increasing VO₂max is the key to achieving optimal performance in this sport.

Pencak Silat, as the cultural heritage of the Indonesian nation, has long historical roots. The word "Pencak" comes from the word "mencakap" which means to attack, while "Silat" refers to the movement of dodging. This martial art is believed to have

developed since the time of the ancestors as a form of self-defense and adaptation to the environment. In addition, Pencak Silat is also influenced by various foreign cultures such as India and China, which is reflected in its movements and philosophy. Over time, Pencak Silat not only serves as a martial arts tool, but also becomes a medium for preserving noble values such as discipline, patience, and respect. These values then became the basis for the formation of the character of the younger generation.

Al-Azhar Martial Arts (ASBD), founded in 1970 under the guidance of Buya Hamka, is a pencak silat school with strong Islamic characteristics. Through the motto "Moslem Martial Arts", ASBD aims to form a young generation that is physically and spiritually strong. Each training session begins and ends with prayer, and values such as discipline, patience, and humility are always emphasized. By integrating various martial arts and Islamic values, ASBD has succeeded in producing silat fighters who are not only proficient in martial arts, but also have noble morals. ASBD's vision in the future is to become a center for Islamic-based character development through martial arts, as well as spreading Islamic values throughout the world.

At the end of 1982, ASBD expanded its wings to Bengkulu Province, choosing this province because of its promising development potential and high public demand for Islamic-based martial arts education. Under the leadership of Iskandar Rais,

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ASBD Bengkulu has managed to grow and develop rapidly. By combining various martial techniques with Islamic values, ASBD Bengkulu has succeeded in producing silat fighters who not only excel in competitions, but also have noble morals. The brilliant achievements at PORPROV 2016 and POPKA 2019 prove the quality of training provided by ASBD. In the future, ASBD Bengkulu plans to improve the quality of training by focusing on the technical, physical, and mental development of martial artists. In addition, ASBD will also continue to expand its reach by opening new branches and collaborating with various parties to advance pencak silat in Indonesia.

Endurance is a determining factor in the success of a martial artist. For this reason, ASBD Bengkulu implements an intensive training program to improve the cardiorespiratory and muscle endurance of the athletes. This training program includes a wide variety, such as Interval Training which combines sprint running and short breaks, as well as circuit training which involves a combination of pencak silat movements and weight training. The frequency and intensity of training are adjusted to the skill level of each player, with the aim of achieving optimal improvement without overtraining. In addition, ASBD Bengkulu also pays attention to nutritional aspects and adequate rest to support the body's recovery process after training.

On average, ASBD Bengkulu fostered silat players experience a decrease in the quality of performance when competing. This is due to a lack of physical endurance. They often have difficulty launching effective attacks, both punches and kicks, especially in the middle of the match. This condition also decreases athletes' concentration and confidence. Extreme fatigue before the last round often makes athletes unable to play optimally. As a result, they are easily repelled by opponents and even often fall, so opponents get extra points. Lack of regular physical exercise is a major factor in causing this problem. Good physical endurance is essential in martial arts to support the quality of technique and tactics.

The importance of physical endurance is certainly a serious problem both as an athlete and a coach. This is directly proportional to the process of improving achievement which of course is a benchmark for the success of each silat fighter and also his teaching, especially the pencak silat school of ASBD Bengkulu. Not only does the decrease in perstasi become a serious problem when the physical endurance ability of each silat or athlete decreases,

this also affects the ability during training which becomes limited in the learning process of the training material presented at each meeting.

Every pencak silat exercise every athlete is required to have a strong physique in order to be able to practice attack and defense techniques, for example, to be able to do just one kick technique, each athlete must have good leg muscle strength, speed in throwing the legs which requires strength and flexibility in the hips and other limbs. Then this must be done repeatedly, to improve the achievement of each technique even done up to 100 repetitions X 4 sets of each technique that is done correctly. Each technical training meeting can do at least 5 types of attack or defense techniques.

Referring to the above problem, physical endurance is certainly the main concern of every coach in martial arts, especially in ASBD. To be able to become a champion and achieve achievements, of course, you must have the right and ideal physical training program to increase the physical endurance of each fighter (Nurhidayah & Graha, 2019). Good endurance in martial arts, especially Pencak Silat, is based on the needs of movements, tactics and techniques that can be used in elements of special physical conditions (Pamungkas & Mahardhika, 2023). Good technique will be directly proportional to good physical condition, for example; Kicking, hitting, dodge, and slamming techniques. Some of the physical conditions required in pencak silat include; speed, leg muscle power, arm muscle power.

In general, the coaches of each ASBD Bengkulu training unit train their athletes so that they can improve their good technical, tactical, physical and mental abilities into a balanced unit. Based on information, observations, and interviews obtained by the researcher from the pencak silat coach of the ASBD Bengkulu Provincial College, the training unit of the Al-Azhar Islamic Elementary School in Bengkulu city, the athletes have mastered the correct general competition techniques but are still not able to increase endurance properly and are not optimal. This can be seen when some ASBD Bengkulu fostered athletes when participating in regional championships or local tournaments, in fact the average athlete has difficulty getting scores because every attack is always not optimal either when attacking or defending, so it is easy to overcome and even dropped by opponents which causes athletes to have difficulty competing to become champions.



In physical training, in general we know the term sports activities, this activity is a physical activity that is carried out in a measurable and structured manner, and is planned. Physical activity involves all parts of the human body periodically and repeatedly with the goal of increasing lung capacity or VO₂Max. Through exercise can also be a basic need of every human being in order to support the quality of health in daily life, helping to increase endurance and immunity in the body.

Based on the above statements, it can be concluded that cardiorespiratory ability is the ability of the components of the heart and lungs to optimize oxygen consumption and distribute it to all parts of the human body. This is a metabolic process that occurs in the human body. The way to measure cardiorespiratory endurance is to use the Multistage Fitness Test.

If we discuss in general, VO₂Max is the body's ability to consume oxygen optimally during intensive activities, such as exercising. VO₂Max also has a size and can be measured in liters per minute, in other words milliliters per minute per kilogram of a person's body weight. The higher the person's VO₂Max capacity, the more the person is able to perform long-term activities, then it can be said that the person has resistance to fatigue. The body's VO₂Max is able to supply oxygen optimally through active muscle cells, and at the same time is able to improve muscle performance in managing oxygen entering the body. VO₂Max can be measured in a variety of ways, including; Multistage Fitness Test, Balke Test, Cooper Test, bleepi Test. In this study, the instrument used was the Multistage Fitness Test. This method is carried out with the help of a tool in the form of a cone that functions as a marker of turning points with a distance of 20 meters, as well as using and using the Multistage Fitness Test audio recording with a Beep sound as a time marker between lines for athletes to start running. The VO₂Max score is obtained based on the Multistage Fitness Test norm, referring to the level level and the amount of running ability obtained by the athlete.

In general, there are four basic components in physical fitness, namely; Strength, Endurance, Agility, and Speed. Cardiovascular physical fitness is the maximum capacity level when inhaling oxygen during activities abbreviated as VO₂Max. The higher a person's VO₂Max, the lower the level of fatigue felt when doing certain activities, this quotes from the statement put forward by (Ilahi et al., 2020). There are several factors that affect the increase in VO₂Max in each person, namely; gender, age, physical exercise,

cardiovascular condition, pulmonary condition, blood cell hemoglobin levels, body structure, and altitude of place. Hormonal differences in individuals are of course one of the main causes of differences. The concentration of hemoglobin in men's blood tends to be higher when compared to women, because usually women have a larger proportion of body fat (Fuadi Dela Fariha & Ramli, 2023). The focus of this study is the effect of physical exercise on one of the components of cardiovascular endurance or VO₂Max.

In a previous study conducted by Jasmani et al (2021), endurance is defined as a person's ability to move by using all parts of the body for a long time, both at maximum speed and slowly, and without feeling significant fatigue. The goal of physical activity is to achieve optimal fitness conditions. Physical activities that vary in each individual will provide a pleasant atmosphere that can improve one's physical fitness condition.

Sport is a physical activity carried out by individuals and teams with the aim of competing and maintaining physical fitness (Ariestika et al., 2020). Exercise is a structured and programmed activity through exercise. These exercises are structured through a training program. The training program is tailored to the needs of the individual or team. Needs can be in the form of recreation, fitness, and achievement-oriented (Nasution & Sibuea, 2022). The training program in this study aims to determine the effect of interval training on the VO₂Max of Golden Silat Club Pencak Silat athletes. The selection of this title was based on the fact that many Golden Silat Club athletes experienced a decrease in endurance when competing in the third round, so they could not maintain their performance and were prone to losing points.

Based on the problems described above, a study is needed to solve these problems. The study in question is a study on the interval training program in Golden Silat Club pencak silat athletes. This interval training program has an impact on increasing cardiovascular endurance or VO₂ Max. Based on the explanation above, the title of the research can be raised "The Effect of Interval Training on Increasing VO₂ Max to Pencak Silat Golden Silat Club athletes fostered by ASBD Bengkulu."

2. MATERIAL AND METHOD

This research method uses a quasi experiment method or a semi-experiment with the aim of determining the influence of independent variables (treatment) on

bound variables (Irmansyah et al., 2020). Bound variables are manipulated by independent variables to then observe their effects after a certain period of time (Nurhayati, 2018). Rusdian et al (2023) stated that the experimental method is one of the research methods with a quantitative approach that is considered the most objective and strong in studying a phenomenon. A phenomenon related to the relationship between the influence of one variable on another variable (Dinda, 2023).

The population in this study was 45 athletes and the sample was determined using purposive sampling technique, Sugiyono (2020) stated that the purposive

sampling technique is a sampling method with certain considerations. The considerations taken are beginner Pencak Silat athletes aged 13-14 years, male gender, education level 1st grade junior high school to grade 3 junior high school. The sample in the population included as a research sample amounted to 26 male athletes with an age range between 13-14 years (pre-adolescent). The data collection technique in the study uses tests. The instrument used is a multi-level running test (Multistage Fitness Test).

3. RESULT AND DISCUSSION

3.1 Result

Table 1. Normality Test

No	N	Test	Beginning	Test	End	Information
		Lo	L _T	Lo	L _T	
1	26	0,084	0,173	0,110	0,173	Distribution Normal

From table 1 above, it is known that $L_0 < L_{table}$ means that the data taken from one group of

experiments studied has a Normal distribution .

Table 2. Homogeneity Test

No	Variabel	Standard Deviation	Varsians (S ²)
1	Initial Tests	5,13	26,31
2	Final Test	6,53	42,64

Based on table 2, it can be seen that the result of the calculation of the initial test variance (X) is 26.31 while the final test variance (Y) is 42.64.

$$F_{cal} = \frac{\text{Largest Variance}}{\text{Smallest Variance}}$$

$$F_{cal} = 1.62$$

From the calculation above, the value of $F_{cal} = 1.62$ while the value of F_{table} at a significant level $\alpha = 0.05 = 1.89$. $F_{cal} < F_{table}$, which is $1.62 < 1.89$, means that there is no difference from each variable or the price of the variance is homogeneous

Table 3. Results of t-test calculations

Group	Dk (n-1)	T _{count}	T _{table}	Criteria
Eksperimen	25	3,61	1,708	There is an influence

Based on table 3 above, the results of the t-test calculation obtained a calculated t value = 3.61 > t_{table} 1.708, then H_a is accepted. So there is an influence of the Interval Training program on VO₂Max ability in pre-teen Pencak Silat athletes Fostered by ASBD Bengkulu at the Ahsanu'amala Islamic Boarding

School training unit.

Specifically, the treatment results can be known by calculating the difference between the average pre-test and the average post-test result of the percentage increase as follows:

Table 4. Percentage Increase

Mean difference	Mean pretest	Percentage increase
7	31	22,58%



Based on table 4, it can be seen that the increase in VO2Max ability in pre-adolescent Pencak Silat athletes Fostered by ASBD Bengkulu in the training unit of the Ahsanu'amala Islamic Boarding School was 22.58%.

3.2 Discussion

Based on the results of the study, it can be concluded that there is a significant influence of interval training on the cardiovascular ability of pre-teen pencak silat athletes of the Golden Silat Club Fostered by ASBD Bengkulu, in a study entitled "The Effect of Interval Training on VO2. Max at the Golden Silat Club Pencak Silat Athlete Fostered by Al-Azhar Bengkulu". This training program is an Interval exercise, where this exercise can be applied to all levels of athletes, but the dosage must be adjusted and adjusted to the goals of each athlete. This interval training method is effective in increasing cardiorespiratory endurance (VO2i Max).

This exercise program is similar to that exercise in that it combines aerobic and anaerobic elements. The principle of this exercise is "alternating repetitive activities and rests," with short rest periods between alternating forms of exercise. The interval training method has been proven to be able to significantly improve the cardiorespiratory ability of athletes (Mubarok & Kharisma, 2021). Busyairi & Ray (2018) stated that interval training is able to show improvements in lactate removal, as well as oxygen absorption, as well as aerobic strength. From the results of the hypothesis test, it is proven that Interval Training can have a significant influence on the increase in VO2. Max at Pencak Silat Golden Silat Club athletes fostered by ASBD Bengkulu.

Interval Training is an effective method to increase VO2 Max. This method involves alternating between periods of high-intensity exercise and periods of low-intensity recovery or rest (Indrayana, 2017). According to Arridh et al., (2021), physical exercise in each sport is the main basis that must be done, in addition to improving technical, tactical, and mental training. Thus, the application of interval training can help pencak silat athletes significantly increase their aerobic capacity. Research conducted by (Gontijo et al., 2023) shows that the Interval training method has a positive impact on improving the endurance and stability of pencak silat athletes' endurance and stability.

Judging from the average (mean) in the pre test, which is 31 before being given an interval training and after being given an interval training program, the

average is 38. This shows positive results from the pencak silat athletes of the Golden Silat Club Fostered by ASBD Bengkulu. Based on the results of the analysis of research data, a significant increase in VO2 was obtained. Max is a pencak silat athlete of the Golden Silat Club Fostered by ASBD Bengkulu. In other words, giving interval training 16 times is able to increase VO2 ability. Max is a pencak silat athlete of the Golden Silat Club Fostered by ASBD Bengkulu.

The results showed that there was a significant increase in the VO2 Max value of athletes after undergoing Interval Training training, which was 22.58%. The data shows that athletes who previously had lower aerobic capacity experienced greater improvements compared to those who already had higher VO2 Max. This suggests that the Interval Training method is more effective in improving aerobic endurance for those with lower initial capacity.

This study shows that Interval Training exercises have an effect on increasing VO2 Max in pencak silat athletes of Golden Silat Club Fostered by ASBD Bengkulu. This method has been shown to be effective in increasing aerobic capacity, which plays an important role in endurance during matches, so coaches and athletes can consider the application of interval training as part of a regular training program to improve performance in pencak silat competitions. The application of Interval Training in pencak silat training not only focuses on increasing VO2 Max, but must also consider other aspects such as competition techniques, strength, and strategy. With a holistic approach, athletes can achieve peak performance and achieve the best results in every match.

Interval training has the advantage of increasing VO2 Max in pencak silat athletes. This method involves alternating between periods of high-intensity exercise and recovery periods, which are effective in increasing aerobic capacity. According to Fernanda Porto Maciel et al. (2023) Interval Training in his research can significantly increase VO2 Max in Taekwondo athletes, who have similar physical characteristics and aerobic needs to pencak silat. Suhdy (2018), stated that Interval Intensive training is a method that aims to improve speed, strength, movement automation, and technique. Interval Intensive can be done in a relatively short time with an intensity between 80%-90%. Interval Training can improve the efficiency of the cardiovascular system and the body's capacity to consume oxygen during intensive physical activity. Thus, the application of

Interval Training in the training program of Pencak Silat athletes can be an effective strategy to increase their endurance and performance in matches.

Then the advantage of this researcher is that the research has been carried out systematically, it has been based on existing theories and then the results of this research are more accurate because it is direct and objective through quantitative data. The data collected can be measured and calculated clearly. The disadvantage of this study is that the population of this study only uses 1 club and there is a sample that is less active in the implementation of the training program.

4. CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that there is an "Effect of Interval Training on the increase in VO₂ Max in the pencak silat athletes of the Golden Silat Club Fostered by ASBD Bengkulu". This effect can be seen from the average difference between the pretest and posttest that has been carried out before and after being given treatment 16 times. Based on the results of the study, it shows that there are good results from the provision of the Interval Training program to increase VO₂ Max. Based on the results of the calculation, the calculation was 3.61 and the table was 1.708. It turns out that the calculation > from the table, so empirically that there is an effect of Interval Training training on increasing VO₂ Max in Pencak Silat Golden Silat Club athletes Fostered by ASBD Bengkulu. The results of the study show that the increase after the program was given was 22.58%.

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6. AUTHOR CONTRIBUTION STATEMENT

Nofriyantoni contributed to the conceptualization, methodology, data collection, analysis, and drafting of the manuscript. Dian Pujianto was responsible for supervision, validation, and providing critical review and refinement of the manuscript. Ari Sutisyana assisted in data collection, statistical analysis, and

preparation of references. All authors actively participated in the research process, reviewed the manuscript thoroughly, and agreed to its final version prior to submission.

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