

The Effects of Interval Training and Circuit Training on VO_{2max} and Basal Pulse Rate

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Abstract: The purpose of this research is to analyze the difference interval training and circuit training on VO_{2max} and basal pulse rate. Research methodology this is participants that consisted of 20 males aged 18-23 years and spiritual physical were purposive sampling. Treatment done three times a week for 3 months. Interval training and circuit training group performed 16 times exercise, the number of exercise: 10 items, high intensity, and frequency: 3 times per week. VO_{2max} measured using Fitmate Pro. Basal pulse rate measured using polar heart rate monitor. The results of studies show that mean VO_{2max} on pretest interval training group is 43.29 and mean posttest is 44.78. While mean VO_{2max} on pretest circuit training group is 44.38 and mean posttest is 49.39. Mean basal pulse rate on pretest interval training group is 61.20 and mean posttest is 53.50. While mean basal pulse rate on pretest circuit training group is 61.20 and mean posttest is 58.40. Conclusions on this research suggests that there are significant differences between interval training and circuit training on VO_{2max} and basal pulse rate. Interval training having a decrease in basal pulse rate which is higher than with circuit training. While circuit training having increased VO_{2max} which is higher than with interval training.

1 INTRODUCTION

Sports as one of investment aims to build participation the community in improving resources so that it will promote commitment sports greater. Badminton is sports popular among the because achievement achieved, Therefore the players are requested to offer an optimal. The development of achievement sports need 4 aspects. The four this aspect of them are physical, technique, tactics and mental (Nassib, et al., 2016: 17). Several kinds method exercise and load exercise effective and efficient is improve performance athletes. Some method of exercise can be used to get an increase in fitness as circuit training and interval training. Bompa and Haff (2009: 155) revealed that circuit training tending to used an athlete who main energy derived from glikolitik/lactate pattern, to add the diversity exercise endurance. Intervals training is largely used to exercise achievement (Bompa and Carrera, 2015: 202).

Badminton athletes have a problem that since 90s achievement for the men's singles, women's singles and women's doubles players have never took All England Champion (Djarum Badminton,

2016). Observation also done researchers in Units of Student Activities Badminton, Yogyakarta State University in august 2017 when participating in Student League Championship (LIMA) in Bandung, that there is a problem with the improve achievement, among others: (1) The physical condition of Units of Student Activities Badminton players, Yogyakarta State University decline where formerly players ready sent down double play, in the next session did not bold played double. (2) The condition of a concentration of Units of Student Activities Badminton players, Yogyakarta State University disturbed, where in an earlier match less than 20 times made a mistake himself, in the next session more than 30 times in a game. (3) Adjustment acclimatization body against a new place affect Units of Student Activities Badminton players, Yogyakarta State University. Problem that happens in an athlete is due to fatigue in the game. Badminton is sport by the intensity of high that an athlete to adapt the physical ability, mean pulse rate at male and female of more than 90% of HRmax or 170-180 beats per minute. The ability aerobic determine performance athletes when compete, because of high aerobic capacity will minimize fatigue as the game. Aerobic capacity person showing maximum oxygen uptake capacity

used by the body (VO₂max). Badminton athletes must have the high VO₂max, because the match was long and drain energy. This is one factor to improve their performance athletes and champion in a match badminton.

2 RESEARCH METHODS

2.1 Study Design

Participants in this research were enrolled in a purposive sampling at male students of Yogyakarta State University to give intervention interval training and circuit training for 3 months (three supervised sessions per week). A sample of 20 males of divided into two the same group by means of match-pair ordinal. 10 males get interval training and 10 males get circuit training. As for technique the division of a group as matched-pair ordinal (Yang and Zhou, 2015: 3). An independent t test conducted to determine whether there is a different variables sectarian. The results of the analysis expressed there is a difference, if value significance less than 0.05 ($P < 0,05$), so trust standard this research is 95%. To assess the effectiveness of the interventions as determined through measurement VO₂max and basal pulse rate. Intervention interval training and circuit training done during three months. All warm-up done before each exercise session and all cool down done after each exercise session.

2.2 Participants

Approval was provided by Yogyakarta State University that is proportional to the with a standard ethics. A total of 20 male students aged 18-23 years apparently spiritual physical health were recruited in this research. Technical sampling is purposive sampling.

2.3 VO₂max Testing

Maximal VO₂max were conducted in accordance with treadmill with Run12 maximal measured use Fitmate Pro guidelines. Fitmate Pro with treadmill and polar was used to collect VO₂max data. Tests were performed on a Fitmate Pro using procedure the implementation of the Fitmate Pro protocol. The protocol consisted of preparing a treadmill with life first approximately 30 minutes, start a Fitmate Pro by pressing buttons "power" and hold on a second, then put a USB for the detection belt HR with Fitmate Pro,

connected on Fitmate Pro cable USB flow mater, connected on Fitmate Pro cable USB liaison to treadmill, pairs of mouth pace already connected by flow mater and adhesives, calibration Fitmate Pro with treadmill is it connection continued with oxygen cells, if all have been calibrated use mouth pace and heart rate polar on an athlete who will test, input the name, date of birth, height and weight of testy, select protocol test run 12, maximal test, click "OK", sample asked to start doing ran through treadmill up to a maximum.

2.4 Basal Pulse Rate Testing

The measurement of basal pulse rate done before treatment and after treatment. The measurement of basalt pulse rate carried out using polar heart rate monitor guidelines (Hernando, et al., 2016: 717).

2.5 Training Interventions

The interval training group and circuit training group performed 16 times exercise, the number of exercise: 10 items, high intensity, and frequency: 3 times per week.

2.6 Statistical Analysis

Statistical analysis was conducted using SPSS version 16. An independent t test was used to identify group differences. Normality test using the Kolmogorov-Smirnov test. Skewness and kurtosis of distribution were visually examined normality. Group differences were compared using independent t tests. Variables on the research were displayed as mean with 95% confidence intervals or standard deviation (\pm) where specified.

3 RESEARCH RESULT AND DISCUSSION

3.1 Data Description

3.1.1 VO₂max Data

Table 1: Description of Data VO₂max

Group	Test	Mean	SD
Interval training	Pre	43.29	6.93
	Post	44.78	6.76
Circuit training	Pre	44.38	4.94
	Post	49.39	4.31

Table 1 explain description of data VO₂max. Mean pretest intervals training is 43.29 and SD= 6.93, mean posttest intervals training is 44.78 and SD= 6.76. Mean pretest circuit training is 44.38 and SD= 4.94, mean posttest circuit training is 49.39 and SD= 4.31.

3.1.2 Basal Pulse RateData

Table 2: Description of Data Basal Pulse Rate

Group	Test	Mean	SD
Interval training	Pre	61.20	7.82
	Post	53.50	5.17
Circuit training	Pre	61.20	6.80
	Post	58.40	6.98

Table 2 explain description of data basal pulse rate. Mean pretest intervals training is 61.20 and SD=7.82, mean posttest intervals training is 53.50 and SD=5.17. Mean pretest circuit training is 61.20 and SD= 6.80, mean posttest circuit training is 58.40 and SD= 6.98.

3.2 Dependent Sample Test

Table3: Dependent Sample TestonVO₂max

Group	t _{count}	t _{table}
Interval training	5.947	1.833
Circuit training	11.150	1.833

Table 3 describing the results of testing that uses dependent sample test on VO₂max, that t_{count} > t_{table}, so can be concluded that there are significant differences between VO₂max before and after given treatment intervals training and circuit training.

Table 4: Dependent Sample TestonBasal Pulse Rate

Group	t _{count}	t _{table}
Interval training	6.666	1.833
Circuit training	11.225	1.833

Table 4 describing the results of testing that uses dependent sample test on basal pulse rate, that t_{count} > t_{table}, so can be concluded that there are significant differences between basal pulse rate before and after given treatment intervals training and circuit training.

3.3 Independent Sample Test

Table5: Independent Sample Teston VO₂max

	t _{count}	t _{table}	Sig (2 tailed)
Equal variances assumed	1.817	1.734	0.086

Table 5 describing the results of testing using independent sample test on VO₂max, that t_{count} > t_{table}, so can be concluded that there are significant differences between VO₂max on interval training and circuit training.

Table 6: Independent Sample Test on Basal Pulse Rate

	t _{count}	t _{table}	Sig (2 tailed)
Equal variances assumed	1.784	1.734	0.091

Table 6 describing the results of testing using independent sample test on basal pulse rate, that t_{count} > t_{table}, so can be concluded that there are significant differences between basal pulse rate on interval training and circuit training.

3.4 Discussion

The investigation in this research has been evaluating the effects of interval training and circuit training on participants aged 18-23 years and spiritual physical health. The results of this research suggests that interval training conducted by producing a decrease in basal pulse rate which is greater than with circuit training. While circuit training produces increased VO₂max greater than with interval training. Intervention high fidelity on both intervention showing that the excellent delivery of interval training and circuit training by the participants. This research results support previous research observes that intermediate-intensity, interval training with BFR improves aerobic capacity and RPE concurrently and prevent decline of VO₂max at result of retraining at transition phase (Amani, et al., 2018: 5). In other research previously showed that increases in VO₂max exhibited in response to different HIIT regimes are due to improvements in oxygen delivery (Astorino, et al., 2016: 1). Circuit training contribute greater on an increase in VO₂max than interval training. A athlete who doing the exercise routine, the vital capacity of pulmonary better than an athlete who

does not an exercise routine. An exercise will allow the use of oxygen per minute to reach a maximum target. Pulmonary heart endurance function optimally while doing activity long enough without an exhaustion that means.

Maximum breathing capacity about 50% greater than pulmonary ventilation that occurred during exercise maximum. This difference give element safety on athletes, gave an athlete extra ventilation called in the way: (1) exercise in altitudes high, (2) exercise under conditions very hot, and (3) abnormal in the respiratory system. The respiratory system abnormal is factor that has an influence limit in sending oxygen to the muscles during aerobic maximum muscle metabolism (Hall, 2016: 1091). The more oxygen being absorbed by the body shows that better performance muscle in working, so substance that causes fatigue numbers will be reduced. Børsheim and Bahr (2003: 1038) to said that during exercise there has been increasing on oxygen absorption (VO_2) to support improvements to energy needs. After training, VO_2 not return to the level rest quickly, but maybe increase above the level of rest on certain period of time. Increased VO_2 after exercise needed to restore oxygen deficiency occurring after the initial exercise, and giving oxygen debt to deprive lactic oxidative.

On the findings before shows that 6 weeks circuit training have significant effect on breath hold time of badminton players (Kumar, 2016: 12). VO_{2max} as the highest oxygen delivered and utilized during exercise, and, if we increase the exercise intensity, the oxygen uptake will not increase. VO_{2max} measuring is recommended as an indicator of aerobic capacity, as it shows the real health status and allows to detect risk groups prone to suffer morbidity conditions, since a healthy person should have an acceptable aerobic capacity. Prescribing and referral exercise programs from primary care centers must be considered as a resource for improving cardiorespiratory fitness (Cantó, et al., 2018: 2).

This research results support previous research observes that exercise especially endurance training and yoga decreases resting heart rate. This effect may contribute to a reduction in all cause mortality due to regular exercise or sports (Reimers, et al., 2018:1). In other research previously showed that the resting heart rate and breath holding time had significantly improved due to 6 weeks of intensive interval training and control group didn't produced any changes on selected dependent variables (Rajan and Mariappan, 2018: 717). On the findings before shows that six week of circuit training involving bodyweight exercises has no significant impact on resting resting

heart rate variability. However, this type of training might decrease the risk for development of cardiovascular disease by reducing arterial blood pressure and by improving body composition, aerobic capacity, muscular endurance and strength (Vrachimis, et al., 2016: 12).

Basal values of systolic, diastolic and pulse rate of trained were lower than that of untrained, but systolic blood pressure and pulse rate after aerobic training is greater for trained than that of untrained (Prasad, 2016: 109). Physiological alterations resulting from activities of moderate to vigorous intensity may imply resting heart rate values above the basal value for prolonged periods.

Finally, for safety and accuracy of exercise prescription a VO_{2max} and basal pulse rate was performed by all participants. However, access to specialised equipment may not always be feasible which may limit circuit training prescription in a real setting. However, the circuit training protocol appears well tolerated and safe, therefore further research are required to evaluate the feasibility to adopt this protocol without a prior VO_{2max} and basal pulse rate on aged 18-23 years spiritual physical health.

4 CONCLUSION

Conclusions on this research suggests that there are significant differences between interval training and circuit training on VO_{2max} and basal pulse rate. Interval training having a decrease in basal pulse rate which is higher than with circuit training. While circuit training having increased VO_{2max} which is higher than with interval training.

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