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REVIEW

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Effects of Aerobic Endurance Training vs HIIT on Energy Intake, Macronutrient Intake, and VO2Max Level on Fitness Centre Participants

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A B S T R A C T

The purpose of the study Nowadays, there are many people who participate in fitness centre to maintain their health and fitness. There are many ways to increase VO2Max, an indicator of cardiorespiratory fitness, two of many were High-Intensity Interval Training (HIIT) and traditional aerobic endurance training. In other hand exercise in any type of way required extra energy, resulting in increased energy and macronutrient intake**.** Was to analyse the effects of HIIT vs. Aerobic Endurance Exercise on energy intake, macronutrient intake, and VO2Max of fitness centre participants in Depok..

Materials and methods 26 participants were recruited voluntarily from one of fitness centre in Depok, West Java, Indonesia, then randomized into HIIT Intervention Group and aerobic endurance exercise intervention group for 3 months. Energy and macronutrient intake were assessed before and after intervention. Bleep test was done to determine VO2Max Level before and after intervention.

Results. Paired t-test between before and after intervention showed that there's significant difference ($p<0.05$) on VO2Max, while independent sample t-test showed that there's no significant difference between both type of exercise.

Conclusions. This study shows that there was no effect of both HIIT and Aerobic Endurance Training on energy and macronutrient intake. However, both interventions increase VO2Max as an indicator of fitness level. Shorter time for HIIT may be useful for increasing VO2Max level on busy individual.

A R T I C L E I N F O

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INTRODUCTION

Physical fitness is strongly related to health. Individual who has optimal fitness is able to do their daily activities well and has low risk of non-communicable disease(s). Therefore, people desire a optimal value of fitness. Optimal fitness can be achieved by doing exercise, such as aerobic exercise or High-Intensity Interval Training (HIIT) (Grant, 2003). To achieve optimal fitness, aside from routine physical exercise, there is also a need for optimal nutrition. During physical activity, skeletal muscle also need energy not just for its inherent metabolism, but to move as well. Meanwhile, heart and lungs also need extra energy to deliver nutrients and oxygen to all body parts and to take

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out metabolism remains from the body. The amount of energy and macronutrients needed to do these is depended on how many muscles are moving, how much is the duration of activity done, and how intense the activity was (Almatsier et al., 2019)

In fight against obesity, many people join fitness centre that offers various exercise program. Exercise in fitness centre is not a need anymore, but also becoming a lifestyle for Indonesian people. Exercising in fitness centre can become a lifestyle since it could lead to weight loss and better appearance. Commonly, fitness centre also offers various exercise program such as aerobic exercise and HIIT. Another benefit of exercising in fitness centre is proper training schedule so the result may reach its maximized point (Sientia et al., 2012).

Aerobic exercise, also known as cardio exercise, is a low-intensity exercise that primarily depends on aerobic energy metabolism, hence the name. This refers to the sufficient usage of oxygen to meet the energy need during exercise (McArdle et al., 2010). Aerobic exercise was done by repeating low to moderate intensity sequentially on certain period (Plowman & Smith, 2013). Examples of cardio/aerobic exercise is running, jogging, swimming, bicycling, taking steps on ladder, and walking. Aerobic endurance training is the most recommended exercise for resolving obesity problem. According to European Clinical Practice Guidelines of the European Association for the Study of Obesity (EASO), aerobic endurance training with moderate and increasing intensity, adjusted with individual's health status and ability, must be done everyday for 30-60 minutes per session for all age groups. Recent study shows that aerobic endurance training improves strength, bone mineral density, body composition, and also prevents sarcopenia (Skrypnik et al., 2015).

High-Intensity Interval Training (HIIT) is a concept of exercise that combines high-intensity exercise interspersed by low or moderate-intensity separated by specific interval of rest. HIIT gain popularity in scientific community and common people as an efficient exercise choice, especially in urban people who have limited time (Gibala et al., 2014). This exercise was done in specific time so it can rise the pacing of the heart, thus increasing oxygen consumption and therefore increase body metabolism (Nuñez et al., 2020). Meta-analysis shows that HIIT reduces bodyweight, BMI, waist circumference, waist-to-hip ratio, fat mass percentage and visceral fat area. The same

research also showed that HIIT is more effective on reducing obesity than moderate-intensity training (Andreato et al., 2018). Based on all descriptions above, the purpose of this study was to analyse the effects of HIIT vs. Aerobic Endurance Exercise on energy intake, macronutrient intake, and VO2Max of fitness centre participants in Depok.

MATERIALS AND METHODS

Study participants

Population of this study were fitness centre participants in Depok, Indonesia. 26 participants were recruited voluntarily from one of fitness centre in Depok, West Java, Indonesia. Total sampling technique were used for determining number of subjects, since total population is under 100.

Study organization

The design of this study is experimental design with two treatment group, HIIT intervention group and Aerobic Endurance intervention group, with pre-test and post-test for each group. There's no control group on this study.

Testing Procedur

Participants were randomized into either HIIT intervention group or Aerobic Endurance Intervention group. Data collected were intake of energy and macronutrients, and beep test score. Each intervention was done for 3 months. Intake of energy and macronutrient were assessed before and after intervention was done, using recall 1x24 hour. The beep test was done in fitness centre, requiring 20 metre-distance for running. This test can provide a quite accurate insight into VO2Max level of subjects, and thus, the fitness level of subjects. The protocol of beep test is as follows: subject runs for 20 metres back and forth across a marked track keeping time with beeps. Every minute or so, the next level commences: the time between beeps gets shorter; participants must run faster. If a participant fails to reach the relevant marker in time, they are cautioned. A second caution ends the test for that runner. The number of shuttles completed successfully is recorded as the score of that runner. The score is recorded in Level.Shuttles format (e.g 6.5). The data then were cleaned, edited, and, since the distribution of data was normal, the data then analysed using paired t-test to get the p-value that indicates the significance of differences between mean of data for before and after intervention. Independent t-test was also used to analyse the effect of HIIT vs. Aerobic Endurance Training subjects' VO2Max level.

RESULTS

Table 1. *Mean differences of energy and macronutrients intake between the start and the end of the study on subjects who received HIIT intervention.*

HIIT DATA	Energy		Protein		Fat		Carbohydrate		VO2Max	
	Before	After	Before	After	Before	After	Before	After	Before	After
Mean	1620	1630	64.9	65.5	65.6	66.5	218.0	220.8	22.0	25.3
SD	567	436	33.1	24.8	30.5	23.7	85.0	78.0	2.4	3.4
p-value		0.952		0.931		0.918		0.901		0.0001

Table 1 shows the mean, standard deviation, and significance of mean difference (p-value) between variables for before and after intervention on subjects who received HIIT as the treatment. This table shows that there was no significant difference ($p>0.05$) of energy and macronutrients intake after intervention compared to value at the beginning of the study. However, there is significant increase of VO2Max value after intervention, suggesting that HIIT does increase VO2Max value on fitness center participants.

Table 2. *Mean differences of energy and macronutrients intake between the start and the end of the study on subjects who received aerobic intervention*

AEROBIC DATA	Energy		Protein		Fat		Carbohydrate		VO2Max	
	Before	After	Before	After	Before	After	Before	After	Before	After
Mean	1569	1670	61.8	62.6	56.3	58.0	204.7	227.8	22.0	24.7
SD	414	481	16.4	18.5	20.2	14.0	60.6	91.4	2.1	3.2
p-value		0.37		0.834		0.724		0.267		0.0001

Table 2 shows the mean, standard deviation, and significance of mean difference (p-value) between variables for before and after intervention on subjects who received aerobic training as the treatment. This table shows that there was no significant difference ($p>0.05$) of energy and macronutrients intake after intervention compared to value at the beginning of the study. However, there is significant increase of VO2Max value after intervention, suggesting that aerobic exercise also increases VO2Max value on fitness center participants.

Table 3*. Difference between energy and macronutrient intake between HIIT intervention and aerobic intervention*

DATA	HIIT VS ENDURANCE				
	Energy	Protein	Fat	Carbohydrate	VO2MAX
p-value (Beginning)	0.793	0.764	0.365	0.652	0.962
p-value (End)	0.825	0.745	0.274	0.834	0.656

Table 3 shows that there was no significant difference between energy intake, macronutrient intake, and VO2Max level between the two types of intervention, both

before and after intervention was done. These shows that both intervention type did not change energy intake and macronutrients intake, while both intervention increased VO2Max value.

DISCUSSION

The results of this study shows that there was no effect of both HIIT and Aerobic Endurance Training on energy and macronutrient intake. However, both interventions increase VO2Max as an indicator of fitness level. There's no difference on increases of VO2Max between both type of intervention. These results are consistent with the results of Donnelly et al., (2014) stating that there was no long-term endurance aerobic exercise with daily energy intake. This may happen because in this study, there was no calculation of exercise's energy cost, in line with the results of Taylor et al., (2018). This study also is in line with Miguet et al., (2020) whose research showed that HIIT and Traditional Aerobic Endurance Training have similar effects on energy intake and appetite regulation in adolescent with obesity.

The increases of VO2Max on both type of intervention have a similar, significant results compared with the VO2Max from before intervention. This result is consistent with Jabbal & Baxter-Jones (2017), whose research showed that even though both HIIT and Aerobic Endurance Training increases VO2Max, there was no significant difference between the increase gained. Low number of participants increased variation within the groups, and may contributed to inconsistency with other literature that showed HIIT is more effective on increasing VO2Max than Aerobic Endurance Training, such as the research of Tabata et al., (1996). Previous literature suggested that more participants would decrease variation and lead to significant results Roxburgh et al., (2014). This result suggests that although both HIIT and Aerobic Endurance Training increased VO2Max significantly, the short time required to do a session of HIIT may give more benefit to certain type of population who does not have much free time.

CONCLUSIONS

Both HIIT and traditional aerobic endurance exercise increase VO2Max but gave no effect on energy and macronutrient intake. There was no significant difference between both type of intervention on all output variables.

CONFLICT OF INTEREST

There was no conflict of interest.

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APPENDIX

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