Original Research

LOW AND MODERATE INTENSITY EXERCISE DECREASED BODY FAT AND INCREASED FREE FATTY ACID IN OVERWEIGHT WOMEN

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ABSTRACT

Overweight is fat imbalances can affect the health. It is one of the problems in many countries, especially Indonesia recorded an increase case in 2007 (8.8%) to 2013 (13.5%). Overweight categorized by 25-30 kg/m^2 body mass index in units. Figures overweight can be pressed to provide some treatments, such as aerobics sports activities. This study aimed to determine the effect of Continuous Low Intensity Training (LICT) and Moderate Intensity Continuous Training (MICT) to decrease body fat content (FM) and increase in free fatty acids (FFA) in overweight women. 18 female subjects completed the study 4X/week exercise LICT or MICT for 5 weeks. LICT and MICT performed for 30 minutes with an additional 5 minutes warm-up and 5 minutes of cooling down with LICT intensity of 60%-70% and MICT 70%-80% of maximum HR where both types of exercise using ergo cycle while measurement FM and FFA were measured before and after practice. LICT occurred decreasing in body fat and increasing in free fatty acids that significant pre and post LICT ($p < 0.05$). MICT occurred decreasing in body fat and increasing in free fatty acids that significant pre and post MICT ($p<0.05$). In the second comparison group (LICT and MICT) were decline against body fat and an increased in free fatty acids between workouts Low-Intensity Continuous Training (LICT) greater tendency than Moderate-Intensity Continuous Training (MICT) with delta FM ($p = 0.120$) and delta FFA ($p=0.131$) in which the value is >0.05. LICT and MICT was increase while body fat was decreased. The results of a comparison test occur list downward trend in body fat while in free fatty acids was increased.

Keywords: *Exercise; intensity; fat; overweight; human & health*

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Highlights:

1. Aerobic exercise was reduced body fat and increased free fatty acids.
2. LICT and MICT decreased body fat and increased free fatty acids.

INTRODUCTION

According to the World Health Organization in 2018, being overweight is a fat imbalance that can affect health. Overweight categorized by 25-30 kg/m^2 body mass index in units. Based on the data of the Ministry of Health in 2007 and 2013, Indonesia is a country that experienced an increase in the overweight number from 2007 (8.8%) to 2013 (13.5%).

Overweight can be pressed to provide some treatments, such as doing aerobics sports activities. Aerobic exercises can be lipolysis fat or triglyceride affecting the use of body fat and free fatty acids into energy by the oxygen (Guyton & Hall 2014). This happens, because the triglyceride hydrolysis that will produce fatty acids and sent to an active network will be oxidized (Wolinsky & Driskell 2008).

Triglycerides cannot immediately turn into free fatty acids and glycerol, but requires some hormones and enzymes. It can be stimulated due to sports activities with a long duration (Jeppesen & Kiens 2012). Cortisol, catecholamine, growth hormone and other hormone that assist fat metabolism will increase triglycerides lipolysis by stimulating the β androgenic hormone receptor with the addition of sensitive lipase (HSL), but for the growth of hormone work during night when the body break (Wolinsky & Driskell 2008).

Fisher et al (2015) in their study which used ergo cycle to determine body composition, fat in the blood, insulin sensitivity, and cardiovascular fitness using High Intensity Interval Training (HIIT) and ContinuousModerate Intensity Training (MICT), stated that the increase results of both practices certainly decreased body fat. Another study examines fat metabolism. especially abdominal visceral fat and body composition in obese women with metabolic disorders exercise Low-Intensity Exercise Training (LIET) and High- Intensity Exercise Training (HIET), resulted that the data were the effective changes in body composition and exercise intensity of HIET (Irving et al. 2009).

In the study of Lazer et al (2011) on body composition and substrate of metabolism in men obese unknown physical activity with low intensity in week-3 of body mass and fat mass, decreased significantly in all groups of Low Intensity (LI) and High Intensity (HI), while the most significant decreased in LI compared to HI. In addition, Iwayama et al (2015) on lipid oxidation using the method of measurement before breakfast, indicated an increase in fat oxidation before breakfast.The bias in the study was that people were trying to do the exercises with their own choice (Iwayama et al. 2015).

Several studies mostly used interval training, but a study on body composition and free fatty acids were compared between Low Intensity Continuous Training (LICT) and Moderate Intensity Continuous Training (MICT) has never been done.

MATERIALS AND METHODS

This study manifold experimental pretest-posttest design. The subjects were 18 females with age range 19-32 years old. Exercises were divided into 2 groups, the LICT and MICT. LICT used an intensity of 60%-70% of maximum HR with a duration of 30 minutes exercise time as well as additional 5 minutes to warm up and 5 minutes for cooling, doing 4X/week for 5 weeks. The procedure was similar to the LICT and MICT, while the difference was the maximum HR intensity of 70%-80%. The exercises were using ergo cycles and monitored using a polar heart rate monitor. The variables were body fat and free fatty acids. Body fat was measured using Body impedance Analyzer (BIA), and free fatty acids were measured using ELISA Human Free Fatty Acid KIT.

RESULTS

The respondents were 18 females aged 19-31 with a dominating amount less than 22 years old as many as 11 females.

Table 1. The mean of age in each group

Age group	Frequency	Percent
19 – 22	11	61.1
23 – 24	5	27.8
25 – 26	1	5.6
32	1	5.6
Total	18	100.0

Table 2. The mean of BMI in each group

BMI group	Frequency	Percent
25 – 27	5	27.8
27.01 - 28.00	6	33.3
28.01 - 29.00	6	33.3
29.01 - 30.00	1	5.6
Total	18	100.0

The overweight group most in groups 2 and 3 on the percentage reached 33.33%. The data normality test results in this study. The study results showed significant with values >0.05 which value indicates data from this study normal distribution.

Table 3. Descriptive analysis

	n ·	Minimum	Maximum	The mean ± SD
Pre-Body fat	18	31.10	48.89	39.8483 ± 4.95831
Post Body fat	18	30.00	47.89	38.3361 ± 4.91210
Pre-Free Fatty Acids	18	710 057	897 133	831.23133 ± 52.525617
Post Free Fatty Acids	18	801 473	994 551	940.92439 ± 47.970949

Table 4. Results of normality test data by Shapi-Wilk

Group		Shapiro-Wilk sig.
Pre-Body fat	low Intensity	0.062
	moderate Intensity	.451
Post Body fat	low Intensity	0.134
	moderate Intensity	0.337
Pre-Free Fatty Acids	low Intensity	0.998
	moderate Intensity	0.076
Post Free Fatty Acids	low Intensity	0.174
	moderate Intensity	0.185

Table 4 shows the data normality test results in this study. The results of this study showed significant with values >0.05 which value indicates data from this study normal distribution.

Table 5. Results of data analysis on decreased body fat and increase in fatty acids using pair t-test

Variables	The mean ± SD	Sig.
Pretest Body Fat - posttest Body Fat	1.863 ± 1.193	0.002
Pretest Free Fatty Acid - posttest Free Fatty Acid	-126.102 ± 47.054	0.000

Table 5 shows the test results data on the effect of exercise on body fat reduction and an increase in free fatty acids from the second exercise shows that there is a difference between before and after exercise which analyzes test results indicate significant value <0.05 between body fat pre-post body fat (p = 0.002) and a free fatty acid pre-post free fatty acid (p = 0.000).

Table 7 Results of data analysis on decreased body fat and increase in fatty acids using pair t-test

Variables	The mean difference ± SD	Sig.
Pretest Body Fat- posttest Body Fat	1.863 ± 1.193	0.002
Pretest Free Fatty Acid - posttest Free Fatty Acid	-126.102 ± 47.054	0.000

The test results data on the exercise effect on body fat reduction and an increase in free fatty acids from the second exercise shows that there was a difference between before and after exercise which analyzes test results indicate significant value <0.05 between body fat pre-post body fat (p= 0.002) and a free fatty acid pre-post free fatty acid (p = 0.000).

Table 8. Results of comparative analysis using independent t-test

	Group	The mean difference ± SD	Sig.
Δ BT	low intensity	-1.863 ± 1.193	0.120
	moderate intensity	-1.161 ± 0.473	
Δ FFA	low intensity	123.102 ± 27.054	0.131
	moderate Intensity	93.283 ± 40.025	

Note: BT: Body Fat, FFA: Free Fatty Acid

The levels of body fat and free fatty acids pretest and posttest with low and moderate intensity exercises had resulted that posttest results of the two variables showed the influence of low and moderate intensity exercises with the interpretation of body fat significantly (p=0.000) and free fatty acids (p=0.010). the results of independent t-test to determine the effective exercise between low and moderate intensity exercises showed no significant difference between the results of body fat (p=0.120) and free fatty acids (p=0.131) with a significance value >0.05, although it was descriptive of both exercises which showed an increase in body fat and a decrease in free fatty acids. These results can be seen in Table 8.

DISCUSSION

In this study, the population was dominated by the age less than or equal to 22 years with a total of 11 people. The samples in this study were females with the highest rate of overweight category, namely in the IMT group 2 and group 3 consisting of 6 each group.

The normality data was normal distribution with a significance value >0.05 in pre-body fat with low intensity (p=0.062), pre-moderate intensity body fat (p=0.451), post-fat body with low intensity (p=0.134), post-body fat with moderate intensity (p = 0.337), pre-free fatty acids with low intensity (p=0.988), pre-free fatty acids with moderate intensity (p=0.076), post-acid low intensity body fat (p=0.174), and post-free fatty acids with moderate intensity (p=0.185).

The significant value in the data analysis between body fat pre-post in body fat (p=0.002) and a free fatty acid in pre-post free fatty acids (p=0.000) with the increasing value <0.05. These studies supported the theory by Wolinsky and Driskell (2018) which stated carbohydrates. Fat was the main provider of energy during endurance exercise. Fat was a major provider of energy during rest, activity, and low intensity exercise. It was due to the increased free fatty acids resulting from the exercise and stimulation hormone cortisol, catecholamines, and increased growth hormones and stimulated androgen receptor ϐ that increased resulting an increased lipolysis of triglycerides through the assistance of HSL (hormone sensitive lipase) (Wolinsky & Driskell 2008), This study supports the theory of Purdom et al (2018) which stated that when the exercise was less than 60%, it could stimulate endocrine to release epinephrine which increased lipolysis and epinephrine concentration that enabled to increase by 2-3 times when it broke, as well as stimulating HSL to produce more to lipolysis TG into FFA and glycerol (You et al. 2012).

Similarly, Lazer et al (2011) also revealed oxidation low intensity that supported the fat and advised for people with overweight or obese to be more feasible and acceptable. Other studies also proved similar results and found the effect of aerobic exercise on body fat, blood, and fitness in overweight and obesity (Powell 2011)

Analysis on body fat and free fatty acids pre-post exercise showed p values of 0.000 each, indicating an increase as the significance value was <0.05. It was in line with Ogasawara et al (2015) that moderate intensity exercise could cause lipolysis acceleration response in humans. During moderate intensity

exercise, the free fatty acids group was bound to carnitine that would bring out of the mitochondrial membrane in acyl-carnitine form. It occurred in low to moderate intensity exercise.

The previous result was in line with the findings of Wewege et al (2017) study which revealed body fat and waist circumference changes during the exercise MICT. In line with Horowitz and Klein (2000), aerobic exercise also increased fat oxidation during submaximal exercise resulting from the body's adaptive response mitochondria thickness that increased in skeletal muscle and increased fat oxidation capacity. Aerobic exercise with duration of 30 minutes could be increased to lipolysis fat (Hargreaves & Spriet 2020). It showed that in 30 minutes of exercise, there was an increase in lipolysis of fat which also balanced with the increased use of fatty acids (Horowitz & Klein 2000).

The changes in body fat and free fatty acids by using low and moderate intensity exercise of prior exercise up to the post-test. The results of this study showed no significant difference in ΔFM ($p = 0.120$), and ΔFFA ($p = 0131$) with the significance value was > 0.05. It was also in line with a study by Kong et al (2016) which compared HIIT workout and MICT with the result that changes in body composition, but the views from the higher used MICT of HIIT (Kong et al. 2016), Lazer et al (2011) compared the exercise LI and HI and resulted no significant difference in fat between the LI and H. In addition, Marra et al (2005) also found the same result that no significant difference in body fat of moderate intensity group (Marra et al. 2005), Descriptively, there was a difference between exercise and MICT with LICT greater value on LICT. Similar result was also relevant to the theory in the study of Wolinsky et al (2008) that to know decreased fat, the most prevalent in low intensity were caused by the increased lipolysis in adipose tissue triglycerides (Wolinsky & Driskell 2008).

Strength and limitation

The study has a clear objective to determine the effect of two types of exercise on overweight women's body fat content and free fatty acids. It does not include a control group, which could have helped to determine whether the observed changes were solely due to exercise or other factors such as diet or lifestyle changes.The study only includes female subjects, which limits the generalizability of the results to other populations.Also, It does not provide information on the intensity of physical activity or diet of the subjects outside of the exercise program.

CONCLUSION

Aerobic exercise can reduce the amount of signaling body fat and increase free fatty acids found in LICT and MICT which indicate a change after a work-out. In this study, there were some decreases in body fat and an increase in free fatty acids in LICT and MICT, but the results of a comparison test obtained a list of downward trends in body fat and an increase in free fatty acids. By suppressing the number of overweight figures with LICT exercise and MICT usage with ergo cycle, the application of exercise on LICT and MICT required a work-out to reschedule.

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Conflict of interest

None.

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Author contribution

All the authors contributed in design of the research, data analysis, and interpretation of the obtained results and collected the specimens and wrote the manuscript.

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