COMPARISON OF THE EFFECT OF HIGH INTENSITY INTERVAL TRAINING AND LOW INTENSITY INTERVAL TRAINING (HIIT) FUNCTIONAL TRAINING METHODS ON BODY FAT PERCENTAGES

[1*] Hariadi, [2] Ardi Nusri, [3] Fery Juanda

Correspondence: [1] Faculty of Sport Science, Universitas Negeri Medan, Medan, Indonesia

Email: hariadi@unimed.ac.id

ABSTRACT

Functional training is one of the most widely used training methods to reduce obesity. There are various types of functional training methods, for this reason, an analysis is needed to compare the effect of these methods through a measurement. This study aims to compare the popular functional training methods High Intensity Interval Training (HIIT) and Low Intensity Steady State (LISS) to body fat percentages. Measurements were taken on 20 women assisted by InBody 270. This study used purposive sampling and used a matching by pairing technique. Data was analysed using t-test. The result shows that the first hypothesis is 4.398> 2.101, which means that there was a significant effect of the HIIT functional training method on percent body fat. In the second hypothesis 13.365> 2.101, which means that there was a significant effect of the LISS functional training method on percent body fat. In the third hypothesis 8.966> 2.028, which means that there was a significant effect of the functional training method HIIT and the functional training method LISS on percent body fat. Based on the mean difference (mean df), the decrease in percent body fat in the functional training group HIIT method is higher (2.47) than LISS method of 1.42. It can be concluded that the functional training method of HIIT is more effective in reducing body fat percentages.

Keywords: Functional training, HIIT, LISS

Introduction

Obesity is the accumulation of fat that exceeds normal for both sex, age and genetics. Obesity is defined as 20% excess fat over ideal body weight, or 20% excess fat in men and 30% excess fat in women. The prevalence of obesity is increasing worldwide, not only in developed countries but also in developing countries, including in Indonesia. One of the most appropriate efforts to prevent obesity is exercise with the right method, one of which is functional training.

The word 'functional' in functional training has the goal of being able to function the body as it should. Functional training is defined as a type of exercise whose movements can be adjusted in daily activities, with the main goal being focused on core muscles such as the lower back and abdomen. Functional exercise is a flexible exercise category, it can be done anytime and anywhere. Functional training has also been proven to improve strength, stability, endurance, mobility and flexibility of the body. Functional training is an exercise that focuses on a goal in carrying out activities such as climbing stairs, carrying groceries, playing with children or lifting things. Activities like this can basically support the burning of fat in the body to reduce obesity.

There are various types of functional exercises, one of which is High Intensity Interval Training (HIIT). HIIT exercise is characterized by relatively short bursts of repeated vigorous activity, interrupted by periods of rest or low-intensity exercise for recovery (Feito, Heinrich, Butcher, Poston, & S., 2018). It is also proven to exercise elevated aerobic capacity, improve muscular endurance, increase lean body mass, and reduce body fat. HIIT typically combines

high-intensity bouts (i.e., duration between 1 and 4 min at 85% of maximum heart rate (HRmax) separated by recovery periods of low-intensity activity or rest with an average total duration between 4 and 16 min (MacInnis dan Gibala, 2017; Gibala, 2012). Moreover, HIIT has recently gained momentum among fitness enthusiasts, and has been identified as a "Top 10 Fitness Trend" in 2018 (Thompson, 2017).

Low Intensity Steady State (LISS) is a type of exercise with low intensity and is generally aerobic in nature. In contrast to HIIT, LISS is generally performed more consistently and is often associated with cardio training. Cardio exercise have good impact on aerobic function of the body, strengthen body parts, and create unique adaptations to the heart (Heffernan, 2013). This type of exercise is done simply and steadily, for example by jogging for 20 minutes or more and maintaining a pulse rate of 120-150 beats per minute. LISS is also often done to reduce weight and shape the body.

The increased risk of obesity is one of the reasons it is important to know the most appropriate method of functional training to reduce body fat. Previous studies have proven HIIT benefits including changes in body composition and decreases in visceral adiposity. LISS is also the preferred option for reducing body fat. Body fat percentage (%BF) is a physical parameter of the body that is closely related to the fat content in the body as well as a cardiometabolic risk factor. Whole-body percentage body fat was calculated as total body fat mass divided by total mass (Flegal et al., 2009). The ideal Body Fat Percentage differs between men and women and is adjusted for age and Body Mass Index (BMI) (Gallagher et al., 2000). Body fat percentage is also an indicator in research on the relationship between exercise methods conducted by Feito (2018) and Heinrich (2015).

This study was to compare the functional training method that has the most influence on obesity in Medan by measuring percent body fat. So far, several related studies generally use HIIT and MICT functional training, while this study tries to compare HIIT with LISS. Similar research has not yet been carried out at gyms in Medan, one of the metropolitan cities in Indonesia. This research is expected to be able to contribute to knowing the best benefits of sports with functional training to prevent obesity.

Method

The research was conducted at New Life Gym Medan, North Sumatra. The population in this study was 54 members who took part in the inbody test weighing program and were female. Purposive sampling was conducted through several criteria as follows: (1) are female, (2) have body fat percentages over, (3) have no history of cardiovascular disease. Based on these criteria, the members obtained in this study were 20 members. This study used experimental research methods (quantitative). The duration of the exercise was 30-60 minutes with a meeting frequency of 3 times a week. The number of meetings was 18 meetings for approximately 6 weeks based on Fox (1988:181).

The research design was pre-test and post-test group design. From several samples obtained based on purposive sampling, the samples were divided into two groups. Group division was carried out using the matching by pairing technique and looking at the high and low body fat percentages. Thus it will be seen that the members who will be the sample are visible and can be classified, samples were women ranging in age from 17 to 35 years.

Table 1. Research Design

Pre-Test	Matching By Pairing	Treatment	Post-Test
	Group A	X1	
T1			T2
	Group B	X2	

Note: T1=Pretest (body fat percentages)
X1=Functional Training HIIT
X2=Functional Training LISS
T2=Posttest (body fat percentages)

The forms of exercises performed using the HIIT and LISS methods are shown in Table 2 and Table 3. In general, the forms of exercise between the two methods are the same, the difference is the repetitions, number of sets, and duration of rest performed.

Table 2. Functional training HIIT Program

Order	Exercise	Reps/Time	Rest	Sets
A1	Two-foot run	30	-	4
A2	Straddle squat hops	30	60	4
B1	Side step on box	30	-	4
B2	Walk / Run in Elliptical machine	30	0	4
C1	Zercher front squat	30	-	4
C2	Step up on box	30	60	4
D1	Shoulder to shoulder press	30	-	4
D2	Two hand kettlebell swing	30	60	4
E1	Sandbag Clean	30	-	4
E2	Medicine ball overhead throw	30	60	4
F1	Kettlebell / Medicine ball twist	30	-	4
F2	Mountain climber	30	60	4

Table 3. Functional training LISS Program

Order	Exercise	Reps/Time	Rest	Sets
A1	Two-foot run	60s	0s	5
B1	Straddle squat hops	60s	0s	5
C1	Side step on box	60s	0s	5
D1	Run in Elliptical machine	60s	0s	5
E1	Zercher front squat	60s	0s	5
F1	Step up on box	60s	0s	5
G1	Shoulder to shoulder press	60s	0s	5
H1	Two hand kettlebell swing	60s	0s	5
I1	Sandbag Clean	60s	0s	5
J1	Medicine ball overhead throw	60s	0s	5
K1	Kettlebell / Medicine ball twist	60s	0s	5
L1	Mountain climber	60s	0s	5

In this study, data collection techniques were carried out by means of tests and measurements of several research variables, in which the sample will be seen and analyzed for body fat percentage using the InBody 270 test, as shown below:

Figure 1. InBody 270, Source: Instruction Manual InBody 270.

Data Analysis
Data was analysed through statistical methods as follows:
1. Prerequisite Analysis Test
      The normality test using the Lilliefors test was carried out to find out whether the data has a normal distribution. Determination of the hypothesis is accepted if the significance value is greater than 0.05. If the criteria are not appropriate then the hypothesis is rejected. Homogeneity test is a test that aims to find out whether the variances of certain populations are the same or not. This homogeneity test was carried out to test the similarity between the variances of the pretest and posttest experimental groups using the Leven's test.
2. Hypothesis Testing
      Hypothesis testing was done by paired t test. The hypothesis is accepted if the t-count is greater than the t-table and the significance is equal to or less than 0.05 ($p \leq 0.05$); in the sense that there is an increasing effect between pretest and posttest. The independent t test was conducted to compare the averages of two unpaired or unrelated groups. The hypothesis is accepted if the significance value is equal to or less than 0.05 ($p \leq 0.05$) then there is a significant average difference between the two methods which means that one of the methods is more effective.

Discussion
      This experimental research involved three types of variables, which consisted of two independent variables and one dependent variable. The independent variables are the HIIT and the LISS functional training method, while the dependent variable is body fat percentages. 20 samples were taken, group division was carried out using the matching by pairing technique and looking at the results of body fat percentages. Members who are sampled are women ranging in age from 17 to 35 years. By doing an initial test of body fat percentages and visceral fat, the results of this test are then sorted from the worst to the best results and divided by group using the matching by pairing method.
      The results of the pre-test in the HIIT method functional training group for decreasing body fat percentages showed an average value of 32.14 and a standard deviation of 1.664. From the results of the post-test obtained an average value of 29.67 and a standard deviation of 1.337. From the pre-test and post-test averages of the HIIT method functional training group, a

different value of 2.47 was obtained with a different standard deviation of 0.327 so that $t_{count} = 4.398$.

The results of the pre-test in the functional training group with the LISS method for decreasing body fat percentages obtained an average value of 39.97 and a standard deviation of 7.677. From the results of the post-test obtained an average value of 38.55 and a standard deviation of 7.922. From the average pre-test and post-test of the functional training group using the LISS method, a different value of 1.42 was obtained with a different standard deviation of 0.244 so that $t_{count} = 13.365$ Then from the final data after processing the data, a combined standard deviation of 6.934 was obtained so that t_{count} was obtained 8.966.

The results of tests and measurements are carried out to reveal the truth of the hypothesis. Through statistical formulas the results of tests and measurements can be described as follows:

Table 4. Body Fat Percentages Data

Data Description	Body fat percentages result			
	HIIT		LISS	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Mean	32,14	29,67	39,97	38,55
Standard deviation	1,664	1,337	7,677	7,922
Mean Difference	2,47		1,42	
Standard deviation difference	0,327		0,244	
t_{count}	4,398		13,365	
t_{table}	2,101		2,101	
Standard deviation		6,934		
t_{count}		8,966		
t_{table}		2,028		

Normality Test

The data used at this stage are body fat percentages data obtained from the InBody 270 test. The nonparametric normality test is a test known as the Lilliefors test, the sample comes from a normally distributed population against the counter hypothesis that the distribution is not normal.

From the list of functional training pre-tests for the HIIT method, the results of body fat percentages for New Life Gym members were $L_{count} = 0.162$ and $L_{table} = 0.258$ with n = 10 and a significant level of $\alpha = 0.05$. Because $L_{count} > L_{table}$, it can be concluded that the sample comes from a normal population. From the list column of the post-test functional training HIIT method, body fat percentages were obtained for New Life Gym members, namely $L_{count} = 0.167$ and $L_{table} = 0.258$ with n = 10 and a significant level of $\alpha = 0.05$. Because $L_{count} < L_{table}$, it can be concluded that the sample comes from a normal population.

The Liliefors test was used to test the normality of the data, from the functional training pre-test listing column of the LISS method, the results of body fat percentages for New Life Gym members were $L_{count} = 0.221$ and $L_{table} = 0.258$ with n = 10 and a significant level of $\alpha = 0 ,05$. Because $L_{count} < L_{table}$ it can be concluded that the sample comes from a normal population. From the post-test functional training list column for the LISS method, body fat percentages were obtained for New Life Gym members, namely $L_{count} = 0.223$ and $L_{table} = 0.258$ with n = 10 and a significant level of $\alpha = 0.05$. Because $L_{count} < L_{table}$, it can be concluded that the sample comes from a normal population.

Table 5. Normality Test

Exercise Group		Mean and Standard Deviation	L_{count}	L_{table}	α	Note
Body fat percentages result	HIIT	Pre-test $\overline{X}_i = 32,14$ $S = 1,664$	0,162	0,258	0,05	Normal
		Post-test $\overline{X}_i = 29,67$ $S = 1,337$	0,167	0,258	0,05	Normal
	LISS	Pre-test $\overline{X}_i = 39,97$ $S = 7,677$	0,221	0,258	0,05	Normal
		Post-test $\overline{X}_i = 38,55$ $S = 7,922$	0,223	0,258	0,05	Normal

Homogeneity Test

Homogeneity test between functional training groups using the HIIT method and functional training using the LISS method for the results of body fat percentages obtained

$F_{count}= 21.283$ it is known that $n_1 = 10, V^1 = 10 - 1 = 9$ while $n_2 = 10 , V^2 = 10 - 1 = 9$ so that $F_{table}= 3.179$ with a significant level of α = 0.05, then $F_{count}>F_{table}$ (21.283 > 3.179) it can be concluded that the exercise was homogeneous. Sudjana (2015: 249) argues that when calculating the average difference and testing the similarities or differences between the two averages, the assumption that the two populations have the same variance is often emphasized so that testing and counting can take place. Thus, the homogeneity test data was stated to be homogeneous, where the two training groups were concluded to be homogeneous.

First Hypothesis Test

From the calculations that have been done, the result of testing the hypothesis t_{count} was 4.398. Then this value was compared with the value of t_{table} with dk= (n1+n2-2=18) with a significant level of α = 0.05 was 2.101, then $t_{count} > t_{table}$ (4.398>2.101). This means H_0 was rejected and H_a was accepted. Thus, there was a significant effect of functional training using the HIIT method on reducing body fat percentages of new life gym members.

Second Hypothesis Test

From the calculations that have been done, the results obtained from testing the hypothesis t_{count} was 13.365 then this value was compared with the value with dk= (n1+n2-2=18) with a significant level α = 0.05 was 2.101, then $t_{count} > t_{table}$ (13,365>2,101). This means that H_0 was rejected and H_a was accepted, there was a significant effect of functional training with the LISS method on decreasing body fat percentages of new life gym members.

Third Hypothesis Test

From the calculations, the results obtained from testing the hypothesis t_{count} was 8.966 then this value was compared with the value with dk = (n1 + n2-2 = 18) with a significant level α = 0.05 is 2.028, then $t_{count} > t_{table}$ (8,966>2,028). So, there was a significant effect of functional training on the HIIT method with the LISS functional training method on reducing body fat percentages of new life gym members.

Based on average values, the decrease in body fat percentages in the functional training group using the HIIT method was higher, which was 2.47, compared to the average decrease in

body fat percentages in the functional training group using the LISS method, which was 1.42. It can be concluded that functional training using the HIIT method is more effective in reducing body fat percentages than functional training using the LISS method.

The effect of the HIIT Functional Training Method on reducing body fat percentages

HIIT exercise is characterized by relatively short bursts of repeated vigorous activity, interrupted by periods of rest or low-intensity exercise for recovery (Feito, 2018). The HIIT functional training method is an exercise that utilizes one's own body weight with movements that are usually carried out every day, where these exercises condition activities such as squatting, running, jumping, lifting weights that we usually do in daily life and are carried out by combining high-intensity exercises and with moderate and low intensity exercise. This exercise is performed for a certain duration of time which can affect the heart pump to be fast thereby increasing the body's metabolism and increasing oxygen consumption, this intense exercise is usually done for no more than 30 minutes, with varying time variations depending on the fitness level of the sample in the study. HIIT training can improve cardiopulmonary capacity and athletic condition as well as increase glucose metabolism.

HIIT training can also obtain several benefits including: (1) thicken the myocardium of the left ventricle of the heart thereby increasing heart contractions, (2) reducing the heart rate per minute, (3) increasing blood vessel dilation and reducing blood vessel resistance, (4) increasing endothelial function and insulin sensitivity thereby reducing hypertension, (5) reducing body fat percentages. This is supported by the results of the research described in the first hypothesis where there is a significant effect of the HIIT functional training method on reducing body fat percentages of new life gym members.

The above statement is supported in a research journal conducted by Putra (2018), entitled "The Effect of Height Intensity Interval Training (HIIT) on Reducing the Percentage of Body Fat in Menopausal Women Suffering from Obesity" Based on the results of the t test on body weight data, the calculated t value can be concluded that Ho is rejected, because the t count obtained is -10.06 and 10.06. then, t table is 2.06 and -2.06. Because t count <-2.06 and t count > 2.06, it can be concluded that high intensity interval training (HIIT) can have a significant effect on decreasing the percentage of body fat in menopausal women who are obese.

Effect of LISS Functional Training Method on decreasing body fat percentages

Functional training of the LISS method is an exercise that is carried out using body weight. It uses daily movement and exercise conditions activities such as squatting, running, jumping, lifting weights that are usually done in daily life and are carried out by combining them with intensity low for 30-60 minutes and the intensity is 60% of the maximum heart rate. In other words, LISS is a method of cardiovascular exercise by performing aerobic activity at low to moderate intensity for continuous periods of long duration. In doing LISS exercise, several benefits can be obtained, including: (1) reducing physical stress on the cardiorespiratory system, (2) increasing endurance, (3) increasing cardiorespiratory fitness, (4) increasing heart efficiency at a slower heart rate, (5) increase the ability to use fat as an efficient fuel source so as to reduce body fat percentages. This is supported by the results of the research described in the second hypothesis where there is a significant effect of the LISS functional training method on reducing body fat percentages of new life gym members.

The above statement is supported in a research journal conducted by Dyaksa (2018), with the title "Effects of Low and Medium Intensity Exercise on Fat Reduction in Overweight." $= 0.002$) and pre free fatty acids – free fatty acids post ($p = 0.000$) it can be concluded that the

effect of low and moderate intensity training can have a significant effect on fat loss in overweight.

The difference between the HIIT Functional Training Method and the LISS Functional Training Method for reducing body fat percentages

Based on the results of applying the HIIT and the LISS functional training method to a number of members during 18 meetings, there was a decrease in body fat percentages. From the two results of functional training, it can be concluded that the decrease in body fat percentages is greater in the functional training method HIIT compared to the functional training method LISS. Based on the results of the Independent sample t-test, it was seen that the average percentage of body fat after training between groups with an average difference in body fat reduction of $5.65 \pm 0.81\%$ in Group 1 and $3.33 \pm 0.59\%$ in Group 2 and obtained a value of $p = 0.002$ ($p < 0.05$). The results of this study indicate that high-intensity interval training is more effective than moderate-intensity continuous training in reducing the percentage of body fat in overweight female students. Other studies conducted in various parts of the world have also shown the effectiveness of HIIT in reducing fat. HIIT significantly decreases in total, abdominal and visceral fat mass (Maillard 2016, Higgins 2016).

The implementation of this study was based on field observations, but not only the functional training method HIIT and functional training method LISS which became the basis for the decrease in body fat percentages. Several other factors became obstacles in conducting this research, namely:

1) The research samples came from members whose profession as career women, so that they started from diet, exercise hours, rest hours, high stress levels that made it difficult for both members and researchers to control.

2) In the exercise program of the two groups, it is possible that the members paid less attention or did not understand the instructions and did not understand the motor movements in the exercise program, so that the data obtained did not reflect the actual situation.

3) Psychological factors also influence the results of research that cannot be considered, including motivation, feelings, individual schedules and the ability to perform motor exercises.

Conclusion

The results showed that there was a difference in the effect of the HIIT functional training method and the LISS functional training method on decreasing the percentage of body fat in new life gym members, where the HIIT functional training method had a more significant effect than the LISS functional training method on reducing the body fat percentage of new life members gym.

References

Dyaksa, R.S. (2018). Efek Latihan Intensitas Rendah Dan Sedang Terhadap Lemak Pada Overweight. *Jurnal Biosains Pascasarjana*, 20(1).

Feito, Y., Heinrich, K. M., Butcher, S. J., Poston, C., & S., W. (2018). High-intensity functional training (Hift): Definition and research implications for improved fitness. *Sports, 6*(3), 1-19.

Flegal KM, Shepherd JA, Looker AC, Graubard BI, Borrud LG, Ogden CL, Harris TB, Everhart JE, Schenker N. Comparisons of percentage body fat, body mass index, waist

circumference, and waist-stature ratio in adults. Am J Clin Nutr. 2009 Feb;89(2):500-8. doi: 10.3945/ajcn.2008.26847.

Fox, E.L. Bowers, R.W. & Foss, M.L. (1988). *The Physiological Basis of Physical Education and Athletes*. United States of America: Saunders College Publishing.

Gallagher D, Heymsfield SB, Heo M, Jebb SA, Murgatroyd PR, Sakamoto Y. Healthy percentage body fat ranges: an approach for developing guidelines based on body mass index. Am J Clin Nutr. 2000 Sep;72(3):694-701. doi: 10.1093/ajcn/72.3.694. PMID: 10966886.

Gibala, M.J.; Little, J.P.; Macdonald, M.J.; Hawley, J.A. Physiological adaptations to low-volume, high-intensity interval training in health and disease. J. Physiol. 2012, 590, 1077–1084

Higgins J.P., Higgins C.L. Prescribing exercise to help your patients lose weight. Cleve Clin J Med. 2016 Feb;83(2):141-50. doi: 10.3949/ccjm.83a.14139. PMID: 26871390.

Heffernan, A. (2013). Steady-State Cardio Vs. High-Intensity Interval Training. *Experience Life*.

Heinrich, K.M.; Becker, C.; Carlisle, T.; Gilmore, K.; Hauser, J.; Frye, J.; Harms, C.A. High-intensity functional training improves functional movement and body composition among cancer survivors: A pilot study. Eur. J. Cancer Care 2015, 24, 812–817.

Maillard F, Rousset S, Pereira B, Traore A, de Pradel Del Amaze P, Boirie Y, Duclos M, Boisseau N. High-intensity interval training reduces abdominal fat mass in postmenopausal women with type 2 diabetes. Diabetes Metab. 2016 Dec;42(6):433-441. doi: 10.1016/j.diabet.2016.07.031. Epub 2016 Aug 24. PMID: 27567125.

MacInnis, M.J. and Gibala, M.J. (2017), Physiological adaptations to interval training and the role of exercise intensity. J Physiol, 595: 2915-2930. https://doi.org/10.1113/JP273196

Putra, M.A. (2018). Pengaruh High Intensity Interval Training (HIIT) Terhadap Persentase Lemak Tubuh Wanita Menopause Penderita Obesitas. *Jurnal Pendidikan Jasmani dan Olahraga*, 2(1): 158-166.

Thompson, R.L. (2017). Worldwide Survey of Fitness Trend for 2018. American College of Sports Medicine