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Research Article

An Experimental Study on the Effect of Sprint Interval Training Versus Traditional Exercise Programs Among Young Obese Adults

Thirulogachandar Gunasekar[1*], Shivaranjani Balamurugan [2], Murali Ravi[3], Muthulakshmi K [4], Bernard Ebenezer Cyrus[5], Saraswathi K[6] and Balaji Kaliyaperumal[7]

[1,4,5,6,7]*Faculty of Physiotherapy, Dr MGR Educational and Research Institute, Velappanchavadi, Chennai.*

[2] *Department of Physiotherapy, Panimalar Medical College Hospital and Research Institute.*

[3] *Faculty of Physiotherapy, Meenakshi Academy of Higher Education and Research.*

Abstract: The aim and objective of the study is that the prevalence of overweight and obesity have peaked in past decades which resulting in many adverse effects on health of young adults; hence this study is designed to compare the effectiveness of sprint interval training and traditional exercise program on body mass index (kg/m^2), waist circumference (cm), body weight (kg) and blood lipid profiles in young adult with obesity. According to WHO, Obesity has become a global epidemic in both developed and developing countries, which is considered one of the major risk factors for cardiovascular diseases. The American Heart Association has recommended reducing the risk of cardiovascular disease by weight loss, which is essential for the obese population. Sprint Interval Training has improved insulin sensitivity, low-density lipoprotein cholesterol [LDL-C], and body composition. Traditional exercises were also effective in improving cardiovascular and metabolic function and consequent reduction in the prevalence of dyslipidemia, hypertension, and insulin resistance. In this comparative study, 30 subjects aged 20-30 with a Body Mass Index >25 were included based on specific selection criteria and divided into two groups. Group A was trained with sprint interval training, and Group B was trained with traditional exercise training. Each group, A and B, consisting of 15 subjects, was recruited from Dr. M.G.R. Educational and Research Institute, Chennai. This study measured Body Mass Index, Waist circumference, and body weight before and after the intervention in groups A and B. Comparing Posttest values between Group A and Group B on Body Weight, Body Mass Index, and waist circumference score showed a highly significant difference in mean values at $P \leq 0.001$ in Group A than Group B. Hence, this study proved that sprint interval training significantly improved in reducing Body mass index, waist circumference, and body weight in obese young adults.

Keywords: Obesity, Sprint interval training, Traditional exercise, Body mass index, Waist circumference.

***Corresponding Author**

Thirulogachandar Gunasekar , Faculty of Physiotherapy, Dr MGR Educational and Research Institute, Velappanchavadi, Chennai.

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1. INTRODUCTION

Obesity is a medical condition in which excess body fat accumulates to the extent that it may hurt health. [1] People with a body mass index over 30kg\m^2 are considered obese.[2] Obesity can result from taking in more calories than are burned by normal daily activities or by exercises. Obesity is one of the preventable conditions.[3] Obesity has nearly tripled Worldwide since 1975. In the year 2016, more than 1.9 billion (39%) adults were overweight with the age of 18 years and older, and 650 million (13%) were obese. The American Heart Association's scientific statement on obesity and weight loss recommends weight loss in overweight and obese patients to reduce the risk of cardiovascular disease.[4] According to WHO, Obesity is recommended as a global epidemic in both developed and developing countries.[5] Much research evidence indicates that increased body weight is associated with a higher risk of adverse health consequences such as hypertension, CVD, metabolic disorders, osteoarthritis, gallbladder stone disease, asthma, and multiple malignancies. International organizations and previous epidemiological cross-sectional studies have reported that people with a large accumulation of body fat in the abdominal region are at greater risk for the development of metabolic syndrome.[6] Obesity is also a major risk factor for cardiovascular diseases such as coronary heart disease, heart failure, stroke, and cardiac arrhythmia.[7] The integral part of a treatment plan for obese individuals, regardless of weight loss goals and in association with cardiovascular benefits, should be physical activity or exercise training. Various research studies document the health benefits of exercise training. Exercise training is essential in optimizing cardio metabolic function, preventing chronic disease, and enhancing physical fitness in obese conditions. To induce fat loss in obese patients, many studies have focused on common exercise protocols like regular steady-state exercise such as walking and jogging at moderate intensity.[8] Recent guidelines promoted by the World Health Organization (WHO) recommended a minimum of 150 min of moderate-intensity physical activity (3 to <6 MET) or 75 min of vigorous-intensity physical activity (≥6 MET per week or any equivalent combination for health benefits, and 300 min of moderate-intensity physical activity or 150 min of vigorous-intensity physical activity per week for additional health benefits.[9] Recent research studies have shown that high-intensity interval training has the potential to be an economical and effective exercise protocol for reducing fat among obese individuals.[7] We believe that our trial could help determine which type of programme improves BMI and waist circumference among obese adults by making more efficient use of an adult's resources over time. In summary, the prevalence of overweight and obesity during the last 3 decades has been inverse and substantial in all societies across the globe; public health actions were focused on reducing obesity by encouraging obese individuals to eat healthily and to exercise more. The primary objective of this study is to contribute to the growing body of literature about physical exercise interventions such as sprint interval training and traditional exercises on obese adults.

2. MATERIALS AND METHODOLOGY

This experimental study includes 30 obese young adults who all fulfilled the inclusion criteria and were selected from the Outpatient Physiotherapy Department at ACS Medical College and Hospital. All those 30 obese adults were assigned randomly into 2 groups (15 in each group): Group A (Sprint Interval training) and Group B (Traditional exercise training).

2.1. *Inclusion criteria*[7]

- Age between 20-30 years
- BMI >25 kg/m^2

2.2. *Exclusion criteria*[7]

- Age above 30 years
- BMI < 25 kg/m^2
- Diabetes
- Hypothyroidism
- Asthma
- Cardiovascular disease was excluded from our study.

The purpose and nature of the study were explained to all young obese adults and informed consent was obtained. Baseline assessment, which includes body weight (kg), body mass index (kg/m^2), and waist circumference (cm), was taken before initiation of the exercise training period. Obese patients in group A underwent Sprint interval training for 30-50 minutes with an intensity range of 60-80% a day for 6 weeks, in which the training sessions consisted of a warm-up period followed by repetitions of high-intensity exercise and then medium-intensity exercises for recovery and down period.[7] The number of repetitions and length of each period depends on the exercises. Sprint interval training exercise sessions includes cycling ergometer, rowing ergometer, running, stair climbing, and uphill walking. Intensity for training involves a 2:1 ratio of work to recovery periods. Table 1 shows that sprint training includes a 6-week training schedule where the first two weeks include sessions with an intensity of 60%, the third and fourth weeks with 70%, and the fifth and sixth weeks with 80% of the intensity of the workout.

Table 1. Group A Sprint Interval Training Protocol

S.NO	WEEKS	SESSIONS	DURATION	INTENSITY
1	1 and 2	1	50	60%
		2	30	60%
		3	30	60%
2	3 and 4	1	40	70%
		2	40	70%
		3	40	70%
3	5 and 6	1	45	80%
		2	45	80%
		3	45	80%

Obese patients in group B were trained with traditional exercise training with moderate intensity continuous training. MICT consists of cycling, jogging, running, walking, rowing, etc., with moderate intensity to a continuous duration of 20-30 minutes.[7]

2.3. Physiological Variables and Its Measurement Technique

a. Body Mass Index (BMI) is derived from a person's mass (weight) and height. The BMI is defined as the body mass divided by the square of the body height and is expressed in units of kg/m^2, resulting from mass in kilograms and height in meters.[10]
b. Weight was measured in kilograms, where subjects' weight was measured using a weighing machine.[10]
c. Waist circumference is a simple method to assess abdominal adiposity that is easy to standardize and clinically apply. Waist circumference is measured in centimeters when the subject is asked to stand straight and, by using a tap, measure just above the hip bone, then bring the tape around the body level and measure over the belly bottom. The tape should be at the same level; it should not be too high, and it should be straight over at the back. Ask the patient not to hold their breath while measuring.[11]
d. Blood lipid profile test is a blood test that measures different types of lipids and cholesterol in the blood.[12]

- **LDL (low-density lipoproteins):** LDL is the cholesterol that is considered "bad cholesterol" because it forms plaques in the arteries and adversely affects heart health. Thus, LDL cholesterol should be maintained in the lower range.
- **HDL (high-density lipoproteins):** HDL cholesterol is also known as "good cholesterol" because it helps clear the bad LDL cholesterol and prevent its build-up.
- **Total cholesterol** is the sum of all the different types of cholesterol in your body, i.e., LDL + VLDL + HDL.

3. STATISTICAL ANALYSIS

In this study collected data were tabulated and analyzed using descriptive and inferential statistics. All the parameters were assessed using the Statistical Package for Social Science (SPSS) version 24. A paired t-test was adopted to find the statistical difference in weight, BMI, and waist circumference between groups A and B before and after the training program. An Independent t-test was adopted to find statistical differences in post-testpost-test weight, BMI, and waist circumference values between groups A and B.

Table 2. Demographic Characteristics of the Participants in Groups A & B

Characteristics	Group A	Group B	t-value	p-value	Significance
	Mean ± SD	Mean ± SD			
Age (years)	25.4±2.257	25.45±2.481	-0.067	0.947	NS
Height (cm)	159.3±5.486	159.9±4.483	-0.410	0.684	NS

In group A, the mean age of subjects was 25.4 years (SD = 2.257), mean height was 159.3 cm (SD = 5.486) whereas in group B, the mean age of subjects was 25.45 years (SD = 2.481), mean height was 159.9 cm (SD = 4.483). Table 2 analyzed the demographic characteristics between groups A and B using an independent 't' test. The two groups had no significant differences in age (years) and height (cm). This shows that the samples were homogenous among the groups.

3.1. Comparison of Pre and Post Test Values of Body Weight, BMI, Waist Circumference, and Blood Lipid Profile Between Group A And Group B

a. Body weight

In group A, Body weight significantly decreased pre to post training with sprint interval training, where the pre-test mean body weight score was 99.80, and the post-test score of body weight was 93.80, which was statistically significant ($p<0.05$) in subjects. In group B, the pre-test mean body weight score was 99.33. In contrast, the post-test body weight score was 97.53, which was statistically significant ($p<0.05$) in subjects who underwent traditional training, as shown in Table 3 and Figure 1.

b. Body mass index

In group A, Body mass index significantly decreased pre- to post-training with sprint interval training, where the pre-test mean score of BMI was 34.87, and the post-test score of BMI of 32.76 was statistically significant ($p<0.05$) in subjects. In group B, the pre-test means the BMI score was 35.78. In contrast, the post-test score of BMI of 34.73 was statistically significant ($p<0.05$) in subjects who underwent traditional training, as mentioned in Table 3 and represented in Figure 1.

c. Waist circumference

In group A, Waist circumference significantly decreased pre- to post-training with sprint interval training, where the pre-test mean score of Waist circumference was 104.60, and the post-test score of Waist circumference was 97.46, which was statistically significant ($p<0.05$) in subjects. In group B, the pre-test mean score of Waist circumference was 103.93. In contrast, the post-test score of Waist circumference was 100.53, which was statistically significant ($p<0.05$) in subjects who underwent traditional training, as shown in Table 3 and Figure 1.

d. Blood lipid profile

In group A, blood lipid profile significantly improved pre- to post-training with sprint interval training where the pre-test mean score of HDL is 42.3, LDL is 109.4, TC is 174.1, and a post-test score of HDLis 48.2, LDL is 98.4, TC is 156.5 statistically significant ($p<0.05$) in subjects. In group B, the pre-test mean score of HDL is 41.2, LDL is 111.3, and TC is 168.2. In contrast, the post-test score of HDL was 45.2, LDL was 102.5, and TC was 159.6, which was statistically significant ($p<0.05$) in subjects who underwent traditional training, as mentioned in Table 3 and represented in Figure 1.

Table 3. Comparison of Pre and Post Test Values of Body Weight, BMI, Waist Circumference, and Blood Lipid Profile Between Group A And Group B

Outcome Measures	GROUP A			GROUP B		
	Pre-test values Mean+ SD	Post-test values Mean+SD	p values (< 0.05)	Pre-test values Mean + SD	Post-test values Mean + SD	p values (< 0.05)
Body Weight (kg)	99.80+4.39	97.40+5.0	0.0001	99.33+4.29	97.53+4.34	0.0001
B.M.I (kg/m^2)	34.87+1.62	32.76+1.57	0.0001	35.78+3.04	34.73+2.7	0.0001
Waist Circumference (cm)	104.60+1.59	99.20+0.41	0.0001	97.46+1.72	100.53+2.16	0.0001
Blood lipid profile						
a. HDL (mg/dl)	42.3+11.1	48.2+12		41.2+12.3	45.2+3.1	
b. LDL (mg/dl)	109.4+30	98.4+13	0.0001	111.3+24	102.5+6.1	0.0001
c. TC (mg/dl)	174.1+51	156.5+2		168.2+3	159.6+2.1	

BMI= body mass index, HDL=high density lipoprotein, LDL=low density lipoprotein, TC=total cholesterol

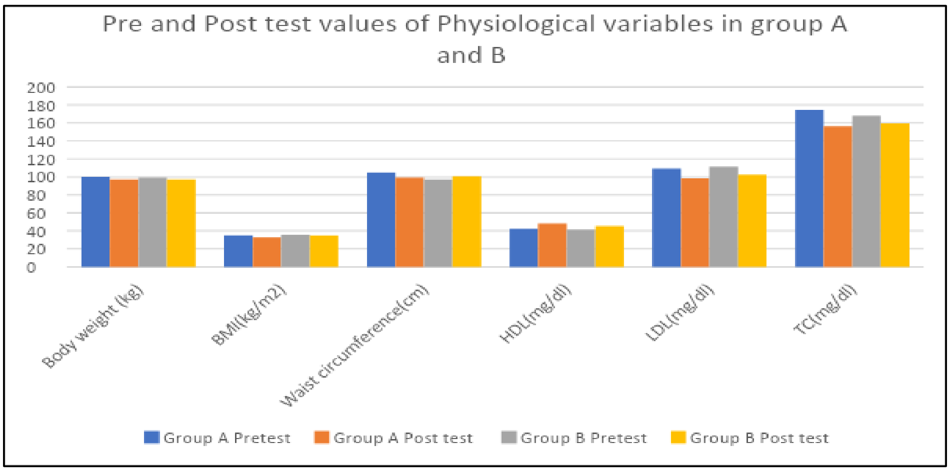

Fig 1. Pre and Post Test Values of Body Weight, BMI, Waist Circumference, and Blood Lipid Profile Between Group A And Group B.

3.2. *Comparison of Post Test Values of Body Weight, BMI, Waist Circumference, and Blood Lipid Profile Between Group A And Group B.*

a. Body weight

In group A, Body weight significantly decreased post-training with sprint interval training in subjects who underwent traditional training, where the post-test mean body weight score was 94.47. In contrast, in group B, the test score of body weight was 97.53, which was statistically significant ($p<0.05$), as mentioned in Table 4 and represented in Figure 2.

b. Body mass index

In group A, Body mass index significantly decreased post-training with sprint interval training in subjects than who underwent traditional training, were the post test score of BMI is 33.13 whereas in group B post-test score of BMI is 35.17 was statistically significant ($p<0.05$) as mentioned in table 4 and represented in figure 2.

c. Waist circumference

In group A, Waist circumference significantly decreased post-training with sprint interval training in subjects who underwent traditional training, where the post-test score of Waist circumference was 99.20. In contrast, the post-test score of Waist circumference was 100.20, which was statistically significant ($p<0.05$), as in Table 4 and Figure 2.

d. Blood lipid profile

In group A, blood lipid profile significantly improved post-training with sprint interval training in subjects than those who underwent traditional training, with the post-test score of HDLis 48.2, LDL 98.4, and TC 156.5. In contrast, a post-test score of HDL was 45.2, LDL was 102.5, and TC 159.6, statistically significant ($p<0.05$), as shown in Table 4 and Figure 2.

Table 4. Comparison of Post Test Values of Body Weight, BMI, Waist Circumference, and Blood Lipid Profile Between Group A And Group B.

Outcome Measures	Group A Post Test Mean+ SD	Group B Post Test Mean+ SD	p values (< 0.05)
Body Weight (kg)	94.47+3.44	97.53+4.34	0.0408
B.M.I(kg/m^2)	33.13+1.57	35.17+2.97	0.0260
Waist Circumference (cm)	99.20+2.37	100.20+2.31	0.2509

Blood lipid profile			
a. HDL (mg/dl)	48.2+12	45.2+3.1	0.001
b. LDL (mg/dl)	98.4+13	102.5+6.1	0.02
c. TC (mg/dl)	156.5+2	159.6+2.1	0.04

BMI=body mass index, HDL= high density lipoprotein, LDL= low density lipoprotein,TC= total cholesterol

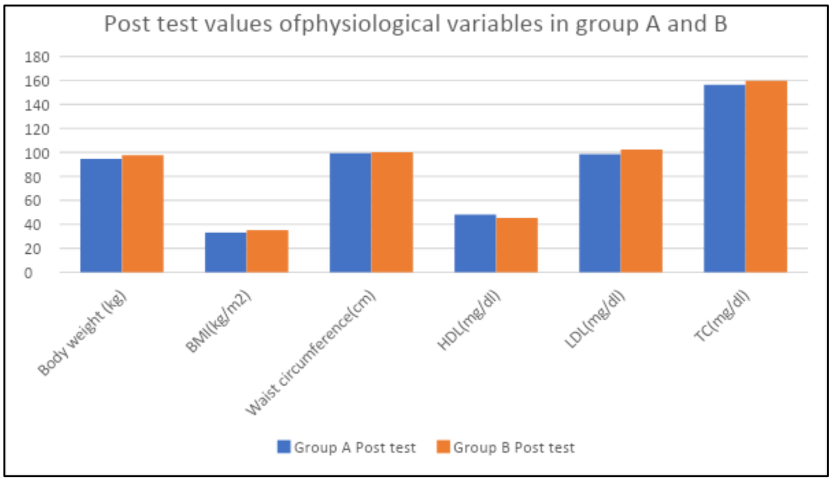

Fig 2. Post Test Values of Body Weight, BMI, Waist Circumference, and Blood Lipid Profile Between Group A And Group B.

4. RESULTS AND DISCUSSIONS

This study aimed to compare the effect of sprint interval training versus traditional exercise programs in obese young adults. This study brought a significant difference between sprint interval training and traditional exercise. The data gave a week's protocol on patients aged 20 to 30 which showed a significant difference between post-intervention body weight, BMI, and waist circumference values. It was evident from the Mean score that both groups showed improvement.

4.2. *Body weight*

In this study, by comparing the post-test mean values of Group A & Group B on Body Weight Score, it shows a significant decrease in the post test mean values in both groups, but (Group A - Sprint Interval Training) shows 93.80 kilograms, which have the lower mean value and are more effective than (Group B - Traditional Interval Training) 97.53 kilograms at $P \leq 0.001$.

4.3. *Body mass index*

On comparing the post-test mean values of Group A & Group B on Body Mass Index score, it shows a significant decrease in the post test Mean values in both groups, but (Group A - Sprint Interval Training) shows 32.76 kg/ m^2 which has the lower mean value and is more effective than (Group B - Traditional Interval Training) 34.73 kg/ m^2 at $P \leq 0.001$.

4.4. *Waist circumference*

On comparing the post-test mean values of Group A & Group B on Waist Circumference score, it shows a significant decrease in the post-test mean values in both groups, but (Group A - Sprint Interval Training) shows 97.46 centimeters which has the lower mean value and is more effective than (Group B - Traditional Interval Training) 100.53 centimeters at $P \leq 0.001$. Hence the null Hypothesis is rejected.

4.5. *Blood Lipid Profile*

On comparing the post-test mean values of Group A and Group B on blood lipid profile values, it showed a significant improvement in the post test mean values in both groups, but (Group A - Sprint Interval Training) shows better improvement as HDLis 48.2mg/dl, LDL is 98.4 mg/dl, TC is 156.5 mg/dl and is more effective than (Group B - Traditional Interval Training) were HDL is 45.2mg/dl, LDL is 102.5mg/dl, TC is 159.6mg/d at $P \leq 0.001$. Hence the null Hypothesis is rejected.

Group A showed greater improvement in the post-test values reduction in the body weight, BMI, and waist circumference. Consistent with our study, Tom K Tong et al. suggested that the lower training load and exercise time commitments of the SIT regime for 12 weeks could optimize the time-efficiency advantage of the traditional HIIT, facilitating the abdominal visceral fat reduction in obese young women, high-intensity interval training (HIIT), which consists of repeated high-intensity exercise bouts interspersed with passive/active recovery, was shown to induce similar metabolic adaptations associated with continuous training among healthy populations as well as in patients with chronic diseases.[13] Potentially, this endeavor might harness the benefits of the higher exercise intensity in SIT and associated higher secretion of lipolytic hormones; SIT also elicited a more desirable aerobic adaptation. In addition to the reasonable feasibility of the SIT regime in obese young women revealed by the high compliance of the participants with the exercise intervention, it appears that the SIT regime could optimize the time-efficiency advantage of the traditional HIIT in developing a regular strategic exercise for combatting obesity, along with the greater primary motor cortex activity in response to the repeated-sprint [14] Catecholamines and growth hormones are lipolytic hormones that increase demonstrably with exercise intensity (Pritzlaff et al., 2000; Zouhal et al., 2013),[15] despite the blunted catecholamine responses to repeated cycling sprints have been reported in obese individuals, and this study indicates that CHO oxidation during exercise and fat oxidation during recovery increase significantly as a function of exercise intensity (Jabbour et al., 2011). The possible higher catecholamine secretion resulting from the greater sympathetic activation in response to the higher exercise intensity in the SIT might have driven lipolysis from visceral fat storage via b3- adrenoceptors (Zouhal et al., 2013; Maillard et al., 2018) in a greater extent in comparison to that of HIIT.HIIT seems to be a better approach for the prevention and management of adolescent obesity and the metabolic, cardiovascular, and hormonal disorders observed in this population than MIIT [15,16]. Marit Salus et al. reported that an important advantage of the study was that the SIT protocol was carried out on cycle ergometers, which may help prevent the prevalence of traumatic injuries that can be caused by excess body weight overloading the joints while engaging in weight-bearing HIIT exercises such as running or jumping, therefore, making cycling SIT a beneficial training mode in improving the cardiometabolic health in obese adolescents. Some of the limitations of this study include a small sample size, an age group between 20-30 years only recruited, and the need for a long-term follow-up of the subjects. Future studies can be done with a larger sample size, can include different age groups, and can be done with other training regimes.

5. CONCLUSIONS

This study concludes that sprint interval training was effective among obese subjects by comparing the post-test values in groups A and B. Group A Sprint training in obese subjects has effectively reduced the body weight with the mean value of 93.80 kilograms at $P \leq 0.001$. Reduced Body Mass Index with a mean of 32.76 kg/ m2 at $P \leq 0.001$. and also reduced waist circumference with a mean value of 97.46 centimeters at $P \leq 0.001$ and improved HDL with a mean value of 48.2mg/dl, reduced both LDL up to 98.4 mg/dl, TC up to 156.5 mg/dl at $P \leq 0.001$.

6. AUTHORS CONTRIBUTION STATEMENT

All authors have contributed their dedication to framing the manuscript and have read and agreed to the published version. The authors would like to thank all participants of the study.

7. CONFLICT OF INTEREST

Conflict of interest declared none.

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