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Effect of "interval training" versus "continuous training" on cardiovascular fitness in obese individuals

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Abstract
Background and Objective: Obesity, which broadly refers to excess body fat, has become an important public health problem. It can cause deleterious effects *on respiratory* function and impair health and quality of life. Its prevalence increases day by day in whole world.
Materials and Methods: A prospective cross-sectional comparative study was done with 30 Participants who were Obese BMI >30 in the age group of 18-25 were included in the study based on inclusion and exclusion criteria. There were 2 groups consisting of 15 patients in each group. Group A received interval training and group B received continuous training 5 days in 4 weeks. Outcome measures included in this study were waist hip ratio, incremental shuttle walk distance, peak Vo^2.
Results: Incremental shuttle walk distance, peak Vo^2 showed sighnificant difference (p>0.0001) in both the groups. Group A showed slightly more improvement in incremental shuttle walk distance, peak Vo^2 compared to Group B. There was no significant difference found in waist hip ratio in both the groups.
Conclusion: The study concluded that both interval training and continuous training improved cardiovascular fitness in obese individuals but interval training is more effective compared to continuous training.

Keywords: interval training, continuous training, obese, treadmill

1. Introduction

Obesity is a chronic disease characterized by excessive accumulation of body fat that is harmful to individuals. According to the World Health Organization, obesity has reached epidemic proportions, affecting people of all ages and social classes in the world. The number of obese individuals has doubled since 1980, and in 2008, more than 1.4 billion adults were obese [1]. Obesity has become an important public health problem; its prevalence continues to increase worldwide. As the prevalence of obesity increases so does the burden of its associated co-morbidities. Non communicable diseases and their risk factors including obesity are now becoming a significant problem not only in affluent societies but also in developing countries. Currently, more than 35% of men and close to 40% of women are overweight or obese [2]. The person accumulation different type of fat like Android fat storage describes the distribution of fat mostly around the trunk/abdomen area (referred to as 'central' fat storage) or the upper body. Due to this type of distribution, those exhibiting excess android fat patterns will portray an 'apple' shaped appearance where the waist is much larger than the hips. This type of fat storage pattern is typical found in males and gynoid fat pattern is characterized by the accumulation of excess fat around the hip, buttocks and thigh region. Due to this type of distribution, excess gynoid fat patterns will have a 'pear' shaped appearance where the buttock and hips are much larger than the waist. This type of distribution is typical found in female [3]
BMI is defined as weight divided by height squared (kg/m2) as it is based on only weight and Height, idea measure of obesity. According to the National Heart Lung and Blood Institute (NHLBI)BMI is calculated as weight in kilograms divided by the square of the height in meters (kg/m^2) [4]

Table 1: adapted from WHO &Asian-pacific guideline: obesity classification**.**

Obesity Classification According To Whoand Asian Pacific Guidelines		
	WHO(BMI)	**Asia Pacific (BMI)**
Underweight	<18.5	<18.523
Normal	18.5 -24.9	18.5-22.9
Overweight	25-29.9	23-24.9
Obese	>30	>25

The body mass index (BMI), which can indirectly represent the degree of obesity is one of the variables that affects the phenotypic expression of the disease, its course and prognosis.

Table 2

BMI(Kg/m2)	Class	Health Risk
BMI<25	Normal weight	Very low
25<BMI<30	Overweight	Low
30<BMI<35	Moderate obesity	Moderate
35<BMI<40	Severe obesity	High
40<BMI	Morbid obesity	Very high

Table 1: adapted from WHO &Asian-pacific guideline: obesity classification [5]
In today's health-conscious society, there is a growing

awareness of obesity in the United States.[6]For various reasons, many people are becoming not just overweight, but over-fat. For reasons of appearance, health or both, many overweight people undertake some form of diet or exercise programme. Changes in diet and/or exercise pattern are the primary ways for one to lose weight. A change in diet facilitates weight loss by restricting total caloric as well as fat intake. A change in exercise pattern also facilitates weight loss by increasing caloric and fat expenditure [7]. There are several avenues in the treatment of obesity, ranging from use of conservative and lifestyle modification methods such as diet and exercise, to administration of drugs such as appetite suppressants and fat absorption inhibitors. Picot *et al*. found that bariatric surgery is clinically effective and cost effective in achieving weight loss in the morbidly obese [8].

Regular exercise improves insulin-sensitivity, cardio-respiratory fitness, muscular strength, endurance and body composition and reduces visceral fat. Overweight and obesity are associated with lower level of life quality and with cardiovascular disease, hyperlipidemia and cancer, while exercise-induced weight reduction improves cardio-respiratory fitness and lowers metabolic risk factors. The recommended exercise prescription for most adults is typically a regular moderate-intensity Continuous exercise program, with 30 min [9]. Traditional endurance training methods for weight control tended to focus on longer-duration sessions involving moderate intensity exercise performed Continuously without rest, and is often termed as Moderate-Intensity Continuous Training [10]. Interval training induces rapid improvements in muscle oxidative capacity and exercise performance. Various methods of High-Intensity Interval Training, such as repeated intense bouts of cycle exercise (15s to 2-min bouts) or repeated sprints on a treadmill or a knee-extension ergo meter, have been used to examine the effects of HIIT on physiological adaptations to acute bouts of Exercise [11]. High intensity interval training sessions are commonly called HIIT workouts. This type of training involves repeated bouts of high intensity effort followed by varied recovery times [12].

Materials and methods

Participants: Total thirty participants both male and female with BMI <30 were included in the study. Participants were screened according to the inclusion and exclusion criteria. Participants with age group of between 18-25, with obese individual who willing to participate were selected for the study. Participants who were medical or any psychiatric illness or injury to lower limb neurological, cardiovascular and musculoskeletal disorder were excluded. from the study. The study received approval from Institutional Ethical Committee of Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences, Loni. Written informed consent was taken from all the participants selected for the study.

The study received approval from Institutional Ethical Committee Ref. no. PIMS/CPT/IEC/2017/184 of Dr. A. P. J. Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences, Loni. Total thirty participants (n=30) were selected and screened according to inclusion and exclusion criteria. Details about the study and intervention were explained to the patient and informed written consent form was obtained. Demographic details of the participants were noted including name, age, BMI, gender, occupation and address. By using convenient sampling method, participants were allocated into two groups. Group A: included 15 participants and Group B included 15 participants. Before starting the intervention, participants were assessed of Hip waist ratio, Incremental shuttle walk test was performed and peak VO2 was taken initially. The procedure was explained to all the participants. Before proceeding for the procedure, Borg perceived exertion scale was given.

Group A: In Group A, interval training was given as an intervention on treadmill that was assessed according to FITT Principle. for 30 minutes after 5 minutes of warm up with 1:2 ratio,1 minute of high intensity (70%) and 2 minutes of moderate intensity (50% - 60%), 5 repetitions with 10 min cool dawn period was given. In this interval training**,** subjects were trained for 5 days in 4 weeks. Maximum heart rate and target heart rate calculated by using 220-age formula and Karvonen formula respectively. The stretching exercises were also performed for 10 min prior and after to the training.

Group B: In Group B, Continuous training was given as an intervention on treadmill that was assessed according to FITT Principle for 35 min after 5 min warm up period (60%) of moderate Continuous training exercise was given 20min with 10 min cool down period. In this Continuous training, subjects were trained for 5 days in 4 weeks. The stretching exercises were also performed for 10 min prior and after to the training.

After 4 weeks of intervention of interval and Continuous training, Hip Waist Ratio, Incremental Shuttle Walk Test and Peak VO_2 were reassessed.

Outcome Measurement

Waist Hip Ratio Incremental Shuttle Walk Distance Peak vo2

Data analysis

The objective of the study was to find the "Effect of interval training versus Continuous training on cardiovascular fitness in obese individuals" on waist hip ratio, shuttle walk distance, peak vo_2 In obese. All 30 participants completed 4 weeks of intervention. All the participants were screened and evaluated for baseline measurements of dependent variables and all the values were recorded. Participants were evaluated and data was recorded after 4 weeks. Statistical analysis was carried out utilizing the trial version of Graph Pad Instate software.

The data was entered into an excel spread sheet, tabulated and subjected to statistical analysis. Various statistical measures such as mean, standard deviation (S.D.) and test of significance such as Paired 't' test and Unpaired 't' test were utilized to analyzed the data. The results were concluded to be statistically significant with $p<0.05$, very significant $p<0.001$ and extremely significant $p<0.0002$. Paired 't' test was used to compare the difference between the pre-intervention and post- intervention values within the group and Unpaired 't' test was used to compare the difference between the post intervention values between the groups.

4.1 Demographics

The total number of participants selected for the study were thirty (n=30, 13 Males and 17 Females) age between 18-25 years after fulfilling the inclusion and exclusion criteria.

Participants were randomly assigned into two groups using convenient sampling method and coin method used for allocation for Group A and Group B.
Fifteen participants were included in group A, in which 11 were female (73.33%) and 4 were male (26.6%). Fifteen participants were included in the group B, in which 9 were male (60%) and 6 were female (40%). The mean age of the participants in group A was 22 with standard deviation of ±2.360 and in group B was 22 with standard deviation of ±2.360 The mean body mass index of the participants was Group A 32.2with standard deviation 1.460 and in Group B was 32.6 with standard deviation 1.496. There were no statistically difference between group in terms of physical characteristics of the participants.

Waist hip ratio

Table 3: Represents the Pre-Post value of Group A & Group B

Group	Pre-Mean ±SD	Post Mean ±SD	t value	p Value	result
Group A	0.812±0.0572	0.812±0.0572	0.11266	0.11266	Not significant
Group B	0.812±0.5722	0.8100±0.4158	0.9150	0.1087	Not significant

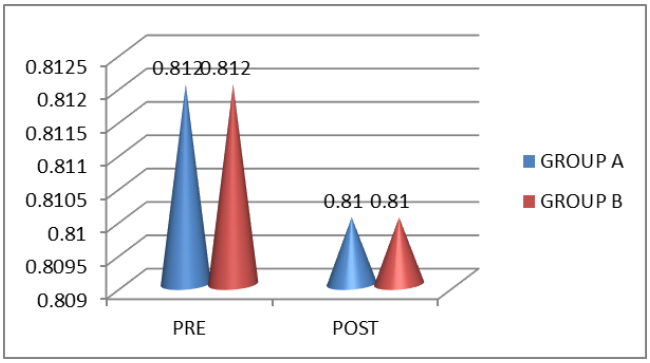

Fig 1: Represents the values of waist hip ratio of Group A & Group B

Shuttle walk test distance

Table 4: Represents the Pre-Post value of Group A & Group B

Group	Pre	post	t value	p value	result
Group A	384.6 ±41.034	459.3 ±38.260	11.552	<0.0001	Extremely significant
group B	386.67±40.99	486.67±40.99	7.921	<0.0001	Extremely significant

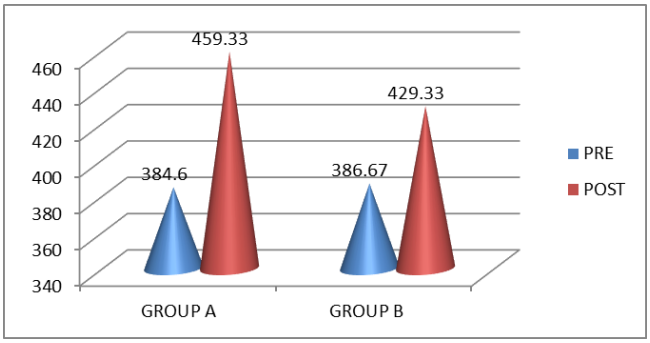

Fig 2: Represents the values of ISWD Group A & Group B

PEAK VO2

Table 5: Represents the Pre-Post Group A & Group B

Group	pre	post	T value	P Value	Result
Group A	13.904±1.057	15.740±0.9364	5.801	<0.0001	Extremely significant
Group B	13.898±1.050	14.1933±1.050	7.956	<0.0001	Extremely significant

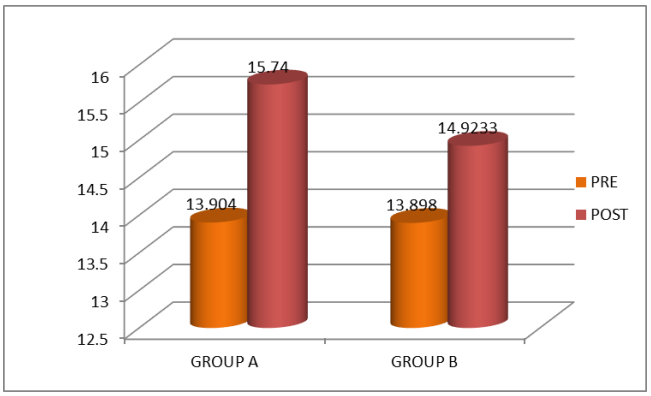

Fig 3: Represents the values of peak vo_2 Group A & Group B

A. Mean difference in waist hip ratio in IT & CT

Table 6

Hip Waist Ratio					
Mean ± SD	**Mean (IT)**	**Mean (CT)**	**P value**	**t value**	**Result**
	0.002±0.06816	0.00866±0.06545	0.7867	0.2732	Not significant

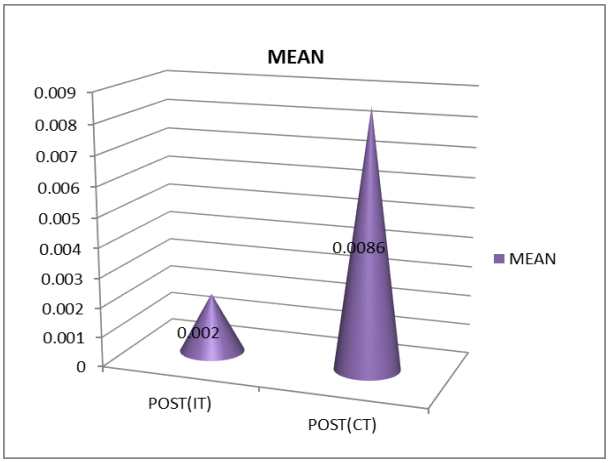

Fig 4: represent comparison mean difference in WHR of IT& CT

Table 7: comparison Mean difference in ISWD of IT & CT

Incremental shuttle walk distance					
Mean ± SD	**Mean (IT)**	**Mean (CT)**	**T value**	**P value**	**Result**
	105.33±103.36	42.66±20.862	2.192	0.036	significant

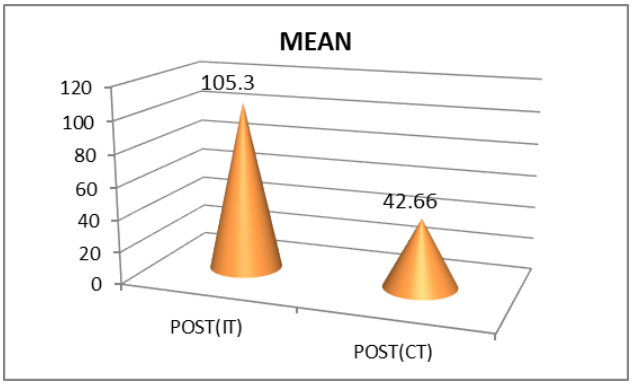

Fig 5: Represent comparison of post mean difference in IT & CT.

Table 8: Comparison mean difference in PEAK VO_2 of IT &CT

Peak VO2					
Mean ±SD	**Mean (IT)**	**Mean (CT)**	**T value**	**P value**	**Result**
	1.8326±1.225	0.986±0.4940	0.0193	2.482	significant

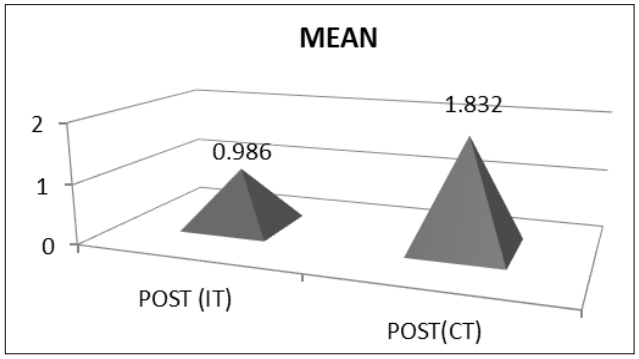

Fig 6: Represent comparison Mean difference of IT & CT.

Discussion

The present study "Effect of Interval Training Versus Continuous Training on cardiovascular Fitness In Obese Individuals" was carried out in the Department of Cardio-Respiratory Physiotherapy, Pravara Rural Hospital, Loni (Bk), Tal- Rahata, Dist- Ahmednagar, Maharashtra, India-413 736.

In both the groups, hip Waist Ratio, Incremental Shuttle Walk Distance, Peak VO_2, were assessed pre and post intervention. The main purpose of this study was to determine the effect of Interval Training Versus Continuous Training on cardiovascular fitness in Obese Individuals.

Both the groups given 4 weeks of intervention, Group A Obese individual trained on interval training, group B trained on continuous training there was showed highly significant difference in incremental shuttle walk distance, Peak Vo2. There was no significant difference as such in waist hip Ratio in IT or CT. The comparative study result

was interval training had a significant improvement in cardio-vascular fitness and endurance as compared to Continuous training. Both the training are using for exercise fitness but IT was more effective compared to CT. This is because IT workouts tend to burn more calories than traditional workouts. The post-exercise period is called Post Exercise Oxygen Consumption (EPOC). This is generally about a 2-hour period after an exercise bout where the body is restoring itself to pre-exercise levels and thus using more energy. Because of the vigorous contractile nature of IT workouts, the EPOC generally tends to be modestly greater, adding about 6 to 15% more calories to the overall workout energy expenditure.

Waist hip ratio

The pre intervention mean value of waist hip ratio in Obese individuals in Group A was 0.812 ±0.05722 and after 4 weeks of Intervention mean value of waist hip ratio was 0.81±0.03817. There was no significant difference found between the pre and post values on waist hip ratio in interval Training. Before the intervention of continuous training the mean value of waist hip ratio in obese was 0.812±0.05722 and after 4 Weeks of intervention mean value of waist hip ratio was 0.8100±0.4158 There was not found significant difference between the pre and post values of waist hip ratio. The mean difference of both Groups was 0.002±0.06816 and revealed that was statistically not significant difference between two groups reason behind of This study was short duration and we were not given diet for obese individuals during intervention, result are correlate to another study.

Study was carried out in Ross LM, Porter RR, Durstine JL. High-intensity interval training (HIIT) for patients with chronic diseases. Journal of sport and health science. 2016 Jun 1;5(2):139-44.) for improvements in body composition in overweight and obese adults. They selected 20 participants with aged 18–45 years old. THEY were direct measured

whole body fat mass and indirect measure waist circumference they compared HIIT and MICT in overweight or obese Studies averaged 10 weeks × 3 sessions per week training. Both HIIT and MICT elicited significant reductions in whole-body fat mass and waist circumference. There were no significant differences between HIIT and MICT for any body composition measure, but HIIT required approx 40% less training time commitment. Running training displayed large effects on whole-body fat mass for both HIIT and MICT, Short-term moderate-intensity to high-intensity exercise training can induce modest body composition improvements in overweight and obese individuals without accompanying body-weight changes [13].

Ncremental shuttle walk distance

The pre intervention mean value of incremental shuttle walk distance on obese individuals in interval training was 384.6 ±41.034 and after 4 weeks of intervention mean value was 459.33±38.260. In CT the differences between the pre and post values of incremental shuttle walk distance was before 386.67± 40.999. After the intervention of the 4 weeks mean value was 429.33±41.998 and Mean value of both the groups was after intervention 459.33 ±38.260. Students unpaired t test used for between IT group and CT group then 4 weeks revealed that was statistically significant difference between two groups.

Two common exercise strategies are high-intensity interval training (HIIT) and moderate-intensity continuous exercise training (MCT). HIIT was first used early in the 20th century and popularized later that century for improving performance of Olympic athletes. The primary premise underlying HIIT is that, compared to energy expenditure-matched MCT, a greater amount of work is performed at a higher intensity during a single exercise session which is achieved by alternating high-intensity exercise intervals with low-intensity exercise or rest intervals.

Peak VO2

The pre intervention mean value of PEAK VO^2 in interval training was 13.904±1.057 and after 4 weeks of intervention mean value of peak vo^2 was 15.740±0.9364nd. The differences between the pre and post values of peak vo2 In IT. Before the intervention of the CT Mean value was in Obese 13.898±1.050 l and after 4 Weeks of intervention mean value of peak vo2 was 14.923 ± 1.050.

The mean difference of both groups was in IT 1.8326±1.225and CT 0.986±0.4940 Students unpaired t test used between IT group and CT group after 4 weeks revealed that was statistically significant difference between two groups.

Improvements in cardiovascular function will increase one's VO_2max Some research suggests that VO_2max improvements with HIIT are superior to those with endurance training. Increase in the number and size of mitochondria (the energy factory of the cell) is becoming a hallmark adaptation to HIIT. This is referred as an increase in mitochondria density, and has been thought for many years to only occur from chronic endurance training. Mitochondria use oxygen to manufacture Adenosine Tri Phosphate (ATP) (the energy molecule of the cell) at high levels through the breakdown of carbohydrates and fat during aerobic exercise. With increased mitochondrial density there is more energy available for the working muscles to produce greater force, and for a longer period of time (i.e., such as running longer at a higher intensity) [14].

Conclusion

The present study shows that high intensity interval training has significant improvement in the distance covered in incremental shuttle walk test and peak vo2 as compared to continuous training. Thus, the conclusion of the study is high intensity interval training is highly significantly effective in increasing endurance and improving cardio-respiratory fitness in Obese individuals.

Limitations

- Small sample size
- Only one geographical area was included in the study.
- Long term effects could not be evaluated.
- Limited age group (18 to 25 years of age).
- Study conducted was for short duration.
- Diet of the participants was not monitored

References

1. Melo LC, Silva MA, Calles AC. Obesity and lung function: a systematic review. Einstein (Sao Paulo). 2014; 12(1):120-5.
2. Segula D. Complications of obesity in adults: a short review of the literature. Malawi Medical Journal. 2014; 26(1):20-4.

3. Wiklund P, Toss F, Weinehall L, Hallmans G, Franks PW, Nordstrom A, Nordstrom P. Abdominal and gynoid fat mass are associated with cardiovascular risk factors in men and women. The Journal of Clinical Endocrinology & Metabolism. 2008; 93(11):4360-6.
4. World health organisation asian pacific classifiation
5. Hakala K. Pulmonary Mechanics and Gas Exchange in Obesity: Effects of weight reduction and body position.
6. Alford, Lee, Church T. Jung HC Effects of High-Intensity Interval Training vs. Moderate-Intensity Continuous Training on Heart Rate Variability in Physically Inactive Adults. 2018; 15:7. pii: E1508. doi: 10.3390/ijerph15071508
7. Gibala MJ, Little JP, MacDonald MJ, Hawley JA. Physiological adaptations to low-volume, high-intensity interval training in health and disease. The Journal of physiology. 2012; 590(5):1077-84.
8. Interval versus Continuous Training Spanoudaki S Spanoudaki, J Sport Medic Doping Studie, 2011.
9. Christopher LK, Kosai NR, Reynu R, Levin KB, Taher MM, Sutton PA, *et al*. Effect of exercise on pulmonary function tests in obese Malaysian patients. Clin Ter. 2015; 166(3):105.
10. Nybo L, Sundstrup E, Jakobsen MD, Mohr M, Hornstrup T, Simonsen L, *et al*. High-intensity training versus traditional exercise interventions for promoting health. Medicine & Science in Sports & Exercise. 2010; 42(10):1951-8.
11. Soraia Pilon Jürgensen, Letícia Cláudia. de Oliveira Antunes The Incremental Shuttle Walk Test in Older Brazilian Adults. R respiration. 2011; 81:223-228 DOI: 10.1159/000319037
12. Roy MC. The real-world outcomes from high intensity interval training, intermittent fasting and whole-food diets (Doctoral dissertation, University of Otago).
13. Ross LM, Porter RR, Durstine JL. High-intensity interval training (HIIT) for patients with chronic diseases. Journal of sport and health science. 2016; 5(2):139-44.
14. Wewege MA, Ahn D, Yu J, Liou K, Keech A. High-Intensity Interval Training for Patients With Cardiovascular Disease—Is It Safe? A Systematic Review. Journal of the American Heart Association. 2018; 7(21):e009305.