

## Effect of CrossFit Training versus Resistance Training on Muscular Strength and Body Composition in Sedentary Obese Collegiate Boys

Nithya Nataraj<sup>1\*</sup>, Gopalakrishnan Rathinasamy<sup>1</sup>, Vinosh Kumar Purushothaman<sup>2</sup>,  
Mohamed Adam Shahul Hameed<sup>2</sup>

<sup>1</sup>KG College of Physiotherapy, Saravanampatti, Coimbatore, Tamil Nadu 641035, India.

<sup>2</sup>Faculty of Health & Life Sciences, INTI International University, Putra Nilai, 71800 Negeri Sembilan, Malaysia.

**\*Email:** nithyadinesh59@gmail.com

### Abstract

The lack of physical activity in daily life induces obesity and increases the risk of diabetes, hypertension and heart disease. Obesity has become a worldwide epidemic that leads to many health-related conditions. Regular exercises can markedly reduce the body weight and fat mass without any dietary caloric restrictions in obese and overweight individuals. determine the effect of crossfit training versus resistance training on muscular strength and body composition in sedentary obese collegiate boys. An experimental study conducted on 20 obese subjects, they were divided into 2 groups of 10 in each group based on the convenient sampling method. Group A underwent Crossfit training and Subjects in Group B underwent Resistance training for 4 weeks. 1 RM Bench press test, 1 RM Squat test and Skinfold thickness measurement were used to measure Upper body muscular strength, Lower body muscular strength and Body composition. An Independent sample t-test was used to compare the two groups. There was a significant difference in Bench press test scores in Group A ( $1.08 \pm 0.05$ ,  $p = 0.002$ ) and in Group B ( $1.22 \pm 0.03$ ,  $p = 0.009$ ),  $t(18)=7.22$ . Squat test scores in Group A ( $1.44 \pm 0.10$ ,  $p = 0.016$ ) and Group B ( $1.21 \pm 0.04$ ,  $p = 0.04$ ),  $t(18)=6.4$ . Skinfold thickness measurement scores at the level of Triceps (Group A =  $28.4 \pm 2.88$ ,  $p = 0.008$  and Group B =  $34 \pm 3.62$ ,  $p = 0.006$ ),  $t(18)=3.8$ , Chest (Group A =  $26.5 \pm 3.03$ ,  $p = 0.021$  and Group B =  $34.2 \pm 4.10$ ,  $p = 0.027$ ),  $t(18)=4.8$  and Subscapular (Group A =  $27.3 \pm 3.20$ ,  $p = 0.005$  and Group B =  $36.7 \pm 4.64$ ,  $p = 0.03$ ),  $t(18)=5.3$ . The results suggest that Crossfit training group have shown significant improvement in all parameters following intervention. The study concludes that the Crossfit training is more effective in improving muscular strength and in reducing body composition than resistance training in sedentary obese collegiate boys.

### Keywords

Body composition, CrossFit training, Obesity, Strength.

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**Submission:** 10 July 2022; **Acceptance:** 13 January 2023



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## Introduction

Obesity has become a worldwide issue causing public health concern and leading to 2.6 million deaths worldwide every year. It leads to various health issues like cardiovascular diseases and diabetes. Obesity has become an independent risk factor for the cardiovascular disease. Obesity is associated with an increased risk of morbidity and mortality. Obesity has also become a major reason for the reduced life expectancy. Previous two decades have witnessed dramatic increases in the healthcare issues regarding obesity and obesity related health problem among children and adolescents (Raj & Kumar, 2010). The lack of physical activity has become a part of daily life, which has contributed to the importance of participating in any exercise programs as a means of physical activity in order to get rid of the obesity and obesity related health issues (Dietz & Gortmaker, 2001).

Crossfit training (CT), which are the high intensity training programs have been recently used to improve the physical conditioning. More recently, a modification of this training, called “High Intensity Power Training” (HIPT), which includes resistance exercises which are performed as fast as possible with the maximum number of possible repetitions that a person can do within a given time schedule. Crossfit rose as a new and popular method of exercise training and competition. As a variant of HIPT, Crossfit is often characterized by the execution of various forms of exercises integrating large number of muscle groups (i.e., squat, press, push, etc.) (de Sousa et al., 2016).

High intensity interval training and body weight workouts are the two main training types included in this CT called “Cindy”. The Crossfit workout does not focus on the rest period, optimum rest time will be taken by the individual within the time duration which is given for the specific workout of the day program. This Cindy Crossfit workout should include resistance and durability models to improve their physical fitness parameters such as strength, power, and durability within a single exercise program (Yuksel et al., 2019).

Resistance Training (RT) is the modality of exercise that has grown in popularity over the past two decades, particularly for its role in improving athletic performance by increasing muscular strength, power and speed, local muscular endurance, motor performance, hypertrophy, balance and coordination. RT is now a popular form of exercise that is recommended by national health organizations such as the American College of Sports Medicine (ACSM) and American Heart Association (AHS) for most populations including adolescents, healthy adults, the elderly and clinical populations (Kraemer et al., 2002).

Fleck and Kraemer described the primary goals of RT as improving muscular strength while the other health related benefits derived from RT include increase in bone mass, reduced blood pressure, increase muscle mass and connective tissue cross-sectional area (CSA), reduced body fat and it may relieve low back pain (Bird et al., 2005).

Resistance exercises were mostly preferred for strength development. It not only increases the strength of the body but also regulates the composition of the body. Two muscles with same circumference and volume can produce different amount of strength because of the fat deposition on that specific muscular tissue. This fat deposition provides impedance i.e., reduces the contraction force of the muscle fibers by producing friction between the muscles during the

contraction. Thus, the excess fat in the body provides extra burden and it also causes extra energy consumption during the exercise program to transport fat for performance of the movements (Ozbay, 2019).

### Methodology

An experimental study was conducted among 20 obese subjects at the outpatient department, KG College of Physiotherapy, Coimbatore. A clear explanation was given to all the subjects and an informed consent was obtained prior to the study. The study was approved by the Research and Ethical Committee of KG College of Physiotherapy, Coimbatore. Male subjects whose age ranging between 18 to 25 years with Body Mass Index ranging from 30 to 39.9 were included in this study and the Subjects who were not engaged in any structured training activities, strength-based sports or any diet program were also included and subjects with musculoskeletal disorders, cardiovascular impairments, neurological disorders, previous history of any surgeries, or injury within 1 month were excluded from the study. Convenient sampling method was adopted in this study. The Subjects were divided into 2 groups – Group A and Group B. Subjects in Group A underwent CT which includes warm up for 10 minutes, CT for 40 minutes and cool down for 10 minutes. Subjects in Group B underwent RT which includes warm up for 10 minutes, RT for 40 minutes and cool down for 10 minutes. Subjects in both groups underwent the respective training for 60 minutes in a day for thrice a week for 4 weeks. The study was carried out for 6 months and the baseline characteristics of Muscular strength and Body composition were similar in both groups. Pre and post test evaluation of Muscular strength and Body composition were measured. 1 RM Bench press test (ICC = 0.99) (Seo et al., 2012), 1 RM Squat test (ICC = 0.99) (Seo et al., 2012) and Skinfold thickness measurement were used to measure Upper body muscular strength, Lower body muscular strength and Body composition. SPSS Version 20.0 was used to analyze and interpret the data. Independent t-test was used to compare the mean difference between the pre and post test of two groups.

### Results and Discussion

Table 1. Demographic characteristics of Group A and Group B

| Subject Characteristics | Group A     | Group B      |
|-------------------------|-------------|--------------|
| Age (Years)             | 21.1 ± 2.31 | 21.65 ± 2.64 |
| BMI                     | 34.2 ± 2.69 | 33.1 ± 2.43  |

BMI – Body Mass Index, Values are presented as mean± standard deviation

Table 2. Results of Body composition and Muscle strength within group

| Variables                      | GROUP A                   |                            | p Value | GROUP B                   |                            | p Value |
|--------------------------------|---------------------------|----------------------------|---------|---------------------------|----------------------------|---------|
|                                | Pre-test<br>Mean $\pm$ SD | Post-test<br>Mean $\pm$ SD |         | Pre-test<br>Mean $\pm$ SD | Post-test<br>Mean $\pm$ SD |         |
| 1 RM Bench Press test          | 0.88 $\pm$ 0.06           | 1.08 $\pm$ 0.05            | 0.002*  | 0.91 $\pm$ 0.05           | 1.22 $\pm$ 0.03            | 0.009*  |
| 1 RM Squat test                | 0.89 $\pm$ 0.06           | 1.44 $\pm$ 0.10            | 0.016*  | 0.90 $\pm$ 0.06           | 1.21 $\pm$ 0.05            | 0.04*   |
| Skinfold thickness Triceps     | 41.9 $\pm$ 4.72           | 28.4 $\pm$ 2.88            | 0.008*  | 41.5 $\pm$ 4.30           | 34 $\pm$ 3.62              | 0.006*  |
| Skinfold thickness Chest       | 37.5 $\pm$ 4.50           | 26.5 $\pm$ 3.03            | 0.021*  | 38.1 $\pm$ 4.91           | 34.2 $\pm$ 4.10            | 0.027*  |
| Skinfold thickness Subscapular | 41.3 $\pm$ 5.33           | 27.3 $\pm$ 3.20            | 0.005*  | 40.5 $\pm$ 4.30           | 36.7 $\pm$ 4.64            | 0.03*   |

\*P<0.05 significantly different from pretest, RM – Repetition Maximum

Table 3. Results of Body composition and Muscle strength between the group

| Variables                                    | PRE TEST                 |                          | p Value | POST TEST                |                          | p Value |
|----------------------------------------------|--------------------------|--------------------------|---------|--------------------------|--------------------------|---------|
|                                              | GROUP A<br>Mean $\pm$ SD | GROUP B<br>Mean $\pm$ SD |         | GROUP A<br>Mean $\pm$ SD | GROUP B<br>Mean $\pm$ SD |         |
| 1 RM Bench Press test                        | 0.88 $\pm$ 0.06          | 0.91 $\pm$ 0.05          | 0.02*   | 1.08 $\pm$ 0.05          | 1.22 $\pm$ 0.03          | 0.005*  |
| 1 RM Squat test                              | 0.89 $\pm$ 0.06          | 0.90 $\pm$ 0.06          | 0.003*  | 1.44 $\pm$ 0.10          | 1.21 $\pm$ 0.05          | 0.012*  |
| Skinfold thickness measurement - Triceps     | 41.9 $\pm$ 4.72          | 41.5 $\pm$ 4.30          | 0.04*   | 28.4 $\pm$ 2.88          | 34 $\pm$ 3.62            | 0.003*  |
| Skinfold thickness measurement - Chest       | 37.5 $\pm$ 4.50          | 38.1 $\pm$ 4.91          | 0.025*  | 26.5 $\pm$ 3.03          | 34.2 $\pm$ 4.10          | 0.031*  |
| Skinfold thickness measurement - Subscapular | 41.3 $\pm$ 5.33          | 40.5 $\pm$ 4.30          | 0.036*  | 27.3 $\pm$ 3.20          | 36.7 $\pm$ 4.64          | 0.02*   |

\*P<0.05 significantly different from pretest, RM – Repetition Maximum

CT, as a variant of High-Intensity Power Training (HIPT) is characterized by the execution of large muscle groups. This type of training elicited increase in anaerobic performance, and it also improves body composition. Crossfit acutely led to ‘very hard’ perceived exertion causing detrimental post-exercise effects on muscles and ventilatory function in experienced athletes, a phenomenon that would likely enhance the “interference effect”. This type of training improves the body fat percentage (%BF) values within the normal range irrespective of the age and sex of

the subjects (de Sousa et al, 2016). Similar findings were found in a research of healthy male university students; it was found that both groups' body fat percentages reduced dramatically, but performance indicators rose and body weight remained constant. Furthermore, the CrossFit group saw a greater rise in push-up activity than the resistance group (Özbay S et al., 2019). Resisted exercises cause decrease in fat oxidation and increase in CHO oxidation (Brandou et al., 2005). The resisted exercise performed for 180 minutes per week without any caloric restriction resulted in significant reduction in total fat, visceral adiposity, waist circumference and improvement in cardiorespiratory fitness in obese individuals. Thereby, these forms of resisted exercises can reduce the body fat to a significant level and has major impact on the body composition in sedentary obese individuals. Furthermore, resistance exercise was effective in improving muscle mass and muscular strength because of the load applied on the muscles during the course of exercise. However, in previous study compared the CrossFit and anaerobic training in several fitness domains in athletes and reported that both groups produce identical result except the muscle strength. This finding was contrast to current study, this variation exists because fitness domain will vary form athletes and sedentary obese individual (Gerhart & Pasternostro, 2014). A recent systematic study reviewed the efficacy of Crossfit treatments enhanced their strength, power, physical endurance, and body composition, among other characteristics (Schlegel, 2020). Nonetheless, similar to our study, studies with adolescents reported no significant changes in grip strength after participation in the CF and the same study found no improvements in push-ups (Eather et al., 2016)

Even though both the training techniques worked significantly, CT has shown significant improvement both clinically and statistically than RT on Muscular strength and Body composition. The limitation of this study is that the study was conducted on a smaller sample size and the age group is limited. Only male subjects were included. Future studies are recommended to include female obese subjects, larger sample size, other training programs and other outcome measures like muscle endurance can also be included.

### **Conclusion**

In conclusion, Crossfit training is more effective in improving muscular strength and in reducing body composition than resistance training in sedentary obese collegiate boys.

### **Acknowledgements**

The authors sincerely thank Dr. Manoj Abraham M, Professor/ Principal, KG College of Physiotherapy, Coimbatore, India for his support and logistical help to conduct this research.

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