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## ORIGINAL ARTICLE

### PLYOMETRIC VERSUS HIGH INTENSITY AEROBIC EXERCISE AMONG OVER WEIGHT COLLEGE STUDENTS

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### ABSTRACT

**Background of the study:** Overweight is more body fat than optimally healthy individuals, overweight is common where food supplies are plentiful and life style is sedentary. Plyometric is designed to enhance muscular power and explosiveness. The word aerobic meaning exercise with oxygen, high intensity aerobic exercise can help on control weight and reduce stress. Objective of the study was to find the effect of plyometric exercise and high intensity aerobic exercise and also to compare the effect between the exercises among overweight college students. **Methodology:** This was a comparative study with quasi experimental design. The subjects were divided into two equal groups, 15 samples in Group A and Group B by convenient sample method. Group A received high intensity aerobics like jogging, burpees, mountain climber exercise, squat with side step, wall push ups, where Group B received plyometric exercises like squat jack, skater jump, jumping side lunge, rock star jump and high knees. Both exercises were given for three sessions in a week. Inclusion criteria include BMI of 25-30 and above, both male and female college students of aged 18-23 years. The measurement tool used was Body Mass Index and Waist Circumference. **Result:** The result showed a decrease in BMI and waist circumference in both the groups. But the weight reduction was more in Group A when compared to the Group B with  $p > 0.000$ . **Conclusion:** The study concluded that high intensity aerobic exercise decreases the BMI and waist circumference effectively among overweight college students when compared to the plyometric exercises.

**Keywords:** Plyometric, High intensity aerobic exercise, Waist circumference, Body Mass Index

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## INTRODUCTION

Overweight is having more body fat than is optimally healthy individuals. The definition of overweight in adults has variations over time. Obesity and overweight constitute an important public health problem because of associated increase risk of hypertension, coronary heart disease, type 2 diabetes, stroke, gall bladder disease, certain type of cancer, osteoarthritis, sleep apnoea and other disorders. Overweight range is calculated according to the body mass index (BMI), where  $BMI > 25$ <sup>1,2</sup>.

High intensity aerobics will help to control weight and reduce stress by conditioning the heart and lungs with the help of oxygen<sup>(4)</sup>. High intensity aerobics will help to relax the tensed muscles and regular practice of aerobics will increase the production of endorphins (a natural sedative) and catecholamine (chemical substance which stabilize the mood). So, long term aerobic exercise is considered to be reasonable and effective to reduce weight. Some scholars suggest that high intensive exercise of 85% VO<sub>2</sub> max with appropriate positive rest in short time is more effective to lose weight<sup>3,4,5</sup>.

Plyometric is a type of training where muscles undergo a rapid elongation followed by immediate shortening (stretch-shortening contraction) utilizing the elastic energy stored during stretching phase<sup>7</sup>. Plyometric training is a fantastic cardio work out and a great way to burn the calories. So, it is an effective work out supplement to lose weight. In fact muscle stronger and improve endurance capabilities. It enhances the metabolism and helps to burn calories. Indeed, this exercise will facilitate weight loss<sup>6,7</sup>.

Both high intensity aerobics and plyometric are meant for burning calories by increasing metabolism. So, it is considered as an important component to reduce overweight. Body mass index (BMI) is a simple and widely used method for estimating body fat mass. Belgian statistician developed BMI in 19<sup>th</sup> century<sup>(4)</sup>. BMI is not only used to classify obesity and overweight but also to find out life expectancy and prevalence of overweight and obesity related issues and co morbidities<sup>8,9,10</sup>

## METHODOLOGY

This was a comparative study with quasi experimental design. The subjects were divided into two equal groups, 15 samples in Group A and Group B by convenient sample method. All samples were selected for the study from the ACS medical college and hospital, Chennai. Group A received high intensity aerobics like jogging, burpees, mountain climber exercise, squat with side step, wall push ups, where Group B received plyometric exercises like squat jack, skater jump, jumping side lunge, rock star jump and high knees. Both exercises were given for three sessions in a week. Inclusion criteria include BMI of 25-30 and above, both male and female college students of aged 18-23 years. The measurement tool used was Body Mass Index and Waist Circumference. The study was conducted for duration of 3 months. Subjects with hypertension, any cardio vascular disease, any depressions, chronic renal failure, smoking status, history of diabetes, any history of recent fracture were excluded from the study.

**Procedure:** According to the BMI reading of over (26-30) is considered as overweight and the BMI was calculated from the following equation  $BMI(\text{in kg m}^2) = \text{Body mass}(\text{in kg}) / \text{Height}^2(\text{in m})$ . Thirty college students were

selected from the ACS medical college and hospital, in the age group of 18-23 years selected conveniently. The selected 30 subjects were provided with the informed consent after obtaining proper consent the selected and subjects were divided into two equal groups of fifteen each namely high intensity aerobic exercise was given to group A(15 subjects) and plyometric exercise was given to group B(15 subjects). Overweight was tested before(pre) and after(post) the training program for both experimental groups by using Waist circumference and conventional method was used to measure BMI, weight, height of each subjects was measured using a wall stadiometer, WHR, body fat percentage%(4). The obtained values were recorded. According to the protocol, the exercises had been given for Group A (High Intensity Aerobic Exercise) and Group B (Plyometric Exercise) followed by three months, the BMI and Waist circumference was again measured and the obtained values are recorded.

### Exercise Intervention

The selected subjects had undergone plyometric and high intensity aerobics thrice a week which have been in practice. Before the training they had undergone warm up for 5 minutes and cool down for 5 minutes. The group A has been engaged with High intensity aerobics of Jogging, Burpees, Mountain climbers, Squat with side sitting, Wall push up, the group B has been engaged with an Squat jack, Skater jump, Jumping side lunge, Rock star jump, High knees. Each exercise consists of 5 repetitions in high interval of 30 seconds practice and low interval of 10 seconds of resting period.

### Group A (High Intensity Aerobic Exercises)

**Jogging:** Jogging is running at a gentle pace. It is as running slower than 6 miles per hour (10 km/h). Jogging will have a wider lateral spacing of foot strikes, creating side- to-side movement that likely adds stability at slower speeds or when coordination is lacking.



Fig.1 Jogging

**Burpees:** Burpees or squat thrust is a full body exercise used in strength training. The basic movement is performed in four steps and known as a "four-count burpees."

**Method:** Begin in a standing position. Move into a squat position with your hands on the ground (count-1). Kick your feet back into a plank position, while keeping your arms extended (count 2). Immediately return your feet into squat position (count 3). Stand up from the squat position (count 4).



**Fig. 2 (a, b, c, d) Burpees**

**Mountain Climber Exercise:** Mountain climbers are a great total body exercise in which you are going to utilize your entire core because it is started in plank position.

The shoulders should stabilize your upper body. The triceps muscle should work isometrically to keep you in place.



(a)



(b)

Fig.3 (a, b). Mountain Climbers



(a)



(b)

Fig.4 (A, B) Squat with Side Step

**Squat With Side Step:** Side step and squat. Stand with your feet together. With your right foot take a wide step out to the right and squat down. As you straighten the legs, step your right foot back in. repeat on the left side.

**Wall Push Ups:** Face the wall, standing a little farther than arm's length away, feet- shoulder width apart. Lean your body forward and put your palms flat against the wall at shoulder height and shoulder width apart.



Fig.5 Wall Push Ups

### Group B (Plyometric Exercises)

**Squat Jack:** Squat is a compound, full body exercise that trains primarily the muscles of the thigh, hips and buttocks, quadriceps femoris muscle( vastus lateralis, vastus medialis, vastus intermedius and rectus femoris),hamstrings as well as strengthening the bones, ligaments and insertion of the tendons throughout the lower body.

**Skater Jump:** It is landing in one foot without touching the other one down and at the same time you can touch the ground with each jump so to make this a little bit easier you can touch your foot down on each sides alternatively.



(a)

(b)

Fig.6 (a, b) Squat Jack



**Fig.7 Skater Jump**



**Fig.8 Rock Star Jump**

**Jumping Side Lunge:** Stand on your left leg with your hips and knees slightly bent extend your left hip, knees and ankle to jump forward and to the right at a 45-degree angle land on the

ball of your right foot with your hips and knees slightly bent to absorb the impact immediately jump off your right leg in the opposite direction.



**(a)**



**(b)**

**Fig.9 (a, b) Jumping Side Lunge**

**Rock Star Jump:** Also called as side-straddle hop in the US military, is a physical jumping exercise performed by jumping to a position with the legs spread wide and the hands touching overhead, sometimes in a clap, and then returning to a position with the feet together and the arm at the sides.

**High Knees:** Skip in place by hopping on your right leg while bringing the left knee up towards your chest. Engage your abs as the knee comes towards your chest. Switch legs, and keep skipping while pumping your arms. This completes one repetition.



(a)



(b)

Fig.10 (a, b) High Knees

**Data analysis and interpretation**

BMI	GROUP - A		GROUP - B		t – test	DF	Significance
	MEAN	S.D	MEAN	S.D			
PRE TEST	27.24	1.21	27.40	1.29	-0.349	28	0.730*
POST TEST	24.49	0.62	26.62	1.15	-6.289	28	0.000**

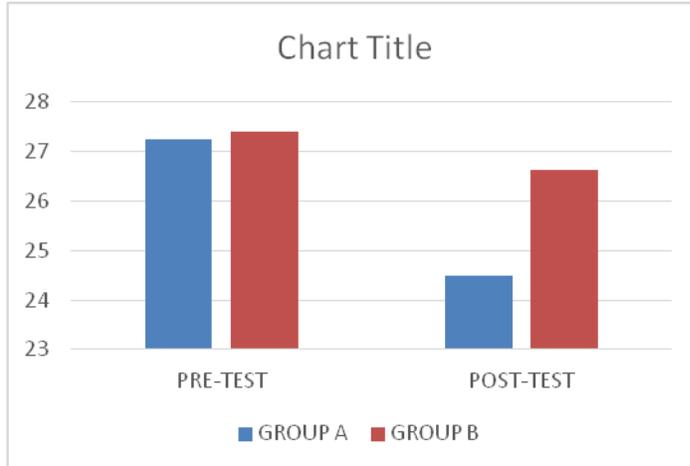
Group-A (\*-P>0.05), Group-B (\*\*-P≤0.01)

**Table-1** comparison of BMI between Group- A and Group- B in Pre and post test

The above table reveals the mean, standard deviation(S.D),T- test, degree of freedom (DF) and P values of the BMI between (Group A) and (Group B) in pre-test and post- test.

between Group A and Group B (\*P>0.05). This table shows that statistically significant difference in the post test values of the BMI between group A and group B (\*\*-P≤0.01).

This table shows that there is no significant difference in the pre-test values of the BMI



**Graph – 1.**Comparison of BMI between Group A and Group B in pre and post test.

Waist	GROUP - A		GROUP – B		t - Test	df	Significance
	MEAN	S.D	MEAN	S.D			
Pre test	96.40	7.00	100.80	8.94	-1.840	28	0.076*
Post test	65.66	8.35	84.26	10.93	-5.234	28	0.000**

Group A: (\*-P> 0.05), Group B: (\*\*-P≤ 0.01)

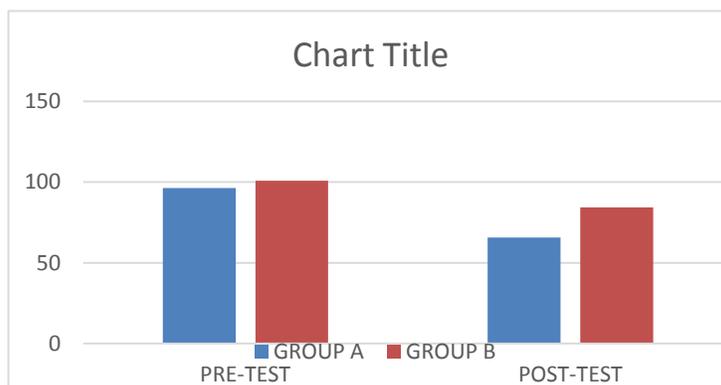
**Table- 2:** Comparison of waist circumference between group-a and group - b in pre and post test

The above table reveals the mean ,standard deviation (S.D),T-test, degree of freedom(DF) and P-values of the waist circumference

between (group A) and (group B) in pre-test and post-test.

This table shows that there is no significant difference in pre-test values of the waist circumference between group A and group B (\*P>0.05).

This table shows that statistically significant difference in post-test values of the waist circumference group A and group B (\*\*-P≤0.01)



**Graph-2:** Comparison of Waist Circumference between Group A and Group B in the pre and post test.

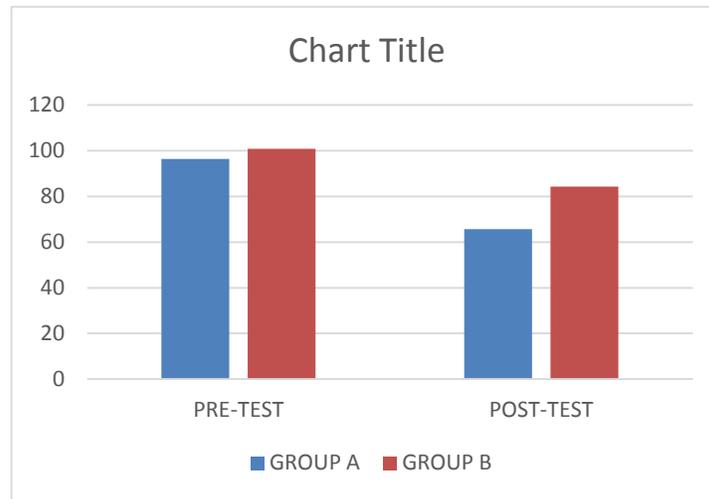
BMI	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	27.24	1.21	24.49	0.62	10.032	0.000*
GROUP-B	27.40	1.29	26.62	1.15	9.020	0.000*

Group-A and Group-B with P≤0.01

**Table 3:** Comparison of BMI within Group A & Group B between Pre & Post Test Values

The above table reveals the mean, standard deviation (SD), t-values and P-values of the BMI between pre-test and post-test within group A and group B.

In BMI there is a statistically highly significant difference in the pre-test and posttest values within group A and group B. (\*\*-P≤0.01)



**Graph-3:** Comparison of BMI within Group-A and Group-B between pre and post test values

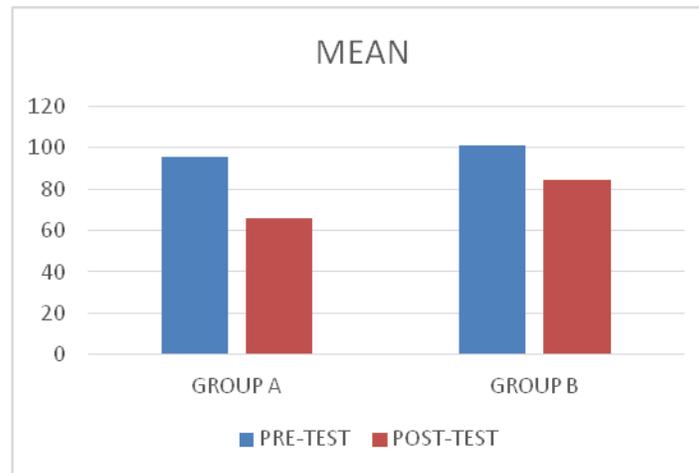
Waist	Pre test		Post test		t - test	Significance
	Mean	S.D	Mean	S.D		
Group- A	95.40	7.00	65.66	8.35	19.855	0.000*
Group-B	100.80	8.94	84.26	10.93	11.639	0.000*

Group-A (\*-P≤0.01) , Group-B (\*-P≤0.01)

**Table 4:** Comparison of waist circumference within Group-A & Group-B between pre & post test values

The above table reveals the mean, standard deviation (SD), t-value and p-value of the waist circumference between pre-test and post-test within group A and group B.

In waist circumference there is a statistically significant difference between the pre-test and post-test values within group A and group B (\*-P≤0.01).



**Graph 4:** Comparison of Waist Circumference within Group A and Group B between Pre and Post- Test Values

## RESULT

Pre and Post-test values within Group A and B, it shows a statistically significant difference in the BMI where P value is 0.000\*. And also in pre and post-test values within Group A and B, it reveals significant difference on Waist Circumference where P value is 0.000\*.

On comparing between the Group A and B found significant difference of P value 0.000\*. BMI found significant mean difference of 2.75 (27.24-24.49) and 0.78 (27.40-26.62) respectively. Waist Circumference also found significant difference with mean difference of 29.74 (95.40-65.66), 16.54 (100.80-84.26) respectively.

## DISCUSSION

Based on the selection criteria 30 subjects with overweight of 25 to 30 were participated in the study. The purpose of this study was to compare the effect of plyometric versus high intensity aerobics among overweight college students.

Aerobic exercise has significant improvement on waist circumference than plyometric exercises. Outcome measures used for this study were Body Mass Index and waist circumference<sup>11</sup>.

Plyometric burns the maximum amount of calories in the shortest amount of time while toning the body from head to toe, reported the importance of Plyometric exercise in fitness. Plyometric exercises to a High intensity interval training program may be more beneficial than only High intensity interval training in obese female adolescents<sup>12,13</sup>.

Training at high intensity is superior to improve cardiopulmonary fitness and to reduce % body fat in adults with obesity compared to traditional exercises. Another issue is the motivation for an exercise program in person with overweight depression; a negative body image and embarrassment are factors that can influence the decision to participate in an exercise program. Recent evidence suggests that HIIT can be a time-efficient strategy to

promote health in sedentary overweight /obesity individuals<sup>14</sup>.

In this review and Meta analysis, the effectiveness of high intensity training in terms of weight reduction was compared to plyometric forms of exercise in overweight college students. Based on the results on this Meta analysis we can conclude that training at high intensity aerobic is a better method to reduce overweight than plyometric<sup>15</sup>.

In this study the values of BMI and waist circumference in centimetres of pre-test and post-test were compared by the mean difference. When the inter group mean values of BMI were analysed, in Group A mean for BMI pre-test and post test was BMI 27.24 and 24.49 respectively. The mean values of Group B for pre test and post test was 27.40 and 26.62 respectively from the data analysis. The result shows that the reduction in body weight is more in Group A (High intensity aerobic exercise) compare to Group B (plyometric exercise).

When the inter group mean values of waist circumference was analysed, Group A pre test mean waist circumference 96.40 and post test mean waist circumference 65.66 .The mean values of group B pre test mean waist circumference 100.80 and post test mean 84.26 from the data analysis it shows that there was reduction in the waist circumference in group A (High intensity aerobic exercise).

**Ethical Clearance:** Ethical clearance has obtained from Faculty of Physiotherapy, DR.MGR. Educational and Research Institute, Chennai to conduct this study with reference number: A-033/ PHSIO/IRB/2017-18 dated 07/01/2018.

**Conflict of interest:** There was no conflict of interest to conduct this study.

**Fund for the study:** It was a self financed study.

## CONCLUSION

This study concludes that the high intensity aerobics has considerable effect in reducing the weight among overweight college students. Therefore the HIAE is considered to be more effective than plyometric exercise program.

High Intensity Aerobic Exercise can effectuate weight reduction in a shorter period of time, but also mechanisms like increased post exercise fat oxidation and a decreased post exercise appetite could play a role.

Training at high intensity is superior to improper cardio pulmonary fitness and to reduce body fat percentage in adults with overweight compared to plyometric exercise.

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