THE EFFECT OF INSPIRATORY MUSCLE TRAINING ON CARDIOVASCULAR ENDURANCE PERFORMANCE IN OVERWEIGHT COLLEGIATE STUDENTS

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Abstract: Obesity and being overweight is a complex, multifactorial, and largely preventable condition affecting, over a third of the world's population today. Obesity is typically defined as excess body weight for height, but this simple definition describes an etiologically complex phenotype primarily associated with excess adiposity, or body fat that can manifest metabolically and not just in terms of body size. As obesity leads to an increase in respiratory demands, it is possible that an intervention such as inspiratory muscle training (IMT) might improve respiratory compliance, exercise tolerance, and show the benefits of exercise training in this population group. The purpose of this study is to find out the effect of IMT in improving cardiovascular endurance performance and the objective of this study is to compare the effect of Pre and Post treatment of inspiratory muscle training on cardiovascular endurance performance in overweight collegiate students. Source of data is Saaii college of medical science and technology, Kanpur. Sample size is 40 and sampling is done by simple random sampling. Type of study is pre-post experimental design study. Duration is 4 weeks. In the procedure the participant was asked to perform the 1.5MILE RUN/ WALK TEST, Then IMT was performed by using a device called SPIROMETER in which the participants were asked to sit and breathe into a small machine called spirometer, with a clip placed on the nose to keep both nostrils closed. A cup like breathing

mask was placed around the mouth. Then participants were asked to take a deep breath in, hold the breath for a few sec. and then exhale as hard as they can into the breathing mask. After 4 weeks of treatment again 1.5 MILE RUN/ WALK TEST was done and Pre and Post treatment result was compared. In the result the null hypothesis is rejected and alternate hypothesis is accepted and we statistically observed significant improvement in the cardio-vascular endurance by Inspiratory muscle training (spirometry) in overweight collegiate students. As per the result, it has been concluded that Inspiratory muscle training (Spirometry) is very helpful in improving cardio-vascular endurance along with controlling the vitals in overweight collegiate students.

Keywords: *Obesity, Inspiratory muscle training, 1.5 miles walk test, VO2 max, SPO2, Dyspnea.*

I – INTRODUCTION

Obesity and being overweight is a complex, multifactorial, and largely preventable condition affecting over a third of the world's population today. If secular trends continue, by 2030 an estimated 38% of the world's adult population will be overweight and another 20% will be obese. In the USA, the direst projections based on earlier secular trends point to over 85% of adults being overweight or obese by 2030. While growth trends in overall obesity in most developed countries seem to have leveled off morbid obesity in many of these countries continues to climb, including among children. In addition, obesity prevalence in developing countries continues to trend upwards toward US levels. Obesity is typically defined quite simply as excess body weight for height, but this simple definition belies an etiologically complex phenotype primarily associated with excess adiposity, or body fatness, that can manifest metabolically and not just in terms of body size. Obesity greatly increases risk of chronic disease morbidity—namely disability, depression, type 2 diabetes, cardiovascular disease, certain cancers—and mortality. Childhood obesity results in the same conditions, with premature onset, or with greater likelihood in adulthood. Thus, the economic and psychosocial costs of obesity alone, as well as when coupled with these co morbidities and squealed, are striking. [1]

Nutrition, physical activity and genetic disposition determine in close interaction with each other, to a large extent the development of overweight. Life circumstances and individual habits represent a challenge to many people to keep a good balance between energy requirements and energy intake. In the last decades, an increase in the prevalence of overweight and obesity has been observed in many countries, recently also in many thresholds and developing countries [2]. Worldwide, the highest prevalence of overweight and obesity for both men and women can be observed in the USA and some islands in the Pacific. Germany belongs to the countries with high overweight and obesity prevalence [2, 3]

Overweight and obesity are usually defined on the basis of the Body Mass Index (BMI). According to the classification of the WHO, overweight is defined with a BMI of 25 kg/m2 and higher. This category includes obesity, which specifies a BMI of 30 kg/m2 and higher. The BMI range between 25 and 30 kg/m2 is referred to as pre-obesity [2]. Obesity can have consequences for a person's social life, mobility and quality of life [3, 4, 5],

but overweight and obesity are also associated with many complaints and diseases [6]. Persons with obesity have an increased risk of type 2 diabetes mellitus [7, 8], cardiovascular disease [9, 10, 11, 12, and 13] and certain types of cancers including cancer of the colon, pancreas, kidneys, breast and cervix [14, 15]. As a result, the life expectancy of obese people is observed to be lower than that of people with normal weight [16, 17]. The health risks of pre-obesity are less well substantiated than those of obesity. [16, 17, 18]

As obesity leads to an increase in respiratory demands, it is possible that an intervention such as inspiratory muscle training (IMT) might improve respiratory compliance, exercise tolerance, and the benefits of exercise training in this population group. The work of breathing is primarily undertaken on inspiration whereby the chest and lungs expand to accommodate an increased volume of air, while expiration is largely passive [19]. Consequently, a training program specifically designed to enhance the performance of inspiratory muscles among overweight and obese individuals might lessen subconscious inhibition of exercise performance, reduce respiratory muscle fatigue, and promote greater performance in response to exercise challenges [20].

Due to the accumulation of adipose tissues in the abdomen, the physiology of breathing gets altered and diaphragmatic fibers get overstretched. This results in length-tension disadvantage with lower cardio respiratory endurance which in turn causes diaphragm dysfunction and leads to smaller pulmonary volumes, greater metabolic demands on the respiratory musculature and increased airway resistance resulting from a reduction in lung volumes and further increases the work of breathing. Also due to truncal fat, there is reduced chest wall compliance. Also, the above factor causes respiratory muscles to develop fatigue during exercises. Severely obese subjects tend to have a rapid shallow breathing pattern that results in increased oxygen cost of breathing. This in turn compromise leg blood flow thereby constraining oxygen uptake (VO2) and limiting exercise tolerance. Respiratory muscle fatigue is a potential mechanism for impaired exercise tolerance. Thus, dysfunction in the ventilator muscles can lead to hyperventilation, reduced exercise tolerance; reduced lung function which results in respiratory insufficiency along with increased work of breathing. This affects the muscle strength of inspiratory muscles. During exercise there is increased chest loading with reduced lung volumes and increased mechanical ventilator constraints in obese individuals. This has been suggested as a possible explanation for impaired exercise performance in the obese and morbidly obese individuals. Increased body fat percentage also contributes to the reduction in the functional exercise tolerance. This evaluates Respiratory Muscle Strength (RMS) and exercises tolerance in such individuals of great clinical importance. Respiratory muscle training increases the strength and reduces the extent of fatigue of respiratory muscle hence improving their performance [21]. Due to this, the metabolic requirement of inspiratory muscles during exercise decreases. This enhances VO2 dynamics resulting in improved exercise performance [22]. Since respiratory muscles are also skeletal muscles, the more they are exercised the bigger and stronger they are expected to become [23]. Exercise performance is assessed by measuring maximal oxygen uptake (VO2 max).

Thus, the purpose of this study was to compare the effect of 4 weeks of inspiratory muscle training by spirometer for improving cardiovascular endurance performance in overweight collegiate students.

OPERATIONAL DEFINITIONS:

Inspiratory Muscle training: Inspiratory muscle training (IMT) is a form of resistance (weight) training which strengthens the muscles. That we use to breathe. When these muscles are strengthened regularly for a period of a few weeks they adapt, becoming stronger & being able to work for longer. We will also be able to exercise more without getting so breathless. By improving muscle strength before an operation, IMT can reduce breathing complications followed major surgery. [24]
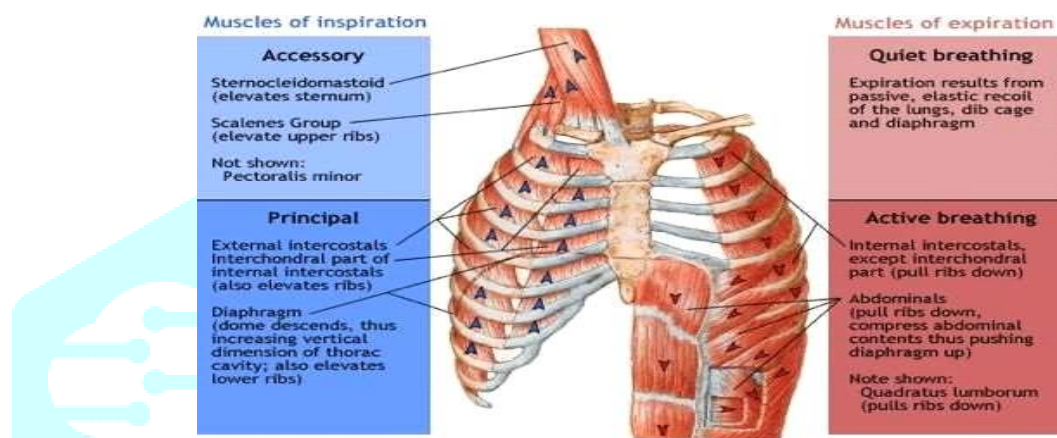
Spirometer: Spirometry is a common office test used to assess how well your lungs work by measuring how much air you inhale; how much you exhale and how quickly you exhale. Spirometry is used to diagnose asthma, chronic obstructive pulmonary disease (COPD) and other conditions that affect breathing. Spirometry may also be used periodically to monitor your lung condition and check whether a treatment for a chronic lung condition is helping you breathe better. [25]
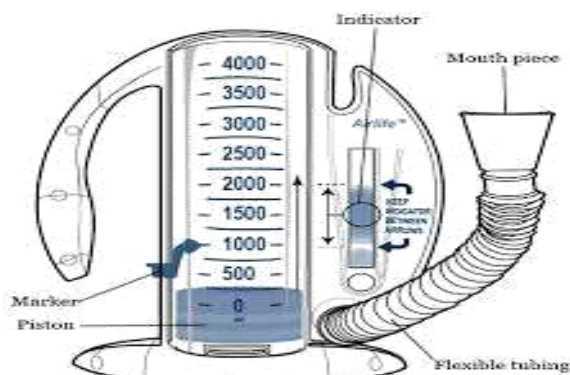
FVC: One of the primary spirometry measurements is FVC, which is the greatest total amount of air we can forcefully breathe out after breathing in as deeply as possible. If our FVC is lower than normal, something is restricting our breathing. [26]

For children 8 to 18years:

Percentage of predicted FVC value	Result
80%orgreater	Normal
lessthan80%	Abnormal

For adults:

Percentage of predicted FVC value	Result
Is greater than or equal to the lower Limit of normal	Normal
Is less than the lower limit of normal	Abnormal

FEV1: The second key spirometry measurement is forced expiratory volume (FEV1). This is the amount of air you can force out of your lungs in one second. It can help your doctor evaluate the severity of your breathing problems. A lower-than-normal FEV1 reading shows you might have a significant breathing obstruction. According to guidelines from the **AMERICAN THORACIC SOCIETY** [26]

Percentage of predicted FEV1 Value	Result
80%orgreater	Normal
70%–79%	mildly abnormal
60%–69%	Moderately abnormal
50%–59%	Moderate to severely Abnormal
35%–49%	Severely abnormal
Lessthan35%	Very severely abnormal

1.5 MILE RUN/WALK TEST:

Purpose – Estimate the body's ability to deliver oxygen to determine cardio vascular fitness level.

Equipment – Standard track or treadmill.

Procedure - Begin with a moderate warm up. Start stopwatch at the beginning of run; stop the stopwatch at the end of the distance Participant should be able to jog for at least 15minutes to complete this test. The total distance is 1.5miles; on a standard track is 6 laps. Pacing and constant motivation are important in order to complete the test in the fastest time possible with an accurate estimation of VO2max. [27] The participants VO2 max in ml/kg/min is determined by formula (Gregory, 2008). [28]

FOR MEN: VO2max (ml/kg/min) = 111.33 - (0.42 x HR)

**FOR WOMEN:** VO2max (ml/kg/min) = 65.81 - (0.1847 x HR)

B.M.I: BMI is calculated as the ratio of an individual's weight in kilograms divided by the height in meters squared (BMI = kg/m^2). BMI provides a useful measure of body fat percentage and obesity. [29]

BMI	Weight status
Below 18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Obesity class I
35.0-39.9	Obesity class II
Above 40	Obesity class III

VO$_2$MAX: $\dot{V}O_2$ max (also maximal oxygen consumption, maximal oxygen uptake or maximal aerobic capacity) is the maximum rate of oxygen consumption measured during incremental exercise; that is, exercise of increasing intensity.[30] The name is derived from three abbreviations: "$\dot{V}$" for volume (the dot appears over the V to indicate "per unit of time"), "O_2" for oxygen, and "max" for maximum. The measurement of $\dot{V}O_2$ max in the laboratory provides a quantitative value of endurance fitness for comparison of individual training effects and between people in endurance training. Maximal oxygen consumption reflects cardiorespiratory fitness and endurance capacity in exercise performance. In male endurance athletes, average value is 84ml/kg/min and in female athletes, average value is65ml/kg/min.

VO2 Max Norms for Women

AGE	VERY POOR	POOR	FAIR	GOOD	EXCELLENT	SUPERIOR
13-19	<25.0	25.0 - 30.9	31.0 - 34.9	35.0 - 38.9	39.0 - 41.9	>41.9
20-29	<23.6	23.6 - 28.9	29.0 - 32.9	33.0 - 36.9	37.0 - 41.0	>41.0
30-39	<22.8	22.8 - 26.9	27.0 - 31.4	31.4 - 35.6	35.7 - 40.0	>40.0
40-49	<21.0	21.0 - 24.4	24.5 - 28.9	29.0 - 32.8	32.9 - 36.9	>36.9
50-59	<20.2	20.2 - 22.7	22.8 - 26.9	27.0 - 31.4	31.5 - 35.7	>35.7
60+	<17.5	17.5 - 20.1	20.2 - 24.4	24.5 - 30.2	30.3 - 31.4	>31.4
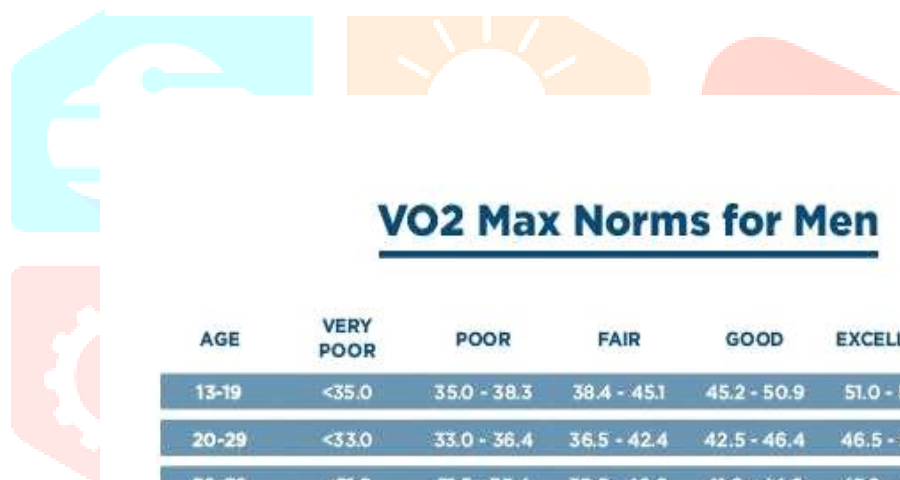
VO2 Max Norms for Men

AGE	VERY POOR	POOR	FAIR	GOOD	EXCELLENT	SUPERIOR
13-19	<35.0	35.0 - 38.3	38.4 - 45.1	45.2 - 50.9	51.0 - 55.9	>55.9
20-29	<33.0	33.0 - 36.4	36.5 - 42.4	42.5 - 46.4	46.5 - 52.4	>52.4
30-39	<31.5	31.5 - 35.4	35.5 - 40.9	41.0 - 44.9	45.0 - 49.4	>49.4
40-49	<30.2	30.2 - 33.5	33.6 - 38.9	39.0 - 43.7	43.8 - 48.0	>48.0
50-59	<26.1	26.1 - 30.9	31.0 - 35.7	35.8 - 40.9	41.0 - 45.3	>45.3
60+	<20.5	20.5 - 26.0	26.1 - 32.2	32.3 - 36.4	36.5 - 44.2	>44.2

II - METHODOLOGY

SOURCES OF DATA: Saaii College of Medical Science and Technology, Kanpur.

METHOD OF COLLECTION OF DATA: Population is overweight collegiate students. Simple random sampling and Sample size is 40. Type of study is pre-post experimental study design and duration of study is 4weeks.

INCULSION CRITERIA: Overweight collegiate students both male and females with age group of 18-29 yrs. Students willing to participate, Students with no respiratory problem, Students with no Cardiac problem, Students with no Musculo-skeletal problem.

EXCULSION CRITERIA: Students not willing to participate, Students with any known case of respiratory conditions, Under-weight students, Students with improper balance, Students with Vertigo.

VARIABLES:

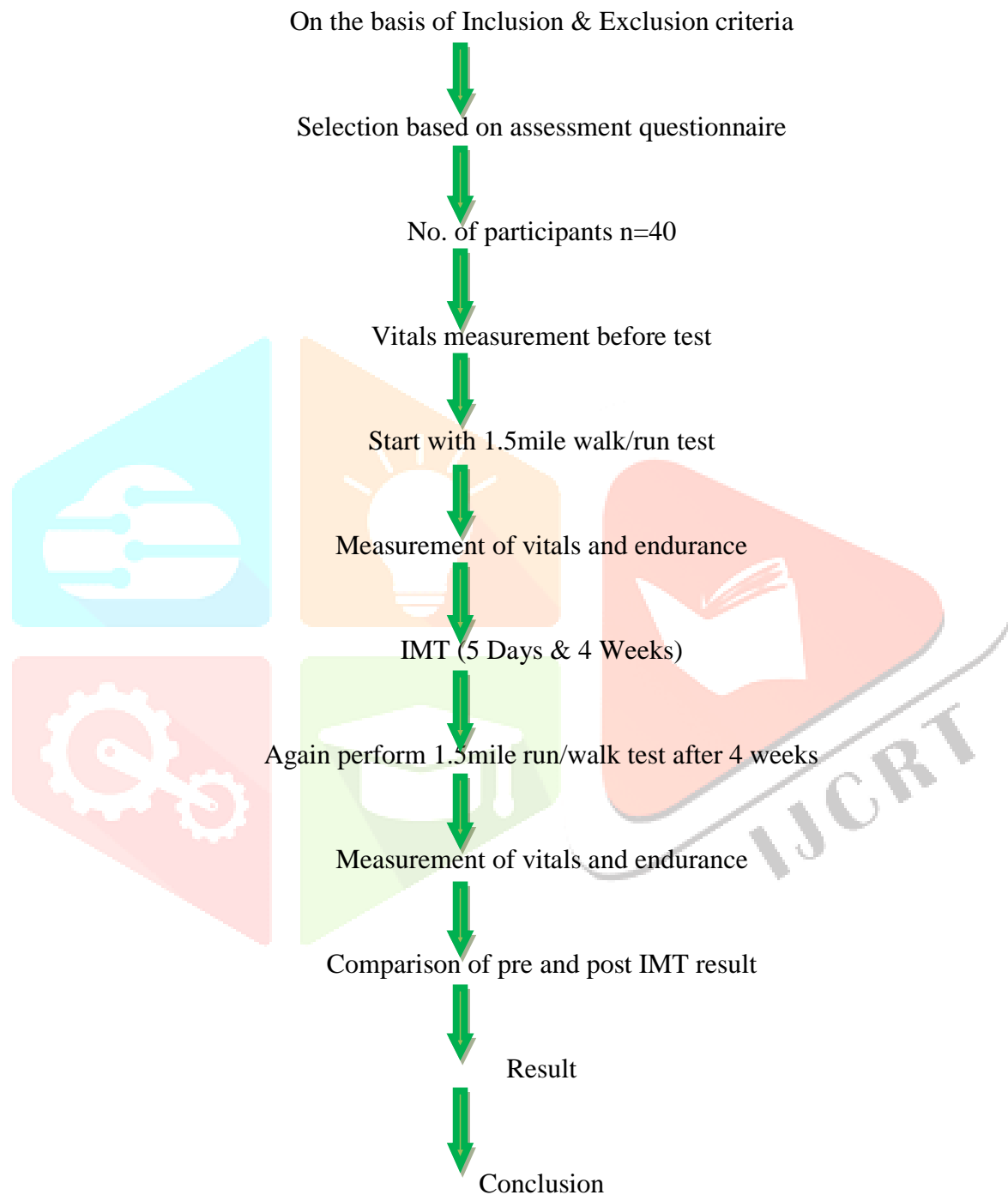**INDEPENDENTVARIABLES:** 1.5 miles walk/run test, IMT

DEPENDENTVARIABLES: Height, Weight, Gender, BMI, Age, Vitals

MATERIALS REQUIRED: Pen, Paper, Stopwatch, weight machine, Measuring tape, Spirometer, Pulse oxy-meter, Standard track.

III - PROCEDURE

Subjects were selected based upon the inclusion & exclusion criteria. They were explained in detail about the type & nature of study before being assigned to participation consent was taken by each subject before participating in the study by signing consent form that contained all the information necessary for them about the study. Procedure was explained in detail & all the necessary precautions were taken to avoid any inconvenience. Subject preparation was carefully done. They were asked to not to indulge in any kind of vigorous act prior to the test or to take any heavy meal up to 1 hour before the test. All the subjects were made sure to be properly hydrated, wore comfortable clothing & footwear. Before starting the test, necessary assessment was done and vitals (BP, HR, RR, SPO2, Dyspnea level). All the necessary data such as age, sex, height, weight, BMI were also documented. Then the participants were asked to perform the 1.5 MILE RUN /WALK TEST .Then VO2 max was calculated using Formula given by Gregory, 2008. Then IMT was performed by using a device called SPIROMETER. In which the participant was asked to sit and breathe into a small machine called spirometer, in which a clip was placed on a nose to keep both nostrils closed. A cup like breathing mask was placed around the mouth. Then participant was asked to take a deep breath in, hold the breath for a few sec. and then exhale as hard as we can into the breathing mask. Then 40-50% of IRM was taken and the training was done for 5 days for 4 weeks. After 4 weeks of treatment again 1.5 MILE RUN/ WALK TEST was done and Pre and Post treatment result was compared.

PROTOCOL

On the basis of Inclusion & Exclusion criteria

Selection based on assessment questionnaire

No. of participants n=40

Vitals measurement before test

Start with 1.5mile walk/run test

Measurement of vitals and endurance

IMT (5 Days & 4 Weeks)

Again perform 1.5mile run/walk test after 4 weeks

Measurement of vitals and endurance

Comparison of pre and post IMT result

Result

Conclusion

IV - DATA ANALYSIS

Data Analysis was done by IBM SPSS software package used for statistical analysis 2019 Ver. – 26. The Descriptive Data statistical analysis was done to determine the demographic characteristics of the subjects in the present study. Paired samples t – test was used in the analysis of present study. p – Value was used in the present study to test the Hypothesis, which helped in deciding whether to accept or reject the Null hypothesis. The p – value is probability of obtaining a test value that is at least extreme as the actual calculated value, if the null hypothesis is true. A commonly used value for the p – value is 0.05.

Table: 1 represents the Descriptive data of subjects.					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	40	20	26	22.93	1.474
Weight	40	58	80	67.40	5.887
Height	40	146	172	159.90	6.975
Body Mass Index	40	25	29	26.33	1.152

The descriptive data of **table 1** shows participant's average age was 22.93 years, average weight was 67.40 Kg. The participants had an average height of 159.90 cm and correspondingly the average BMI of participants was calculated to be was 26.33. This reflects that average participant were in the over – weight category.

| Table 2: represents the statistical data of subjects						
	Mean	Std. Deviation	Std. Error Mean	t - value	df	p – value
PrI_VO2_dif – PoI_VO2_dif	5.721	2.246	.355	16.113	39	.000
PrI_SPO2_dif – PoI_SPO2_dif	1.300	1.522	.241	5.400	39	.000
PrI_HR_dif – PoI_HR_dif	19.325	14.366	2.271	8.508	39	.000
PrI_RR_dif – PoI_RR_dif	6.200	2.472	.391	15.860	39	.000
PrI_DL_dif – PoI_DL_dif	1.788	.250	.040	45.163	39	.000
PrI_Time_dif – PoI_Time_dif	6.525	1.826	.289	22.605	39	.000

The **table 2** shows the statistical data of recruited subjects, while analyzing the data it has been found that inspiratory muscle training was found significant in improving cardio-vascular endurance in the over-weight individuals. There is marked improvement in VO2 max with Mean ($\pm$SD) of 5.721 ($\pm$2.246) and t – value was 16.113 with p – value of .000, SPO2 % with Mean ($\pm$SD) of 1.300 ($\pm$1.522) and t – value was 5.400 with p – value of .000, Heart Rate with Mean ($\pm$SD) of 19.325 ($\pm$14.366) and t – value was 8.508 with p – value of .000, Respiratory Rate with Mean ($\pm$SD) of 6.200 ($\pm$2.472) and t – value was 15.860 with p – value of .000, Dyspnea level with Mean ($\pm$SD) of 1.788 ($\pm$.250) and t – value was 45.163 with p – value of .000, and time difference with Mean ($\pm$SD) of 6.525 ($\pm$1.826) and t – value was 22.605 with p – value of .000. So, the above table shows that the Inspiratory muscle training (Spirometry) was significant at the 95% confidence level.

V – RESULT

In the present study the statistical analysis in the 95% confidence level of paired samples t – test shows significant improvement i.e., the null hypothesis is rejected and alternate hypothesis is accepted and we statistically observed significant improvement of cardio- vascular endurance by Inspiratory muscle training (spirometry) in overweight collegiate students.
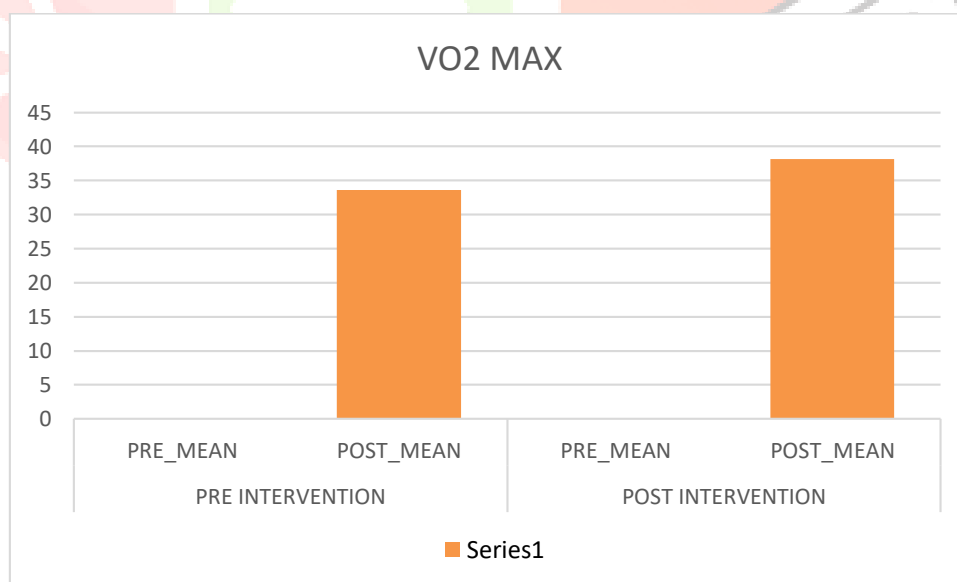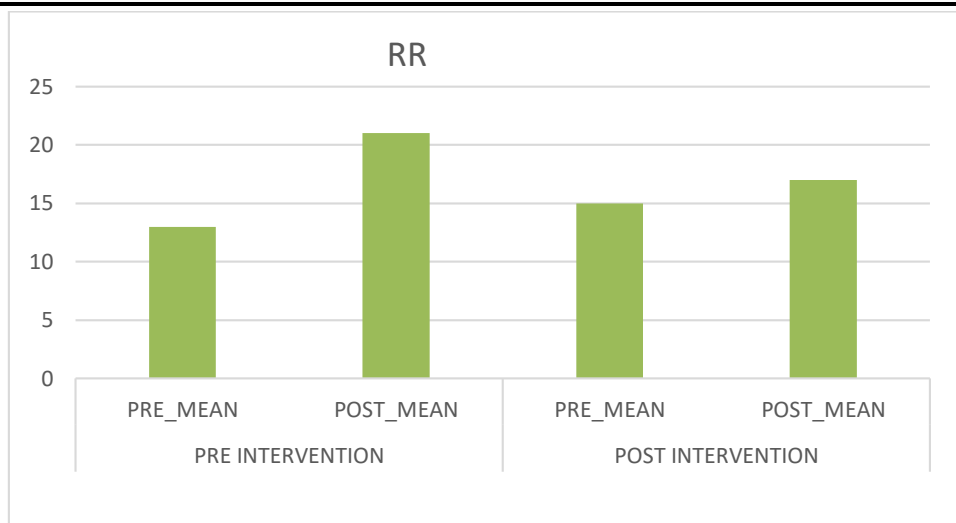

Graph – 1 represents the VO2 max level of all the subjects recruited in the present study, with pre and post intervention. A finding shows VO2 max with Mean ($\pm$SD) of 5.721 ($\pm$2.246) and t – value was 16.113 with p – value of .000, which shows IMT statistically significant in improving cardio – vascular endurance.
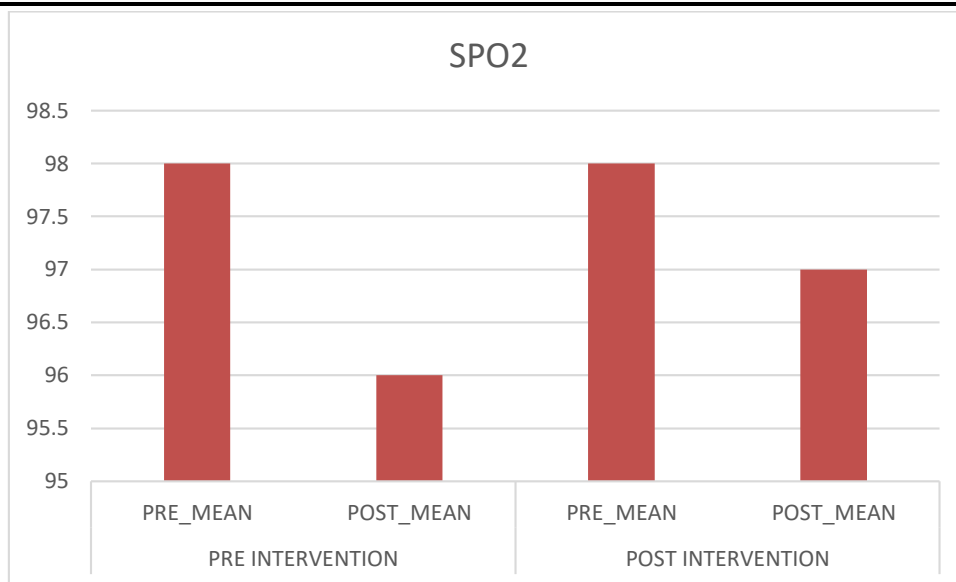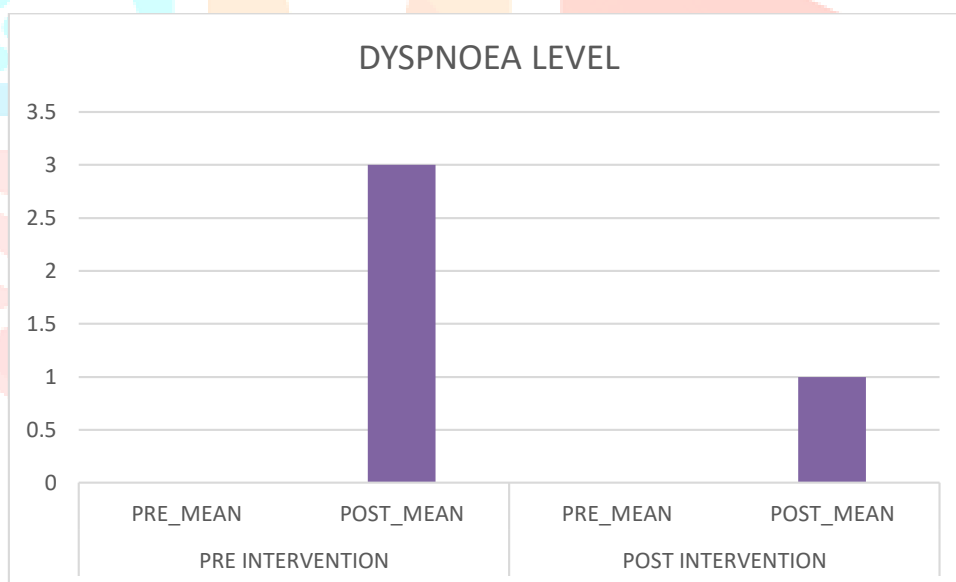
Graph – 2 represents the SPO2 % level of all the subjects recruited in the present study, with pre and post intervention. A finding shows SPO2 % with Mean (±SD) of 1.300 (±1.522) and t – value was 5.400 with *p* – value of .000, which shows IMT statistically significant in improving cardio – vascular endurance.
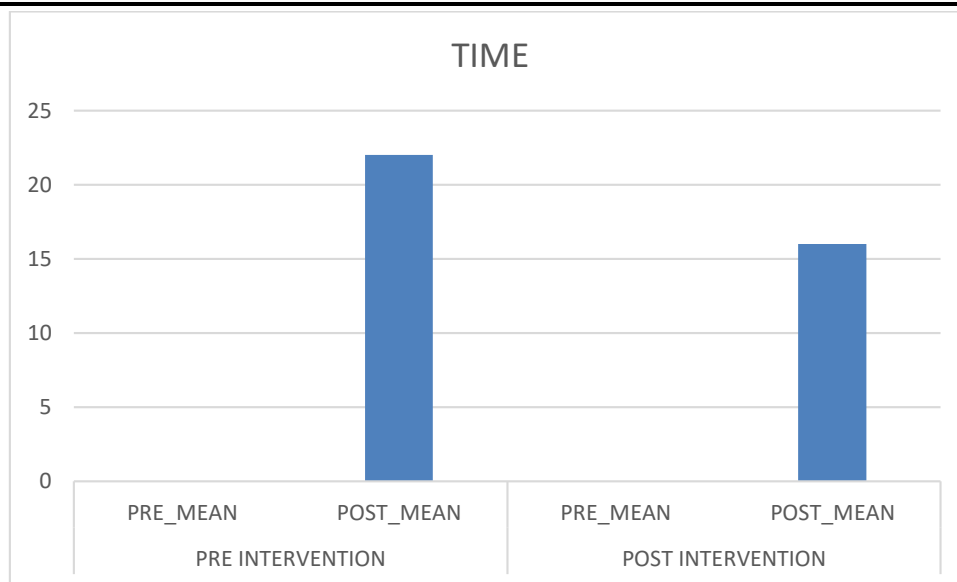

Graph – 3 represents the HR level of all the subjects recruited in the present study, with pre and post intervention. A finding shows HR with Mean (±SD) of 19.325 (±14.366) and t – value was 8.508 with *p* – value of .000, which shows IMT statistically significant in improving cardio – vascular endurance.

RR

Graph – 4 represents the RR level of all the subjects recruited in the present study, with pre and post intervention. A finding shows RR with Mean ($\pm$SD) of 6.200 ($\pm$2.472) and t – value was 15.860 with p – value of .000, which shows IMT statistically significant in improving cardio – vascular endurance.

DYSPNOEA LEVEL

Graph – 5 represents the Dyspnea level of all the subjects recruited in the present study, with pre and post intervention. A finding shows Dyspnea level with Mean ($\pm$SD) of 1.788 ($\pm$.250) and t – value was 45.163 with p – value of .000, which shows IMT statistically significant in improving cardio-vascular endurance.

Graph – 6 represents the time taken by all the subjects recruited in the present study, with pre and post intervention. A finding shows Time taken in the intervention with Mean ($\pm$SD) of 6.525 ($\pm$1.826) and t – value was 22.605 with p – value of .000, which shows IMT statistically significant in improving cardio – vascular endurance.

CONCLUSION

In the conclusion, based on the results of present study and all the previous research done in the past, we concluded that null hypothesis is rejected and alternate hypothesis is accepted. As per the result, it has been concluded that Inspiratory muscle training (Spirometry) is very helpful in improving cardio-vascular endurance along with controlling the vitals in overweight collegiate students.

DISCUSSION

The present study was done to determine whether the Inspiratory muscle training was efficient or not in controlling the vitals and improving in cardio-vascular endurance in the overweight collegiate students. The pre and post interventions were observed by pulse oximeter for SPO2 and heart rate, and stop watch for time, spirometer is for Inspiratory muscle training, weighing machine, measuring tape and etc. A total of 40 subjects were recruited for the present study according the Inclusion and Exclusion criteria. Those subjects who fulfilled the criteria were allowed to participate in the study. All the subjects were taken from Saaii college, Kanpur.

The data collected from the study represents that null hypothesis is rejected and alternate hypothesis is accepted, which means the Inspiratory muscle training (Spirometry) is effective in stabilizing vitals and improve the cardio-vascular endurance in the overweight collegiate students.

We also found same conclusion in (2021) Ketki Ponde, et.al.in their study "Additional Effect of Inspiratory Muscle Training Along with Aerobic Exercises in Overweight and Obese Individuals" concluded that adding IMT to conventional walking program improved subjects inspiratory muscle strength and their exercise performance.

(2019) Camila Cargnin, et.al. in their study "Inspiratory muscle training after heart valve replacement surgery improves inspiratory muscle strength, lung function and functional capacity" concluded that IMT performed for 4 wk after HVRS was effective in restoring the values of inspiratory muscle strength and lung function to the pre-operative level and increasing the functional capacity assessed by the 6MWD. [31]

(2018) Neslihan Duruturk, et.al. in their study "Effect of inspiratory muscle training in the management of patient with asthma" suggest that IMT may be an effective modality to enhance respiratory muscle strength, exercise capacity, quality of life, daily living activities, reduced perception of dyspnea, and fatigue in asthmatic patients. [32]

(2018) Dr. Pournima Pawar, et.al. in their study "Effect of inspiratory muscle training on cardio vascular endurance in Lawn Tennis Player" concluded that that there is significant improvement in cardiovascular endurance and strength in lawn tennis players after progressive inspiratory muscles training. [33]

(2017) Raphael Martins de Abreu, et.al. in their study "Effect on inspiratory muscle training on cardiovascular autonomic control" concluded that IMT can promote benefits for cardiac autonomic control. [34]

(2016) Ander Luiz Lisboa Cordeiro, et.al. in their study "Effect of inspiratory muscle training and functional capacity in patient undergoing cardiac surgery" concluded that inspiratory muscle training was effective in improving functional capacity submaximal and inspiratory muscle strength in this sample of patients undergoing cardiac surgery. [35]

(2016) Flavia Cristina Rossi Caruso, et.al. in their study "High-Intensity inspiratory protocol increases Heart rate, variability in Myocardial revascularization patients" concluded that after 6 months post- CABG reductions in MIP and MEP were persisted. In addition, a high-intensity inspiratory protocol promoted a greater parasympathetic modulation in comparison to maneuvers at lower loads. These results provide important implications for rehabilitation procedures following CABG, in particular including a RMT component as a standard of care. [36]

(2015) Barbar Maria Hermes, et.al. in their study "Short term inspiratory muscle training potentiates the benefits of aerobic and resistance training in patient undergoing CABG in phase II cardiac rehabilitation program" concluded that The present study demonstrated that the addition of inspiratory muscle training, even when applied for a short period, may potentiate the effects of combined aerobic and resistance training, becoming a simple and inexpensive strategy for patients who underwent coronary artery bypass and are in phase II cardiac rehabilitation. [37]

(2011) Meral Bosnak-Gucul, et.al. in their study "Effect of Inspiratory muscle training in patient with Heart Failure" concluded that The IMT improves functional capacity and balance, respiratory and peripheral muscle strength; decreases depression and dyspnea perception in patients with heart failure. IMT should be included effectively in pulmonary rehabilitation programs. [38]

(2009) Paulo Eduardo Gomes Ferreira, et.al. in their study "Effect of an inspiratory muscle rehabilitation program in the post - operative period of cardiac surgery" concluded that our domiciliary program of inspiratory muscle training was safe and improved the forced vital capacity and the maximum voluntary ventilation, although the clinical benefits of this program were not clearly demonstrable in the present study. [39]

(2006) Pedro Dall'Ago, et.al. in their study "Inspiratory muscle training in patients with heart failure and inspiratory muscle weakness" concluded that in patients with CHF and inspiratory muscle weakness, IMT results in marked improvement in inspiratory muscle strength, as well as improvement in functional capacity, ventilatory response to exercise, recovery oxygen uptake kinetics, and quality of life. [40]

(2001) Hildegard Sanchez Riera MD, et.al. in their study "Inspiratory Muscle Training in Patients With COPD: Effect on Dyspnea, Exercise Performance, and Quality of Life" concluded that We conclude that targeted IMT relieves dyspnea, increases the capacity to walk, and improves HRQL in COPD patients. [41]

The current study is very unique, so we can do a lot in future. This study was conducted for a short period of time and with small sample size; future research involving long time period and larger sample size is also possible. The result of this study will help the physiotherapist to choose that the Inspiratory muscle training is best for stabilizing the vitals and improve cardio – vascular endurance in over - weight collegiate students.

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