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The Effect of Pursed - Lip Breathing Exercise Vs Diaphragmatic Breathing in Stabilizing the Vitals after 6-MWT among Overweight Individuals

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Abstract: ***When you exercise and your muscles work harder, your body uses more oxygen and produces more carbon dioxide. To cope with this extra demand, your breathing has to increase from about 15 times a minute (12 litres of air) when you are resting, up to about 40–60 times a minute (100 litres of air) during exercise. Your circulation also speeds up to take the oxygen to the muscles so that they can keep moving. Any kind of exertion causes some change in vitals. Some amount of fluctuation in vitals after any kind of exertion occurs in every individual and is considered to be normal. But if there is extreme fluctuation in vitals even after mild or moderate form of exertion, it indicates some kind of abnormality or an increased stress on cardiovascular or respiratory system and needs attention.In any case if the vitals fluctuate during any kind of exertion it needs to be stabilized so that its harmful effects can be avoided. For these breathing exercises have been proven to be very beneficial. There are several types of breathing exercises such as deep breathing, diaphragmatic breathing, pursed lip breathing, etc. The need for the study is to compare the effectiveness of Pursed-Lip Breathing & Diaphragmatic Breathing exercise instabilizing the vitals after 6 MWT in young individuals. The objective of this study is to measure the exertion level of the individual, to assess the effect of pursed lip and diaphragmatic breathing exercises on vitals after exertion and also the comparison of both techniques. In the present study we took 60 subjects from saaii college, Kanpur. Method of data collection is random and study design is comparative study with study duration of 4 weeks. Subjects were divided into two equal groups. The paired samples t-test shows significant changes observed i.e., null hypothesis is rejected and alternate hypothesis is accepted and we observed that significant improvement along with effectiveness of pursed lip breathing on stabilizing vitals in overweight individuals.***

Keywords: Pursed Lip Breathing, Diaphragmatic Breathing, 6MWT, Vitals, Overweight

I. INTRODUCTION

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. The energy expenditure can be measured in kilocalories. Physical activity in daily life can be categorized into occupational, sports, conditioning, household, or other activities. Exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness. Physical fitness is a set of attributes that are either health- or skill-related. The degree to which people have these attributes can be measured with specific tests[1].

During exercise, two of the most important organs come into action: the heart and the lungs. The lungs bring oxygen into the body to provide energy and to remove carbon dioxide, the waste product created when you produce energy. The heart pumps oxygen to the muscles that are doing the exercise. Exercise induces stress on one's body by increasing heart rate and blood pressure, just to name a couple of resulting factors. The autonomic nervous system (ANS) influences the cardiovascular system through the sympathetic nervous system (SNS) and parasympathetic nervous system (PNS).

Heart rate recovery (HRR) has been used to determine the health of the cardiovascular system post-exercise. An abnormal HRR has been shown to predict, or is strongly associated with, coronary artery disease, pre-hypertension, hypertension, and all-cause mortality.BP is proportional to blood flow and resistance. During exercise BP increase in a stepwise progression along with an increase in exercise intensity in order to meet oxygen demand to the active muscles through increase in cardiac output.

When you exercise and your muscles work harder, your body uses more oxygen and produces more carbon dioxide. To cope with this extra demand, your breathing has to increase from about 15 times a minute (12 litre of air) when you are resting, up to about 40–60 times a minute (100 litre of air) during exercise. Your circulation also speeds up to take the oxygen to the muscles so that they can keep moving.[2]

Six-minute walk test is one such activity that places some amount of stress on the cardiorespiratory system. It can also be used to test the exertion level. The six-minute walk test is an objective method, to measure the ability to perform daily living activities. It is more often performed, to evaluate the functional status, monitor therapy, or assess the prognosis in patients with cardiac and pulmonary diseases.

In comparison to traditional pulmonary exercise test, 6MWT needs less technical support or equipment, making it a simple and inexpensive method to measure functional capacity. The validity and the reliability of 6MWT was studied in different conditions, including obstructive lung diseases, interstitial lung diseases, pulmonary hypertension, heart failure and peripheral arterial diseases.[3,4,5,6,7,8,9,10,11,12] The safety of 6MWT was explored in several populations. A study of 6MWT in elderly individuals and in patients with ischemic heart disease found the test to be safe, reliable and correlates with several other parameters.[13,14,15] Correlation of 6MWT and pulmonary function test measurements were seen in patients with chronic respiratory diseases.

Recovery from exercise refers to the time period between the end of a bout of exercise and the subsequent return to a resting or recovered state. It also refers to specific physiological processes or states occurring after exercise that are distinct from the physiology of either the exercising or the resting states. For example, heart rate recovery (HRR) has been used to determine the health of the cardiovascular system post-exercise. An abnormal HRR has been shown to predict or is strongly associated with coronary artery disease, pre-hypertension, hypertension and all-cause mortality. Any kind of exertion causes some change in vitals. Some amount of fluctuation in vitals after any kind of exertion occurs in every individual and is considered to be normal. But if there is extreme fluctuation in vitals even after mild or moderate form of exertion, it indicates some kind of abnormality or an increased stress on cardiovascular or respiratory system and needs attention.

While indulging any individual in any kind of physical activity that requires exertion if the vitals fluctuate more than the acceptable range with respect to the intensity of the activity, it may impose an increased burden on the cardio- respiratory system and if not brought to their normal resting state within few minutes, it may put an increased burden on the heart and lungs.

In any case if the vitals fluctuate during any kind of exertion it needs to be stabilized so that its harmful effects can be avoided. For these breathing exercises have been proven to be very beneficial. There are several types of breathing exercises such as deep breathing, diaphragmatic breathing, pursed lip breathing, etc. When you breathe slowly your heart rate starts to synchronize to the rhythm of your breathing and your body sends a message to your brain which helps to calm down the body and brings down the vital to their normal resting Level.[16]

Diaphragmatic breathing is relaxing and therapeutic, reduces stress, and is a fundamental procedure of Pranayama Yoga, Zen, transcendental meditation and other meditation practices. Analysis of oxidative stress levels in people who meditate indicated that meditation correlates with lower oxidative stress levels, lower cortisol levels and higher melatonin levels. It is known that cortisol inhibits enzymes responsible for the antioxidant activity of cells and that melatonin is a strong antioxidant; therefore, in this study, we investigated the effects of diaphragmatic breathing on exercise-induced oxidative stress and the putative role of cortisol and melatonin hormones in this stress pathway. [17]

Purse-lip breathing is a technique that allows people to control their oxygenation and ventilation. The technique requires a person to inspire through the nose and exhale through the mouth at a slow controlled flow. The expiratory phase of respiration is going to prolong when compared to inspiration to expiration ratio in normal breathing. The maneuver presents as a controlled breath directed through the nostril then exhalation directed through lips having a puckered or pursed appearance. This technique creates a back pressure producing a small amount of positive end-expiratory pressure (PEEP). During exhalation, the forces cause the airways that lack cartilage to drag inward towards the lumen obstructing airflow by increasing airway resistance which could lead to carbon dioxide trapping.[13]When there is an increased in carbon dioxide levels the central chemoreceptor's are triggered to immediately increase the rate of respiration in an attempt to bring the body's pH back to a baseline range of roughly 7.4 in a normal individual.[18,19]While the increase in the rate of respiration is effective in clearing carbon dioxide, it can potentially cause more air trapping and fatigue of the respiratory muscles.[20] PEEP mitigates the increase in work by creating an artificial splint that supports the patency of the airways and alveoli, increasing surface area and recruiting more alveoli to participate in gas exchange.[21]

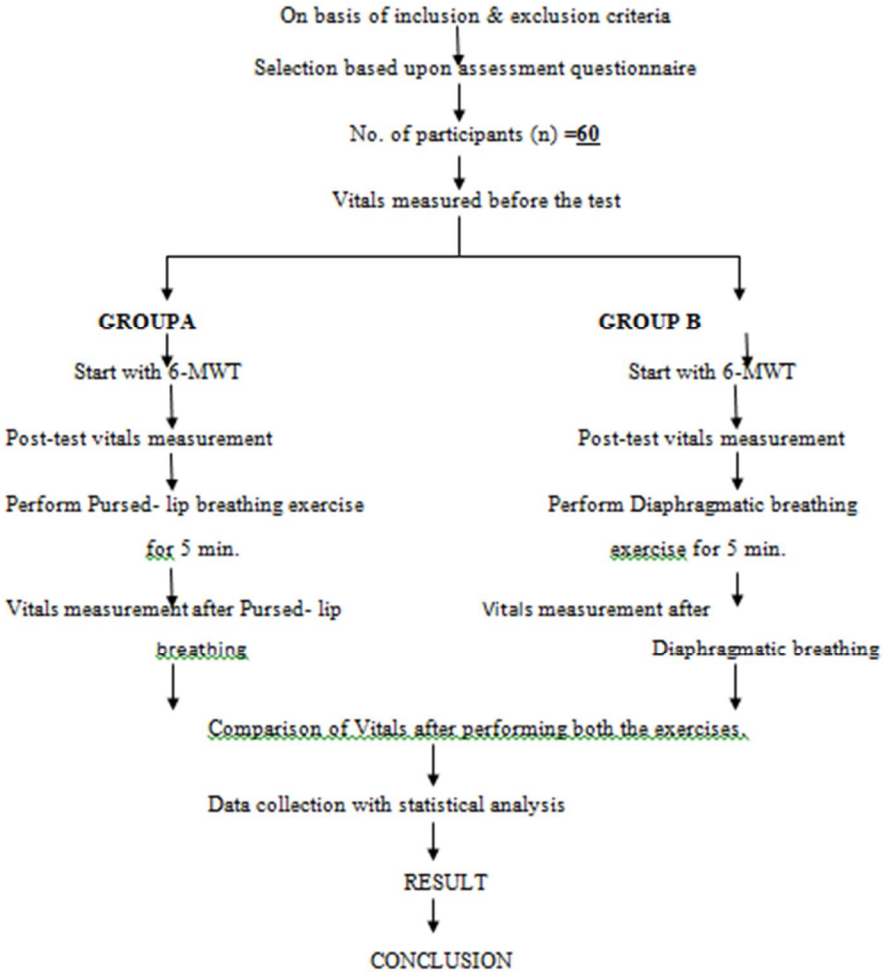
Breathing exercises are manual techniques commonly used in clinical practice. They can affect breathing patterns and thoracoabdominal movement, prioritize one compartment of the chest wall (CW) over another, and change the degree of participation of the respiratory muscles.[27] Breathing practice, also known as "diaphragmatic breathing" or "deep breathing," is defined as an efficient integrative body–mind training for dealing with stress and psychosomatic conditions.

Diaphragmatic breathing involves contraction of the diaphragm, expansion of the belly, and deepening of inhalation and exhalation, which consequently decreases the respiration frequency and maximizes the amount of blood gases.[28]It helps you relax, lowering the harmful effects of the stress hormone cortisol on your body.It lowers your heart rate.It helps lower your blood pressure.It helps you cope with the symptoms of post-traumatic stress disorder (PTSD).It improves your core muscle stability.It improves your body's ability to tolerate intense exercise. Pursed lip breathing (PLB) is a breathing technique in which air is inhaled slowly through nose (as smelling a rose), keeping the mouth closed and exhaled slowly through mouth by lips holding in a pursed manner (as blow out a candle).[29]Improve gas exchange (both oxygen and carbon dioxide). Slow the rate of expiration.

Increase the volume of expired air. Limit dynamic hyperinflation during periods of increased ventilatory demand, including daily activities and exercise. Decrease the respiratory rate and minute ventilation. Increase tidal volume, and reduce the work of breathing. Relieve dyspnea and increasing exercise tolerance. The 6MWT evaluates the global integrated response of all the bodily systems involved during exercise, including the pulmonary system, cardiovascular system, systemic and peripheral circulation, blood, neuromuscular and muscle metabolism.[30] Lung transplantation, Lung resection, Lung volume reduction surgery, Pulmonary rehabilitation, COPD, Pulmonary hypertension Heart failure. Contraindications of six-minute walk test-Unstable angina, Myocardial infarction during the previous month, A resting heart rate of more than 120, A systolic blood pressure of more than 180mmHg, A diastolic blood pressure of more than 100mmHg. BMI can be measured based upon height and weight of an individual. It gives a measure of body fat. It can be calculated: -**BMI =** Weight(kg)/[Height(m)]^2. BMI Categories:Underweight = < 18.5, Normal weight = 18.5-24.9, Overweight = 25-29.9, Obesity = BMI of 30 or greater.

II. METHODOLOGY

This chapter deals with the methods used for the study. This includes the information on subject, inclusion criteria, exclusioncriteria, protocol and procedures used in this study.Source of data:Saaii College of Medical Science and Technology, chaubepur, Kanpur.Method of data collection israndom, Sample size is60 Subjects, Study Duration is4 weeks and Study design isComparative study. In inclusion Criteria is Subjects willing to participate in the study, Age is 18-30 years, Both Genders male and female can participate, BMI (body mass index) = 25-29.9(overweight), Stablevitals, Asymptomatic subject with no history of any Cardiovascular, Skeletal, Neuromuscular Disease and there is no use of Tobacco, Non-alcoholics and non-smokers in subjects.
Exclusion Criteria is Resting BP>139/89mmHg, resting heart rate >100bpm, if there is any difficulty in walking, Vertigo, Subject with underweight, normal or obese BMI, any kind of neurological disease, Asthma, Pregnant females, Individuals involved in regular exercise or sports.



Flowchart 1: represent the whole protocol of present study.

III. PROCEDURE

Subjects were selected based upon the inclusion & exclusion criteria. They were explained in detail about the type & nature of study before participation. Consent was taken by each subject before participating in the study by signing a consent form that contained all the information necessary for them about the study. Procedure was explained in detail and 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 activity prior to the test or to take any heavy meal up to 1 hour by the test. All the subject were made sure to be properly hydrated, wore comfortable clothing & comfortable footwear. Before starting the test, necessary assessment was done and vitals (BP, HR, RR, SPO_2) were measured. All the necessary data such as Age, Sex, Height, Weight and BMI were also documented. According to the **guidelines published in American Thoracic Societies,** all 6MWTs were conducted using a marked corridor 30 m in length in SCMAT.

The subjects were divided into 2 groups, GROUP **A** & GROUP **B**. Both groups **A** was asked to perform 6-MWT and participants were asked to walk back & forth along this pathway at their own best pace but not to run or race. We encouraged the participants with statements like "You are doing well" or "Keep walking, you are half way done". Subjects were allowed to stop and rest during the test but instructed to resume walking as soon as they were able to do. After completion of 6MWT, dyspnea, SBP, DBP, HR, RR, SPO_2 were measured. In 'group A', immediately after the vitals measurement, Pursed- lip breathing exercise was performed while in 'group B', Diaphragmatic breathing exercise was performed, for 5 min. After this, again vitals were measured in both groups and the difference in vitals was measured between the 2 groups to see which type of breathing exercise was better to stabilize the vitals after exertion.

IV. DATA ANALYSIS

Data was done using IBM SPSS statistics (software package used for statistical analysis 2019 version - 26). Descriptive statistical analysis was done to determine the demographic characteristics of the subjects recruited in the study; paired sample t-test used in the analysis of this study. P – value used in the stud to test hypothesis, which help in deciding whether to reject or accept 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: Showing descriptive data of Group 1: DIAPHRAGMATIC BREATHING

	N	Minimum	Maximum	Mean	Std. Deviation
Age (Years)	30	22	28	24.80	1.710
Weight (Kg)	30	61	90	74.00	7.870
Height (cm)	30	154	185	167.63	8.143
BMI	30	25	29	26.16	.781

The descriptive data of **table 1** shows average age for Group 1 participants was 24.80 years and the average weight was 74.00 Kg. The participants had an average height of 167.63 cm and correspondingly the average for Group-1 BMI was calculated to be 26.16. This reflects that average participant were in the over-weight category in Group-1.

Table 2: Showing descriptive data of Group 2: PURSED LIP BREATHING

	N	Minimum	Maximum	Mean	Std. Deviation
Age (Years)	30	22	30	25.03	1.847
Weight (Kg)	30	60	80	71.00	7.502
Height (cm)	30	151	185	164.17	8.726
BMI	30	25	29	26.32	.839

The descriptive data of **table 2** shows average age for Group 2 participants was 25.03 years and the average weight was 71.00 Kg. The participants had an average height of 164.17 cm and correspondingly the average for Group-2 BMI was calculated to be 26.32. This reflects that average participant were in the over-weight category in Group-2.

Table 3: Showing statistical data of Group 1: DIAPHRAGMATIC BREATHING

	N	Mean	Std. Deviation	df	t – value	p - value
SBP	30	10.400	3.997	29	14.253	.000
DBP	30	4.767	1.794	29	14.551	.000
HR	30	12.300	6.081	29	11.079	.000
RR	30	2.567	1.591	29	8.839	.000
SPO2	30	1.267	.450	29	15.452	.000

The **table 3** shows the statistical data of group-1 i.e.; Diaphragmatic breathing, while analyzing the group 1 data it has been found that Diaphragmatic breathing was significant in improving the vital signs. There is improvement in systolic blood pressure with Mean (±SD) of 10.400 (±3.997) and t – value was 14.253 with p – value of .000, diastolic blood pressure with Mean (±SD) of 4.767 (±1.794) and t – value was 14.551 with p – value of .000, heart rate with Mean (±SD) of 12.300 (±6.081) and t – value was 11.079 with p – value of .000, There is improvement in respiratory rate with Mean (±SD) of 2.567 (±1.591) and t – value was 8.839 with p – value of .000, There is improvement in SPO2 with Mean (±SD) of 1.267 (±.450) and t – value was 15.452 with p – value of .000. so, the table three shows that diaphragmatic breathing was significant at the 95% confidence level.

Table 4: Showing statistical data of Group 2: PURSED LIP BREATHING

	N	Mean	Std. Deviation	df	t – value	p - value
SBP	30	18.067	5.583	29	17.725	.000
DBP	30	8.600	5.654	29	8.331	.000
HR	30	12.033	5.102	29	12.918	.000
RR	30	2.500	1.757	29	7.794	.000
SPO2	30	1.300	.596	29	11.948	.000

The **table 4** shows the statistical data of group-2 i.e.; Pursed lip breathing, while analyzing the group 2 data it has been found that Pursed lip breathing was significant in improving the vital signs. There is improvement in systolic blood pressure with Mean (±SD) of 18.067 (±5.583) and t – value was 17.725 with p – value of .000, diastolic blood pressure with Mean (±SD) of 8.600 (±5.654) and t – value was 8.331 with p – value of .000, heart rate with Mean (±SD) of 12.033 (±5.102) and t – value was 12.918 with p – value of .000, There is improvement in respiratory rate with Mean (±SD) of 2.500 (±1.757) and t – value was 7.794 with p – value of .000, There is improvement in SPO2 with Mean (±SD) of 1.300 (±.596) and t – value was 11.948 with p – value of .000. so, the table three shows that diaphragmatic breathing was significant at the 95% confidence level.

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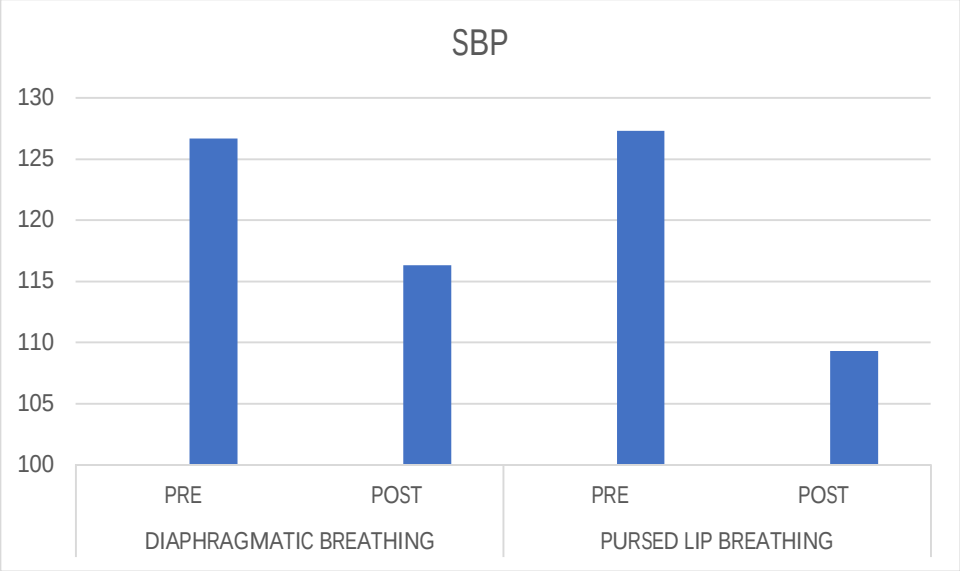
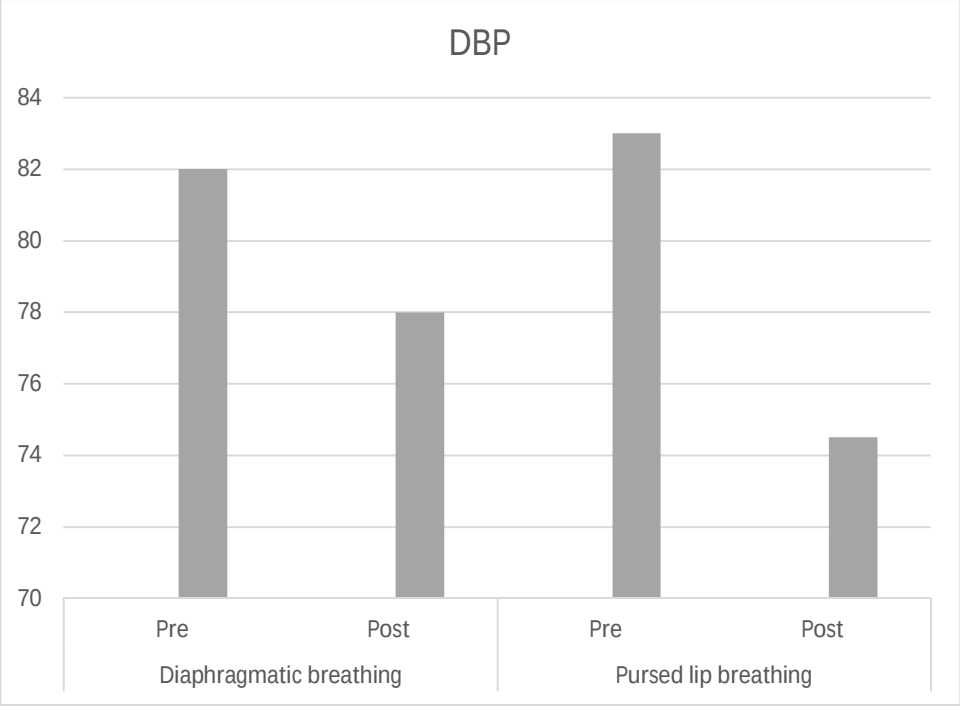
V. RESULT

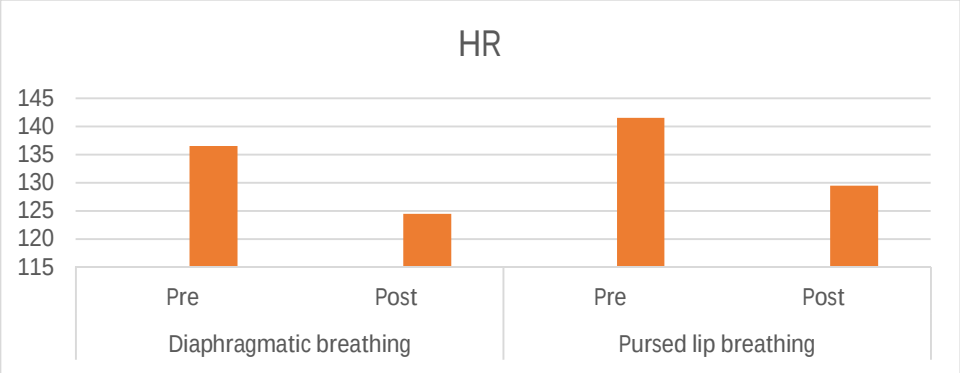
The 95% confidence level of paired samples t - test shows significant improvement i.e., null hypothesis is rejected and alternate hypothesis is accepted and we statistically observed improvement along with effectiveness of pursed lip breathing on stabilizing vitals in over weight individuals.



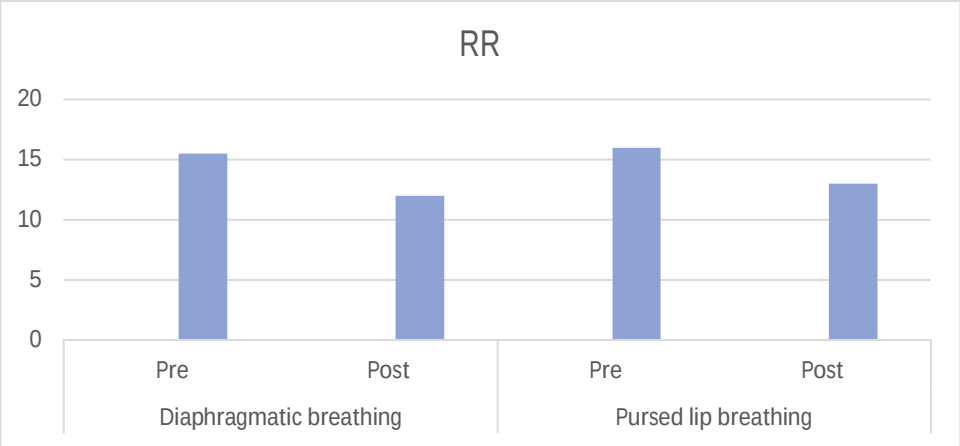
Graph – 1: show the systolic blood pressure distribution of all the study subjects of both groups i.e., Diaphragmatic breathing group & pursed lip breathing group. A finding shows SBP with Means(±SD) of 10.400 (±3.997) for diaphragmatic breathing & SBP with Means(±SD) of 18.067 (±5.583) for pursed lip breathing, which shows statistically significant difference between both groups.



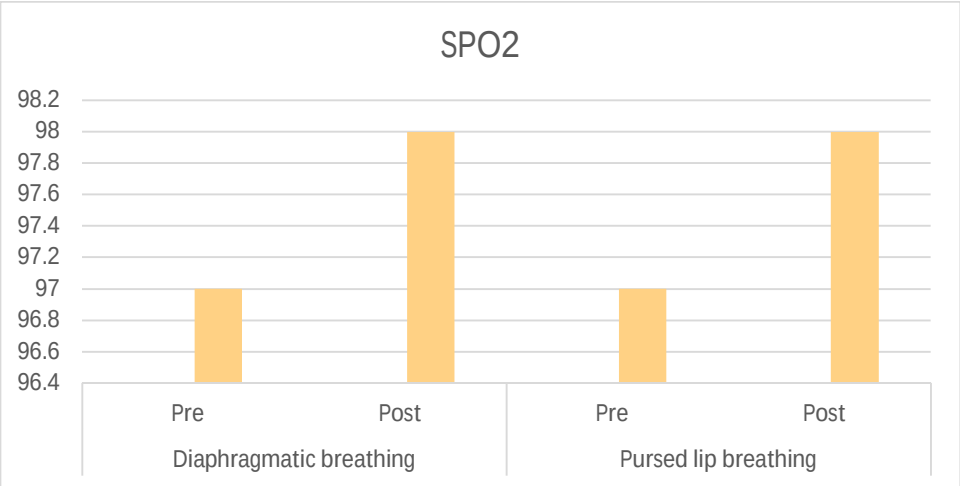
Graph – 2: show the diastolic blood pressure distribution of all the study subjects of both groups i.e., Diaphragmatic breathing group & pursed lip breathing group. A finding shows DBP with Means(±SD) of 4.767 (±1.794) for diaphragmatic breathing & DBP with Means(±SD) of 8.600 (±5.654) for pursed lip breathing, which shows statistically significant difference between both groups.



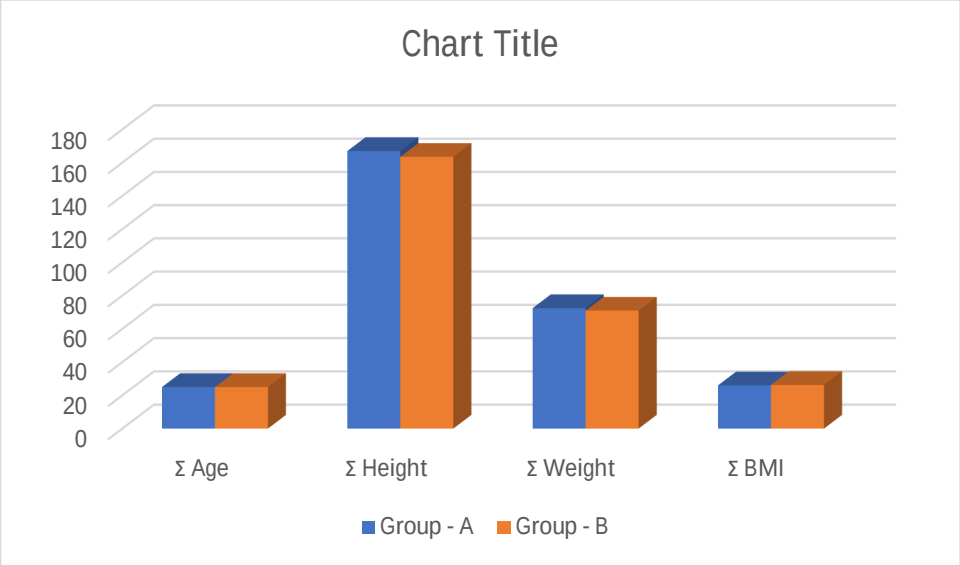
Graph – 3: show the Heart Rate distribution of all the study subjects of both groups i.e., Diaphragmatic breathing group & pursed lip breathing group. A finding shows HR with Means(±SD) of 12.300 (±6.081) for diaphragmatic breathing & HR with Means(±SD) of 12.033 (±5.102) for pursed lip breathing, which shows statistically significant difference between both groups.



Graph – 4: show the Respiratory Rate distribution of all the study subjects of both groups i.e., Diaphragmatic breathing group & pursed lip breathing group. A finding shows RR with Means(±SD) of 2.567 (±1.591) for diaphragmatic breathing & RR with Means(±SD) of 2.500 (±1.757) for pursed lip breathing, which shows statistically significant difference between both groups.



Graph – 5: show the Oxygen Rate distribution of all the study subjects of both groups i.e., Diaphragmatic breathing group & pursed lip breathing group. A finding shows SPO2 with Means(±SD) of 1.267 (±.450) for diaphragmatic breathing & SPO2 with Means(±SD) of 1.300 (±.596) for pursed lip breathing, which shows statistically significant difference between both groups.



Graph – 6: shows compare wise distribution on Age, Height, Weight & BMI of all subjects of both groups i.e., Group – A: Diaphragmatic Breathing & Group – B Pursed Lip Breathing. A finding shows no significant difference between in all four parameters among both groups.

VI. CONCLUSION

Hence, we concluded that, based on the results of this study and previous research, null hypothesis is rejected and alternate hypothesis is accepted. As per the result, it has been also concluded that Diaphragmatic Breathing and Pursed lip breathing both can used to control the vitals in over weight patients. While both the protocols were effective, there is Pursed lip breathing that statistically shows significant improvement over Diaphragmatic breathing.

VII. DISCUSSION

The present study was done to determine the efficacy of Diaphragmatic and Pursed lip breathing on stabilizing vitals. The study was done on over - weighted individuals. The pre and post effect of Diaphragmatic and Pursed lip breathing is taken with the help of stethoscope, sphygmomanometer and pulse-oximeter. There is total 60 subjects (30 subjects in each group) were recruited according to inclusion and exclusion criteria. Those who satisfied the criteria were allowed to perform the study. All total 60 subjects were successfully completed 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 both treatment protocol i.e., diaphragmatic and Pursed lip breathing were effective in stabilizing the vitals in over weight subjects. The study also represents that the average mean of both group shows that Pursed lip breathing statistically significant over the Diaphragmatic breathing.

We also found same conclusion in Shahriar Sakhaei et al., in their study The Impact of Pursed-lips Breathing Maneuver on Cardiac, Respiratory, and Oxygenation Parameters in COPD Patientsconcluded that effective PLB as an easy, inexpensive, non- invasive and non-pharmacological method is considered as an important factor in improving the status of oxygenation and physiological indicators in patients with COPD and should be considered as an important part of rehabilitation programs for these patients.[39]

Visser F.J. Et al., in their study Pursed-Lips Breathing Improves Inspiratory Capacity in Chronic Obstructive Pulmonary Diseaseconcluded that there was an improvement in IC after PLB, supporting the idea of a decreased hyperinflation in patients with severe COPD and a possibly higher collapsibility of the bronchial airways. SO_2, end-tidal pCO_2, and BF also improved. We were not able to correlate these changes with a decreased VAS dyspnea score, however.[46]

Nield, Margaret et al., in their study Efficacy of Pursed-Lips Breathing: A breathing pattern retraining strategy for dyspnea reductionconcluded that Pursed-lips breathing provided sustained improvement in exertional dyspnea and physical function.[47]

R Garrodl et al., in their study an evaluation of the acute impact of pursed lips breathing on walking distance in nonspontaneous pursed lips breathing chronic obstructive pulmonary disease patientsconcluded that PLB during exercise and recovery results in lower post exercise RR and speeds return to pre-exercise breathlessness, compared with exercise and non-PLB. Reductions in RR appear to be greatest in those patients with resting breathlessness.[49]

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 and compariing of two different intervention is also possible. The result of this study will help the physiotherapist to choose whether which intervention is best for lowering the vitals in overweight subjects.

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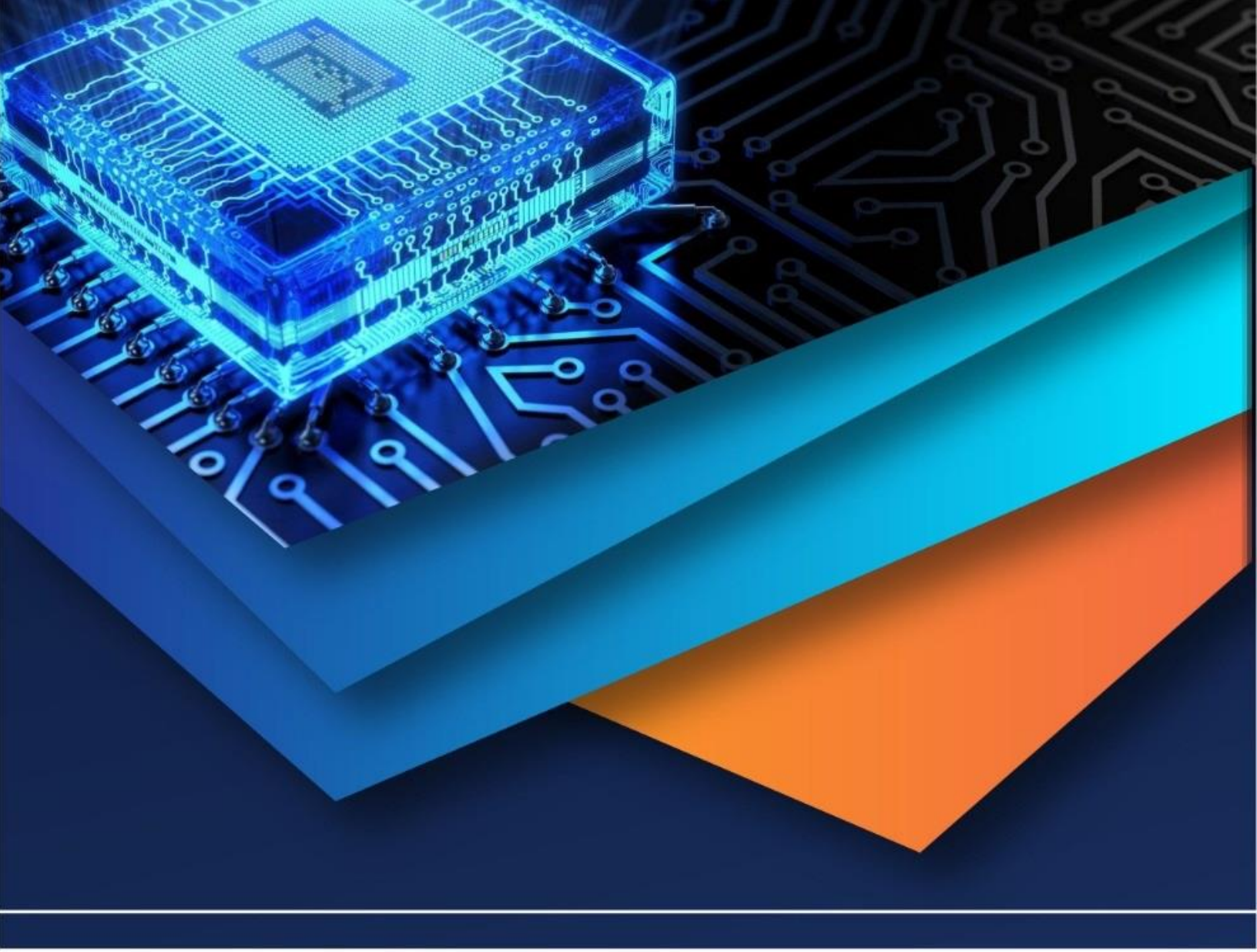

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