

Study To Check The Immediate Effect Of Pursed Lip Breathing Exercise Versus Relaxed Diaphragmatic Exercise On Heart Rate, Blood Pressure And Oxygen Saturation In Young Adults Of College Of Physiotherapy, Adesh University.

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Abstract- Objective: This study has been performed to check the immediate effect of Pursed Lip Breathing Exercise Versus Relaxed Diaphragmatic Breathing Exercise on Heart Rate, Blood Pressure and Oxygen Saturation in young healthy adults.

Method: 60 subjects both male and female were selected using random sampling method and divided into two groups (Group A and B). Pre-interventions readings of Blood Group, Heart Rate and Oxygen Saturation were taken. Subjects of Group A were instructed to perform PLBE and Group B to perform Relaxed DBE. Post-interventions readings of Blood Group, Heart Rate is taken by Digital sphygmomanometer and Oxygen Saturation by pulse oximeter (Oximeter Pulse Fingertip). Data were analyzed by student t-test.

Result: The study shows that statistically significant improvement in mean of BP (97.42 ± 98.25), HR (85.033 ± 84.93), SpO₂ (98.5 ± 99.43) in Group A. Mean of BP (93.58 ± 94.95), HR (89.83 ± 84.96), SpO₂ (98.06 ± 99.6) in Group B.

Conclusion: Hence from the result of the study, it is concluded that PLBE (Group A) is most effective technique (more significant) than Relaxed DBE (Group B).

Index Terms- Pursed Lip Breathing Exercise, Relaxed Diaphragmatic Breathing Exercise, Blood Pressure, Heart Rate, and Oxygen Saturation.

I. INTRODUCTION

Respiration is the process by which Oxygen is inhaled and Carbon dioxide is exhaled. It is a reflex process but it can be controlled voluntarily. Respiration occurs in two stages; initially inspiration during which the air enters the lungs from the atmosphere and later on expiration during which the air leaves the lungs. While passing through the lungs, the atmospheric air (inspired air) delivers oxygen to the blood into the pulmonary capillaries and in exchange, it takes away carbon dioxide from the blood.⁽¹⁾

Breathing is one of the most important and vital acts we do. It is one of the few bodily processes that can either be voluntary or involuntary. Breathing exercises can be defined as the

therapeutic intervention by which purposeful alteration of a given breathing pattern are categorized as breathing exercises.⁽²⁾ These exercises are frequently prescribed to reduce pulmonary complications after abdominal and thoracic surgeries.⁽³⁾ By traditional treatment, breathing exercises is well established in chronic lung disease, particularly where emphysema and bronchospasm are present.⁽⁴⁾

These exercises aim at assisting active expiration, teaching general physical relaxation, and increasing the efficiency of respiratory work, reduction in chest wall movement in deep respiration.⁽⁵⁾

It is known that the regular practice of breathing exercises increase parasympathetic tone, decrease sympathetic activity, improves cardiovascular and respiratory functions. It decreases the effect of stress and strain on the body and improve physical and mental health. Breathing is considered to be a regulator of the autonomic nervous system and consequently of mental processes.⁽⁶⁾ By voluntarily changing the rate, depth and pattern of breathing, the messages being sent from the body's respiratory system to the brain can be altered.⁽²⁾ Controlling the breath and thus calming the nerves is a pre-requisite to controlling the mind and the body.⁽⁶⁾

Pursed lip breathing (PLB) exercise is a type of breathing exercise that consists of two mechanisms, namely strong and deep inspiration, and active and long expiration. PLB helps the client to control the breath.⁽⁷⁾ It is a technique whereby exhalation is performed through a resistance created by constriction of the lips. Although the breathing maneuver is often spontaneously adopted by COPD patients, it is also routinely taught as a breathing-retraining exercise in pulmonary rehabilitation programs because it is thought to alleviate dyspnea and other respiratory conditions.⁽⁸⁾ PLB performed at rest promoted an increased abdominal expiratory muscle recruitment compared to control breathing.⁽⁷⁾

A pursed lip breathing prolongs exhalation thus prevents bronchiolar collapse and air trapping. It relieves shortness of breath and promotes comfort by reducing hyperventilation and increasing CO₂ levels in the alveoli. The increased CO₂ levels relaxes and dilates smooth muscles of airway, increase the ratio of

ventilation perfusion and also oxygen level in blood.⁽⁷⁾ In addition, due to healing effects of CO₂ on lung damage, gradual breathing control leads to reduction in dyspnea even in severe cases of COPD. Thus, the patient gains control over breathing, especially during exercise and at times of dyspnea.⁽⁸⁾ Pursed lip provide resistance to the air flowing out of the lungs. Thereby prolonging the exhalation and preventing airway collapse by maintaining positive pressure on the airway. CO₂ in the lung can be removed and O₂ fills more alveoli. High differences in the O₂ pressure gradient increase gas exchange in the alveoli to pulmonary capillaries.⁽⁷⁾ PLB causes the inspiratory muscles to work more optimally so that the burden on the inspiratory muscles is reduced.⁽⁸⁾

In Pursed lip breathing, subjects are positioned in a comfortable and relaxed position. Physiotherapist ask the subject to breathe in slowly and deeply through the nose and breathe out gently through lightly pursed lips as if blowing on and bending the flame of a candle but not blowing it out. It should be practiced 3 to 4 repetitions and then rest.⁽⁹⁾

PLB exercise causes decreased respiratory rate and work of breathing (oxygen consumption), also increases tidal volume (TV).⁽¹⁰⁾ Pursed lip provide resistance to the air flowing out of the lungs. Thereby prolonging the exhalation and preventing airway collapse by maintaining positive pressure on the airway.⁽⁷⁾

Increasing the amount of oxygen that moves to the pulmonary capillaries increases the amount of oxygen bound by haemoglobin and can bind SaO₂. oxygen saturation (SaO₂) is the ratio of oxygenated haemoglobin (HbO₂) thus increases the level of SaO₂.⁽⁷⁾

In Diaphragmatic breathing exercise, the subject's position should be half lying position and ask the subject to breathe in slowly and deeply through the nose while keeping the shoulder and upper chest quiet, allowing the upper chest rise slightly, ask the subject to relax and exhale slowly through the mouth. It should be practiced 3 to 4 repetitions and then rest.⁽⁹⁾

Diaphragmatic breathing exercise is a one of the relaxation technique which increases blood and oxygen flow to the brain to function in its optimal state.⁽¹¹⁾

Diaphragmatic breathing causes increased venous return to the heart. With inhalation, the diaphragm generates negative intrathoracic pressure, and blood is pulled into the thorax through a vacuum effect. This leads to increased stroke volume, which triggers arterial stretchreceptors and results in increased parasympathetic activity, and decreased sympathetic activity. These changes bring about decreased heart rate and total peripheral resistance.⁽⁶⁾

Diaphragmatic breathing increases baroreflex sensitivity and reduces sympathetic activity and chemo reflex activation. Baroreflex is the system in the body that regulates blood pressure by controlling heart rate, strength of heart contractions, and diameter of blood vessels. Deep breathing reduces the blood pressure and enhances baroreflex sensitivity, increases vagal activity and therefore decreases baseline heart rate and blood pressure. This is associated by improving vagal tone and by decreasing sympathetic discharge. Improvement in both sympathetic and parasympathetic reactivity may be the mechanism that is associated in those practicing the diaphragmatic breathing exercise.⁽⁶⁾

Diaphragmatic breathing increases blood and oxygen flow to the brain to function in its optimal state. It creates a connection between mind and body that can lead to greater self – awareness, mindfulness and clear thinking, improves circulation, which improves heart health, Energy levels and helps the body eliminate toxins, as well as reduce stress. Hence practicing diaphragmatic breathing exercise influence automatic functions and has therapeutic benefit.⁽⁶⁾

Diaphragmatic breathing causes increased tidal volume while maintaining optimal minute ventilation. The increase in tidal volume causes cardiopulmonary baroreceptor stretch which in turn leads to decreased sympathetic outflow and subsequently decreased peripheral vascular resistance.⁽⁶⁾

Diaphragmatic breathing increases heart rate variability (HRV), which is a proxy measure of the balance of sympathetic and parasympathetic influence on the heart.⁽¹⁰⁾

In all the cardiorespiratory problems and post-operative periods, the risk of pulmonary complications is highest. General anaesthesia and use of pain medication increase the risk of this complication as does extended confinement to bed. Breathing exercises initiated on the day of surgery and early standing and ambulation may reduce the risk of pneumonia or atelectasis. Also pursed lip breathing and diaphragmatic breathing exercises are commonly used in COPD and Asthma and in other respiratory condition. Hence study is undertaken to throw more light on the two physiotherapy techniques (pursed lip breathing and Relaxed diaphragmatic breathing) and their effect on BP, HR and SpO₂.⁽¹⁰⁾

II. MATERIALS AND METHODS

The present study is a pre and post interventional study, conducted on young healthy adults of college of physiotherapy, Adesh University, Bathinda. A total no. of 68 subjects were screened using the following proforma out of which 60 subjects met the inclusion criteria. The subjects were required to fulfil the following criteria to be included in the study: (1) age 18-25 years (2) Both male and female (3) participants willing to participate in the study (4) able to understand and follow simple commands. Ethical clearance from Ethical Research Committee of Adesh University was obtained prior to the commencement of the study. The purpose of the study was explained to the subjects in their language. All subjects signed an institutionally approved informed consent statement prior to data collection.

60 subjects were assigned into two groups (group A and group B). Each group consisted of equal number (30) of subjects. The subjects of group A were instruct to relax and positioned in a comfortable position so that the back and head are fully supported and abdominal wall relaxed. Then the Subjects were instruct to do PLBE by inhaling through the nose for two counts, keeping mouth closed. Then the subjects were asked to pursue their lips, and breathe out (exhale) slowly and gently through pursed- lips while counting to four. The intervention was applied for 3 to 4 times and then rest (for one minute), five sets were applied in a treatment session. Post-exercise readings will be taken [Pulse Rate (bpm), Oxygen saturation (%) and blood pressure (mmHg)].

The subjects of group B were instruct to relax and positioned in a comfortable position so that the back and head are fully supported and abdominal wall relaxed. Then the subjects

were asked to breathe in slowly and deeply through the nose, relax the shoulder and upper chest quiet following the abdomen to rise. Then the patient was instructed to slowly let all the air out through the mouth. . The intervention was applied for 3 to 4 times and then rest (for one minute), five sets were applied in a treatment session. Postexercise readings will be taken [Pulse Rate (bpm), Oxygen saturation (%) and blood pressure (mmHg)].

STATISTICAL ANALYSIS: Data were analyzed by student t-test (unpaired t-test). All data were expressed as mean±SD.

III. RESULTS

To assess the outcome measures of BP, HR and SpO2 in group A and group B. Unpaired t- test was used to compare the pre post values of BP, HR and SpO2. The calculated p-value for BP,HR and SpO2 was less than the table value when compared at 0.05% level of significance (df-29) .

Group A	MEAN	SD	P-VALUE
BP(PRE)	97.42	10.53	0.06403
BP(POST)	98.25	15.13	
HR(PRE)	85.033	11.53	0.477294
HR(POST)	84.93	12.13	
SpO2(PRE)	98.5	1.02	0.000323
SpO2(POST)	99.43	0.84	

Table 1.1: showing pre and post comparison of BP, HR and SpO2 values following exercise program of group A.

Group B	MEAN	SD	P-VALUE
BP(PRE)	93.58	9.24	0.277066
BP(POST)	94.95	11.04	
HR(PRE)	89.83	14.11	0.015454
HR(POST)	84.96	13.65	
SpO2(PRE)	98.06	2.17	0.000512
SpO2(POST)	99.6	0.61	

Table1.2: showing pre and post comparison of BP,HR and SpO2 values following exercise program of group B.

READINGS	GROUP A	GROUP B
SPO2(P-value)	0.000323	0.000521
BP(P-value)	0.06403	0.277.66
HR(P-value)	0.477294	0.015454

Table 1.3: showing The Comparison between the p values of group A and group B

IV. DISCUSSION AND CONCLUSION

The aim of the study was to examine the effect of PLBE and DBE technique on BP, HR, and SPO2 in 60 healthy individuals. Then pre and post intervention, readings were taken and compared to see the effectiveness of Group A and Group B. Findings of this

study revealed that there was statistically significant differences of HR, BP and SpO2 before and after PLBE and DBE. After the comparison between the Group A and Group B, it could be said that Group A is having stastically more significant difference of BP and SPO2 and Group is having statistically more significant difference of HR then the Group A.

This study is in line with the study of Budiono, Mustayah and Aindrianingsih indicated that the provision of PLBE has a significant differences of oxygen saturation before and after the exercise in COPD patients. Hence the result of this study support the current study because current study result shows that practicing PLBE has a significant differences of oxygen saturation before and after the exercise.

A study conducted by Ramos EMC, Vanderlei LMC et al. which indicate that practicing PLBE Produces changes in the RR, HR and SPO2 but not alter BP significantly .Hence the result of this study partially support the current study because current study result that practicing PLBE the HR is decreased, BP and SPO2 is increased . The possible mechanism behind the effectiveness of PLBE is that this kind of exercise improves the lung mechanics by prolonging the exhalation that increases the amount of trapped carbon dioxide and increase the transport of oxygen, so that the medulla oblongata is not stimulated to increase the effort of breathing because there has been a balance of gas homeostasis in the body, and this will stabilize the respiratory pattern to be effective. Through a strong and deep inspiration mechanism, PLBE helps increase the intake of O2 into the alveoli .The high O2 pressure in the alveolus compared with the O2 pressure in the alveolus compared with the high pressure of CO2 in the pulmonary capillaries, lead to increased gradient pressure of the gases between the two sides. The difference of high CO2 pressure also increases the gas exchange of CO2 diffusion from the pulmonary capillaries to the alveolus for subsequent expulsion into the atmosphere .Increasing the amount of that moves to the pulmonary capillaries increases the amount of oxygen bound by Hb and can bind the oxygen saturation. Hb is a component of red cells, which the increased number of red blood cells, which the increased number of red blood cells will automatically increases Hb levels.

A study conducted by Dr.Labiba Abd El-Kader Mohamed, Dr.Naglaa Fawzy Hanafy and Dr.Amel Gonna Abd El-Naby indicates that practicing slow deep breathing exercises decreases the systolic and diastolic BP as well as HR of patient with essential hypertension. Hence the result of this study partially support the current study because current study result that practicing DBE the HR is decreased but BP is increased. Similar findings were supported by study conducted on healthy individuals by tharion at al. in which there is also significant decrease in HR. The possible mechanism behind the effectiveness of DBE is that, this kind of exercise increases baroreflex sensitivity, which is a system in the body that regulates blood pressure by controlling heart rate, strength of heart contractions and diameter of blood vessels and reduces sympathetic activity and chemo reflex activation. It improves vagal activity and therefore decreases HR and BP. This is associated by improving vagal tone and decreasing sympathetic discharge .Improvement in both sympathetic and parasympathetic reactivity may be the mechanism that is associated in those practicing deep breathing.

After applying both the interventions, group A is compared with group B and hence the result of the two studies, it is concluded that PLBE is most effective technique (more significant) than Relaxed DBE.

CONFLICT OF INTEREST: None

REFERENCES

- [1] Sembulingam K, Sembulingam P. Essentials of medical physiology. JP Medical Ltd; 2012 Sep 30.
- [2] Subin Solomen, Pravin Aaron. Breathing techniques- A review, International Journal of Physical Education, Sports and Health 2015; 2(2): 237-241.
- [3] Yokogawa M, Kurebayashi T, Ichimura T, Nishino M, Miaki H, Nakagawa T. Comparison of two instructions for deep breathing exercise: non-specific and diaphragmatic breathing. Journal of physical therapy science. 2018; 30(4):6148.
- [4] McNeill RS, McKenzie JM. An assessment of the value of breathing exercises in chronic bronchitis and asthma. Thorax. 1955 Sep; 10(3):250.
- [5] Sinclair JD. The effect of breathing exercises in pulmonary emphysema. Thorax. 1955 Sep; 10(3):246.
- [6] Mohamed LA, Hanafy NF, El-Naby AG. Effect of slow deep breathing exercise on blood pressure and heart rate among newly diagnosed patients with essential hypertension. J Educ Pract. 2014; 5(4):36-45.
- [7] Budiono B, Mustayah M, Aindrianingsih A. The effect of pursed lip breathing in increasing oxygen saturation in patients with chronic obstructive pulmonary disease in internal ward 2 the general hospital of Dr. R. Soedarsono Pasuruan. Public Health of Indonesia. 2017 Sep 19; 3(3):117-23.
- [8] Spahija J, de Marchie M, Grassino A. Effects of imposed pursed-lips breathing on respiratory mechanics and dyspnea at rest and during exercise in COPD. Chest. 2005 Aug 1; 128(2):640-50.
- [9] Shine G, Saad S, Nusaibath S, Shaik AR, and Padmakumar Comparison of effectiveness of diaphragmatic-breathing and pursed lip expiration exercises in improving the forced expiratory flow rate and chest expansion in patients with bronchial asthma. International Journal of Physiotherapy. 2016 Jan 1; 3(2):154.
- [10] Carolyn kisner, Lynn Allen Colby. Therapeutic exercise (Foundation and Techniques), 5th edition 2013.
- [11] Janet KS, Gowri PM. Effectiveness of deep breathing exercise on blood pressure among patients with hypertension. Int J Pharma Bio Sci. 2017; 8(1):B256-60.

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