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RESEARCH ARTICLE

TO COMPARE THE EFFICACY OF PURSED LIP BREATHING AND BUTEYKO BREATHING TECHNIQUE TO REDUCE THE SYMPTOMS OF EXERCISE INDUCED ASTHMA IN OBESE CHILDREN

***Megha V Chavda and Hetshri M Shah**

Assistant Professor, Ashok & Rita Patel Institute of Physiotherapy, Changa -388421 Anand, Gujarat

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ABSTRACT

Background: Asthma is one of the commonest chronic childhood illness. Childhood obesity forms a link between adult obesity and cardio-vascular risk. Exercise-induced asthma is defined as an intermittent narrowing of the airways, demonstrated by a decrease in some measure of flow, that the patient experiences as wheezing, chest tightness, coughing and difficulty in breathing that is triggered by exercise.

Objective: Objective is to compare the effectiveness of Pursed Lip Breathing (PLB) and Buteyko Breathing Technique (BBT) in reducing the symptoms of Exercise Induced Asthma (EIA) in obese children.

Method: 50 subjects ,diagnosed as Exercise Induced Asthma by paediatrician were randomly selected in to two groups – group A and group B. Group A was treated with pursed lip breathing and group B was treated with Buteyko breathing technique for period of one week. Both the groups were given a common exercise program of chest mobilization with upper limb PNF pattern. Prior to the treatment both the subjects were given relaxation for 5 minutes. Outcome measures of peak expiratory flow rate and paediatric asthma diary scale were taken on 0, 3rd and 7th day. Data was analysed by independent sample t test (SPSS version 21.0)

Result: Group B (Buteyko breathing technique) exhibited more improvement in PEFR 70 l/min than group A (Pursed lip breathing) 67.6 l/min. The mean difference of PAD in day time symptoms in group A and group B was 19.47% and 28% respectively, whereas the mean difference in night time awakening symptoms in group A and group B 18.93% and 26.67% respectively.

Conclusion: In this study the patients were treated with pursed lip breathing and Buteyko breathing technique respectively. Both of this exercise are statistically significant in reducing the symptoms but Buteyko breathing technique shows more clinical improvement when compare with pursed lip breathing technique.

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INTRODUCTION

Asthma is one of the commonest chronic childhood illness. The prevalence of both obesity and asthma have clearly increased in recent decades. (Mohammad Reza, 2011) Childhood obesity forms a link between adult obesity and cardio-vascular risk. Obesity is associated with large number of changes in physiology that may mediate the relation of obesity with asthma (Frank *et al*., 2003) several mechanisms have been established that could justify the increase in obesity. Obesity is associated with various co-morbidities that could increase asthma symptoms such as gastro esophageal reflux disease (GERD) and obstructive sleep apnoea syndrome (OSAS). (Gonzalez-Barcalaa *et al*., 2013) On the other hand, some regions of the human genome, such as chromosomes 5, 6, 11 and 12, are associated with both asthma and obesity. (Rabec *et al*., 2011) Obesity restricts mechanical conditions of the respiratory system, reducing chest wall compliance, increasing respiratory effort and altering lung elastic retraction (Gonzalez-Barcala *et al*., 2007) The study done in urban and rural children in Tamil Nadu in the age group of (6 – 12) years reported 18% prevalence of wheeze. The mean prevalence was 7.24 ±5.42. In a recent study carried out in Delhi 11.9% of the school children in the age group of 5 – 16 years had current bronchial asthma (Ranabir Pal *et al*., 2009)

Exercise-induced asthma (EIA) is defined as an intermittent narrowing of the airways, demonstrated by a decrease in some

Corresponding author: Megha V Chavda,
Assistant Professor, Ashok & Rita Patel Institute of Physiotherapy, Changa -388421 Anand, Gujarat.

measure of flow, that the patient experiences as wheezing, chest tightness, coughing and difficulty in breathing that is triggered by exercise (Weiller *et al*., 1996). It is commonly seen in children due to their greater participation in sports activities. This is mainly because the child tends to breathe quickly, shallowly and through mouth. The air that reaches the lungs is cold and dry as it misses the warming and humidifying effects of nasal breathing (Henry milgrom *et al*., 1999). The diagnosis of EIB is established by changes in lung function provoked by exercise, not on the basis of symptoms. The airway response is expressed as the percent fall in FEV1 from the baseline value. The difference between the pre-exercise FEV1 value and the lowest FEV1 value recorded within 30 minutes after exercise is expressed as a percentage of the pre-exercise value. The criterion for the percent fall in FEV1 used to diagnose EIB is >10%. The severity of EIB can be graded as mild, moderate, or severe if the percent fall in FEV1 from the pre-exercise level is ≥10% but <25%, ≥25% but < 50%, and >50%, respectively (Jonathan *et al*., 2013).

Pursed lip breathing Pursed lip breathing is an excellent "Rescue Technique" for acute dyspnoea due to chronic obstructive pulmonary disease, emphysema and asthma (Kisner and Colbey, 3rd edition). In most obstructive conditions, on expiration, a dynamic bronchial compression and collapsing of airways takes place. Pursed lip breathing imposes a slight obstruction to expiration by mouth. This generates back pressure throughout the airways and helps to properly open the airways and assist the emptying of lung. Due to prolonged and relaxed expiration, pursed lip breathing causes less air trapping which results in reduction of hyperinflation. Pursed lip breathing decreases the respiratory rate, minute volume and partial pressure of carbon dioxide in arterial blood and increases tidal volume and partial pressure of oxygen (Gail Dechman *et al*., 2013). Where as in pursed lip breathing, rib cage and accessory muscle recruitment increases during inspiration and expiration. It also increases recruitment of abdominal muscles during expiration. Pursed lip breathing causes no change in pressure across the diaphragm and thus results in a less fatiguing breathing pattern of the diaphragm. Pursed lip breathing causes a reduction in dyspnea sensation due to these alterations in the pattern of respiratory muscle recruitment (Roberto Bianchi *et al*., 2014) 17 Breathing training programmes can be effective in improving patient-reported outcomes such as symptoms, quality of life and psychological impact and may reduce the use of rescue bronchodilator medication in asthmatics (Bruton and Thompson, 2011).

Buteyko breathing technique Buteyko breathing technique was developed in Russia by Konstantin Buteyko and is based on the belief that asthma is caused by hyperventilation and hypocapnea. This can be cured in most of the patients using special breathing techniques to reduce the minute ventilation(S Cooper *et al*., 2003). Buteyko theorized that asthma is made worse by hyperventilation or over breathing. Buteyko breathing technique is based on Bohler‟s effect where presence of carbon dioxide decreases the affinity of haemoglobin to oxygen and enhances further release of oxygen to the tissue and vital organs. Hence hyperventilation in asthmatics leads to reduction in the blood and alveolar carbon dioxide levels and strengthens the bonds between haemoglobin and oxygen. This causes oxygen deficiency in the tissues and vital organs. Carbon dioxide is bronchodilator of the lung and in asthmatics, body compensates for hypo-capnea with corrective mechanisms to limit the release of carbon dioxide. This is due to tightening of bronchial muscles and production of excess mucus in the airways. These are well known symptoms of asthma. The Buteyko breathing technique helps to reduce hyper-inflation through the periods of controlled reduction in breathing known as "slow breathing" or "reduced breathing". This combined with periods of breath holding, known as "control pause" and "extended pause". Buteyko breathing technique also includes advice on benefits of nasal breathing over oral breathing. The patients are encouraged to breathe through the nose during the day and to try "tapping" the mouth at night (Robert *et al*., 2008). This technique reduces hyperventilation, improves quality of life and reduces the use of Beta-2 agonists in asthmatics. Chest mobilization exercises combine active movements of the trunk or extremities with deep breathing. They are designed to maintain or improve mobility of the chest wall, trunk, and shoulder girdles when it affects ventilation or postural alignment. Chest mobilization exercises are also used to reinforce or emphasize the depth of inspiration or controlled expiration. In asthma, lung hyperinflation increases the volume of air remaining in the lung and reduces elastic recoil, thus giving rise to air trapping, which results in alveolar hypoventilation. Poor biomechanics of chest movement and weak respiratory muscles affect respiratory ventilation. To solve inefficient ventilation from thoracic pump dysfunction- thoracic mobility exercise or mobilization techniques can be performed. The mechanism of chest mobilization technique -increases the length of the intercostal muscle and therefore helps in performing effective muscle contraction. Maximal relaxed recoiling of the chest wall helps in achieving effective contraction of each intercostal muscles. Thus, chest mobilization using breathing, respiratory muscle exercise or function training allows clinical benefit in chronic lung disease, especially COPD with lung hyperinflation. 23 Chest mobilization along with upper limb PNF pattern also helps in reducing the use of accessory muscle. Upper limb activities commonly require unsupported arm exercise such as upper limb PNF pattern, which poses a unique challenge for patient with COPD whose upper limb muscles may also be required to act as accessory muscles of respiration. During chest mobilization along with upper limb PNF pattern exercise, the participation of accessory muscles of ventilation decreases and there is a shift of respiratory work to the diaphragm (Jennifer A prayor and S Ammani Prasad 4th Edition). Till date there are many studies that show the comparison of pursed lip breathing either with yoga or with placebo treatment, whereas Buteyko breathing technique is also compared with the yoga and other breathing techniques. Much evidence are available that support the pursed lip breathing but very less evidences are there that show the effect of Buteyko breathing technique till date. No such evidences are available that show the comparison of Pursed Lip Breathing and Buteyko Breathing Technique in asthmatic children.

Null and alternate hypothesis for this study is:

Null hypothesis: There is no difference between pursed lip breathing and buteyko breathing technique in reducing the symptoms of exercise induced asthma in obese children.

Alternative hypothesis: There is a difference between pursed lip breathing and buteyko breathing technique in reducing the symptoms of exercise induced asthma in obese children.

MATERIALS AND METHODS

Total 50 subjects diagnosed with exercised induced asthma in Anand district, Gujarat, India were screened by taking inclusion and exclusion criteria in consideration. The inclusion criteria was: Subjects with the age group of 6-12 years, diagnosed with exercise induced asthma (EIA) by paediatrician, Both genders, Children with BMI >95th percentile (Kayoung Lee *et al*., 2009), Subjects on regular medication such as bronchodilator, corticosteroids, Subjects with mild to moderate asthma., Subjects with Peak Expiratory Flow Rate (PEFR) or Forced Expiratory Volume in one second (FEV1) more than 15% after exercise., Hemo-dynamically stable subjects. Exclusion criteria were: Severe persistent asthma, change of medication in preceding 4 weeks, history of any cardiovascular pathology, subjects with pleural disorder, subjects with active lung infections like tuberculosis, pneumonia, orthopaedic conditions such as deformities of chest wall, trauma to the chest wall or lower limb. All the subjects who were ready to participate and fit for the study were informed about the procedure and purpose of the study and written consent was taken approved by ethical committee of the university (ARIP) from each subject prior to the study. The pre-treatment baseline assessment was done on 0^{th} day, 3^{rd} and 7^{th} day by the investigator. The subjects were randomly allocated on the basis of close envelope lottery method into two equal groups that is GROUP A (pursed lip breathing technique group), GROUP B (Buteyko breathing technique group).

Flow chart of the procedure

Treatment protocol

GROUP A (Pursed lip breathing technique group)

Prior to the treatment subjects were given relaxation for 5 minutes. The subjects were given comfortable semi-fowler's position with a pillow placed below his/her knees. Subject's abdominal muscles were checked for any contractions during the technique. The subjects were instructed to inhale through the nose slowly and deeply with the mouth closed and then exhale roughly twice as long as inhalation with pursed lips (Butron, 2005). Each section last for 15 minutes and one session/day for 7 day.

GROUP B (Buteyko breathing technique)

Subjects were in sitting position with his or her nose pinched with his/ her thumb and forefingers. The subjects with the nose pinched and mouth close were asked to do nodding of the head until they could not hold their breathing any longer. They were asked to stop at that point. The therapist then place a figure just below the subjects nose to ensure shallow nasal breathing after a few minutes. Once they feel comfortable they were asked to continue nodding of head from where they stopped. The therapist noted the pulse rate before and after each session (Denise Esteves *et al*., 2000). Each session last for 15 minutes and one session/day for 7 days.

Common exercise programme for both groups

Both groups received a common exercise programme that consists of chest mobilization using upper limb proprioceptive neuromuscular facilitation (PNF) pattern. Subjects were in upright sitting position. While sitting in a chair, have the patient reach with both arms overhead (180- bilateral shoulder flexion and slight abduction) during inspiration and then bend forward at the hips and reach for the floor during expiration (Butron, 2005).

Outcome measures

Paediatric asthma dairy score (Nancy C Santanello Glenn Davies *et al*., 1999):

Minimal clinically important difference (MCID) still not established. But for this study 20% difference from base line was considered as an improvement. For PAD, It consists of two domains:

1) Daytime asthma symptom scale
2) Night time awakening scale

The daytime asthma symptom scale consist of three questions scored on a 6 points scale form 0 (symptoms none of the time, no bother and effect on daily activities at any time) to 5(symptoms all of the time, greatest bother possible and effect on activities all the time).40 The nocturnal diary included single question scored on a 4 point scale form 0 (no awakening) to 3 (awake all night).40

Peak Expiratory Flow Rate

Minimal clinically important difference (MCID) for PEFR was established 18.8 L/min as an improvement from base line(Cecilia *et al*., 2008). Subject should perform the test in standing position holding the mini wright peak flow meter horizontally without interfering with the movement of the marker (arrow) or covering the slot. He or she was asked to take deep breath then exhale it by forceful expiration as fast as possible after maintaining air tight seal between lip and mouth piece of the instrument. Reading was taken by keeping the instrument horizontal position (Silverman *et al*., 1972).

Data analysis

The response variables were found to be consistent with a normal distribution, so parametric statistics were used. Means, standard deviations, and 95% confidence intervals were calculated for all outcome measures and p value $< .05$ considers as significant level. Comparisons of groups at baseline and after 3^{rd} and 7^{th} day were conducted with independent sample t test and data were analysed in SPSS Version 21.

RESULTS

Mean difference of Paediatric asthma diary between the groups

The Table 1 showes the gender distribution among 50 subjects who participated in the study. There were 14 males (56%) and 11 females (44%) in group A whereas 15 males(60%)and 10 females (40%)in group B. The mean age of 25 subjects in group A was 10.72± 1.69 and the mean age in group B was 10.47±2.40.

The graph 2 showed mean difference of PEFR between the groups. In group A mean difference of PEFR was 67.6 l/min from baseline and in group B was 70 l/min. Both groups had more mean difference than established MCID (18.8 l/min).

But group B shows more clinical significance of treatment than group A. And table also shows statistical significance with p value < 0.05 in both the groups.

Gender distribution

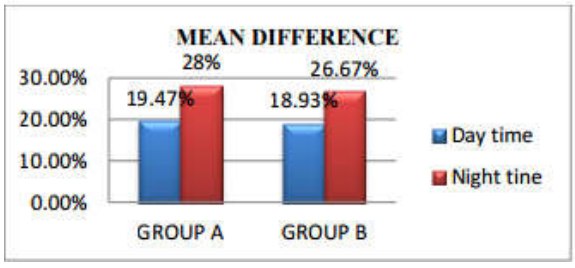
Gender	Group A	Group B
Male	14	15
Female	11	10
Total	25	25

Analysis of Paediatric asthma diary between groups

	Groups	Mean±SD	Mean difference	Paired difference 95% confidence interval of the difference Lower	Upper	Sig.(2tailed)
PAD-day time symptoms	A	4.16±2.26	-1.040	-2.205	0.125	0.079
	B	5.20±1.80				
PAD-night time awakening symptoms	A	0.44±0.58	-0.400	-0.702	-.098	0.010*
	B	0.84±0.47				

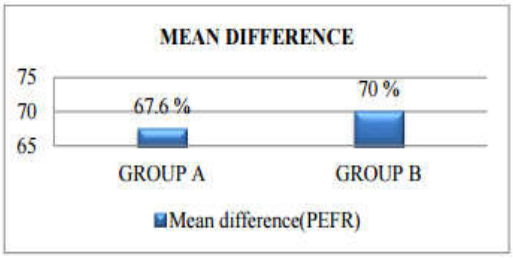
Analysis of peak expiratory flow rate between groups

	Groups	Mean ±SD	Mean difference	Paired difference 95% confidence interval of the difference Lower	Upper	Sig.(2tailed)
Peak Expiratory Flow Rate (l/min)	A	298.80±20.88	20.8	7.85	33.74	.02*
	B	278.00±24.29				



Graph 1

The graph 1 showed mean difference of between the groups. In group A mean difference in day time symptoms was 19.47% and for night time was 28%. In group B mean difference in day time was 18.93% and for night time 26.67%. Both groups has more mean difference in night time than day time symptoms MCID(20%), which showed clinical significance of treatment which reduces night time awakening symptoms.



Graph 2

DISCUSSION

Efforts were made in this study to examine the results of Pursed Lip Breathing and Buteyko Breathing Technique as a treatment approach for reducing symptoms of EIA in obese children. The study was conducted in 50 subjects diagnosed with EIA by physician, for duration of one week. The subjects were divided in to two groups consisting of 25 subjects in each group. Group A was given pursed lip breathing and Group B was given Buteyko Breathing Technique. Both the groups were given common exercise programme for 3 days in week. Common exercise was chest mobilization using upper limb Proprioceptive Neuromuscular Facilitation (PNF) patterns. There was drop out of 2 Subjects in group A. The results demonstrated that the subjects treated with both the interventions were significant in reducing the symptoms of EIA. However statistically there was significant difference between the 2 groups but clinically Buteyko Breathing Technique showed better improvement than pursed lip breathing.

Within group comparison of pediatric asthma diary

The Intergroup comparison of pediatric asthma diary and peak expiratory flow rate for Group A was done by paired sample t test. The mean of pretreatment and post treatment in day time symptoms was 7.08±1.03 and 4.16±2.26.Where as in night time awakening symptoms mean of pre exercise and post

exercise was 1.28±0.45and 0.44±0.58.The pre exercise and post exercise mean of peak expiratory flow rate was 231.20±38.98 and 298.80±20.88. According to this result the Pursed lip breathing technique is effective in reducing the symptoms of exercise induced asthma in obese children which supports the result of Margaret A E *et al* who found in their study that pursed lip breathing was an effective breathing retraining pattern to reduce exertional dyspnea in COPD patients. Pursed lip breathing is simple technique that can be used with all activities and without any restriction or limitation associated with medication or device. Dyspnea relief with PLB during exercise was associated with decreases in end-expiratory lung volume coupled with lower tidal volume (Bruton, 2011).

Within group comparison of peak expiratory flow rate

The Intergroup comparison of paediatric asthma diary and peak expiratory flow rate was done by paired sample t test. The mean of pretreatment and post treatment in day time symptoms was 7.96±0.97 and 5.20±1.8. Where as in night time awakening symptoms mean of pre exercise and post exercise was 1.64±0.4 and 0.84±0.4.The pre exercise and post exercise mean of peak expiratory flow rate was 208±38.94 and 278±24.49. According to this result Buteyko Breathing Technique is effective in reducing the effects of exercise induced asthma which supports the result of Robert *et al.* who conducted RCT of Buteyko breathing technique as an adjunct to conventional management of asthma. This study showed that Buteyko breathing technique provide additional benefit and prevented the exacerbations there by improved the quality of life among adult clients with asthma who are being treated with inhaled corticosteroid (Cooper 2003). Study by Buteyko *et al*. included children with regular asthma attacks who had problem with breathing through the nose, palpitation, and were bronchodilator users. In 1-5 days the patient were able to stop the attacks, cough, blocked nose and wheezing using the method. [34]Other studies on Buteyko breathing showed that it is effective in improving the quality of life of patients suffering from asthma and it helps in reducing the use of inhaled steroids. Study by A Bruton *et al*. showed that BBT also includes advice and training on the benefits of nasal breathing over oral breathing. The nose not only warms filters and humidifies the inspired air, but also produces nitric oxide- a potent bronchodilator. Another component involves encouraging patients to minimize their use of ß2 agonist and is in line with Buteyko philosophy that 'reliever' inhalers exacerbate the loss of CO_2. [21]

Between group comparison of pediatric asthma diary and peak expiratory flow rate

The intra-group comparison of both the breathing pattern was done by independent sample t test. The mean of pediatric asthma diary in day time symptoms in group A was 4.16±2.26 (p=0.07) and in group B was 5.20±1.8 (p=0.01).Mean and SD of night time awakening symptoms in group A was 0.44±0.5 and in group B was 0.84±0.4.The above results for group A shows that breathing techniques are significant in reducing the night time symptoms but not significant in reducing the symptoms of day time in pediatric asthma diary because of p value greater than 0.05. And in groups B the exercise is effective in reducing the symptoms in day time as well as in night time with the p value <0.05. As the minimal clinical importance difference for pediatric asthma diary was not developed so we assumed 20% of MCID from the base line. In our study we found mean difference of pediatric asthma dairy in day time symptoms in group A was 19.47% and in group B was 28% whereas mean difference in night time awakening symptoms in group A was 18.93% and in group B was 26.67%. By comparing both the treatment group B had more MCID than group A. This shows clinical significance of Buteyko breathing technique in treatment of exercise induced asthma. The intra-group comparison of peak expiratory flow rate was also done by Independent sample t test. The mean of peak expiratory flow rate in group A was 298.80±20.88 and in group B was 278±24.49 with the p value 0.02 which showed statistical significance (p<0.05). Established MCID of peak expiratory flow rate was 18.8 l/min from the base line value. In our Study the mean difference of peak expiratory flow rate in group A was 67.6 l/min and in group B was 70 l/min. This result shows that group B had more MCID than group A. So this result conclude that Buteyko breathing technique is more effective in reducing the symptoms of exercise induced asthma in obese children As such no study was established that shows the comparison of pursed lip breathing vs. Buteyko breathing technique. Our efforts were made to see which exercise is more effective in reducing the symptoms of exercise induced asthma in obese children. By comparing both the statistical and clinical results in pursed lip breathing and Buteyko breathing technique, Buteyko breathing technique shows statistical as well as clinical improvement.

Limitation of the study

The study was conducted for a short duration and no follow up with patients, so study only shows immediate effects and not the long term effects.

Further scope

Further study can be done to check the efficacy of pursed lip breathing and Buteyko breathing technique in reducing the symptoms of asthma in adults. The study of the same treatment approaches with the inclusion of control group can be done.

Conclusion

The subjects were treated with pursed lip breathing and Buteyko breathing technique along with relaxation technique and chest mobility exercise using bilateral upper limb patterns of PNF for duration on 1 week. Both the group were found to be effective in reducing the symptoms of EIA. We found clinical significance in both the groups But clinically subjects with Buteyko breathing technique showed more improvement than subjects with pursed lip breathing technique.

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