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Comparative study on the effectiveness of inspiratory muscle training versus Buteyko breathing technique in asthmatics

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Abstract
Bronchial asthma is a chronic inflammatory lung condition marked by airway hyper-responsiveness, leading to recurrent episodes of wheezing, breathlessness, chest tightness, and cough, particularly during exertion or at night and early morning. It affects individuals across all age groups, with young and middle-aged adults being more vulnerable. The present study was undertaken to compare the effectiveness of Inspiratory Muscle Training (IMT) and the Buteyko Breathing Technique (BBT) in reducing dyspnea and improving the quality of life in individuals with asthma. A randomized controlled trial was designed with twenty participants diagnosed with bronchial asthma. They were randomly assigned into two groups: Group A underwent IMT using a threshold device (n=10), while Group B practiced BBT (n=10). Both interventions were carried out for a period of eight weeks. The severity of dyspnea was assessed using the Modified Borg Dyspnea Scale, with measurements taken before and after the intervention period. Data were analyzed statistically using paired and unpaired 't' tests, and mean with standard deviation was calculated to determine the effectiveness of the techniques. The results revealed a statistically significant reduction in dyspnea among participants in both groups, with IMT showing greater improvement compared to BBT. This suggests that IMT enhances inspiratory muscle strength more effectively, thereby reducing the severity of breathlessness and improving the functional capacity of asthmatic individuals. The findings support the alternative hypothesis, demonstrating that structured respiratory interventions are beneficial in managing asthma symptoms. In conclusion, while both IMT and BBT are effective non-pharmacological approaches for reducing dyspnea in asthmatic patients, IMT provides superior benefits in strengthening respiratory muscles and alleviating symptoms, thus offering a promising adjunct to conventional asthma management strategies.

Keywords: Inspiratory muscle training, Buteyko breathing technique, modified Bor g-Dyspnea scale

Introduction
Bronchial asthma is a respiratory disease, usually characterized by chronic inflammatory disease of the airways. The narrowing of the airways is produced by the combination mucosal edema and bronchial secretion of muscle spasm. The main pathology is hyper reactivity of the airways producing shortness of breath during exertion [1].

The prevalence of the bronchial asthma is higher in adults less in younger age groups. The mean age group is 30-45 years and those with a family history of asthma. Further the prevalence of asthma is higher in males than females and it affects more than 300 million people worldwide [2].

Further on higher prevalence in adults identified in agricultural dominant region, and post harvesting season (highest number of episodes of wheezing and breathlessness observed in months of December-January and April-May when crop harvesting season) [3].

Asthma has two phases, one is early phase and another one is late phase. The early phase is initiated by IgE antibodies. When a pollutant or trigger factor gets inhaled the mast cells release cytokines. The mast cells release the histamine, prostaglandins, and leukotriene. These cells turn to contract the muscle and cause airway tightening. Mast cells play a crucial role in the late phase reactants to inflamed sites. The result of inflammation and bronchoconstriction cause increased work of breathing [4].

Airway hyper responsiveness is elevated by the histamine and it is produced by the mast cells. These mechanisms cause airway remodeling it may worsen inflammation and aggravate asthma. In combination with inflammation, granular white blood cells, exudate, and mucus occupying the bronchial trees, it can increase breathing difficulty [5].

The quality of breathing is based on the respiratory muscle power and less muscle power produces shallow breathing with high respiratory rate. It produces high amount of CO_2 in the lungs leading to acidic nature in the blood. Weakness of respiratory muscles mainly inspiratory muscle include the diaphragm, external intercostal muscles causes breathing difficulty and these are the major reason for reduced alveolar ventilation. Maximal inspiratory mouth pressure (PImax) is a measurement of the maximum negative pressure created when the airway is temporarily obstructed. It is used to evaluate respiratory muscle strength [6].

Common clinical features include dyspnea, cough, chest tightness, and wheezing that vary over time and in intensity. The recurrent episodes of acute shortness of breath, typically occurring at night and early morning hours [7].

Bronchial asthma is classified into two groups based on the symptoms one is early onset asthma-A genetic predisposition towards the IgE antibodies in response to stimulus by pollen, house dust, fungi, and animal derived proteins. In childhood period bronchial asthma is usually due to allergies [8]. Another one is late onset asthma-It is a non-allergic asthma in adults arising from some viral infections of the lower respiratory tract [9].

Based on the types of severity it can further be classified. In episodic asthma symptoms occur in interval periods with dyspnea and paroxysms of wheezing with relatively sudden onset [10].

In severe acute asthma (status asthmatics) symptoms present with unproductive cough. Physical signs including sweating, central cyanosis, tachycardia [10].

In chronic asthma the symptoms are wheeze, chest tightness, breathlessness on exertion, spontaneous cough produced in the night time and early morning period [11].

First-line therapy for asthma involves the use of inhaled corticosteroids (ICS) in combination with inhaled beta2-agonists enabling both the control of airway hyper responsiveness [12].

Anticholinergic drugs can be used to treat asthma by opening the airway in the lungs. Anticholinergics work by blocking the parasympathetic effects of acetylcholine on the airway smooth muscle and pulmonary parasympathetic nerves. They are generally well tolerated and have mild side effects. Anticholinergic relax bronchial smooth muscles through competitive inhibition of muscarinic cholinergic receptors. Corticosteroids inhibit airway inflammation, reverse beta-receptor down-regulation, and inhibit cytokine production and adhesion protein activation [13]. Immunomodulators are used to decrease the allergic response of the airway walls. Common bronchodilators are salbutamol, salmeterol, formeterol, and theophylline. Due to the high prevalence of asthma and associated healthcare costs, it is important to identify low cost alternatives such as breathing exercises [14].

Breathing exercises (BTE) like Buteyko breathing and Inspiratory Muscle (IMT) Training are the non-pharmacological interventions for improvement of asthma control [15].

Inspiratory Muscle Training is a quantitative technique which includes resistance exercise designed to strengthen inspiratory muscles by providing resistance during expiration. Threshold Inspiratory Muscle Training is a device used to strengthen the inspiratory muscles [16]. IMT is given for the inspiratory muscles to overcome the resistance. IMT produces effects in respiratory muscles like increasing the diaphragm thickness & strength, decrease in dyspnea level. IMT provides benefits like pulmonary function, respiratory muscle strength and endurance, increase levels of functional capacity, decrease emotional disorders and the use of medical services, improves quality of life [17]. IMT was applied by Threshold Inspiratory device. The device creates a resistance to your inspiration, which makes your breathing muscles work harder. The main types of IMT devices are threshold trainer, resistive trainer, incentive spirometer [18].

The Buteyko breathing technique (BBT) was introduced by the Russian scientist Dr. Konstantin Buteyko in 1950. This BBT technique is based on the breath holding maneuvers and breathes control to guide patients back to nasal breathing. It was designed to reduce breathing volumes and restores metabolic balance. This technique was aimed to reduce hyperventilation and encouraged slower, shallower breathing through the nose. It cans also improving athletic performance and sleeping quality [19].

BBT breathing was clinically effective and increases the bronchial volume and significant reduction of respiratory pharmacotherapy. BBT breathing technique improves the quality of life and lung function and reduces asthma symptoms and medication use [20].

The dyspnea level is measured by Modified Borg Dyspnea score; it includes assessment scale from 0 to 10, where 0 represents no dyspnea and 10 represents maximal dyspnea [21].

Meterials

The following instruments and deviced were utilised for therapeutic approach:

- Modified Borg-Dyspnea Rating scale to evaluate dyspnea level
- Threshold Inspiratory Muscle Trainer device

Methodology

Study design

Comparative study design

Study setting

The study was conducted in the Pulmonology department, Sri Ramakrishna Hospital, Coimbatore-641044. Informed consents were obtained from all patients were included for the study.

Sampling method

Patients with bronchial asthma of the age group between 35 and 45 years were selected for the study by purposive sampling method.

Criteria for Sample Collection

Inclusion Criteria

- Patient who were diagnosed with bronchial asthma
- Patients between the age group of 35-45 years are included in the study
- Both female and male were included in this study

- BMI ≤ 30 Kg/m2
- Patients willing to participate in the study
- Patient who were received bronchodilators

Exclusion Criteria
- Age more than 45 years and lesser than 35 years
- Neurological deficit
- Cardiovascular impairment
- Recent myocardial infarction
- Brain tumor
- Ventilator support
- Heart Valvular disease
- Chronic infections disease like hepatitis, mononucleosis
- Metabolic disease

Sample size
A total of 20 people between the age group of 35 to 45 years who met the inclusion criteria were assigned as Group A(n=10), who received Inspiratory muscle training exercises and as Group B(n=10) who received Buteyko breathing technique.

Study period
The study duration was only 6 month

Duration of intervention
The study was carried out for duration of 6 months and the treatment duration was 3 days carried out for the period 1 week. The patients were treated every session for 30-45 minutes once daily and the data was collected on zero and on day 21.

Variables
Independent variable
- Inspiratory muscle training
- Buteyko breathing technique

Dependent variable
- Respiratory muscle power
- Dyspnea
- Reducing asthmatic episodes

Measurement Tools
Spirometry
Inspiratory muscle trainer device
Modified Borg dyspnea scale

Treatment Technique
Procedure
This comparative study evaluates the effectiveness of Inspiratory Muscle Training (IMT) versus the Buteyko Breathing Technique over 6 weeks, with 3 sessions per week lasting 30-45 minutes.

Group A (IMT): Patients perform 30 breaths against resistance at 50-60% of maximum inspiratory pressure, twice daily (morning & evening, 6 hours apart). Load is increased weekly based on tolerance.

Group B (Buteyko): Patients exhale slowly, hold breath by plugging the nose until urge to breathe, then inhale and breathe normally for 10 seconds before repeating.

Intervention 1
Threshold IMT: (Group A)
Position
Sit up and place the mouthpiece in your mouth

Breathing
Inhale deeply and hard for about two seconds, then exhale 3 seconds through the device

Repetitions
Repeat 12-15 breaths for a minute a day

Duration
Do this for 10-15 minutes a day

Frequency
Use the device three to five times a week

Progression
Gradually increase the length of your treatments every session

Limitations
Stop using the device if you get tired, can't breathe, or your heart races

Adjuust Resistance
If you can't do 30 breaths, you can adjust the resistance or break up the number of breaths

Method
1. Place the mouthpiece in your mouth and seal it with your lips
2. Breathe in as deeply and hard as you can for about two seconds
3. Breathe out through the device as you normally would

Intervention 2
Buteyko Breathing Technique (Group B)
The first thing to remember when practicing Buteyko breathing is to breath in a very controlled and shallow manner air should not be sucked like your last breath, it should be a gentle rhythm of breathing in and out.

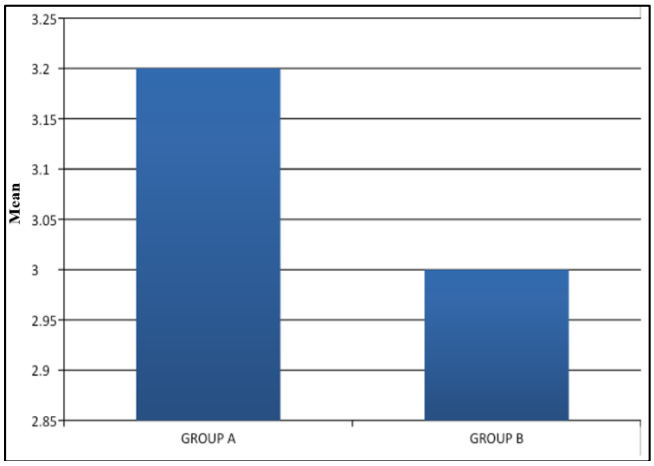
Patient Position: Sitting
Step 1: Nose Breathing
Sit upright, mouth closed.
Breathe only through the nose (blocked nose may clear gradually).

Step 2: Diaphragm Breathing
Focus on gentle diaphragm movement.
Keep shoulders and chest still.

Step 3: Shallow Breathing
Breathe very lightly, almost unnoticeable.
Imagine a blade of grass under the nose that barely moves.

Step 4: Breath-Hold Practice
Continue shallow breathing for 2-3 minutes.
After exhale, pinch nose and pause breathing until urge to breathe appears.
Beginners may last only a few seconds, aim to improve gradually.

Step 5: Resume Shallow Breathing
Release nose pinch and avoid deep breaths.
Return to gentle, shallow breathing rhythm.



Graph 1: Post-test mean values of group A and group B

Discussion

Asthmatic patients often face nocturnal breathing difficulties due to airway obstruction, necessitating strategies to strengthen inspiratory muscles and reduce dyspnea. This study aimed to evaluate the efficacy of Inspiratory Muscle Training (IMT) and the Buteyko Breathing Technique (BBT) in asthma management. Participants were divided into two groups: Group A (IMT) and Group B (BBT), each receiving interventions for 8 weeks, three sessions per week, 30 minutes per session.

Research shows IMT enhances respiratory efficiency, increases inspiratory muscle endurance, reduces dyspnea, and improves exercise tolerance and quality of life. It strengthens diaphragm and intercostal muscles, reduces oxygen cost of breathing, and enhances lung capacity, making it suitable for asthma and COPD patients. Conversely, BBT emphasizes slow nasal breathing to correct hyperventilation, restore CO_2 balance, and improve asthma symptoms by addressing dysfunctional breathing patterns.

Comparative findings suggest IMT is more effective for improving muscle strength, exercise tolerance, and reducing medication use, while BBT is effective for long-term asthma management by promoting relaxation and correcting breathing patterns. In conclusion, both IMT and BBT provide distinct yet complementary benefits in improving respiratory health in asthmatic patients.

Conclusion

The comparison between Threshold IMT and BBT exercises in asthmatic individuals reveals significant insight into respiratory health improvements strategies. Both techniques are effective in enhancing respiratory function, reducing asthma symptoms, but they work through distinct mechanisms. Threshold IMT primarily strengthens the inspiratory muscles, leading to improve muscle capacity, reduce dyspnea and better physical performance. This method is particularly beneficial for individuals with diminished respiratory muscle strength.

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