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Improving Asthma Patients' Peak Expiratory Flow Rate and Reducing Dyspnoea through Inspiratory Muscle Training

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ABSTRACT: The purpose of this research is to investigate whether or not training for the muscles that control breathing during inspiration may lessen symptoms of dyspnea and increase the peak expiratory flow rate in asthma patients. Using a straightforward random sample strategy, twenty individuals with acute asthma ranging in age from 35 to 55 were chosen for the study. The 20 individuals who went to the physiotherapy department at Vinayaka Missions Kirupananda Variyar Medical College and Hospital in Salem had their pre-test measurements of dyspnoea and peak expiratory flow rate taken using a modified borg scale and a peak flow metre. These measurements were taken before the patients were given the test. Following the pre-test evaluation, the subjects underwent inspiratory muscle training for a period of eight weeks. At the conclusion of the eighth week, a post-test measurement of dyspnoea and peak expiratory flow rate was performed on the group utilising a modified borg scale and a peak flow metre in a manner that was analogous to the manner in which the pre-test measurement was carried out. According to the findings of the research, individuals with asthma had less dyspnea and an increase in their peak expiratory flow rate after engaging in inspiratory muscle exercise. This study faces challenges in participant selection, recruitment, sample size, and adherence to inspiratory muscle training protocol, requiring larger sample size, long follow-up periods, and control group intervention.

Keywords: Asthma, Inspiratory muscle training, Dyspnoea, Peak expiratory flow rate.

INTRODUCTION

A significant public health and socioeconomic problem, asthma may be found in every region of the globe. This is the millennium world that we live in now. There has been a significant advancement in the fields of science and technology, as well as defence and internet services, etc. The amount of physical exercise that human beings engage in has decreased as a direct result of the proliferation of modern technologies. The modern man is more vulnerable to the effects of stress, hypokinetic sickness, and psychosomatic illness. It is imperative that we do not dismiss the significance of living a healthy lifestyle in this day and age. Everyone wants to be happy, and taking care of one's health is one of the most important things they can do to achieve this goal. Maintaining a healthy lifestyle is one of the best ways to protect oneself against the onset of many illnesses. Many individuals in this day and age are dependent on pharmaceuticals in order to live a normal and symptom-free life; nevertheless, this dependence has a multitude of negative impacts on one's health. It is generally agreed that asthma is an inflammatory illness of the airway, which leads to an increase in airway reactivity, blockage, hyperproduction of mucus, and participation in airway wall repair. Due to the anatomical involvement, asthma has also been referred to as bronchial asthma. Both terms are used interchangeably. Due to the considerable clinical dysfunction that is involved, the treatment of asthma has historically been a difficult task for both medical professionals and physiotherapists.

According to (Holgate, 2000) a major influence of silkworm hybrids on asthma is detected by the movement of the airways, which ultimately leads to reversible airflow restriction accompanied by enhanced airway reactivity and edoema. The majority of cases of asthma develop in infancy as a result of sensitization to allergens that are often breathed, such as dust mites, cockroaches, animal dander, fungi, and pollens. These inhaled allergens stimulate the growth of T helper type 2 (Th2) cells, which then leads to the production and release of Th2 cytokines including interleukin (IL)-4, IL-5, and IL-13. Numerous fundamentals and clinical education point to the enlargement of the airways as a primary factor in the pathophysiology of the illness. It

has been known for more than a century that asthma patients would continue to have chronic airway edoema. Repeated bouts of wheezing, coughing, dyspnea, lower exercise tolerance, reduced peak expiratory flow rate, and chest tightness are all indications of asthma. Accompanying these symptoms are periods of severe worsening of the symptoms, which are referred to as exacerbations (Zhang *et al.,* 1999; Ammous *et al.,* 2023). Patients with asthma are offered training to enhance their peak expiratory flow rate and lessen their dyspnea via the use of their inspiratory muscles. Because they are skeletal muscles, the inspiratory muscles are responsive to training in the same way that any other muscle in the locomotor system would be. Inspiratory muscle training with the use of an inspiratory muscle trainer is a technique that may be used to enhance the strength or endurance of the inspiratory muscle, which in turn improves pulmonary function and results in improved overall performance (Lage *et al*., 2021; Durutürk *et al*., 2018; Lima *et al*., 2008; Vázquez *et al.,* 2022).

MATERIAL AND METHODS

Twenty patients with acute asthma who were seen at the physiotherapy department of Vinayaka Missions Kirupananda Variyar Medical College and Hospital, Salem, and who were between the ages of 35 and 55 were chosen at random using a simple random sample approach. These patients are the focus of this research. Patients with associated disorders that prohibit them from following the procedures were not allowed to participate in the trial. A modified borg scale and a peak flow metre were used in the course of the pre-test examination of the group's dyspnea and peak expiratory flow rate. The modified borg's scale for dyspnoea is a numerical rating system that measures the difficulty in breathing in an increasing sequence from least difficult to most difficult. On a scale from 0 to 10, where 0 indicates no issue at all and 10 indicates the most trouble in breathing, the patient is asked to rate the level of difficulty in breathing that they are experiencing (Kendrick *et al*., 2000).

A peak flow metre was used in order to determine the peak expiratory flow rate. Before beginning the method, the value of the sliding pointer was initialised to zero. The participants were instructed to stand with their backs straight and grasp the peak flow meter's handle. They were then instructed to take a deep breath, place the mouthpiece in their mouth, and securely seal their lips and teeth around the mouthpiece. After that, they were to blow out as forcefully and quickly as they possibly could. It was important to take note of the number on the scale that corresponded to the moving pointer. Each time, the pointer was reset to zero, and the data from the three recordings were averaged to get the final score. The score was determined by taking the numerical number that corresponded to the position of the slide pointer (Thorat *et al*., 2017). Following the completion of the pre-test measurement, the individuals underwent inspiratory muscle training for a period of eight weeks, after which the post-test measurement was carried out. Inspiratory muscle training was performed for a total of eight weeks at a frequency of twice per day. The instruction was provided on a daily basis, six days a week. A mouthpiece that provides variable resistance ranging from 9 cm H2O to 41 cm H2O is the essential component of a device known as an inspiratory muscle trainer. The patient's capabilities are taken into account while determining the appropriate level of resistance for the inspiratory muscle trainer. The nose clip is then positioned within the nose. The patient has a mouthpiece for an inspiratory muscle trainer inserted in their mouth, and they are instructed to blow against varying degrees of resistance, beginning with the least amount of resistance possible and working their way up to the greatest amount possible according to their capabilities. The duration of the treatment was ten to fifteen minutes. Inspiratory muscle training has been proven to enhance inspiratory muscle strength in asthma patients, which in turn reduces dyspnea and improves peak expiratory flow rate. When it comes to asthma patients, non-pharmacological therapy strategies are just as significant as pharmacological treatment methods in terms of bringing symptoms under control and reducing the number of times they have exacerbations. At the conclusion of the eighth week of therapy, the post-test results were gathered. The treatment consisted of inspiratory muscle training.

RESULTS AND DISCUSSION

The paired t-test that was used in the statistical analysis was the method that was used to arrive at the findings of the research. In asthma patients, employing an inspiratory muscle training device was associated with a statistically significant improvement in peak expiratory flow rate and a decrease in dyspnea. These findings were uncovered by the use of a paired t-test. Following inspiratory muscle training for a period of eight weeks, the results of the study showed that there was a statistically significant difference between the pre-test and post-test values. This difference indicated that dyspnoea was reduced, and peak expiratory flow rate had significantly improved. The decrease in dyspnea and the improvement in peak expiratory flow rate may be due to the fact that the blockage in the air route was reduced, the broncho spasm was reduced, and the utilisation of the main muscles of respiration was enhanced, which resulted in an increased peak expiratory flow rate. Inspiratory muscle training with the help of an inspiratory muscle training device improves the strength of the inspiratory muscles, which in turn improves the ventilation-perfusion ratio of the lungs. It also increases the metabolic needs of the tissues and oxygen supply, which in turn reduces dyspnea and increases the muscle contraction to meet the exercise tolerance of the individuals to complete the task.

A randomised controlled study was used to investigate the effects of inspiratory muscle training on the function of the inspiratory muscles, the functional capacity of the patient, and also the quality of life of the asthmatic patient. The primary purpose of this research is to investigate the effects of a specific training programme

for the inspiratory muscle on the functionality of the inspiratory muscle, functional capacity, and quality of life in asthmatic patients. According to the findings of the research, individuals who had their asthma under control had a significant gain in both the endurance and strength of their inspiratory muscles after participating in training for eight weeks (Lage *et al*., 2021).

The results of inspiratory muscle training may be the most effective modality for improving the strength of respiratory muscle, capacity of conducting exercises, quality of life, daily living activities, reduced feeling of dyspnoea, and tiredness in asthmatic patients. This is because these improvements can be achieved in a shorter amount of time (Duruturk *et al*., 2018)

According to the findings of the study, exercising the inspiratory muscles may enhance the mechanical efficiency of the respiratory muscles, in addition to increasing peak expiratory flow rate and severity factors (Lima *et al*., 2008).

Table 1: The collected data were analyzed using paired 't' test.

Variables	't' calculated value	't' table value
Peak expiratory flow rate score	11.61	2.09
Dyspnoea	12.52	2.09

t calculated value > t table value.

CONCLUSION

The integration of inspiratory muscle training as a supplemental strategy for the therapy of asthma is supported by these results, which have substantial ramifications as a result. This sort of exercise has the potential to improve respiratory function and contribute to a better quality of life for asthma sufferers since it targets particular muscles that are involved in the inspiration process.

FUTURE SCOPE

Further research with larger and more diverse populations is needed to confirm and generalize these findings. Long-term follow-up studies could explore the sustainability of the observed benefits and provide insights into the optimal duration and intensity of inspiratory muscle training for asthma management. Overall, this research contributes to understanding the potential benefits of inspiratory muscle training in asthma patients.

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Conflict of Interest. None

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