

Changes in Respiratory Function in Asthma Patients using Respiratory Inspiration Muscle Exercise: Literature Review

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ABSTRACT

Asthma is characterized by narrowing and inflammation of the bronchi, with symptoms of dyspnea, fatigue, and limited activity. This study aims to explain the effect of respiratory inspiratory muscle training on changes in respiratory function based on the results of previous studies. This study was compiled based on a literature review that came from the databases: PubMed, springer link, and google scholar which were selected based on the inclusion criteria that have been set. From 272 articles found, only 6 articles deserve to be reviewed. The results of the review stated that respiratory inspiratory muscle exercise had an effect on changes in respiratory function in asthmatic patients with a very significant significance value. Changes provided by inspiratory muscle training are related to respiratory muscle strengthening which reduces respiratory stimulus and ventilation requirements for a given workload, contributing to more efficient breathing patterns and decreased perception of dyspnea. Inspiratory respiratory muscle exercise, either done alone or in combination with other respiratory rehabilitation programs, can increase the strength of the respiratory muscles so as to have an improved impact on the respiratory function of children with asthma from children to adults.

Keywords: inspiratory muscle exercise; asthma; changes in respiratory function

INTRODUCTION

Asthma is a non-communicable disease that is a serious global problem and needs to be addressed (Zul' Irfan et al., 2019). According to WHO, there are about 300 million people who suffer from asthma worldwide and there are approximately 250,000 deaths per year (Dharmage et al., 2019; Sumartini et al., 2020). Deaths that occur due to asthma are associated with airway obstruction which results in pulmonary hyperinflation and causes an increase in total lung capacity and secondary functional residual volume as well as a decrease in expiratory reserve volume (VCE) and vital lung capacity (KVP) (Mayuni et al., 2015). The results showed a decrease in expiratory reserve (VCE) and vital lung capacity (KVP) reaching 26% (Greece et al., 2018). The decrease in the vital capacity of the lungs itself results in an increase in the anteroposterior diameter of the chest so that the chest will resemble a barrel (Barrel Chest) and can reduce chest wall compliance, resulting in less effective breathing and can worsen the condition of asthmatics (Mayuni et al., 2015). Asthma that is not handled properly can cause an increase in morbidity, and the symptoms will get worse and interfere with the quality of life, and can be fatal to death (Hardina & Wulandari, 2019). Nurse must be know about handle patient with asthma. The initial assessment must be carried out by the nurse and important early nursing assessment (Putri, et al, 2021).

Asthma is currently mostly treated medically, including nebulization intervention (Kurniawan & Ningsih, 2017). However, non-pharmacological innovations such as inspiratory muscle training techniques need to be introduced as an intervention in asthma management (Zul' Irfan et al., 2019). Inspiratory muscle training is a technique intended to increase the strength of the diaphragm and other respiratory accessory muscles (Silva et al., 2013). Inspiratory respiratory muscle exercise is thought to be beneficial in increasing overall functional capacity and reducing dyspnea and thereby reducing the need for health care interventions (Duruturk et al., 2018). In addition, inspiratory muscle training is included in conventional therapy at an affordable price for all asthmatics (Chung et al., 2021). Seeing the potential of respiratory inspiratory muscle training, it is deemed necessary to conduct a literature review to explore information related to the effect of respiratory inspiratory muscle training on improving respiratory function in asthmatics based on previous research.

METHOD

A systematic search was carried out in the following 3 databases: PUBMED, SPRINGER LINK, GOOGLE SCHOLAR using the keywords “asthma AND respiratory muscle training”, “asthma AND breathing exercises”, “asthma AND breathing exercises AND adult”, “Asthma AND Respiratory muscle training AND respiratory function improvement. The search results found 272 journal articles with the following distribution: PUBMED found 53 articles, SPRINGER LINK found 119 articles, and GOOGLE SCHOLER found 100 journals. The articles found were then selected using the following inclusion criteria: 1) RCT or experimental research design; 2) articles are accessible and full-text; 3) articles published in 2016- July 2021; 4) articles published in English or Indonesian; 5) articles were declared eligible based on the results of the critical appraisal so that 6 articles were eligible for review as listed in table 1.

Table 1. Identification of Article

Author	Year	Title	Design	Sample
Ibai López-de-Uralde-Villanueva, Pablo Candelas-Fernández, Beatriz de-Diego Cano, Orcalez Mínguez-Calzada, Tamara del Corral	2018	The Effectiveness Of Combining Inspiratory Muscle Training With Manual Therapy And A Therapeutic Exercise Program On Maximum Inspiratory Pressure In Adults With Asthma: A Randomized Clinical Trial	Randomized Controlled Trial	43 Respondents Asthma Patients
Neslihan Duruturk, Manolya Acar, Mustafa Ilgaz Doğrul	2018	Effect of Inspiratory Muscle Training in the Management of Patients With Asthma: A Randomized Controlled Trial	Randomized Controlled Trial	38 Respondents Asthma Patients
Ragab K. Elnaggar	2021	A Randomized Placebo-Controlled Study Investigating The Efficacy Of Inspiratory Muscle Training In The Treatment Of Children With Bronchial Asthma	Randomized, Placebo-Controlled, Assessor-Blinded Clinical Trial	34 Respondents Asthma Patients
Shiny S. James, K. Rekha, Vaiyapuri Anandh, L. Chandrasekar, Radhakrishnan Unnikrishnan	2016	Effects Of Threshold Inspiratory Muscle Trainer In Bronchial Asthma	Randomized, Placebo-Controlled	34 Asthma Patient Respondents
Susan Martins Lage, Danielle Aparecida Gomes Pereira, Anna Luísa Corradi Magalhães Nepomuceno, Anna Cláudia de Castro, Augusto Gonçalves Araújo, Mariana Hoffman, Bruna Mara Franco Silveira, Verônica Franco Parreira	2021	Efficacy Of Inspiratory Muscle Training On, Functional Inspiratory Muscle Function Capacity, And Quality Of Life In Patients With Asthma: A Randomized Controlled Trial	Randomized Controlled Trial	39 Respondents Asthma Patients
Yi Chung, Ting-Yu Huang, Yi-Hung Liao, Yu-Chi Kuo	2021	12-Week Inspiratory Muscle Training Improves Respiratory Muscle Strength In Adult Patients With Stable Asthma: A Randomized Controlled Trial	Randomized Controlled Trial	60 Patient Respondents A SMA

RESULT

The results of a review of 6 journal articles found that the total respondents involved in the 6 studies were 224 respondents with an age distribution of 12 to 70 years. 70.97% are respondents of female gender and 28.03% are respondents of the male gender. The majority of respondents involved were asthmatic patients with mild to moderate asthma degrees.

The results of the identification of 6 articles showed that after asthmatic patients performed respiratory inspiratory muscle training for the duration set by each researcher, the respiratory inspiratory muscle exercise had an effect on increasing or improving respiratory function as listed in table 2.

Table 2. Effect of Respiratory Inspiratory Muscle Exercise in Asthma Patients

Authors	Effect of Inspiratory Muscle Exercise on Breathing
Ibai López-de-Uralde-Villanueva, Pablo Candelas-Fernández, Beatriz de-Diego Cano, Orcáez Mínguez-Calzada, Tamara del Corral	Inspiratory muscle training protocol combined with a manual therapy program and therapeutic exercises more effective than an inspiratory muscle training protocol alone for increasing maximal inspiratory pressure and forward head posture in the short term in adults with asthma.
Neslihan Duruturk, Manolya Acar, Mustafa Ilgaz Doğrul	Changes in Respiratory Function: The results of the measurement of respiratory function indicated that there was no significant difference between the inspiratory muscle training group and the control group with P=0.041. Changes in Maximum Respiratory Pressure: The results of the measurement of maximal respiratory pressure showed a significant difference between the inspiratory muscle training group and the control group: MIP (P < .001), MIP % predicted (P < .001) and MEP % predicted (P=.002). Changes in Functional Capacity: There was a significant difference between the inspiratory muscle exercise group and the control group in terms of the results of the six-minute walk test with P = .001
Ragab K. Elnaggar	There was a significant difference between the inspiratory muscle training group and the placebo group after the interventions FEV1 (P=.003), FVC (P=.001), FEV1/FVC (P=.004), IPmax (P=.002), EPmax (P=.004), and ACT (P=.001)
Shiny S. James, K. Rekha, Vaiyapuri Anandh, L. Chandrasekar, Radhakrishnan Unnikrishnan	There was a significant difference between the experimental and control groups with P < 0.0001 for all variables FEV1, PEFr and the 6-minute walk test.
Susan Martins Lage, Danielle Aparecida Gomes Pereira, Anna Luísa Corradi Magalhães Nepomuceno, Anna Cláudia de Castro, Augusto Gonçalves Araújo, Mariana Hoffman, Bruna Mara Franco Silveira, Verônica Franco Parreira	There was a significant change in the predicted maximum inspiratory pressure and duration of power tests resistance between the inspiratory-breathing exercise group and the control group with P value < .001
Yi Chung, Ting-Yu Huang, Yi-Hung Liao, Yu-Chi Kuo	Except for forced vital capacity, which decreased in the BTE group, all other measurable variables increased in both groups, and no significant difference between groups was found. BMI appears to be more effective than the breathing exercise intervention in promoting increased respiratory muscle strength.

DISCUSSION

Table 2 shows that respiratory inspiratory muscle exercise performed on adult and pediatric asthmatic patients has an impact on changes in respiratory function as measured by variables FEV1, FVC, FEV1/FVC, PEFr, MIP, MIP % prediction, MEP, and other variables. with a very significant significance value. These results are consistent with the evidence that inspiratory muscle training (BMI) has been shown to increase inspiratory muscle strength, dyspnea on exertion, and exercise tolerance in healthy individuals and respiratory patients such with COPD (Turner et al., 2011). Changes in respiratory function in Asthma patients who undergo respiratory inspiratory muscle training show the effect of respiratory inspiratory muscle training is produced through the inspiratory muscles that are given resistance during inspiration so that they are able to adapt to overcome the 'resistance' (Chung et al., 2021). The resistance imposed during inspiratory muscle training has an effect on strengthening respiratory muscles because this training stimulates changes in peripheral muscle structure, namely improvements in the redistribution of fiber types, mitochondrial density, number of capillaries, and oxidative enzyme activity. These changes can result in reduced respiratory stimulus and ventilation requirements for a given workload, contributing to a more efficient breathing pattern and decreased perception of dyspnea (GimenoSantos et al., 2018).

Table 2 also shows that inspiratory respiratory muscle training is more effective when combined with other pulmonary rehabilitation therapy programs. This is in accordance with previous evidence which explains that BMI is effective alone or in association with pulmonary rehabilitation programs (Beaumont et al., 2018). This effect occurs because the combination of respiratory inspiratory muscle training with other pulmonary rehabilitation therapy programs

will help place the inspiratory and accessory respiratory muscles in a favorable position to be able to stretch maximally to increase the speed of shortening of the inspiratory muscles, provide more time for expiration and reduce pulmonary hyperinflation (López-de-Uralde-Villanueva et al., 2018).

CONCLUSION

Inspiratory respiratory muscle exercise, either done alone or in combination with other respiratory rehabilitation programs, can increase respiratory muscle strength so that it has an improved impact on the respiratory function of children with asthma in children and adults.

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