IJBPAS, May, 2025, 14(5): 2754-2761

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

EFFECT OF RESPIRATORY MUSCLE STRETCH GYMNASTIC ON PEAK EXPERATORY FLOW RATE AND EXERCISE CAPACITY AMONG CARPENTERS: AN EXPERIMENT STUDY

KALYANI I[1*], DOBARIYA A[2] AND PATEL GJ[3]

1: MPT Scholar, Ahmedabad Physiotherapy College, Opp. Kabir Enclave, Bopal Ghuma Road, Ghuma, Ahmedabad- Parul University

2: Dr. Asha Dobariya (MPT, PhD Scholar) Associate Professor, Ahmedabad Physiotherapy College, Parul University, Gujarat, India College, Opp. Kabir Enclave, Bopal Ghuma Road, Ghuma, Ahmedabad- Parul University

3: Dr. Gaurav Patel (PT, PhD) Principal, Ahmedabad Physiotherapy College, Parul University, Gujarat, India. Opp. Kabir Enclave, Bopal Ghuma Road, Ghuma, Ahmedabad- Parul University

***Corresponding Author: Dr. Isha Kalyani: E Mail: ishakalyani1999@gmail.com**

Received 16th Jan. 2024; Revised 20th Feb. 2024; Accepted 13th July 2024; Available online 1st May 2025

https://doi.org/10.31032/IJBPAS/2025/14.5.9009

ABSTRACT

Background: Occupational exposure, particularly in industrial settings such as the wood industry, plays a significant role in the development of various respiratory illnesses and a notable decline in lung function. The respiratory capabilities of the aged lung have been improved by the use of various exercises, mobilizations, and respiratory muscle training methods. One such method is respiratory muscle stretch gymnastics (RMSG). Traditionally, stretching and breathing exercises are taught separately, but in RMSG, they are combined.

Methodology: A 44 carpenters of Ahmedabad city were recruited based on the inclusion and exclusion criteria. In this present experimental study, the participants were randomly assigned

into group A (diaphragmatic breathing) and group B (RMSG with diaphragmatic breathing). Pre and post PEFR and 6 MWT for exercise capacity were taken as an outcome measures and analysis were performed by use of Microsoft excel and SPSS version 29.

Results: The study showed within group analysis for different outcome measures in group A and group B were statistically significant ($p< 0.05$). Furthermore, between group analysis for different outcome measures in group A and group B were also suggested statistically significant ($p< 0.05$).

Conclusion: The present study concluded a group-B Respiratory muscle stretch gymnastic with Diaphragmatic breathing exercises showed a greater improvement in peak expiratory flow rate and exercise capacity.

Keywords: Occupational hazards, Carpenters, RMSG, PEFR, Exercise capacity

INTRODUCTION:

Occupational health encompasses the comprehensive array of activities and initiatives dedicated to ensuring the utmost health and safety for individuals engaged in any form of employment. Essential for upholding the dignity of the workplace, occupational safety and health are pivotal components in the sphere of employment **[1]**. Occupational exposure, particularly in industrial settings such as the wood industry, plays a significant role in the development of various respiratory illnesses and a notable decline in lung function. Lung function impairment stands out as the most prevalent respiratory issue among industrial plant workers, as emphasized in studies such as Liou *et al*. (1996) **[2]**. According to Talini *et al*. (1998), furniture workers were also exposed to a number of sensitizers or irritants, including isocyanate vapors, wood dust, and other chemicals (solvents, paints, and phenol-formaldehyde resin dust), which may have contributed to the development of asthma and other respiratory symptoms **[2]**. The term used to denote the maximum speed at which air is expelled during forced expiration is referred to as the Peak Expiratory Flow Rate (PEFR). This parameter serves as a crucial indicator for evaluating the degree of bronchial airway obstruction. The observed reduction in PEFR among carpenters is attributed to their persistent exposure to wood dust, instigating inflammatory changes in the respiratory system. This inflammatory response contributes to heightened airway resistance through processes such as airway remodelling and mucosal cell hypertrophy **[3]**. Notably, findings from Boskabady *et al*. (2010) revealed that carpenters exhibited significantly lower results in pulmonary function tests. Moreover, earlier investigations indicated that the group of

carpenters displayed a lower mean peak expiratory flow rate.

Furthermore, the interconnection between functional capacity and low peak expiratory flow underscores the significance of respiratory factors in determining an individual's overall ability to engage in and sustain physical activity **[4]**. Exercise capacity, a crucial metric in assessing an individual's physical resilience, refers to the extent of physical effort a patient can endure in a single session **[5]**. The six-minute walk test (6MWT) is a frequently employed outdoor walking test for determining functional exercise capacity and evaluating the prognosis and course of treatment for a number of disorders **[6]**.

The respiratory capabilities of the aged lung have been improved by the use of various exercises, mobilizations, and respiratory muscle training methods. One such method is respiratory muscle stretch gymnastics (RMSG). Traditionally, stretching and breathing exercises are taught separately, but in RMSG, they are combined. This has been shown to be helpful in enhancing the performance of the respiratory muscles. By stretching the internal and external intercostal muscles of the chest wall during inspiration and expiration, respectively, it tries to lessen stiffness in the chest wall **[7]**. Exercise performance, maximum inspiratory muscular strength, and QoL were all improved by RMSG for 4 weeks **[6]**. Minehiko Yamada *et al*. (1996) conducted research on the advantages of respiratory muscle stretching gymnastics (RMSG) for COPD patients and came to the conclusion that it is a secure and efficient conditioning technique to enhance lung function and lessen dyspnoea **[1]**.

The indispensable act of breathing, vital for sustaining life, involves the coordinated functioning of various respiratory muscles, with the diaphragm standing out as a key player essential for maintaining healthy respiration **[8]**. Diaphragmatic breathing is characterized by a deliberate inhalation process involving slow, deep breaths through the nose, employing the diaphragm, and minimizing chest movement while in a supine position. With one hand on the chest and the other on the abdomen, practitioners are encouraged to maintain minimal chest motion and focus on rubbing their stomachs against their hands, concentrating on the contraction of their diaphragms **[8]**. Typically, DB practitioners adhere to a rhythm of inhaling over six seconds and exhaling over an equivalent duration **[8]**.

There is no evidence to see the effect of RMSG on PEFR and EXERCISE CAPACITY among carpenters. Hence, this study is carried out to improve better quality of life by improving in pulmonary function and exercise capacity among carpenters.

MATERIAL AND METHODOLOGY

During the academic years in Ahmedabad, an experimental study was conducted on carpenters, with a sample size of 44 selected through convenient sampling. The intervention, lasting 4 weeks and comprising 6 days per week, aimed to assess the effects of a specific program or treatment on the carpenters' skills or health outcomes.

INCLUSION CRITERIA

- Their ages were between 18-50 year
- Work at least 8 hours per day for 6 days a week.
- Not using any self-protection ways as face mask so there was a significant dust exposure.

EXCLUSION CRITERIA:

- The exclusion criteria were subjects who smoke cigarettes, cigar, narjil (hookah).
- Any diagnosed respiratory diseases by a physician as bronchial asthma, bronchiectasis, TB, malignancy, and any chronic severe illnesses.
- Any Musculoskeletal abnormality of thoracic cage or vertebral column.

PROCEDURE: [4, 6, 8]

- Following approval from the Institutional Ethical Committee, the study took place in Ahmedabad.
- Participants aged between 18 to 50 were selected in accordance with the inclusion criteria.
- Upon explaining the study procedure, written consent was obtained from each individual.
- The entire carpenters' population, totalling 44 subjects, was then divided into two groups:

Group A: 22 Subjects Conventional

Group B: 22 Subjects Conventional + RMSG

RMSG Techniques:

Pattern 1: 'Elevating and pulling back the shoulders' Start with your back straight and in a relaxed position. Raise both shoulders gradually while bringing them back. Lean back and take a deep breath at the same moment. After taking a deep breath, slowly release it, unwind, an return to your starting posture.

Pattern 2: 'Stretching the upper chest' Participants in the study were instructed to position their hands on the upper region of their chest. Following this initial placement, they were directed to engage in a specific physical maneuver by extending their chest forward and simultaneously retracting their shoulders backward. This set of movements aimed to promote the stretching and elongation of the chest muscles.

RMSG No. 3: 'Stretching the back muscles' Hold both hands in front of the chest, fingers intertwined, palms facing in, back straight. In this role, give it your all. Next, slowly release the breath while bending the upper body forward and extending the arms. After bending your torso and extending your arms, inhale fully while in that posture. Next, take a deep breath and return to your starting posture.

RMSG No. 4: 'Stretching the lower chest' Hold cloth with the both hands above the head, arms extended, palms down, while maintaining a straight back. In this position, bring the arms back after taking a complete breath and exhale slowly. Return to your starting posture and take a deep breath after the entire expiration.

RMSG No. 5: 'Elevating the elbow' Accompany your head with one hand. Breathe deeply through your nose. Raise your elbow as high as it is comfortable to do so, extending your trunk while you slowly release air through your mouth. Breathe regularly as you return to the starting position. With the other hand behind the head, repeat the procedure.

Diaphragmatic breathing exercise:

The subjects were positioned in a semi-fowler with the abdominal wall relaxed and the head and back fully supported. notice the elevated abdomen during breathing, they had to be at ease. The person should release their breath through their mouth. The subject must feel this movement of the abdomen during inhalation and exhalation by placing his or her hand on the rectus abdominis, right below the anterior costal border.

STATISTICALANALYSIS:

The analysis of the data was conducted utilizing the SPSS version 29, with a predetermined level of statistical

significance set at $\alpha = 0.05$ and a confidence interval of 95%. To assess the normal distribution of the data, the Shapiro-wilk Test was employed. Given that the data was satisfy the normality assumption, a parametric-t test was used to compared the mean of two independent group.

LEVEL OF SIGNIFICANCE: The significance level (alpha) was set at 5%, indicating that the researchers considered a p-value less than 0.05 as statistically significant.

Table 1 shows group A and group B comparison of PEFR test value the analyses of the data were statistically significant result for the PEFR measures post-intervention.

Table 1: Between group A and Group B Comparision of Pefr

VARIEBLES	GROUP-A		GROUP-B		T VALUE	P VALUE
	MEAN DIFF.	SD	MEAN DIFF.	SD		
PEFR	30	17.182	40	6.90	-2.533	<0.001

Table 2: Between Group A and Group B Comparision of Distance Walk

VARIEBLES	GROUP-A		GROUP-B		T VALUE	P VALUE
	MEAN DIFF.	SD	MEAN DIFF.	SD		
DISTANCE WALK	13.63	7.267	38.63	18.84	5.805	<0.005

DISCUSSION

Occupational health encompasses the comprehensive array of activities and initiatives dedicated to ensuring the utmost health and safety for individuals engaged in any form of employment. Exposure to wood dust impairs lung function, raises the risk of respiratory illnesses, increases the likelihood of developing cancer, and causes mucositis by increasing mucociliary clearance.

Before the initiation of the intervention, a comprehensive collection of all outcome measures, including age, Peak Expiratory Flow Rate (PEFR), and the 6-Minute Walk Test (6MWT), was meticulously undertaken. In the control group, participants received diaphragmatic breathing exercises exclusively, while in the experimental group, participants were subjected to the same diaphragmatic breathing exercises with respiratory muscle stretch gymnastics.

The findings of the current investigation revealed that both groups, control group with diaphragmatic breathing exercises and the experimental group with a combination of Respiratory Muscle Strength Training (RMSG) and diaphragmatic breathing exercises, demonstrated statistically significant effects ($p<0.05$). The results were indicative of noteworthy improvements in both groups. However, between-group comparison of the mean differences in outcome measures, such as Peak Expiratory Flow Rate (PEFR) and the 6-Minute Walk Test (6MWT), it was observed that the experimental group exhibited a more statistically significant impact. This suggests that the combined intervention of RMSG and diaphragmatic breathing exercises yielded superior outcomes compared to diaphragmatic breathing exercises alone in the control group.

The principle behind RMSG is Lapascle's law, which states that the length of the respiratory muscle determines how much air a lung can breathe. When the respiratory muscles are at their optimal length, they provide the most force. Because the ideal length of the respiratory muscle varies with age (Diaphragm & Intercostal muscle). When provided, RMSG Extrafusal fibre of the muscle spindle contracts as a result of the stimulation and signals that the muscle spindle sends to the alpha motor neuron. The Frank Starling Law states that a muscle will relax more after it contracts **[7]**.

Anjali Chandrakant Awacha *et al*. concluded that a four-week prescription of Respiratory Muscle Strength Training (RMSG) resulted in notable enhancements in exercise performance, maximal inspiratory muscle strength, and quality of life (QoL) among elderly individuals **[8]**.

CONCLUSION

The analysis of the data concluded that both the groups were individually effective for showing the improvement in peak expiratory flow rate and exercise capacity in carpenters of Ahmedabad city. Respiratory muscle stretches gymnastic with Diaphragmatic breathing exercises showed a greater improvement in peak expiratory flow rate and exercise capacity.

ACKNOWLEDGMENT

First and foremost, I (**Dr. Isha Kalyani**) would like to thank my **Krishna** for giving knowledge and strength in completing the project on "**EFFECT OF RESPIRATORY MUSCLE STRETCH GYMNASTIC ON PEAK EXPERATORY FLOW RATE AND EXERCISE CAPACITY AMONG CARPENTERS: AN EXPERIMENT STUDY**. Is a genuine work carried out by **Isha Chetanbhai Kalyani**. I would like to thank my parents **Mr. Chetan Bhai Kalyani and Mrs. Diptiben Kalyani.** Who had supported me all the time; whose

valuable support gave me courage taught the day.

I am sincerely thankful and grateful to my **guide Dr. Asha Dobariya**, Assistant Professor, Ahmedabad Physiotherapy College, for his cordial support, valuable information. Her immense knowledge; constant supervision and guidance helped in completing thesis, without his suggestion and encouragement this project work cannot be possible thank you **Dr. Asha Dobariya** for emboldening me.

I would like to thank, **Dr. Dhaval Patel, Dr. Ayesha Mulla, Dr. Rushi Gajjar** and all faculty members of **Ahmedabad Physiotherapy College** for their constant moral boosting, cultivating me in the necessary clinical skills, providing a homely environment to the work and friendly help extended from time to time.

Last but not the least I would like to thank all the **carpenters** who had participated in this study without whose cooperation this task would have been impossible.

REFERENCES

[1] Kulkarni S, Kulkarni MM. A Study to Assess The Knowledge Regarding Prevention Of Occupational Hazards Among Carpenters Working In Timber Areas From Sangli Miraj Kupwad corporation.

[2] Banibrata das. prevalence of respiratory symptoms and respiratory disorder among carpenters in India. journal of human ergology 48(2).

[3] Pooja Bharat Mistry, Anagha Palkar. International Journal of Health Sciences and Research. Vol.11; Issue: 6; June 2021

[4] Mohd Abass Dar1*, Nidhi Jain1 , Showkat Ahmad Bhat2 Association of peak expiratory flow rate with obese and overweight individuals December 2020 | Vol 7 | Issue 12.

[5] Goldstein RE. Exercise capacity.

[6] Tekerlek H, Saglam M, Kucukdagli AC, Aykan HH, Vardar-Yagli N, Calik-Kutukcu E, Inal-Ince D, Karagoz T. Assessment of exercise capacity using field walking tests in patients after the Fontan procedure: A case–control study. Heart & Lung. 2023 Jul 1;60:66-73.

[7] Hetal M, Ashok BP. Respiratory Muscle Stretch Gymnastic in Elderly: Impact on Maximum Breathing Capacity, Peak Expiratory Flow Rate and Exercise Capacity. International Journal of Health Sciences and Research (Www. Ijhsr. Org). 2020 Mar;10:145.

[8] Hamasaki H. Effects of diaphragmatic breathing on health: a narrative review. Medicines. 2020 Oct 15;7(10):65.