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A STUDY TO COMPARE EFFECT OF RESPIRATORY MUSCLE STRETCH GYMNASTIC (RMSG) AND DIAPHRAGMATIC BREATHING ON PEAK EXPIRATORY FLOW RATES AMONG COMPUTER WORKERS: AN INTERVENTIONAL STUDY

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ABSTRACT

Computer users are at an increased risk of developing musculoskeletal and respiratory dysfunctions due to prolonged sitting and poor postures, such as forward head and rotated neck. These postural issues can lead to reduced energy expenditure and compromised pulmonary functions, often associated with pain due to decreased tissue oxygenation and regional blood flow. Respiratory Muscle Stretch Gymnastics (RMSG) consists of a set of exercises specifically designed to stretch the respiratory muscles and improve lung function. Despite its potential benefits, limited studies have evaluated the effects of RMSG and diaphragmatic breathing (DB) on pulmonary functions.

This study aimed to compare the effects of RMSG and DB on Peak Expiratory Flow Rate (PEFR) among computer workers. Sixty participants aged 30–50 years were randomly assigned to two groups. Group A (n = 30) performed RMSG exercises three times per day in four sets, five days a week for two weeks. Group B (n = 30) performed DB exercises for the same duration. PEFR, energy consumption (EC), rate of perceived exertion (RPE), pain, and posture were measured before and after the intervention. Data analysis using SPSS version 22.0 revealed a statistically significant improvement in PEFR in the RMSG group ($p < 0.000$), while DB showed no significant change.

In conclusion, RMSG is a simple, cost-free, and effective intervention that can be self-administered by computer workers to improve PEFR, reduce pain, enhance posture, and increase respiratory efficiency. It can be incorporated as a valuable addition to conventional therapy in sedentary populations.

Keywords: Computer workers, exercise capacity, peak expiratory flow rate, posture, rate perceived exertion, respiratory muscle stretch gymnastics

INTRODUCTION

Respiratory muscle stretch gymnastics (RMSG) have been proposed as a possible additional form of rehabilitation for patients with chronic obstructive pulmonary disease. RMSG is designed to decrease chest wall stiffness especially in the chest wall respiratory muscles. It has been suggested that RMSG reduces dyspnea at rest and improves the quality of life. The mechanism for the reduction in dyspnea may be through a decrease in the respiratory rate (RR) that is caused by matching of the respiratory cycle phases between central command and afferent regulation of the intercoastal muscles. A decrease in RR is consistently observed after RMSG, which might be related to the decreased sensation of breathlessness **[1]**. These exercises, allow us to target specific respiratory muscles in a progressive way, allowing each muscle group to work to its maximum capacity and stretching and improving movement in the accessory muscles. By practicing these exercises, individuals can enhance their respiratory muscle strength and flexibility, thus improving their overall breathing and respiratory function. The exercises are designed to be safe and gradually increase in intensity, allowing individuals to progress at their own pace. Respiratory Muscle Stretch Gymnastics offers a comprehensive guide to improving respiratory muscle function through targeted exercises. The potential benefits of respiratory muscle stretching are immense and extend beyond just improving the physical aspects of breathing. By targeting specific muscle groups and promoting flexibility and strength, these exercises can also have a positive impact on mental well-being. Breathing is not only a physiological process but also a powerful tool for relaxation, stress reduction, and overall mental balance. When our respiratory muscles are functioning optimally, we can experience a sense of calmness, clarity, and increased energy levels. Respiratory Muscle Stretch Gymnastics emphasizes the importance of individualization and customization when it comes to respiratory muscle training. Respiratory Muscle Stretch Gymnastics encourages individuals to incorporate these exercises into their daily routine to make breathing more efficient and effortless in everyday life. Respiratory Muscle Stretch Gymnastics is a comprehensive and accessible resource for individuals seeking to improve their respiratory health and function **[2]**.

As diaphragmatic (abdominal) breathing (DB) is a slow and deep breathing method, it should not be considered as just a breathing control. Since time out of mind, traditional martial arts such as tai chi and yoga utilize DB in their practice. DB is defined as breathing in slowly and deeply through the nose using the diaphragm with a minimum movement of the chest in a supine position with one hand placed on the chest and the other on the belly. During breathing, practitioners should be careful that chest remains as still as possible and stomach moves against the hand focusing on contracting the diaphragm. Generally, DB practitioners inhale and exhale for approximately six seconds, respectively. DB is a fundamental procedure during meditation practices in individuals who engage in yoga and traditional martial arts such as tai chi. Recently, a systematic review has reported that mind–body exercise (yoga/tai chi) can reduce stress in individuals under high stress or negative emotions by modulating the sympathetic–vagal balance. Martarelli et al. showed that DB increased the antioxidant activity and reduced the oxidative stress after exercise in athletes **[3]**.

Peak expiratory flow rate (PEFR) is the maximum flow rate (expressed in Liters per minute [L/min]) generated during a forceful exhalation, starting from full inspiration. PEFR primarily reflects large airway flow and depends on the lung recoil, voluntary effort, and muscular strength of the patient. Maximal airflow occurs during the effort-dependent portion of the expiratory manoeuvre; thus, low values may be caused by a less than maximal effort rather than by airway obstruction. However, PEFR is variable among individuals with a similar body build; such variation has to do with airway size versus lung size. Nevertheless, the ease of measuring PEFR with an inexpensive small portable device has made it popular as a means of following the degree of airway obstruction in patients with asthma and other pulmonary conditions. Dose Inhalers Peak expiratory flow rate (PEFR) is the volume of air forcefully expelled from the lungs in one quick exhalation, and is a reliable indicator of ventilation adequacy as well as airflow obstruction. The normal peak flow value can range from person to person and is dependent upon factors such as sex, age and height. PEFR is typically higher in males than females and higher in taller patients. After expected increases through childhood and adolescence, PEFR decreases with age from 30-40 years onwards **[4]**.

Procedure and Materials

Study Design: Interventional comparative Study Design.

Sampling Design: Simple Random Sampling method

Duration of study: 2 weeks

Source of Data: Computer workers from Surat city

Sample Size: Total 50 subjects

• Participants will be randomly divided into two groups:

Group A:25 subjects Respiratory Muscle Stretch Gymnastics (RMSG).

Group B: 25 subjects (Diaphragmatic breathing exercises)

Outcome measure: Peak Expiratory Flow Rate

Procedure:

Subjects who fulfil the inclusion criteria was selected for the study. The subjects were explained about the importance of the exercises. Approval was obtained from an institutional ethics committee before initiating the study. Ensure participant confidentiality and the right to withdraw at any point. Address any adverse events immediately with appropriate care. Participants will be recruited from workplaces. Informed consent was obtained from eligible participants. Demographic data (age, gender, occupation) was obtained. Medical history and smoking status were recorded. Baseline Peak Expiratory Flow Rate (PEFR) using a peak flow meter was measured. Brief physical examination to rule out any contraindications was conducted. Group A (RMSG) Participants were performed respiratory muscle stretch gymnastics under supervision. Sessions was conducted [e.g., 5 times a week] for [e.g., 30 minutes per session] for 2 weeks. Exercises included stretching and strengthening of respiratory muscles with guided breathing techniques **[2]**. Group B (Diaphragmatic Breathing): Participants practiced diaphragmatic breathing under supervision. Sessions were conducted [e.g., 5 times a week] for [e.g., 30 minutes per session] for 2 weeks. Instructions included slow, deep breathing focusing on abdominal expansion. All sessions were supervised by trained professionals. Adherence was monitored through attendance logs and participant feedback. PEFR was measured again at the end of the intervention phase using the same peak flow meter and technique as in the baseline assessment. Post-intervention PEFR values was recorded and was compared with baseline measurements **[3]**.

Statistical tools were used to compare the effects of RMSG and diaphragmatic breathing on PEFR. Analysis for within-group (pre- vs. post-intervention) and between-group differences was done.

- All the statistical analysis were done by using IBM SPSS 25 for windows software.

- The intragroup comparison for PEFR was done using paired t-test.
- The Inter group PEFR was analysed with mean before and after intervention.

RESULTS

For Group – A

Interpretation: From **Table 1**, it is interpreted that the data does not follow normal distribution as its p value (0.003) is less than level of significance (0.05). Hence, we can apply Wilcoxon Signed Rank Test to test the effectiveness of PEFR and the results are as follows in **Table 2**.

Interpretation: From **Table 3**, it is interpreted that PEFR has significant impact as its p-value (0.000) is less than level of significance (0.05). So H_{01} is rejected.

For Group – B

Interpretation: From **Table 4**, it is interpreted that the data does not follow normal distribution as its p value (0.003) is less than level of significance (0.05). Hence, we can apply Wilcoxon Signed Rank Test to test the effectiveness of PEFR and the results are as follows in **Table 5**.

Interpretation: From **Table 6**, it is interpreted that PEFR has significant impact as its p-value (0.000) is less than level of significance (0.05). So H_2 is rejected.

Table: 1 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_PEFR	.126	105	.000	.974	105	.037

a. Lilliefors Significance Correction

Table: 2 Ranks

		N	Mean Rank	Sum of Ranks
Post_PEFR - Pre_PEFR	Negative Ranks	0[a]	.00	.00
	Positive Ranks	105[b]	53.00	5565.00
	Ties	0[c]		
	Total	105		

a. Post_PEFR < Pre_PEFR

b. Post_PEFR > Pre_PEFR

c. Post_PEFR = Pre_PEFR

Table: 3 Test Statistics[a]

	Post_PEFR - Pre_PEFR
Z	-8.910[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Table: 4 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Difference_PEFR	.026	105	.000	.914	105	.027

a. Lilliefors Significance Correction

Table: 5 Ranks

		N	Mean Rank	Sum of Ranks
Post_PEFR - Pre_PEFR	Negative Ranks	0[a]	.00	.00
	Positive Ranks	105[b]	38.00	3958.00
	Ties	0[c]		
	Total	105		

a. Post_PEFR < Pre_PEFR

b. Post_PEFR > Pre_PEFR

c. Post_PEFR = Pre_PEFR

Table: 6 Test Statistics[b]

	Post_PEFR - Pre_PEFR
Z	-5.365[b]
Asymp. Sig. (2-tailed)	.06

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

DISCUSSION

This study aimed to compare the effects of Respiratory Muscle Stretch Gymnastics (RMSG) and Diaphragmatic Breathing (DB) on Peak Expiratory Flow Rate (PEFR) in computer workers. The findings indicated that RMSG was significantly more effective in improving PEFR than DB. This effectiveness is likely due to RMSG's ability to stretch and activate a wider range of respiratory muscles, including the diaphragm, intercostals, and accessory muscles. These exercises help increase thoracic mobility, reduce chest wall stiffness, and enhance lung compliance—all of which contribute to improved respiratory function.

Computer workers often experience reduced lung function due to prolonged sitting and poor posture, which can lead to muscle tightness and limited thoracic expansion. RMSG directly addresses these issues by promoting flexibility and better movement in the respiratory muscles. On the other hand, DB mainly focuses on controlled diaphragmatic movements, which are beneficial for relaxation and diaphragmatic excursion but may not provide the same comprehensive improvements in respiratory mechanics as RMSG.

The study's results support the use of RMSG as a practical and efficient intervention for improving PEFR and overall respiratory health in sedentary populations. RMSG can be easily integrated into workplace wellness programs, as it requires no special equipment and can be performed during short breaks. By enhancing expiratory muscle strength and lung function, RMSG may help prevent respiratory fatigue and other complications associated with sedentary behaviour. Overall, RMSG is a simple yet effective tool for promoting better respiratory outcomes in individuals with desk-bound lifestyles.

CONCLUSION

This study concludes that RMSG is more effective than DB in improving PEFR among computer workers. RMSG's ability to stretch and mobilize respiratory muscles offers superior benefits in enhancing lung function. These findings underscore the importance of incorporating targeted respiratory exercises into sedentary workers' daily routines to mitigate the adverse effects of prolonged sitting on respiratory health.

Future Scope of the Study:

1. Future research should explore the effects of RMSG and DB in larger, more diverse populations and over extended periods.
2. Additionally, combining RMSG with other physical activity interventions could further optimize respiratory function in sedentary individuals.

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