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Effect of Abdominal Curls on Peak Expiratory Flow Rate (PEFR) in Middle Age Females

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ABSTRACT

Background: The lifestyle and pollution has direct impact on the respiratory system in patients as well as normal individuals. Abdominal muscles are expiratory muscles which help in forceful expiration. It was assumed that abdominal muscle exercises improve the strength of abdominal muscles.
Objective: The aim of this study was to see the influence of abdominal muscle exercises on peak expiratory flow rate in middle-aged women. Any normal person may benefit from abdominal muscle exercises to increase peak expiratory flow rate, which enhances quality of life.
Methods: Experimental study included 15 females between age 35-55 years randomly selected as per inclusion and exclusion criteria. They performed upper abdominal strengthening exercises (abdominal curls- 10 repetitions) for 15 days consecutively.
Outcome measure used was PEFR measured before and after intervention. Peak Flow Meter device was used in this study to measure Peak Expiratory Flow Rate. Paired 't' test was used to analyze the data.
Results: Data of 15 subjects were analyzed. After 15 days of abdominal muscle exercises, the results revealed a highly significant increase in Peak Expiratory Flow Rate.
Conclusion: Abdominal muscle exercises enhanced Peak Expiratory Flow Rate in middle age females

Keywords: Abdominal muscle exercises, Peak Expiratory Flow Rate, middle age females.

INTRODUCTION

The current study sought to ascertain the effect of abdominal exercises on Peak Expiratory Flow Rate (PEFR) in middle-aged females. Aim of the study was to discover how abdominal exercises affect the Peak Expiratory Flow Rate (PEFR) in middle-aged females. Objective of the study was to increase Peak Expiratory Flow Rate through abdominal muscle strengthening exercises. Significance of the study was to know the importance of forceful expiration in keeping large airways patent and easy expiration thereby improving quality of life. Primary expiratory muscles: these are internal intercostal muscles, which are innervated by intercostal nerves. Accessory expiratory muscles: these are abdominal muscles. The abdominal muscles (rectus abdominis, external oblique, internal oblique, and transverse abdominis) are powerful expiratory muscles that assist in returning the diaphragm to its resting position, forcing air out of the lungs. As a result, abdominal strengthening exercises are beneficial in clearing secretions and sputum, enhancing lung compliance and general activities. [1] An individual with partial or complete abdominal muscle weakness is unable to cough and produce forced expiration, resulting in sputum retention and secretion retention. [2] By

definition, it is "The highest expiratory flow rate achieved with a maximally forced effort from a place of maximum inspiration," expressed in liters/min (BTPS). [3]

Peak Expiratory Flow Rate was determined by using Wright's Peak Flow Meter.

MATERIAL AND METHODS

The research design was experimental study. Convenient sampling was done. Total 15 middle age females were recruited according to inclusion and exclusion criteria. The inclusion criteria for this study were normal healthy female participants, age between 35-55 years, those willing to participate in the study, BMI between 18.5- 24.9. The exclusion criteria were recent abdominal surgery, individuals with a history of back pain. Purpose of the study was explained and participants were asked to sign an informed written consent form. Peak Expiratory flow rate was used as an outcome measure. Pre intervention Peak Expiratory Flow Rate was measured and recorded. Participants followed intervention for 15 days. Post intervention Peak Expiratory Flow Rate was measured and recorded again.

Procedure of the study:

Demographic data was obtained from the participants in the form of Name, Age, Height, Weight, BMI, Waist Hip Ratio and then Pre intervention Peak Expiratory Flow Rate was measured using Wright's Peak Flow Meter. It is an effort dependent test. Participants were instructed how to use instrument and demonstration was also done, they were asked to perform the test three times. For making the measurement, the subject/patient breathes out (blows out; blasts out) maximally into the peak flow meter after having taken a maximum inspiration. [4] Out of them, the best of three trials was recorded as reading.

Specifications of Mini-Wright Standard Peak Flow Meter are below: [5]

Size- 100 x 60 x 240 mm

Weight- 25 grams

Measurement Range- 60-880 L/min (ATS scale)

Accuracy +/- 10% or 10 L/min

Repeatability < 5 l/min

Abdominal Strengthening Exercises: Upper Abdominals: Curl Ups: The participants were instructed to get into a crook lying position and raise their heads off the mat. Then they were instructed to lift their shoulders until their scapula and thorax cleared the mat while keeping their arms horizontal. Since the hip flexor muscles perform the majority of the motion after the thorax clears the mat, the participants make sure they don't come to a complete sit up. Exercises were performed for 10 repetitions for 15 days.

Post intervention Peak Expiratory Flow Rate was measured again and recorded. The dial range is 0–1000 litres/min (lpm) though the ATS recommends a range of 100 lpm to < 850 lpm [3]

This flow rate may show a diurnal variation of about 7% in the morning and 3% in the evening as estimated by measuring the variation in the amplitude % of the mean [6] while pollution in the atmosphere can also contribute to this effect [7]

STATISTICAL ANALYSIS

Statistical analysis was performed for the data obtained from 15 subjects. The data was analysed with SPSS software version 20.0. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and tests of significance such as paired 't' test used for comparing data. Data was considered statistically significant with p value <0.05 and highly significant with p<0.01. The level of significance was kept at 5%. p value determined was 0.001

RESULTS

Table 1: Demographic characteristics of variables

Variables	Mean ± SD
Age	43.33 ± 4.61
BMI	26.25 ± 3.94
WHR	0.82 ± 0.06

After 15 days of abdominal muscle exercises, the Peak Expiratory Flow Rate increased significantly. p value determined was 0.001 which was highly significant.

Table 2: Mean and SD of Outcome measure

Variable	Mean ± SD
Pre PEFR	280 ± 74.73
Post PEFR	328 ± 50.12

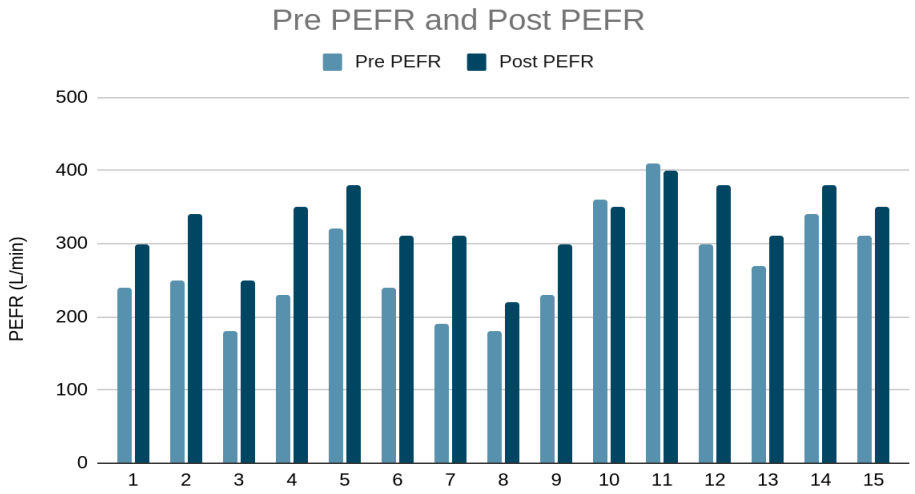

Figure 1: Pre and post PEFR of all participants

DISCUSSION

The present study was carried out to know the effect of abdominal muscle exercises on Peak Expiratory Flow Rate in middle age females. The result from the statistical analysis of the present study found that there is a beneficial effect of peak expiratory flow rate on the subjects treated with abdominal muscle strengthening exercises. The mean values of data from present study indicates that subjects showed better peak expiratory flow rate after 15 days of abdominal strengthening exercises. The increase in peak expiratory flow rate is most likely due to the abdominal muscles' facilitator function, which improves the diaphragm's ability to produce pressure during respiration. [8]

During expiration, the diaphragm simply relaxes, and the lung, chest wall, and abdominal structures all recoil, compressing the lungs and expelling the air. The muscles that pull the rib cage downward during expiration are primarily the abdominal recti, which have a powerful effect of pulling downward on the lower ribs while pushing the diaphragm and the internal intercostals upward.

However, during heavy breathing, the elastic forces are insufficient to induce the requisite rapid expiration, so extra force is provided primarily by abdominal muscle contractions, which drive the abdominal contents upward against the bottom of the diaphragm, compressing the lungs.

A study conducted by Sheela RS stated that daily Peak Expiratory Flow Rate monitoring is a useful measure both clinically and epidemiology. [9]

Karia RM conducted a study comparing Peak Expiratory Flow Rate in smokers and non-smokers and discovered that Peak Expiratory Flow Rate was substantially lower in the smokers community than in the non-smokers group. [10]

The relationship between obesity indices and peak expiratory flow rate in males and females was investigated by Ilango S. The findings revealed that PEFR was significantly lower in obese males but not in obese females when compared to their non obese counterparts. [11]

Limitation of the present study is that the duration of the intervention was short. Home exercise program was not

given. Follow up was not done. Only female subjects were recruited.

Future studies may be done which may include duration of 3-4 weeks for better accuracy of results, male and female subjects both can be recruited. Other pulmonary function test outcome measures can be taken instead of only PEFR. Studies can be done which may include subjects with different age groups to compare response differences between different age groups. More subjects can be included in the study. Studies can be conducted with long term follow-up sessions to know the effectiveness of treatment. Specific diseases with obstructive or restrictive patterns can be taken into consideration.

CLINICAL APPLICATION

In biomechanical terms, during cough mechanism, expiratory muscles play a critical role both during relaxation in the inspiratory phase and during isometric contraction in the compression phase, which allows raising intra-abdominal pressure up to 300 mmHg. [12]

The study can be clinically implied to improve respiratory parameters like dyspnea in obese individuals and cardiovascular rehabilitation programme. Abdominal muscle exercises can be used along with other adjunct therapies to improve the fitness of an individual.

Obesity is linked with respiratory problems, which occur when the extra weight of the chest wall squeezes the lung and causes restricted breathing. Increased body mass loading of the respiratory apparatus (chest and lungs) is thought to play a role in the onset of respiratory failure by putting an insurmountable burden on respiratory muscle or creating severe ventilation-perfusion inequalities. [13]

Obesity has a negative impact on health often resulting in reduced respiratory functions and reduced strength of abdominal muscles. [14] Because of the increased weight of the chest wall and the higher location of the diaphragm in the thoracic cavity, obesity reduces lung and chest wall compliance, impacting PEFR and, as a result, increasing work of breathing. Furthermore, the central pattern of fat deposition on the chest wall may obstruct chest expansion and rib cage excursion, either directly or by altering intercostal muscle function. [15]

PEFR is influenced by various factors such as age, height, gender and environmental conditions. [16]

The primary factors that influence PEFR are the strength of the expiratory muscles that generate the force of contraction, the elastic recoil pressure of the lungs, and the size of the airway. [17]

These factors can be compromised in obese women due to fat deposition and hyperresponsiveness of the airways.

CONCLUSION

This study concludes that abdominal muscle exercises are beneficial in improving peak expiratory flow rate in middle age females.

Hence, regular abdominal muscle strengthening exercises can be done to improve strength of abdominal muscles which in turn help in forceful expiration which can be beneficial in clearing cough out of airways, enhancing cough reflex thereby improving quality of life of individuals.

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Ethical Approval: Approved

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