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Original Research Article

Effects of Abdominal Muscle Exercises on the Respiratory Muscle Strength & Peak Expiratory Flow Rate in Females with BMI More than Twenty Five

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ABSTRACT

Obesity is defined as abnormal or excessive accumulation of fat in the body that may impair health. [1] India ranks 3rd in the World's obese population comprising of 30 million individuals. Studies from different parts of India have provided evidence of rising prevalence of obesity. [2] Obesity has an effect on respiratory muscles & parameters.

It is important to understand the alignment of the respiratory muscles and their actions and how they function. Muscles like Diaphragm, Rectus Abdominis, Transverse Abdominis, Internal & External Oblique's contribute largely in inspiration and expiration. The Aim of study was to improve Respiratory Muscle Strength (MIP, MEP) and Peak Expiratory Muscle Strength by training the abdominal muscles.

Method: Thirty subjects were selected in which their Height (mts), Weight (Kgs), BMI(kg/m^2), Abdominal muscle strength(using Isometric Abdominal strength tests)were assessed. Pre values for Peak Expiratory Flow Rate (PEFR)(L/min), Maximum inspiratory pressure (MIP)(cmH_2O), Maximum Expiratory Pressure (MEP)(cmH_2O) were taken. Abdominal exercises (superficial, deep & core muscles) for 6-Weeks, 3 Sessions/week on (alternate days) were taught to the Participant

Conclusion: The study showed a significant improvement in abdominal muscle strength, PEFR, MIP & MEP values post 6 week of abdominal training programme.

Key Words: Abdominal muscle, Respiratory Muscle Strength (MIP, MEP), Peak Expiratory Flow rate (PEFR).

INTRODUCTION

Overweight and Obesity are defined as an abnormal or excessive accumulation of fat in the body that may impair health. [1] Also WHO global estimates of 2014 show that 13% of world population (11% men, 15% women) who are 18years & above are obese. [1]

According to the World Health Organization (WHO), obesity is one of the most common, yet among the most neglected, public health problems in both developed and developing countries. According to the WHO World Health Statistics Report 2012, globally one in six adults are obese and nearly 2.8 million individuals die each year due to overweight or obesity. Due to the increased risk of morbidity and mortality, obesity is now being recognized as a disease in its own right. [2]

India ranks 3rd in the World's obese population comprising of 30 million individuals and is currently experiencing rapid epidemiological transition. Under nutrition due to poverty which dominated in the past, is being rapidly replaced by obesity associated with affluence. Industrialization and urbanization also contribute to increased prevalence of obesity. Studies

from different parts of India have provided evidence of the rising prevalence of obesity. [2]

Obesity has an effect of the respiratory parameters. It is therefore important to understand the Alignment of the respiratory muscles and their actions and how they function.

Diaphragm is the principal muscle for inspiration. The Contraction of diaphragm causes the dome to flatten, leading to a downward movement into the abdominal cavity. This increases volume of thoracic cavity, creating negative pressure that is proportional to extent of the movement, thus to the force of contraction. [3]

For expiration the principal muscles are Rectus Abdominis, Transverse Abdominis, Internal & External Obliques which form the muscular corset of abdominal wall Contraction of these muscles during expiration pull the lower rib margins downward, compressing the abdominal compartment, also causing upward movement of diaphragm into thoracic cavity and thereby overall increase in the internal pressure. These Abdominal muscles are important during any exercise or when forced breathing is required. [3]

Obesity has a negative impact on health often resulting in reduced respiratory functions and reduced strength of abdominal muscles. [4] It is therefore important to strengthen abdominal muscles so that they can improve respiratory muscle strength and enhance their function.

Excessive fat in the body has a negative impact on health often resulting in reduced respiratory functions and reduced strength of abdominal muscles. [4]

Obesity decreases the lung and chest wall compliance owing to the increase in the weight of the chest wall and the higher position of diaphragm in the thoracic cavity thereby affecting PEFR, which subsequently leads to the increase in work of breathing. In addition, the central pattern of deposition of fat on the chest wall may impede the chest expansion and excursion of the rib cage, through a direct loading effect or by altering the intercostals muscle function. [5]

Obesity thus has a clear potential to have a direct effect on respiratory wellbeing by increasing oxygen consumption and carbon dioxide production, while at the same time it stiffens the respiratory system and increases the mechanical work needed for breathing. [6]

Respiratory muscle strength is related to fitness of an individual therefore any dysfunction in this musculature can lead to hyperventilation, reduction in exercise tolerance and even respiratory insufficiency. There is a sub- and supra-atmospheric pressure generated by the inspiratory and expiratory muscles respectively, i.e. maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) which reflects the pressure that is being generated by the action of respiratory muscles. [7]

PEFR is the most commonly used method to monitor lung function. It is the maximal expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration and is expressed in litres/min. [8]

PEFR (Peak Expiratory Flow Rate) gives idea about the strength of expiratory muscles, since forceful expiration is required for the above. Abdominal muscle exercises improve the strength of abdominal muscles which assists in the act of forced expiration. [9]

MATERIALS & METHODS

Participants: Thirty subjects were part of the study according to the inclusion criteria which consisted of Overweight & Obese young females (BMI >25), Age:18 to 25 yearsand those not under any physical training program for at least 6 months. All the procedures were explained to the subjects and their information was kept confidential.

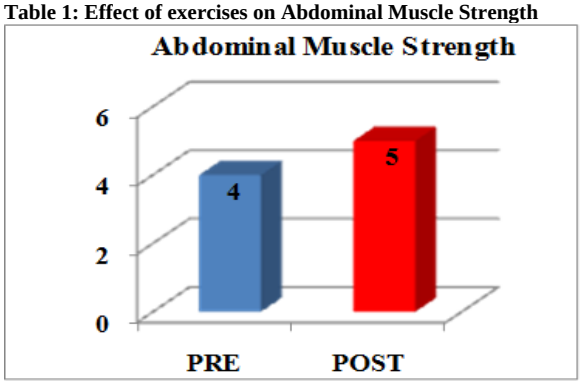
Materials Used: Weighing scale, measuring tape, calculator, Peak Flow meter, Respiratory Pressure Meter, Consent Form, Paper, Pen & Yoga mat.

Method: The evaluation of the subjects Height(mts), Weight(kgs), BMI(kg/m^2), abdominal muscle strength (using Isometric abdominal strength test) was done. Their pre–readings of PEFR(L/min), MIP(cmH_20), and MEP(cmH_20) were noted. Abdominal exercises (superficial, deep & core) were taught to the Participant. Exercise Protocol was for 6-Weeks, 3 Sessions/week on (alternate days) which was performed under supervision of the Researcher. After completion of 6-Weeks, re-evaluation of abdominal muscle strength, PEFR, MIP & MEP was done. Pre & Post Exercise Regimen values were compared. The data collected was statistically analysed using Normality Test (Shapiro-Wilk tests) and Wilcoxon Signed Ranks Test.

DEMOGRAPHIC DATA	MEAN ± STANDARD DEVIATION
AGE(yrs)	21.7 ±2.2
HEIGHT(mts)	159 ±6.2
WEIGHT(kgs)	68.5 ± 6.1
BMI(kg/m^2)	27 ±1.4

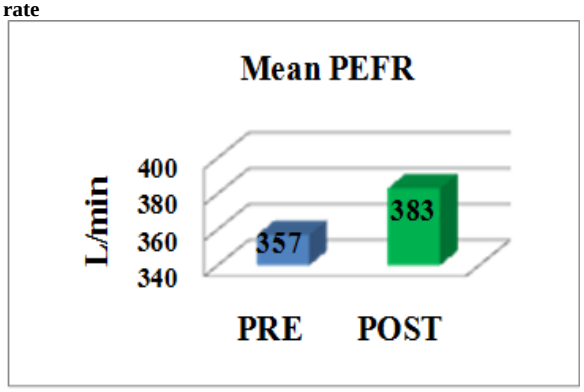
RESULTS

Table 1: Effect of exercises on Abdominal Muscle Strength



The abdominal muscle strength showed a significant improvement after 6 weeks of exercises programme.

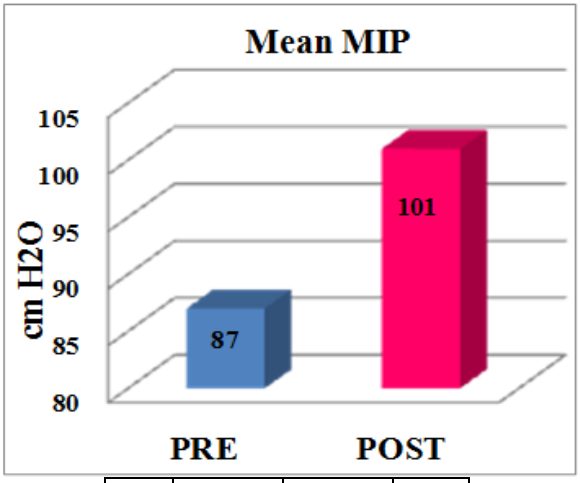
Table 2: Effect of Exercises on change in Peak expiratory flow rate



Variable	PRE	POST	P-Value*
PEFR	357 ±27.8	383.6± 27.4	0.000

There is significant improvement seen between Pre-Post values of PEFR as p-Value is <0.05*

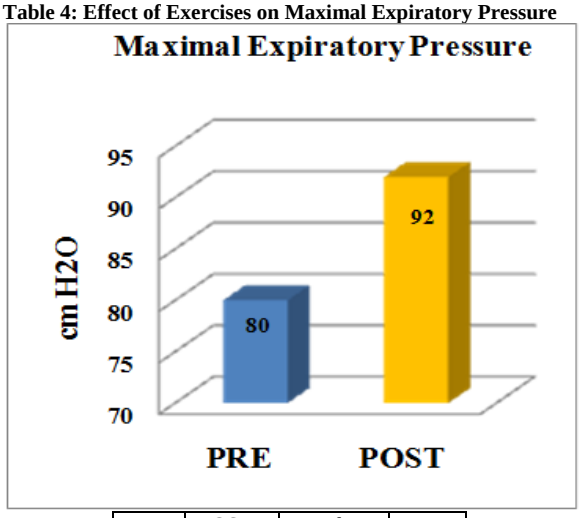
Table 3: Effect of Exercises on Maximal Inspiratory Pressure



PRE	POST	P-Value*	
MIP	86.7 ±1.7	101 ±3.3	0.000

There is significant improvement seen between Pre-Post values of MIP as p-Value is <0.05*

Table 4: Effect of Exercises on Maximal Expiratory Pressure



PRE	POST	P-Value*	
MEP	79.8 ±2	92.1± 3.1	0.000

There is significant improvement seen between Pre-Post values of MEP as p-Value is <0.05*

DISCUSSION

Abdominal muscle strength improved post 6 weeks due to activation and recruitment of more muscle fibres. [10]

Subjects initially experienced difficulty during first week however towards the end they felt an effective change in their inspiration and expiration.

Increase in PEFR can be as there is recruitment of external inter-costal muscle during abdominal exercise which has

already proved to show positive mechanism in increasing PEFR. [11,12]

Also diaphragm strengthening achieved by abdominal exercises helps in maintaining an optimum length tension relationship of diaphragm, thereby increasing lung and chest wall compliance this further correlates to a proportionate sub and supra atmospheric pressures generated by respiratory muscles. Thus helps in increasing MIP and MEP. [13]

CONCLUSION

Significant improvement was seen in abdominal muscle strength, PEFR, MIP and MEP post six weeks of training programme.

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