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Original Article

Effects of arm ergometry exercise on the pulmonary function in young obese women

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Abstract

Background: Pulmonary function in young obese women is reduced than when compared to non-obese individuals**.** This study was aimed to evaluate the effectiveness of arm ergometry combined with breathing exercise on the pulmonary function for young obese women.
Materials and Methods: 30 subjects based on inclusion and exclusion criteria**:** Participants in both groups performed Diaphragmatic breathing exercise. Participants in intervention group performed arm ergometer in addition. Outcome measures: FEV1/FVC %. The intervention was given for 8 weeks, 30 min/day for 5days/week.
Results: A comparison between the mean values of arm ergometer plus breathing exercise group and breathing exercise alone group showed that there was a statistically significant difference in pulmonary function test ($p<0.0001$)
Conclusion: Arm ergometer may be combined with breathing exercise in improving the pulmonary function for young obese women.

Keywords: Aerobic Exercise, Obesity, Gender

Introduction

It has been reported that pulmonary function diminishes when muscles that contribute to respiratory function are weakened. Hence these muscles are weakened due to variety of causes and the ability to perform exercises can also be affected.[1] Female subjects tend to have lower PFT values as their respiratory muscles endurance and chest wall compliance is lower than male. This is because of decreased in lung compliance that may relate to increased pulmonary blood volume seen in obese individuals.[2] The WHO classified obesity as BMI of 30 kg/m^2 or higher is considered obesity.[3] Weight may have effects on pulmonary function test by causing decreased chest wall and lung compliance, decreased pulmonary gas exchange, lower control of breathing and limitation in exercise capacity.[4] In the prospective study of pulmonary function test in obese patients, it was found out that half of the obese patients were having abnormal PFT.[5] However, the primary reason is owing to a decrease in chest wall compliance associated with the accumulation of fat in and around the ribs, the diaphragm and the abdomen of women.[6]

A variety of breathing training methods was proven to increase muscle strength and endurance resulting in an increase of breathing function.[9] While responding to patients weakened breathing efficiency and changed breathing mechanisms, it is necessary to properly maintain expansion of the chest wall, lung volume and lung capacity.[7] A number of studies have investigated the use of breathing exercises in diverse subject groups, including one that applied feedback respiratory equipment to normal, healthy individual.[8] However, very few studies have been conducted on

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the effect of diaphragmatic breathing exercises with upper extremity exercises, including of shoulder girdle exercises on the pulmonary function. Thus, the present study aims to determine the effects of diaphragmatic breathing exercise with upper extremity exercises for young obese women.

Material and Methods

Study Design: pre-test, post-test non-equivalent two group design.
Study Setting: The outpatient of physiotherapy department, Saveetha Medical College, and Hospital.
Sampling Method: Convenient sampling**.**
Sample Size: 30 subjects.
Materials: Arm ergometer.
Inclusion criteria: Age of 18-25 years, Gender - BMI >30 for women, Subjects willing to participate in the study.
Exclusion criteria

Recent rib fracture, Bronchial asthma, Subjects not willing to participate in the study, uncontrolled hypertension, COPD**.**

Procedure

30 individuals were selected according to inclusion and exclusion criteria. The consent was obtained from the participants. Participants were explained about the risk factors, safety, and procedure of the study. All the participants were selected according to a convenient sampling technique. Subjects are allocated into the breathing exercise plus arm ergometer group or diaphragmatic breathing exercise alone group. Before initiation of the treatment session, PFT are done as a pre-test outcome. Participants were demonstrated to breathe into a mouthpiece that is connected to a spirometer instrument called a spirometer and were asked to hold the mouthpiece of the spirometer in their mouth and instructed to inhale as much air as possible, then blow out as hard as they can into the spirometer. The maximum amount of air expelled, forced vital capacity (FVC) and the amount forced out in 1 second,FEV1 (forced expiratory volume) were measured. The patient was asked to be seated for few minutes and they were explained about the procedure after which therapist demonstrated the exercises to the patient and the outcomes were measured after the 8 weeks of the treatment procedure.

Intervention

Participants in both groups performed Diaphragmatic breathing exercise. Participants in intervention group performed arm ergometer in addition.

Diaphragmatic breathing exercise

The diaphragmatic respiration was an up and down motion of the diaphragm. Participant in a hook lying position was asked to put his/her hands on the abdomen and to inhale slowly and deeply only by swelling of abdomen without moving upper chest while relaxing shoulders, then were asked to exhaled all the air slowly. One breathing consisted of three seconds of inhalation, three seconds of suspension, and six seconds of exhalation.

Arm ergometer

Intervention group was provided in addition with a commercially available static cycle, with variable resistance .The static cycle, placed on a table, was used as an arm ergometer. Participants exercised at a moderate exercise intensity; 50%-70% maximum heart rate and a BORG rate of perceived exertion 13-18. Duration, intensity and frequency were progressed to a target of 150 minutes of cumulative exercise per week, as recommended by American College of Sports Medicine guidelines. Participants in control group performed Diaphragmatic breathing exercise alone.

Outcome measure

We used FEV1/FVC% as respiratory function measurements. Each person repeated the complete test at least three times. If the two highest FVCs agreed within 10%, no additional trials were applied. A clinic doctor reviewed all results.

Statistical analysis

The data were statistically analysed using descriptive and inferential statistics; mean and standard deviation were estimated. Paired t test were used to compare data sets within the groups and unpaired t test were used to compare between the groups. P value of <0.05 was considered as statistically significant.

Results

All Participants were similar in baseline characteristics(Table-1)There was a significant difference in the FEV1/FVC ratio within groups and between groups(Table-2).Based on statistical analysis, both Groups showed improvement in pulmonary function. However subjects who received diaphragmatic breathing exercise with arm ergometry showed better improvement in pulmonary function than the subjects who received breathing exercises alone, at the end of 8 weeks.

Table 1: Baseline characteristics

	Breathing exercise + arm ergometer group, N=15	Breathing exercise group, N=15
Age, years-mean (SD)	23.4(2.1)	22.1(2.5)
BMI,	32.2(1.3)	33.4(2.1)
Hypothyroid, n	7	6
Polycystic ovarian disease	5	7

Table 2: Within and between group analysis

	Breathing exercise + arm ergometer group			Breathing exercise group			Between group
	Pre	Post		Pre	Post		P-Value
FEV1/FVC %	62.27(7.89)	82.20(2.65)	p-value<0.0001	59.13(7.07)	72.07(2.76)	p-value <0.001	<0.0001

Discussion

The purpose of this study was to examine the effects of diaphragm breathing exercise with arm ergometer. The diaphragm breathing exercise with arm ergometer was more effective on FVC and FEV1 when compared to the breathing exercise alone group. Spahija et al concluded that the breathing increased expiratory time and total time both at rest and during exercise; in addition inspiratory time increased significantly during exertion, the end results in an improvement in ventilator efficiency.[10] Here this study to improve the breathing efficiency and produces a more physiological and efficient ventilation. Thus, the breathing pattern seems to be more effective. Taranen et al stated that arm ergometry exercises were useful for activating abdominal muscles. Bilateral and unilateral shoulder extension and unilateral shoulder horizontal adduction and abduction with the pelvis fixed elicited the greatest activity of the core muscle.[9]

Our study results are similar to results of Ji Won Han and Young Mi Kim where they concluded that breathing exercises with dynamic arm ergometry exercise improves pulmonary function and that breathing and dynamic arm ergometry exercise described here should be considered in patients who require breathing therapy, it seems to have beneficial effects on pulmonary function.[11,12]

Conclusion

Breathing exercises when combined with upper limb exercise such as arm ergometry was effective in improving the pulmonary function in young obese women and can be recommended to address pulmonary function as part of obesity management.

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