Comparison of Breathing Exercises and Aerobic Exercise in Asthmatic Children

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Abstract

Purpose- To determine the comparison of effects of breathing exercise with aerobic exercise training on lung volumes of asthmatic children. *Need of the Study*-Children suffering from asthma lead a less active lifestyle. Avoidance of day to day triggers such as exercise and cold air generally imposes inappropriate restriction on life. This results in weakness of primary respiratory muscles and overuse of accessory muscles in breathing. There are also abnormal changes in lung volumes. These impairments or abnormal changes are associated with decreased tolerance to exercise, frequent episodes of dyspnea, decreased walking speed and distance, and eventual inability to perform activities of daily living at home or in workplace or to remain active participant in the community. The present study was conducted to compare the role of breathing exercise with that of aerobic exercise in the patients of asthma. The study has also explored physiological capacities of lung in these patients. *Method*- The sample size of forty subjects was taken to perform the study. The subjects were divided in two groups of twenty each. One group was given breathing exercise intervention and other group was given aerobic exercise intervention. Before and after the intervention period, the child was investigated with spirometeric analysis to find out the changes in the lung volumes after the effect of exercises in each group. Both exercises interventions were administrated four 6 weeks period. *Results*- The overall improvement of lung function was significantly more in aerobic exercise interventions than breathing exercise interventions. *Conclusions*- The breathing exercise intervention was effective in improving the lung volumes in asthmatic children. The aerobic exercise intervention was also effective in improving the lung volumes in asthmatic children. However, the quantum of reduction in lung obstruction and therefore, the overall improvement in lung functions was found to be more significant with the aerobic exercise intervention than breathing exercise intervention.

Keywords: Asthma, Aerobic exercises, Breathing exercises, Spirometry, Lung Volumes

Introduction

Asthma is defined as a chronic inflammatory disorder of airways characterized by reversible airflow obstruction causing cough, wheeze, chest tightness and shortness of breath Crompton et al [(7)]. Childhood Asthma begins at any age, and its clinical etiology and clinical course are variable. Children with early medical histories including low birth weight, bronchopulmonary dysplasia, respiratory syncitial and viral infection may be at increased risk of developing asthma *Luo et al (2003).* Asthmatic attacks are set up by exposure to specific allergens such as house dust mite, pollen and animal dander. Some other factors are exercise particularly running, dyes, air pollution, infection, cigarette smoke, dry inhaled air, certain foods such as fish, eggs, yeast, and wheat which presumably reach the bronchi via blood stream. There is noticeable increase in healthcare burden from asthma in several areas of world. There is also a global concern on the change in asthma epidemiology and

clinical spectrum. Over 50 million people in Central and Southern Asia have asthma and many do not have access to the medications that control the disease. Due to rapid industrialization and urbanization throughout the region, the prevalence of asthma is predicted to increase rapidly in coming years. The increase is likely to be particularly dramatic in India, which is projected to become the world's most populous nation by 2050.

Cibella et al (2002) conducted a study on lung function decline in Bronchial asthma. Results showed that FEV1 had linear decay with ageing in each subject. FEV1 decay was significantly higher among younger asthmatics with poorer baseline functional condition. Farid et al. [8] conducted a study to examine the effects of course of aerobic exercise on pulmonary function and tolerance of activity in asthmatic patients. Significant changes were observed in FEV1, FVC, PEF, PEF25-75%, MVV, RF and 6MWT between asthmatic patients of the two groups ($P \leq 0.05$), but FEV1/FVC showed no significant changes.

Neder et al (1999) conducted a study on short term effects of aerobic training in the clinical management of moderate to severe asthma in children. Aerobic improvement with training was inversely related to baseline level of fitness and was independent of disease severity. Although the clinical score and occurrence of EIB did not change after training, aerobic improvement was associated with significant reduction in the medication score and the daily use of both inhaled and oral corticosteroids.

Saxena & Saxena (2009) studied the effect of various breathing exercises (pranayama) in patients with bronchial asthma of mild to moderate severity. 50 cases of bronchial asthma were studied for 12 weeks. They were trained to perform Omkara at high pitch with prolonged exhalation as compare to normal Omkara. Breathing exercises showed significant improvement in symptoms, FEV1, and PEFR. It was concluded that breathing exercises (Pranayama), mainly expiratory exercises, improved lung function subjectively and objectively and should be regular part of therapy.

Children suffering from asthma lead a less active lifestyle. Avoidance of day to day triggers such as exercise and cold air generally imposes inappropriate restriction on life. This results in weakness of primary respiratory muscles and overuse of accessory muscles in breathing. There are also abnormal changes in lung volumes. These impairments or abnormal changes are associated with decreased tolerance to exercise, frequent episodes of dyspnea, decreased walking speed and distance, and eventual inability to perform activities of daily living at home or in workplace or to remain active participant in the community. Many studies have been conducted related to prevalence of asthma; few studies have tried to examine the efficacy of breathing exercise and aerobic exercise in a single study. Therefore, the present study was conducted to compare the role of breathing exercise with that of aerobic exercise in the patients of asthma. The study has also explored physiological capacities of lung in these patients.

Materials and Methods

The sample size of this study was forty subjects with twenty subjects in each group. The group A was given breathing exercises interventions and group B was

given aerobic exercises interventions. These forty subjects suffering with asthma were recruited for the study. A written consent was taken from each school and from the parents of the children before their participation into the study. The study was performed at four schools in Patiala, Ryan International School, Urban Estate, Patiala, Apollo Public School, Urban Estate, Patiala, Auro Mira Centre of Education, SST nagar Patiala and Modern Senior Secondary School near Guruduwara Dukhniwarn Sahib, Patiala. The study was also done in Rekhi Pediatrics' clinic. The baseline of spirometeric analysis of both the groups was taken in 0 week and both groups were assigned treatment interventions and after 6 weeks the spirometeric analysis was performed.

The independent variables in the study were Aerobic Exercises and Breathing Exercises. The dependent variable in the study was spirometeric analysis. Dependent variable was measured initially at baseline and then at six weeks for both groups.

DEEP BREATHING

PAPER STRIP BLOWING

BALLOON BLOWING

Aerobic Exercise Intervention

1) *Warm up Phase-* to raise heart rate and temperature of muscles to provide adequate blood flow .This phase included general range of motion and flexibility exercises like arm circles, toe raises, half knee bend and running in place.

2) *Activity Phase-* included the rhythmic steps of aerobics with graceful dance movements with less jumping action, but more of footwork, which wre coordinated with the rhythm of the music being played.

3) *Cool down Phase-* to gradually bring down the heart rate and metabolism to near normal.

Duration Of Exercise – 5-7 mins of warm-up 20 mins of activity. 5-7 mins of cool down period.

Frequency Of Exercise- 5 times a week for 6 weeks.

Intensity Of Exercise - Moderate intensity exercise at 60% of MHR (Age Predicted) of the patient of activity phase.

Aerobic Exercises

RESULTS

All data was expressed as Mean± SD and statistical significance of difference between results was evaluated by Student's t-test. Paired t-test was used to examine the changes in dependent variables from base-line to after completion of intervention in each group. Unpaired t-test was used to compare and analyze the changes in the dependent variables between the groups. After calculating t value, p value was looked at appropriate degrees of freedom and hence the significance of the results was determined at appropriate level of significance. On the basis of overall reduction in the lung obstruction.The spirometeric analysis provided the overall picture of obstruction to airways that was categorized in the form of grades as following:

4 – No obstruction
3 - Mild obstruction,
2 - Moderate obstruction and
1 - Severe obstruction

TABLE 1: The pre-post intervention comparison of lung obstruction of breathing exercise intervention.

Breathing Exercise	Pre-Intervention (MEAN±SD)	Post-Intervention (MEAN±SD)
	2.25±1.16	3.2±0.89
T-TEST	- 2.09	

Table 1 presents the Pre and Post intervention mean values of reduction in lung obstruction by breathing exercises interventions in the experimental groups 2. The calculated t value is 2.09 is more than the t critical value which is1.729. This indicates that the differences between the scores obtained from the pre and post value interventions are highly significant indicating that there was improvement in lung function.

Table 2: The pre-post intervention comparison of lung obstruction of both aerobic exercise interventions

Aerobic Exercise	Pre-Intervention (MEAN±SD)	Post-Intervention (MEAN±SD)
	2.45±1.27	3.65±0.81
T-TEST	-3.64	

Table 2 presents the Pre and Post intervention mean values of reduction in lung obstruction by aerobic exercise intervention test in the experimental group- 2. The calculated t value is 3.64 is more than the t critical value which is1.729. This indicates that the differences between the scores obtained from the pre and post value interventions are highly significant indicating that there was improvement in lung function.

Table 3: Comparison between the two experimental groups

	Breathing Exercise	Aerobic Exercise
T-TEST	-1.66	

Table 3 shows the comparison between the two experimental group interventions. The calculated t value between the two exercise interventions came out to be 1.66 and its critical value is 1.63. The differences between the scores statistical values are highly significant. This indicates that the improvement in the reduction of lung obstruction was better in the aerobic exercise intervention than the breathing exercise intervention.

Table 4: Shows Pre-Post Intervention of Comparison All the Five Lung Volumes within the Two Experimental Groups.

Variable	GROUP	Intervention		T	% Improvement
		Pre Mean±SD	Post Mean±SD		
FVC	Aerobic	1.6±0.12	1.8±0.10	0.90	12.5%
	Breathing	1.6±0.10	1.7±0.10	0.70	6.25%
PEFR	Aerobic	4.1±0.25	3.9±0.24	0.58	-5%
	Breathing	4.3±0.23	4.2±0.26	0.39	2.3%
FEV1/FVC	Aerobic	75.5±6	84.6±4.6	1.36	-8%
	Breathing	67±7	85±5.1	2.00	2.24%
SVC	Aerobic	4.03±0.35	4.26±0.36	0.88	5.7%
	Breathing	3.14±0.59	3.6±0.36	0.9	14.6%
MVV	Aerobic	54.4±2.85	50±4.6	1.24	-8%
	Breathing	31.2±6	31.9±3	0.10	2.24%

Table 4 presents the Pre and Post intervention mean values of the lung volumes in the two experimental groups 1 and 2. Six weeks of exercise resulted in insignificant results; however there was great scope of improvement in calculating the %age of improvement of the lung volumes.

Table 5: Comparison of five lung volumes between the two experimental groups of lung obstruction.

Parameters	Group	Pre-Post Mean±SD	T
FVC	Aerobics	0.10	NA
	Breathing	0.10	
PEFR	Aerobics	-0.19±1.35	0.16
	Breathing	-0.12±1.35	
FEV1/FVC	Aerobics	9±126.1	0.21
	Breathing	17.9±126.1	
SVC	Aerobics	0.2±2.21	0.42
	Breathing	0.5±2.21	
MVV	Aerobics	-4.3±16	4.1
	Breathing	20.36±16	

Table 5 shows the comparison to all lung volumes between the two experimental groups, the values of the came out to statistically insignificant. This suggests that the data cannot be compared statistically.

DISCUSSION

Bronchial asthma, which has been increasing in incidence worldwide, is a morbid disease that can also be fatal. Pathologically there is mucosal inflammation, collection of inflammatory mediators, bronchial constriction with air trapping. Presently it is difficult to control all the triggers in a single patient, but it is always possible to improve the lung function by therapeutic interventions. Therefore, the present study was carried out in the asthmatic school children to compare the two different kinds of therapeutic interventions.

The results of the present investigation have been discussed in this chapter under the following subheadings:
Effects of breathing exercise intervention on lung volumes of asthmatic children:
Effects of aerobic exercise intervention on lung volumes of asthmatic children:
Comparison between breathing exercise intervention and aerobic exercise intervention in asthmatic children:

Effects of breathing exercise intervention on lung volumes of asthmatic children:

While analyzing the effects of breathing exercise intervention on the lung volumes, it was found that the FVC showed 6.25% improvement, while PEFR showed 2.3% increase from the baseline-value at 0 week. On examining SVC it was found that there was 14.6% improvement in asthmatic children undergoing breathing exercise intervention, the MVV showed 2.24% scope of improvement in lung volume. The FEV1/FVC ratio showed 2.24% of improvement from breathing exercise intervention. Thus, breathing exercises have helped in improving all the lung volumes of the asthmatic children Breathing exercises in the present study were based on the expiratory phase of respiration, this is because the expiration in the breathing process is greatly affected and it is also shallow in nature. The exercises that enhance expiration process were balloon blowing and paper strip blowing. Besides expiration exercises, the stretching of accessory respiratory muscles which followed diaphragmatic breathing exercises helped the patients to get back to their normal way of breathing process. It produced relaxation of accessory muscles.

Effects of aerobic exercise intervention on lung volumes of asthmatic children:

In the present study, the lung volume values in the group of aerobic exercise intervention also showed improvement. The FVC value was found to be 12.5% improved from the base line test performed at 0 week, while there were 5.7% increase in SVC values and 12% increase in FEV1/FVC ratio of the group doing aerobic exercises interventions. The results of present investigation also exhibited 5% decrease in the PEFR and 8% decrease in MVV values. The present finding that aerobic exercise reduced the obstructions in the bronchial pathways could be explained on the basis that it increases the ventilatory efficiency. Hence there is better exchange of gases in the alveoli. One more important advantage of aerobic exercise in asthmatic patients is their accumulative desensitization on fear of dyspnea. The physical exercises can increase the asthmatic patient's residual airflow and decrease the ventilation with reinforcement of bronchi expansion during exercise. The results of present study are well in line with the findings of *Farid et al. (2005)* who conducted a study to examine the effects of course of aerobic exercise on pulmonary function and tolerance of activity in asthmatic patients. This study showed that aerobic exercises

in asthmatic patients lead to an improvement in pulmonary functions.

Comparison between breathing exercise intervention and aerobic exercise intervention in asthmatic children:

Comparison between breathing exercise intervention and aerobic exercise intervention in the present study was made on the basis of improvement observed in the values of lung volumes.

Statistical analysis suggested that there was no significant difference in the level of improvement of different lung volumes namely FVC, PEFR, FEV1/FVC, SVC, and MVV. This indicates that both interventions are effective in improving the values of lung functions in asthmatic children on the basis of clinical significance. This is because most of the children who participated in the study gave less complains of breathlessness in their daily functional activities to their doctors and parents. However no scale was used to measure the above terms in this study. It is the well known fact that in the normal breathing pattern the diaphragm moves downward when the person inhales and moves upward when the person exhales. However, an asthmatic patient breathes in an abnormal way by using only the upper portion of the chest for breathing. Over the period of time the patient develops weakness of chest muscles as the muscles are not being used properly. The findings of the present study have demonstrated that for the asthma patients breathing exercises can really help in reducing the airways obstruction. In addition to this, the breathing exercises help the person to use the inspiratory muscles. This mechanism may have helped in overcoming the feeling of the suffocation and breathlessness in the children.

On the basis of overall lung reduction-

Statistical analysis within the groups suggested that there was significant reduction in the lung obstructions in both groups (t=2.09 breathing exercises intervention and t=3.64 in aerobic exercise intervention). Nevertheless, when the improvement score of both groups was compared it was found that quantum of reduction in lung obstruction was much more in group of aerobic exercise intervention than the breathing exercise interventions (t=1.66 between both the experimental groups). This suggests that the overall improvement of lung function was significantly more in aerobic exercise interventions than breathing exercise interventions. The improvement in aerobic exercises may have occurred because the regular exercises strengthen the respiratory muscles (diaphragm and intercostals), this may have further helped in better chest expansion and therefore, improving the chest cavity. Thus larger chest cavity means more air could be inspired and therefore increasing the vital capacity and more capillaries form around the alveoli, so more gaseous exchange can take place. During aerobic exercise, minute ventilation increases and an increased load is placed on the respiratory muscles. Both the frequency and the speed of contraction in the muscle are increased. Increased work of breathing during strenuous exercise in healthy subjects can limit exercise performance whereas unloading the respiratory muscles during the strenuous activity, using assisted ventilation, results in significantly longer exercise tolerance.

CONCLUSIONS- In the present study it was concluded that-

1) The breathing exercise intervention was effective in improving the lung volumes in asthmatic children.

2) The aerobic exercise intervention was also effective in improving the lung volumes in asthmatic children.
3) However, the quantum of reduction in lung obstruction and therefore, the overall improvement in lung functions was found to be more significant with the aerobic exercise intervention than breathing exercise intervention.

Thus, a combination of the breathing exercises and aerobic exercise should be incorporated into the pulmonary rehabilitation program of the asthmatic child

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