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Research Article

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Upper Limb Aerobic Training versus Chest Physical Therapy in Asthmatic Children Rehabilitation

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Abstract

With asthma, children have a significant impairment in ventilatory functions which lead to impairment in functional capacity and developing lung infections. The purpose of this study was to evaluate the effect of treadmill training versus arm ergometry on ventilatory functions in children with asthma. Children for 16 weeks of training - 40 asthmatic children of both sexes participated in this study. They were classified randomly into 2 groups of equal number. (Group A) 20 children received chest physical therapy, (Group B) 20 children received arm ergometry training. Discovery diagnostic spirometer was used to measure the ventilatory functions. Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV1), Maximum voluntary ventilation (MVV) and Peak Expiratory Flow Rate (PEFR). The pre-treatment results showed that there were no significant differences in all measured parameters among both groups, The post-treatment results revealed that there was a significant improvement in both groups of the patient's ventilatory function "FVC, FEV1 and PEFR"

Keywords: Aerobic training, Asthma, Chest Physical Therapy, ventilatory functions

Introduction

Asthma is defined as chronic airways inflammation with the reversible occurrence of an obstruction, due to an allergic reaction of the airways to various stimuli [1].

Asthma is characterized by the presence of extensive airflow hindering with irreversible loss of pulmonary function [2].

Asthma leads to pulmonary functions deterioration leads to functional capacity and quality of life impairments that is affected by the patient age of and severity of the disorder [3].

Physical therapy modalities such as breathing exercises, incentive Spirometer and aerobic training help patient to improve their quality of life, maintain the capacity to perform daily activities without hazards and minimize use of pharmacological medication [4].

Many factors contribute to causing attack of asthma as allergens, smoking, diet behavior and infections [5].

Asthma is a widespread pulmonary disorder, it distinguished by reversible airway hindrance and inflammation. children with asthmatic have a considerable defect in pulmonary functions that lead to impairment in functional capacity and quality of life. In developed countries, many epidemiological studies show the increased mortality due to asthma [6].

Ventilatory function test is significant in the diagnosis, classification, and treatment of lung diseases [7].

Ventilatory function tests give an objective assessment of pulmonary function, these tests are useful in the assessment of the effect of the cardiopulmonary diseases pathology and the treatment results [8].

Chest physical therapy is a fundamental component of pulmonary rehabilitation. The frequency of treatments has to be individualized, according to the severity of the disorder and the state of airway secretions. Traditional chest physical therapy include postural drainage and respiratory exercises in addition to modern modalities as mechanical chest percussion and mask positive airway pressure [9].

Aerobic exercise is a significant component of pulmonary rehabilitation and it improves the functional capacity of the patient with chest diseases [10].

Aerobic exercise intervention consisting of treadmill training, swimming, arm ergometer training, up and down stairs, cycling, jumping, and rowing [11].

This study was a trail to compare the therapeutic efficiency of upper limb aerobic training versus chest physical therapy in asthmatic children rehabilitation

Methods

40 mild asthmatic children of both sexes with age ranged between 8 to and 12 years were participated in this study. Children were excluded if they had any of the following: 1-Associated cardiovascular abnormalities.2-Participating in any sport activities.3- Moderate or severe asthma. All participants in both study groups received their treatment regimen for 30 minutes, 3 times / week, for 16 successive weeks. They were assigned randomly into two groups :(Group A) 20 children who received chest physical therapy program including: Breathing Exercise and Incentive Spirometer training, (Group B) contained 20 children who received arm ergometry training protocol and Forced vital capacity "FVC", Forced expiratory volume after 1 second "FEV1", Peak Expiratory Flow Rate "PEFR " were evaluated by Discovery Spirometer pre and post treatment for both group.

Data analysis &statistical design

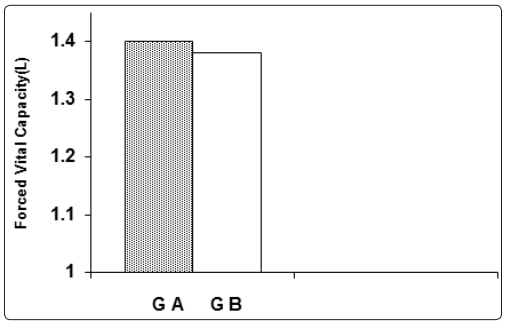
The data were tested for significance by using unpaired T-test to compare between pre &post treatment for both study groups. The obtained results were discussed and interpreted then final conclusion &recommendations were put forward. All statistical calculations were done using computer program SPSS.

Results

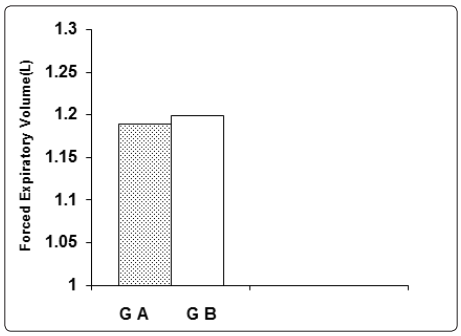
The pre-treatment results of this study showed that there were no significant differences in all measured parameters among both groups, The post treatment results of this study revealed that, there were significant improvement in both groups of the patient's ventilatory function "FVC, FEV1 and PEFR"

Demographic characteristics		Mean± SD	Min	Max	P-Value	Significance
Age/year	G(A)	9.3±1.2	8	12	1.36	NO
	G(B)	9.5±1.4				
Weight/Kg	G(A)	27.6±3.2	24	34	0.486	NO
	G(B)	28.2±3.4	26	35		
Height/m	G(A)	1.2±0.043	1.13	1.24	0.543	NO
	G(B)	1.23±0.057	1.1	1.29		

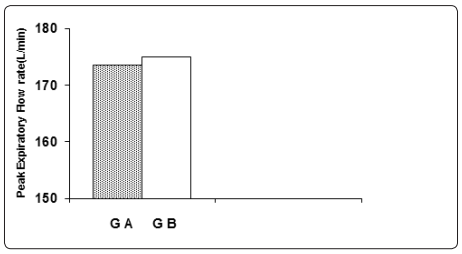
Variable	Item	Mean ± SD	P-value	Significance
Forced Vital capacity (L)	Pre group A	1.404±0.1169	0.223	NS
	Pre group B	1.388±0.1195		
Forced Expiratory Volume (L)	Pre group A	1.194±0.107	0.192	NS
	Pre group B	1.205±0.0934		
Peak Expiratory Flow Rate (L/Min)	Pre group A	173.5±10.35	0.39	NS
	Pre group B	175±10.49		



Pre treatment mean values of FVC (L) for both groups.



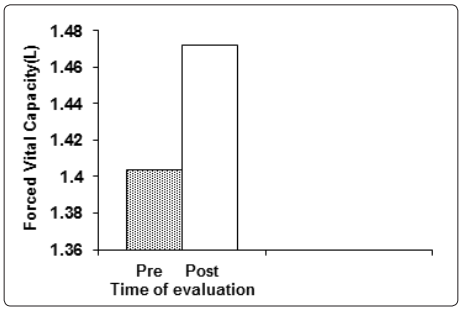
Pre treatment mean values of FEV1 (L) for both groups.



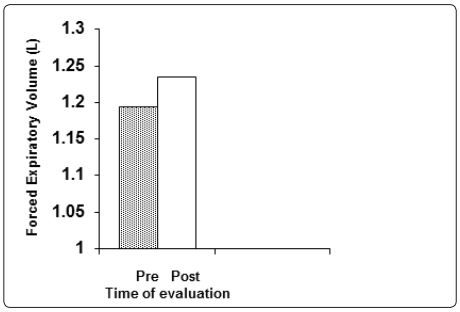
Pre treatment mean values of PEFR (L/min.) for both groups.

Group A

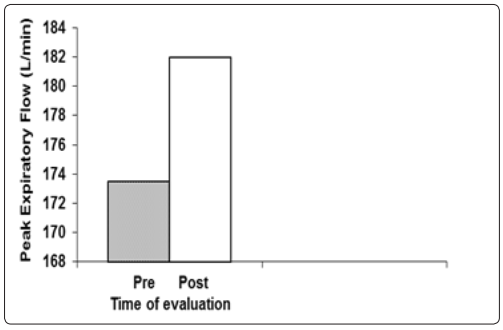
Variable	Item	Mean ± SD	P-value	Significance
Forced Vital capacity (L)	Pre group A	1.404±0.116	0.0441	S
	Post group A	1.472±0.0947		
Forced Expiratory Volume (L)	Pre group A	1.194±0.1074	0.0777	S
	Post group A	1.235±0.0905		
Peak Expiratory Flow Rate (L/Min)	Pre group A	173.5±10.35	0.0563	S
	Post group A	182±11.5		



Pre and Post Treatment Mean values of FVC (L) for Group A.



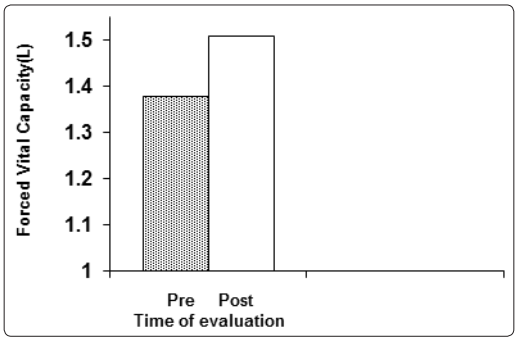
Pre and Post Treatment Means Values of FEV1 (L) for Group A.



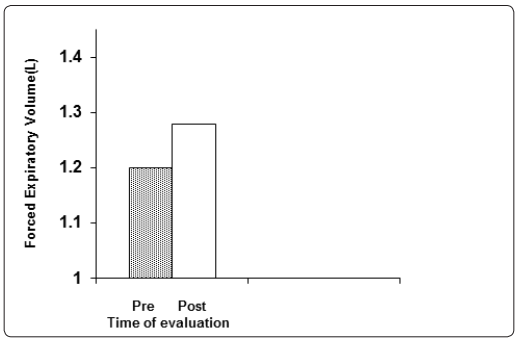
Pre and Post Treatment Mean values of PEFR for Group A

Group B

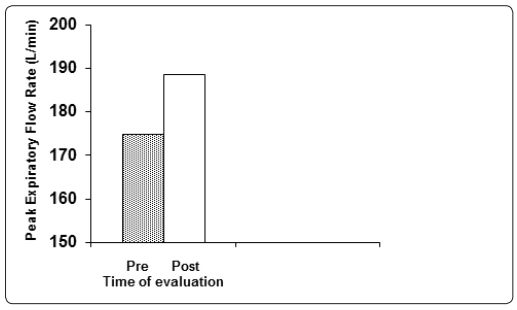
Variable	Item	Mean ± SD	P-value	Significance
Forced Vital capacity (L)	Pre group B	1.38±0.119	0.005	S
	Post group B	1.51±0.136		
Forced Expiratory Volume (L)	Pre group B	1.205±0.0934	0.0026	S
	Post group B	1.3±0.0737		
Peak Expiratory Flow Rate (L/Min)	Pre group B	175±10.49	0.004	S
	Post group B	188.6±17.03		



Pre and Post Treatment Mean values of FVC (L) for Group B.



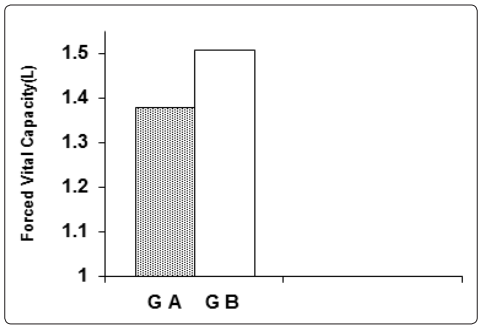
Pre and Post Treatment Means Values of FEV1 (L) for Group B.



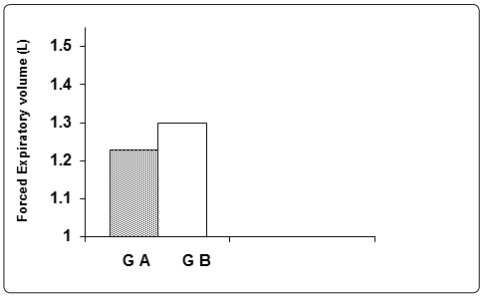
Pre and Post Treatment Mean values of PEFR for Group B.

Group A&B

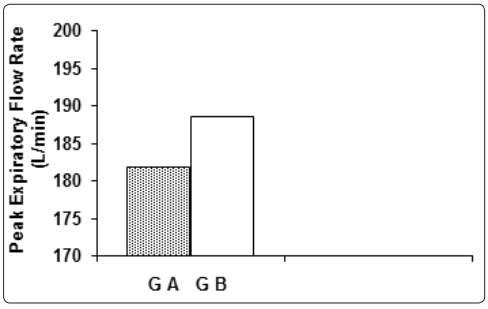
Variable	Item	Mean ± SD	P-value	Significance
Forced Vital capacity (L)	Post group A	1.474±0.0947	0.0161	S
	Post group B	1.518±0.1361		
Forced Expiratory Volume (L)	Post group A	1.23±0.0905	0.0094	S
	Post group B	1.3±0.0737		
Peak Expiratory Flow Rate (L/Min)	Post group A	182±11.5	0.0697	S
	Post group B	188.6±17.03		



Post Treatment Mean Values of FVC (L) for both groups.



Post Treatment Mean Values of FEV1 (L) for Both Groups.



Post Treatment Mean Values of PEFR (L/min) for both Groups.

Discussion

This study was conducted to compare the therapeutic efficiency of arm ergometry training versus chest physical therapy on the ventilatory functions in asthmatic children. The pre treatment results of this study showed that there were no significant differences in all measured parameters among both groups of patients in the ventilatory functions, These revealed that both groups were matched in the measured variables at the start of the study and the ventilatory functions (FVC, FEV1 and PEFR) were below the predicted values for these patients in relation to their ages, weights and heights.

The post treatment results of this study revealed that, there were significant improvement in both groups of the patient's ventilatory

function " FVC, FEV1 and PEFR" represented by significant differences between the pre-treatment and post-treatment ventilatory functions after 16 weeks of training for GB .

The improvement in post treatment results of Group A may be attributed to increase alveolar ventilation and decrease in dead space ventilation [12].

Also it may be attributed to strengthing of respiratory muscles. This was confirmed by Rutchik et al., who concluded that a respiratory muscle strengthening is most likely responsible for the improvement in ventilatory function sand reduction of dyspnea [13]. Also Darnley et al., supported that strengthening of respiratory muscles improve exercise capacity and reduce symptoms of breathlessness [14].

Bott stated that the Incentive spirometer give visual feedback for diaphragmatic exercise as it improve deep diaphragmatic breathing and expanding collapsed areas [12].

The improvement in post treatment results of Group B may be attributed to the improvement in the skeletal muscles strength, endurance and oxidative capacity. Emiel documented that during aerobic training, the body requires increasing the need for oxygen, so the respiratory system has to allow an increase in oxygen supply to the active muscles [15]. So aerobic training improves the respiratory system function to increase the oxygen supply.

Porcari and Kline reported that treadmill training, running, bicycling and other forms of aerobic exercise provide a sufficient stimulus to improve ventilatory functions [16]. Similar findings were reported by Normandin et al. and Rochester who reported that improvement in ventilatory functions and exercise capacity of patients with obstructive disease after aerobic exercise training [17, 18].

Conclusion

The arm ergometry training protocol used in this study can be considered as a beneficial therapeutic program that can be used to improve the pulmonary functions in asthmatic children Recommendations are made for establishing the arm ergometry training protocol in schools for asthmatic children.

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Conflict of interest statement

The authors declare that there was no conflict of interest.

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