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Original Article

Effects of a Period of Selected Activity on Lung Capacities in Children 5-10 Years with Asthma Caused by Exercise

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Abstract

Introduction:
Asthma due to causing disruption in the work of breathing and obstruction of the pulmonary tract creates the physical restrictions in the social, emotional and psychological, aspects and performing daily life activities, hence the present study is conducted to determine effects of a period of selected activity on spirometry parameters on children 5-10 years suffering from asthma caused by exercise.

***Materials and Methods*:**
In this half experimental respiratory research, respiratory indexes of 11 children with suffering from asthma caused by exercise were measured before and after eight weeks of selected exercises and pranayama by spirometry were measured.

***Results*:**
The results showed that the selected exercise routine improves on the status of activities and being short of breath (Z=0/003). Also the average of spirometry indexes prior to a ten minutes exercise, before and after the intervention, compared with the average of spirometry indexes after a ten minute exercise, before and after intervention in the parameters: Forced expiratory volume (time) (FEV1) in the first second, and Peak expiratory flow (PEF) the maximum expiratory flow, the results are statistically significant ($p<0.05$).

***Conclusions*:**
The present study shows the impact of the selected exercises in improving mobility status and being short of breath and Exercise-induced asthma symptoms (EIA) as well as strengthening the respiratory muscles significantly.

***Keywords**:* Asthma, Exercise, Pulmonary capacity, Pranayama, Spirometry.

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Received date: Jun 11, 2014 ; Accepted date: Jul 22, 2014

Introduction

The changes and developments of modern life has made mobility and physical activities inevitable necessities. Doing sports improves our performance and efficiency and strengthens and rehabilitates our internal organs including the nervous system, muscular, heart and vascular, and skeletal system, urinary system and temperature and breathing system in particular (1). But in the meantime there are people with some diseases, including asthma who because of the fear of recurrence of their disease refuse to participate in exercise programs since evidence and personal experience and past studies suggest that at some occasions even a slight exercise can lead to an asthma attack and so the question is whether these individuals can benefit from physical activity and sport or not? Asthma in recent years due to the existence of multiple stressor factors is increasing and has become a problem in the world of medicine, in spite of the progress of science in modern treatments of disease pathophysiology and modern treatments (2). According to the investigations conducted, asthma causes going to the doctor more than 27 million times a day, 6 million days off work ranged from 1 to 20 days and on average 3 days that has caused 90.5 million days limitations in daily activities per year. Plus the disease causes an annual 470000 cases of hospitalizations and the families of patients may spend more than 18 percent of their total spending in the family on it. In the pharmaceutical industry in 1975 over 292 million dollars were spent on providing drugs used for treatment of the diseases related to air ducts (1). In a survey conducted in 1998 on the students of elementary and middle school, the abundance of asthma was estimated to be higher than the global average of children (2). One of the most well-known programs to upgrade the quality of life in chronic lung diseases today is the Pulmonary rehab (PR) (3) that is one of the new treatments. Rehab programs are supplementary treatment for patients with asthma and make significant improvements in the quality of patient's lives (4). Physical exercises are a series of scheduled and recurring physical movements and with emphasis on shoulder muscles, hands and feet as well as the respiratory muscles plus aerobic exercises that are done to increase the physical capacity and fitness. Recent studies have reported considerable benefits within only three to four weeks of doing sports and of course more improvement will be seen when doing them even more. Obviously, the rate of recovery and the level of tolerance are different on different people, and depend on several factors including the severity of the condition of the person (5). Light and modified exercises follow two major aims: The primary aim of doing exercises is to build skills in setting up and coordinating the respiration during activities and the secondary aim is to increase strength and power of muscles (6). Rom and Robinson (2000) suggest that regular physical exercises have psychological benefits such as more confidence in carrying out activities of daily living, which reduces the incidence of asthma attacks (7). Despite the changes of the viewpoint of medical science from the past till present regarding the importance and the necessity of exercise planning in these people, researchers such as the Amtner (1998) and Rom (2000) and Paul (2004) in their research have stated that the effect of these exercises on the lung function and quality of life are not yet clear and have advised to do more research to determine the precise effects of physical exercises on patients who have asthma (7-9).

On the other hand doing physical exercises on a regular basis to reduce the respiratory symptoms of asthma and reduce shortness of breath by mechanism such as strengthening the respiratory muscles, the decrease in the minute conditioning as much as 6 percent, the decrease in the shortness of breath to 30 percent, reducing

the level of acid lactic to 17 percent for each level of sports activity, will be followed by increasing motivation, improving the performance of the respiratory muscles and improving the exercise techniques. In addition, noting the important fact that these illness will probably be with the person for the rest of their life and more than half of the people suffering from the disease of asthma in the society have this since childhood, and considering the population of children with asthma in Isfahan and its geographic and industrial location that is a high percentage in the world (2), the necessity and importance of this research is doubled. And finally the low costs of physical activities, as well as their practicality to be done at home, and educating families to use them under the supervision of professionals are of the necessitates that must be noted. According to the above mentioned descriptions, this study aims to determine the effects of a period of selected activity on lung capacities of children 5-10 years, suffering from asthma caused by exercise.

Materials and Methods

In a semi-empirical study, 11 boys (aged 5 to 10) were chosen who were suffering from asthma caused by exercise (EIA) and in the year 2014 visited the doctors of pediatric respiratory disease specialist and were diagnosed with Lung age estimation (ELA) by two lung specialist pediatrician according to the results of the spirometry before and after activities. The spirometry test was conducted at first by stimulating exercise and the medical information forms were completed by the children's parents. In this study the results were confidential and at the end of the study were given to their parents.

The independent variable which includes 18 sessions of 30-minute gatherings outdoors carried out three days a week for 8 weeks. Exercises per session included a three-step warm-up (stretching with walking for 10 minutes), professional movements (correct breathing exercises, training main and secondary respiratory muscles and yoga breathing exercises with emphasis on deep breathing and from diaphragm such that weight of 0.5 kg are placed on the upper part of the abdomen of the child while lying down and they are asked to breathe from diaphragm moving the weights up and down and do this practice 3 sets of 10 in every session.

This is a very effective exercise for strengthening the diaphragm muscle was done at an elementary level during Pranayama breathing exercises at stages of breathing and recovery for 3 seconds inhale and 3 seconds exhale and was gradually increased such that in the end of the practice sessions the children had 5 seconds inhale, 12 seconds keeping the breath and 6 to 7 seconds exhale) and at the last phase cooling for 5 minutes at the end of the sessions including stretching, walking and running very slow, along with deep breathing, and full recovery during cooling. The intensity of the training program was controlled with questions asked of children about their ability to do the exercises and they were stressed to immediately notify the researcher in any case of fatigue that they may feel in each session, and they were allowed to rest at any moment during the exercises. Spirometry test was done again at the end of the proceedings and a similar form as the medical information earlier was provided.

Research limitations:

Because of the lack of access to adequate samples in the present study to control the effect of drugs in other circumstances (severity of the condition and homogeneity of samples), a control group was not used and only one group was used. Another limitation was the selected location of the research which due to being in an open space, the effective control of allergens on the severity of the condition was impossible. Also there was no interference

with the physician's work so there was no control on the children's medicine routines.

Descriptive statistics is applied for data analysis in this research using statistical characteristics including mean, standard deviation, Wilcoxon test and statistical inference and such as paired T-test with significant level of (P<0.05) to compare the findings of before and after intervention. The obtained results were analyzed using SPSS software version 18 and the significant level of (P<0.05) was considered.

Results

Presents the means of spirometry indexes before ten-minute exercise stimulation, before and after the intervention, compared with the means of spirometry indexes after ten-minute exercise stimulation, before and after the intervention (Table.1).

Table 1: The comparison of the means of spirometry indicators, before and after the intervention.

Respiratory parameters	Before intervention		After intervention		Test results	
	Mean	Standard deviation	Mean	Standard deviation	t	p
FVC	1.39	0.4104	1.4936	0.3448	2.04	0.0687
FEV 1	1.1418	0.3354	1.2459	0.333	2.26	0.0471
%FEV1/FVC	82.947	11.724	83.097	9.9199	0.05	0.9607
PEF	2.1014	0.5888	2.4568	0.6522	2.60	0.0268
FEF 25%-75%	0.0218	0.4466	1.1627	0.454	1.54	0.1537

As the results indicate, according to the observed in the expiratory parameters, Forced expiratory volume in 1 second (FEV1), the volume of the exhale force in the first seconds and Peak expiratory flow (PEF) the maximum exhale flow, the results are statistically significant (P<0.05) and in the parameters of Forced vital capacity (FVC), FEV1/FVC% and Forced expiratory flow (FEF) at 25%-75% the difference was not significant (P>0.05). See also (Figuer.1).

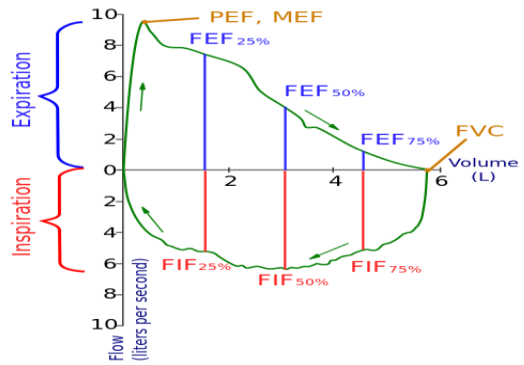

Fig.1: Spirometry and diagnostics

Flow-Volume loop showing successful FVC maneuver. Positive values represent expiration, negative values represent inspiration.

At the start of the test both flow and volume are equal to zero (representing the volume in the spirometer rather than the lung). The trace moves clockwise for expiration followed by inspiration. After the starting point the curve rapidly mounts to a peak (the peak expiratory flow). (Note the FEV_1 value is arbitrary in this graph and just shown for illustrative purposes; these values must be calculated as part of the procedure).

And (Table.2) shows, according to the wilcoxon test, doing the selected exercises has been significantly effective in the reduction of the score of mobility and breathing condition Medical Research Council (MRC) (P=0.003).

Table 2: The comparison of mobility and breathing condition form score (MRC) before and after six weeks of activity.

Experimental group	Before intervention		After intervention		Results	
	Mean	Standard deviation	Mean	Standard deviation	Z	p
	3.000	0.894	1.545	0.6875	-3.017	0.003

Discussion

The results indicated that performing a period of selected activities causes a significant increase in the parameters of (FEV1exhale force volume in the first second) and (PEF) maximum exhale flow and parameters of FVC, FEV1/FVC% and FEF 25%-75% difference did not appear to be significant. Alfaro (1996) in his research on 13 chronic lung patients indicated that cycling and upper body exercises increased FVC significantly (10), which is contradictory to the results of the present research, but the results of the researchers such as Carson (2002), and Yekeh Falah (2001) is consistent with the results of the present research (11 and 12). It seems that perhaps the selected exercises, due to the limitation of the volume or intensity of the exercises, was not been able to make significant changes in evacuating the air with maximum dilation during the six weeks.

The comparison of the means of FEV1 results indicated no significant increase in ($P<0.05$) level, which is in line with the results of researchers such as Amtnero Hrala (1997), Alfaro (1996), Angstram (1999), Makano (1988) (8,10,13,14) and is contradictory to the results of the Halstrand (2000), Finn Vamtner (1998) Paul (2005) and Yekeh Falah (2001) (15,16,9,12). It seems that the results are a consequence of improving asthma symptoms and the asthma caused by exercise in children. As noted earlier the 15 percent reduction in of this factor (FEV1) after exercise indicates a person's asthma and the reduction to less than 10 percent negates the existence of the disease. According to the statistical results, this situation has improved in all samples, which is a consequence of the reduction of resistance of the airways as well as an increase in the amount of inhaling air. In the reviewed studies there have been no contradictory reports to the above result. Apparently, since there have been no significant changes in the vital capacity, there have also not been a significant change in the result of the ratio % FEV1/FVC which can be attributed to the limited time or intensity of the exercises or the severity of the children's illnesses.

The results of Amtneroharalar (1996) and Yekeh Falah (1999) and Singh (1987) are consistent with the results of the present study (12,16,17) and are contradictory to the results of researchers such as Makona (1988) and Paul (2004) (9,14). This result probably represents an increase of muscular power of respiratory muscles and confirms the direct effect of exercises on respiratory muscles.

According to the results, despite the increase in FEF 25%-75% after intervention, it was not significant that the results are consistent with the results of researchers such as Cox (1993), Angstram (1991) and Yekeh Falah (18 and 13) and contradictory to Amtnerohrala's (1996) (16). It seems that the maximum air flow in pulmonary tree (small air ways) during a deep exhale in children, due to low intensity of intervention or length of exercise or finally the severity of the illness have not had significant impact on the parameter.

The comparison of the form rates of MRC means or the mobility and breathing condition has had significant reduction in the rates observed before and after the

intervention which is in line with the results of Cox (1993), Fitch (1986), My Donald (1994) Yekeh Falah (1999) and contradicts the findings of Paul (2004) (5,18,19). This may be a result of independent variables influencing the respiratory activity and mobility and improving the situation of the child.

Conclusion

The present study showed that the implementation of selected activities in a period of eight weeks has a positive impact on some children's (5 to 10 years old) spirometry parameters as well as their mobility status. An important mission of the physical education authorities (sports medicine society) to upgrade the quality of life for patients with asthma, especially children, is to consider people who despite their need for mobility and activities, evade it due to the recurrence of their disease and fear of participating in social activities. The researchers during the program and many investigations have shown that selected physical exercises improve the asthma symptoms caused by exercise, as well as the patient's breathing, mental status and the tolerance of the activity; and improving sports techniques assists them in performing their daily activities and childish games. In this study with coordination with the doctor, the patients were asked not to increase their medications during the eight-week program. Thus it can be said that increasing the maximum amount of expiratory flow and expiratory volume force in the first seconds seems to be in direct connection with the fitness program, and the asthma symptoms seems to have significant improvement during this period. The researchers believe that doing selected exercises the respiratory delays fatigue and weakness by strengthening respiratory muscles and reducing shortness of breath and as a result decreases the anxiety caused by the occurrence of shortness of breath when doing activities, especially sports activities and increases the confidence and mental status of patients. It can be concluded that physical exercises does not improve all spirometry parameters but is effective in improving some of them.

Conflict of Interest

The authors declare that they have no competing interests.

Acknowledgments

The authors would like to acknowledge the generosity of children who agreed to participate in this research. This study was done with obtaining informed consent of parents and children after explaining the study and its objective.

References

1. Jonathan M. F, Paul M. L, Soo B, Teal S. H, Mahmood I. S. Health Care Use and Quality of Life Among Patients with Asthma and Panic Disorder. J Asthma Apr 2005; 42(3): 179–84.

2. Iranpur A. The prevalence of asthma in children aged 12 to 14 years at guidance school in Esfahan city. Thesis for getting Professional doctorate, School of Medicine, Esfahan University of Medical Sciences. 2000: 29.

3. Baradun J. Value and costs of pulmonary rehabilitation. Schweiz rundsch med prac. 1997 Dec 10;86(50):1979-83.

4. Ries AL. The importance of exercise in pulmonary Regablitation. Clin-chest-med. 1997; 15(2):327-37.

5. May Donald F. Rehabilitation and continuity of care in pulmonary disease. 1994: 85.

6. Farias CC, Resqueti V, Dias FA1, Borghi-Silva A, Arena R, Fregonezi GA. Costs and benefits of pulmonary rehabilitation in chronic obstructive pulmonary disease: a randomized controlled trial 2014 Mar-Apr;18(2):165-73.

7. Chandratilleke MG, Carson KV, Picot J, Brinn MP, Esterman AJ, Smith BJ. Physical training for asthma. Cochrane Database Syst Rev 2013;9:CD001116.

8. Varray AL, Mercier JG, Terral CM, Prefaut CG. Individualized aerobic and high intensity

training for asthmatic children in an exercise readaptation program. Is training always helpful for better adaptation to exercise? Chest 1991 Mar; 99(3):579-86.
9. Paul T. Determinants of physical Fitness in Children With Asthma. Pianos and heather S. Davis. Pediatrics 2004 Mar;113(3 Pt 1):e225-9.
10. Alfaro V, Torras R, Prats MT, Palacios L, Ibáñez J. Improvement in exercise tolerance and spirometric values in stable chronic obstructive pulmonary disease patient after individualized outpatient rehabilitation program. J Sports Med Phys Fitness 1996 Sep; 36(3):195-203.
11. Carlsen KH, Carlsen KC. Exercise-induced asthma.PaediatrRespir Rev. Paediatr Respir Rev. 2002 Jun; 3(2):154-60.
12. Yeke falah L. Care of their health and quality of life in patients with asthma. Journal of Nursing 2001; 17:20-29.
13. Engström I, Fällström K, Karlberg E, Sten G, Bjure J. Physiological and respiratory physiological effects of physical exercise program for boys with severe Asthma. Acta Paediatr Scand 1991 Nov;80(11):1058-65.
14. Makwana K, Khirwadkar N, Gupta HC. The effect of short term yoga practice on ventilator function tests. Indian J Physiol Pharmacol 1988 Jul-Sep; 32(3):202-8.
15. Hallstrand TS, Bates PW, Schoene RB. Aerobic conditioning in mild asthma decrease hyperpnea of exercise and ventilator capacity . Chest 2000 Nov; 118(5):1460-9.
16. Emtner M, Finne M, Stålenheim GA-3year follow up of asthmatic patients participating in a 10 week rehabilitation program with emphasis on physical training. Arch Phys Med Rehabil 1998 May; 79(5): 539-44.
17. Singh v. Effect of respiratory exercises on asthma. The Pink City long exerciser. J Asthma 1987; 24(6):355-9.
18. Cox NJ, Hendricks JC, Binkhorst RA, van Herwaarden CL. A pulmonary rehabilitation program for patients with asthma and mild chronic obstructive pulmonary disease (COPD). Lung. 1993; 171(4):235-44.
19. Fitch KD, Blitvich JD, Morton AR. The effect of running training on exercise-induced asthma. Ann Allergy Aug 1986; 57(2):90-4