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Original Article

Effect of Aerobic Exercise Training on Peak Expiratory Flow Rate: a Pragmatic Randomized Controlled Trial

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ABSTRACT

Background Aerobic exercise is an important component of pulmonary rehabilitation for patients with chronic obstructive pulmonary disease (COPD). There are few studies on aerobic exercise and pulmonary function in general population. This study was carried out to explore the effect of aerobics on pulmonary function in general population. Aim To evaluate the effect of aerobic exercise training on Peak Expiratory Flow Rate (PEFR) in healthy volunteers. Methods We recruited eighty, apparently healthy medical students of either sex, aged 17-20 years. Randomizations into experimental and control groups (40 each), was carried out with a table of random numbers. Experimental group participated in a 16 weeks aerobic exercise plan (five 20 minute sessions of jogging in a week), while control group had no plan of exercise during that period of time. PEFR was recorded by computerised spirometer, before the commencement of training and at the end of 16 weeks in both the groups. Student ± s paired ± t ± test (2 tail) was applied to compare the pre and post training values of both the groups. Statistics were tested at the $p<0.05$ level of significance and data were reported as mean±standard deviation. Results At baseline, PEFR (L/min) values of experimental and control group were 437.8±64 (mean±S.D.) and 429.7±53 respectively. After 4 months of aerobics training, the PEFR values in experimental and control groups were 512.9±62 (P=0.007), and 431.5±59 (P=0.491) respectively. There was 17% improvement in PEFR in experimental group after the training. Conclusion We conclude that aerobic exercise training leads to improvement in pulmonary function in healthy subjects; and thus provides further support for the aerobic exercise being an important component of pulmonary rehabilitation. The health care community should better recognize aerobics as a complement to conventional

1. Introduction

Aerobic exercise is an important component of pulmonary rehabilitation for patients with chronic obstructive pulmonary disease (COPD).The American College of Sports Medicine (ACSM) defines aerobic exercise as "any activity that uses large muscle groups, can be maintained continuously, and is rhythmic in nature." It is a type of exercise that overloads the heart and lungs and causes them to work harder than at rest [1]. Examples: walking, jogging, running, skipping, dancing, swimming, bicycling, etc.

Peak Expiratory Flow Rate (PEFR) is the maximal expiratory flow rate achieved and this occurs very early in the forced expiratory maneuver. The peak expiratory flow rate measures how fast a person can breathe out (exhale) air. It is one of many tests that measure how well your airways work. It is a simple method of measuring airway obstruction and it will detect moderate or severe disease [2].

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Impaired pulmonary functions are associated with increased mortality and morbidity [3-5]. Physical activity is known to improve physical fitness and to reduce morbidity and mortality from numerous chronic ailments [6].There are few studies on aerobic exercise and pulmonary function in general population [7]. Most studies on the effects of physical activity are cross sectional ones, on special populations such as athletes or patients with Chronic Obstructive Pulmonary Disease [8-11]. Physical activity rehabilitation is widely used in patients with pulmonary diseases. Exploration of the relation between aerobic exercise and respiratory functions, will aid in understanding the mechanisms of how aerobics improve patient's quality of life and in finding a better way to evaluate the effects of rehabilitation. The present study was carried out to investigate the relationship between aerobic exercise and pulmonary function in an Indian setting.

2. Materials and methods

This study was approved by ethics committee of the institute. We recruited eighty, apparently healthy medical students of either sex, aged 17-20 years. Informed consent was obtained. Participants were non-athletes, non-smokers, non-obese and non-alcoholics. Randomisation into experimental and control groups (40 each), was carried out with a table of random numbers. Experimental group participated in 16 weeks aerobic exercise plan (five 20 minute sessions of jogging [high-intensity activity] in a week with 5 minutes of warm-up exercise before aerobic practice and 5 minutes of cool-down exercise after the practice), while control group had no plan of exercise during that period of time.

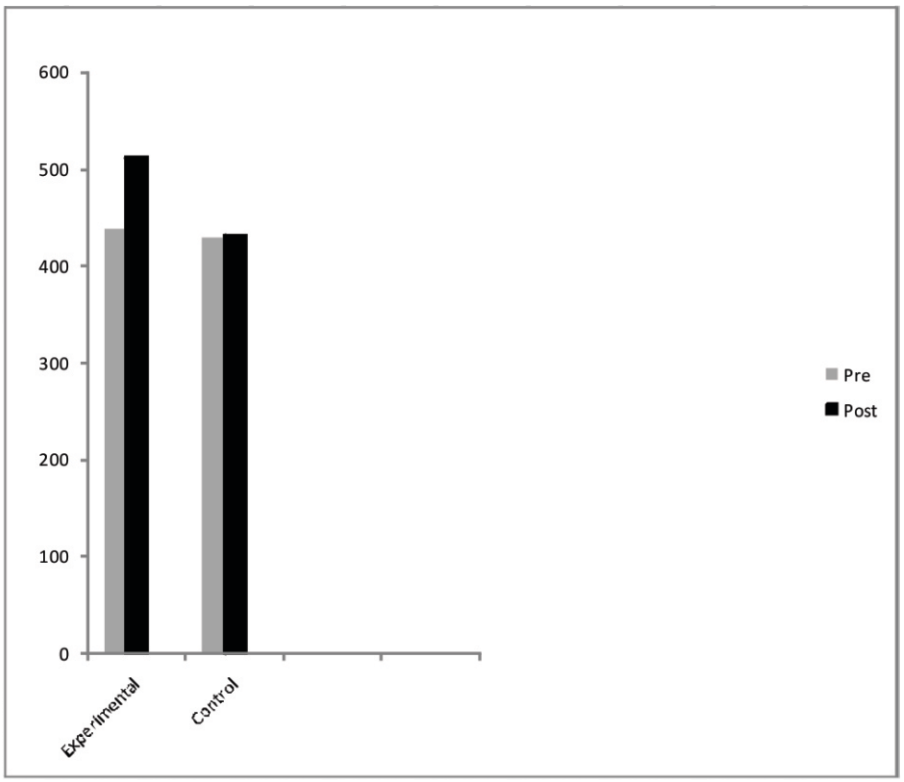
PEFR was recorded by computerised spirometer (CPFS/DUSB, Medgraphics Company) before the commencement of training and at the end of 16 weeks in both the groups. The subjects were instructed to take maximum inspiration and blow into the mouthpiece as rapidly, forcefully and completely as possible. It was ensured that a tight seal was maintained between the lips and mouthpiece of the spirometer. The best of three trials was recorded for each subject. Calibration of the spirometer and all testing protocols were performed as outlined in the instruction manual of the spirometer.

The data were analyzed using Microsoft Excel software. Student's paired't' test (2 tail) was applied to compare the pre and post training values of both the groups. Statistics were tested at the $p<0.05$ level of significance, and data were reported as mean±standard deviation.

3. Results

The subjects in two groups were comparable as regards their age, educational status, socioeconomic status and anthropometric parameters. At baseline, PEFR (L/min) values of experimental and control group were 437.8±64 (mean±S.D.) and 429.7±53 respectively. After 16 weeks of aerobics training, the PEFR values in experimental and control groups were 512.9±62 (P= 0.007), and 431.5±59 (P=0.491) respectively (see Fig.I). There was 17% improvement in PEFR in experimental group. There were no serious adverse events during the study. The subjects were comfortable.

Fig 1. Mean PEFR in pre test and post test in experimental and control groups.



4. Discussion

Physical inactivity and low cardio-respiratory fitness are recognized as important causes of morbidity and mortality [6, 7]. It is generally accepted that people with higher levels of physical activity tend to have higher levels of fitness and that physical activity can improve cardio-respiratory fitness [8].

In the present study, PEFR increased significantly in the experimental group after 16 weeks of aerobic exercise plan. It can be explained that as both groups had similar conditions at the beginning of the study, aerobic exercise caused the increase among the experimental group. Thus an association between aerobic exercise training and improvement of lung function was supported by our data.

Other studies comparing respiratory function among men and women engaged in various sports found that sports person have higher level of function [12] than sedentary people. Our result correlates with Y.J. Cheng et al. who showed in their study that physical activity improved pulmonary function in healthy sedentary people [13]. Our study also corresponds with Reza Farid et al. who have showed an improvement in pulmonary function with aerobic exercise training in asthma patients [14]. Cedric Nourrey et al. showed in a prospective study that aerobic exercise improves pulmonary function and alters exercise breathing pattern in children [15]. K.D. Fitch et al. studied the effect of 5 month swimming training on school children with asthma and found improved lung function, and improved posture and fitness [16].Bruce G Nickerson et al. have shown in their study that distance running program improved fitness in asthmatic children without pulmonary complications or changes in exercise induced bronchospasm [17]. C.J Clark in his study found that cardio-respiratory fitness significantly improved and breathlessness decreased over a wide range of work corresponding to activities of daily living [18].

Christopher Kaufman et al. studied the effect of aerobic training on ventilatory efficiency in overweight children, and found that the training helped to reverse the decrements in cardiopulmonary function observed overtime in overweight children [19]. Our study also correlates with the above findings.

Our study also showed that the experimental group was able to have more powerful and more effective inspiration and expiration as opposed to what they have been able to before participating in such aerobic exercise.

One limitation of our study is that most of our healthy subjects were from mid to upper socioeconomic strata. This shortcoming may affect the generalisability of the results to other sections of society.

5. Conclusion

In conclusion, the effects of aerobic exercise on pulmonary function depend on intensity and duration of training. We conclude that aerobic exercise training leads to improvement in PEFR in healthy people; and thus provides further support for the aerobic exercise being an important component of pulmonary rehabilitation. The health care community should better recognize aerobics as a complement to conventional medical care. This will lead to better and improved treatments of COPD.

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6. References

[1] Guidelines for Exercise Testing and Prescription. American College of Sports Medicine- Lea and Fabiger. 1988: 168-169.

[2] David P.Johns and Rob Pierce, Pocket Guide to Spirometry. Mc Graw Hill Australia, 2003, 1-30.

[3] Blair SN, Kampert JB, Kohl HW. Influences Of Cardio respiratory Fitness and Other Precursors on Cardiovascular Disease and All-Cause Mortality in Men and Women. JAMA. 1996; 276:205-10.

[4] Schunemann HJ, Dorn J, Grant BJ. Pulmonary Function Is A Long-Term Predictor Of Mortality In General Population: 29-Year Follow Up Of The Buffalo Health Study. Chest. 2000; 118:656-664.

[5] Neas LM, Schwartz J. Pulmonary Function Levels as Predictor of Mortality in a National Sample of US Adults, 2009.

[6] U.S. Department of Health and Human Services. Physical Activity and Health: A Report of the Surgeon General. Atlanta, GA: Department Of Health And Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.

[7] Twisk JW, Staal BJ, Brinkman MN.. Tracking Of Lung Function Parameters and the Longitudinal Relationship with Lifestyle. European Respiratory Journal. 1998; 12:627-634.

[8] Burchfiel CM, Enright PL, Sharp DS. Factors Associated With Variations in Pulmonary Functions among Elderly Japanese-American Men. Chest. 1997; 112:87-97.

[9] Doherty M, Dimitriou L. Comparision Of Lung Volume In Greek Swimmers, Land Based Athletes, And Sedentary Controls Using Allometric Scaling. Br J Sports Med. 1997; 31:337-341.

[10] Malkia E, Impivaara O. Intensity of Physical Activity and Respiratory Function in Subjects with and Without Bronchial Asthma. Scand J Med Sci Sports. 1998; 8:27-32.

[11] Tiep BL. Disease Management of COPD with Pulmonary Rehabilitation. Chest. 1997; 112:1630-56.

[12] Mehrotra PK, Varma N, Tiwari S. Pulmonary Function In Indian Sportsmen Playing Different Sports. Indian Journal of Physiology and Pharmacology. 1998; 42:412-16.

[13] Cheng YJ, Macera CA et al. Effects Of Physical Activity On Exercise Tests And Respiratory Function. Br. J. Sports Med. 2003;37:521-528

[14] Farid R, Farahzad A et al. Effect of Aerobic Exercise Training on Pulmonary Function and Tolerance of Activity in Asthmatic Patients. Iranian Journal of Allergy, Asthma and Immunology. Vol. 4, No.3, September 2005.

[15] Nourry C, Deruella F. High Intensity Running Training Improves Pulmonary Function And Alters Exercise Breathing Pattern In Children. European Journal of Applied.Physiology. 2005; 94; 415-425.

[16] Fitch KD, Mortan AR et al. Effect of Swimming Training On Children with Asthma. Archives of Disease in Childhood,. 2001; 51. 190-194.

[17] Bruce G. Nickerson, Daisy B. Bautisia et al. Distance Running Improves Fitness In Asthmatic Children Without Pulmonary Complications Or Changes In Exercise Induced Bronchospasm. Pediatrics.1983; 71(2): 147-152.

[18] Clark CJ. The Role of Physical Training in Asthma. Chest. 1998;101: 293-298.

[19] Kaufman C et al. Aerobic Exercise Training Improves Ventilatory Efficiency In Overweight Children. Pediatric Exercise Science. 2007; 19: 82-92.