International Journal of scientific research and management (IJSRM)
||Volume||3||Issue||2||Pages|| 2090-2096||2015||
Website: www.ijsrm.in ISSN (e): 2321-3418

Effect of Aerobic Exercise on Respiratory Parameters In Untrained And Trained Subjects

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Abstract

Physical fitness is required not only by athletes for better performance but also by non-athletes for maintenance of physical and mental health. The aim of the study was to assess the role of aerobic exercise on respiratory parameters among untrained and trained subjects. The present study was conducted in the Dept. of Physiology, Dr. S.N. Medical College, Jodhpur after ethical approval. Informed written consent was obtained from all the subjects included in the study. In this study total 200 male subjects were included, which were further divided in two groups. **Group I** included 100 randomly selected untrained male subjects (medical students) at the beginning of their training period. **Group II:** It included the same 100 healthy medical students, as in group I, but after their training period of 3months duration. **Group III:** 100 randomly selected male Athletes participating in city/district/state competition constituted the trained group. All the subjects in untrained group participated in aerobic exercise for three months. Untrained Subjects were assessed for pulmonary function tests (FEV1 and PEFR), with the help of computerized spirometer (Helios 401, RMS Recorders & Medicare Systems) before and after training. Values obtained were compared with data obtained from athletes. Aerobic exercise training resulted in improved ventilatory functions in untrained, in the form of increase in the forced expiratory volume at the end of 1st second (FEV1; $p<0.0001$), and Peak expiratory flow rate (PEFR; $p<0.0001$). Thus, our finding showed that regular practice of aerobic exercise for three months helped in achieving efficient lung function especially FEV1.

❖ **Keywords:** Aerobic Exercise; Medical Education Group; Pulmonary Function Test

I-Introduction

Aerobic exercise is physical exercise of relatively low intensity that depends primarily on the aerobic energy-generating process. [1] Aerobic means "with oxygen", and refers to the use of oxygen to adequately meet energy demands during exercise via aerobic metabolism. [2] The term and the specific exercise methods were developed by Kenneth H. Cooper and Col. Pauline Potts, a physical therapist, in the United States Air Force.

Most of medical students lead a physically inactive life, probably because heavy academic demands of medical college may cause medical students exhausted or may leave no time to

exercise. It is also possible that the advances in modern technology have almost completely eliminated the necessity for physical exertion in daily life.

On the other hand Athletes lead a physically active life as their academic curriculum itself includes daily physical exercise and outdoor games. An impressive accumulation of research data over the past three decades has documented that regular exercise is important for health and well being and physical inactivity is a major health problem. Compelling evidence suggests that physical inactivity is contributing factor in several chronic diseases and conditions.[3]

Physiology of Exercise offers the student an opportunity to observe the effect of training and helps to evaluate the respiratory system. This has created a great enthusiasm in our mind to undergo this study. The present study was undertaken to investigate effect of aerobic exercise on respiratory parameters in trained and untrained exercise performers.

Ii-Design Of The Study

The present study was conducted to assess and compare important cardiopulmonary fitness parameters between students of Medical College and Athletes of Sports Authority of India.

In the present study, none of the ME students gave history of regular physical exercise in the past 9 months where as all the athletes gave history of regular exercise for about 2- 4 hours/day for six days a week.

Exclusion Criteria: Subjects suffering from asthma, chronic bronchitis, tuberculosis, muscular, neurological disorder and cardiovascular disease were excluded from the study. At the onset of study written consent was obtained from the participating subjects after explaining the purpose of the study and outcome.

The present study was carried out in the Department of Physiology, Dr. S. N. Medical College Jodhpur on 200 volunteers in the age group 18-26, on male subjects. All the subjects were then divided into three groups.

Group I: It included 100 randomly selected untrained male subjects (medical students) at the beginning of their training period.

Group II: It included the same 100 healthy medical students, as in group I, but after their training period of 3months duration.

Group III: 100 randomly selected male Athletes participating in city/district/state competition constituted the trained group. Trained group (Athletes) performed daily, sports activity and untrained group performed aerobic exercise for one hour under the guidance of qualified instructors for three months.

All the subjects in both the group were subjected to various anthropometric measurements and respiratory parameters were recorded (with the help of computerized spirometer (Helios 401, RMS Recorders & Medicare Systems) before and after training. Based on observations obtained before and after training, statistical analysis was done and a comparison was done between trained and untrained group (after 3 months of aerobic exercise) to assess, impact of aerobic exercise on untrained subjects (medical students).

Iii-Observation And Results

The present study was conducted in three groups. Group I: (n=100) randomly selected untrained male subjects (medical students) at the beginning of their training period and Group II included the same 100 healthy medical students, as in group I, but after their training period of 3months duration. Group III (n=100) randomly selected male Athletes.

Table & Figure I and II shows the comparison of mean values of respiratory parameters (FEV1 and PEFR), in resting and after three months of physical activity in untrained subjects and obtained values are compared with the data obtained from the trained subjects.

Results were presented as Mean ± SD. For statistical analysis students –t test was used. . A significance level of $p< 0.05$ was chosen.

Table No. I Comparison Of FEV1 In Untrained And Trained Subjects

Parameters		G-I (n=100) Initial	G-II (n=100) After 3 months	G-III (n=100)	p value		
					GI&GII	GI & GIII	GII &GIII
FEV1	Pre	75.36±10.28	78.53±7.66	87.78±8.24	<0.0001	<0.0001	<0.0001
	Post	79.39±8.19	95.92±7.83	107.31±8.51	<0.0001	<0.0001	<0.0001

Note – All values are showed as Mean + SD; p value >0.05 (NS)*, p<0.05 (S)**, p<0.01 (HS)*** ; Abbreviation - forced expiratory volume at the end of 1st second (FEV1)

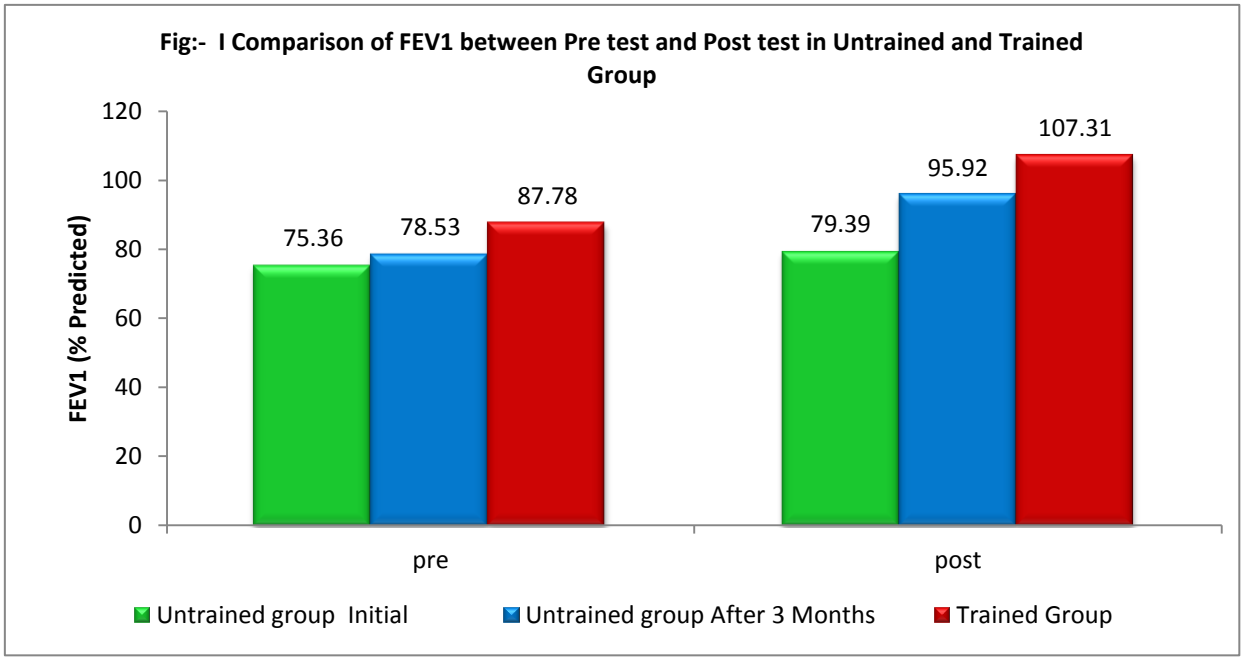
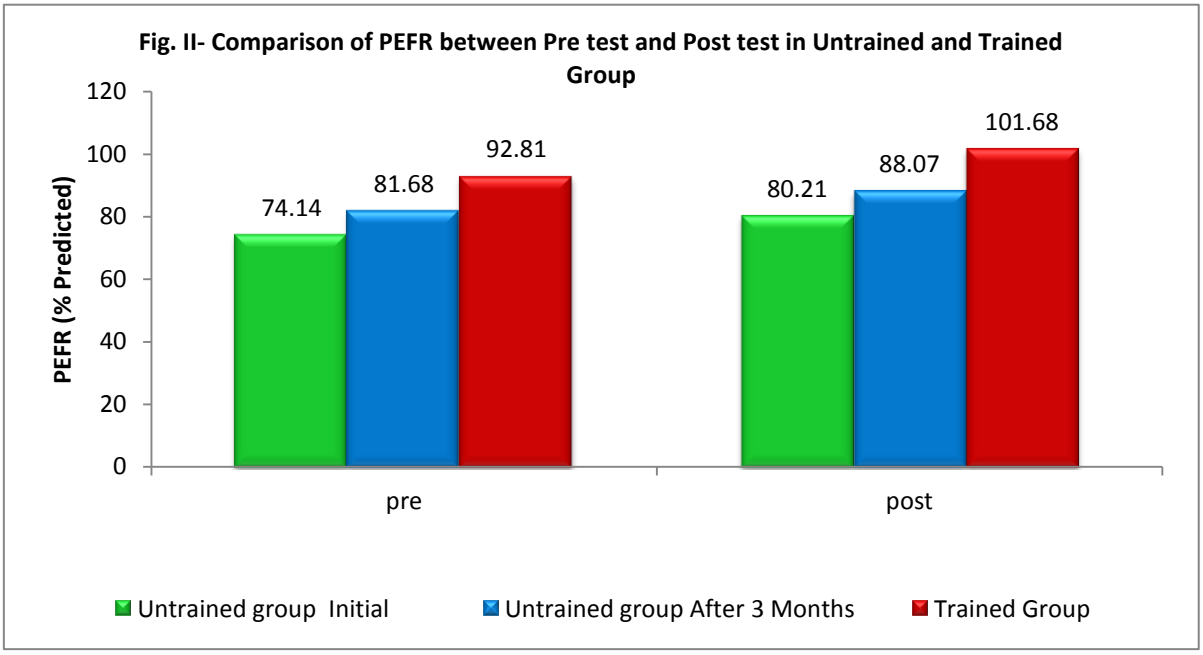


Table No. II Comparison Of PEFR In Untrained And Trained Subjects

Parameters		G-I (n=100) Initial	G-II (n=100) After 3 months	G-III (n=100)	p value		
					GI&GII	GI & GIII	GII &GIII
PEFR	Pre	74.14±10.78	81.68±11.73	92.81±10.76	<0.0001	<0.0001	<0.0001
	Post	80.21±10.73	88.07±6.15	101.68±9.91	<0.0001	<0.0001	<0.0001

Note – All values are showed as Mean + SD ; p value >0.05 (NS) *, p<0.05 (S)**, p<0.01 (HS)*** ; Abbreviation - Peak expiratory flow rate (PEFR)



Iv - Discussion

Physical exercise is a stressful condition which produces a marked change in body functions and lungs are no exception. Sedentary life styles could be associated with less efficient pulmonary functions. There is an increasing evidence to show that regular physical activity causes many desirable physical, physiological and psychological changes in an individual consequently raising his level of fitness. Physical fitness is required not only by athletes for better performance but also by non-athletes for maintenance of physical and mental health. Heavy academic workloads in medical college make it difficult for medical students to maintain a regular exercise program.

Present study has compared pulmonary functions of healthy volunteers (Medical students) before and after 3 months of aerobic exercise. Obtained results were compared with data obtained from trained (athletes) group. Our results showed improvement in FEV1 and PEFR in untrained group though trained group had higher values. Several studies have shown significant improvement in pulmonary functions as a result of

the effect of exercise (Chandran et al, 2000; Cedric et al, 2005; Shivesh et al, 2007; Thaman RG et al, 2010). [4,5,6,7]

In the present study, FEV1 (a dynamic lung volume that indicates any impairment of airway resistance) increased significantly in the untrained group after 12 weeks of aerobic exercise plan. After three months of training untrained group (Group II) pre-exercise (78.53±7.66) and post-exercise value of FEV1 (95.92±7.83) increased from baseline data of untrained group (Group I) showing effect of aerobic exercise on respiratory parameters. The trained group (group III) pre-exercise value of FEV1 (87.78±8.24) and post-exercise value (107.31±8.51) were higher than untrained group (group I & II). The values were statistically highly significant ($p<0.0001$).

This finding is consistent with researches conducted by Watson (1995)[8], Joshi (1998)[9], Huang chuang (2006)[10], Candy Sodhi (2009)[11], Shilpa S. Gupta and et al (2012)[12] and Vimal Singh (2012)[13] Cheng YJ& et al (2003)[14] in their groups. Result of study by Shehab and kader (2003)[15] showed that the amount of VC, FEV1 after exercise (walking on treadmill), and three times per week for 8 weeks was significantly higher than before training (Shehab and kader, 2003).[15] This increase in the amount of FEV1 after exercise, may be due to one or all of the following factors, which include improved aerobic capacity, either muscular strength or both, increase motivation and development in respiratory muscles (Normandin et al.,2002).[16] Increase in values of FEV1 in untrained group could be explained due to better strengthening of respiratory muscles especially expiratory muscles as a result of physical training. FEV1 is related to maximum expiratory pressure which is a representation of respiratory muscle strength.

The Peak Expiratory Flow Rate (PEFR) is generally considered as a sensitive indicator of changes in elastic recoil pressure / or resistance of small airways. PEFR is subject to wide variability and is effort dependent (Joshi LN et al, 1998)[10]. In our study there is a gradual increase in values of PEFR from group I to III. The trained group (group III) pre-exercise value of PEFR (92.81±10.76) and post-exercise value (101.68±9.91) were higher in comparison to untrained group (group I & II). The values were statistically highly significant ($p<0.0001$). After three months of aerobic exercise the untrained subjects (Group II) pre-exercise (81.68±11.73) and post-exercise value of PEFR (88.07±6.15) increased from baseline data of untrained showing positive impact of aerobic exercise on respiratory parameters. This can be explained as aerobic training cause's regular forceful inhalation and deflation of the lungs for prolonged periods. This in turn leads to strengthening of respiratory muscles and structural charges in the airways which increase PEFR values in both trained and untrained subjects.[7] Previous studies by various authors have also reported a significantly high PEFR in trained subjects when compared to untrained subjects.[17,7,18,19]

The possible explanation for significant improvement in pulmonary functions could be that regular forceful inspiration and expiration for prolonged periods during training period, leads to the strengthening of the respiratory muscles, both voluntary and involuntary. This helps the lungs to

inflate and deflate maximally. This maximum inflation and deflation is an important physiological stimulus for the release of lung surfactant[20] and prostaglandin[21] into the alveolar spaces thereby increasing the lung compliance and decreasing the bronchial smooth muscle tone respectively.

According to Centres for Disease Control and prevention (CDC) and The American College of Sports Medicine (ACSM),[22] physical activity need not be strenuous to be beneficial. Moderate amounts of daily physical activity are recommended for people of all ages, which provide substantial benefits across a broad range of health outcomes for sedentary people. A positive association between physical activity and academic performance is revealed by a review of several cross sectional studies by Trudeau F et al.[23]

The present study suggests that regular aerobic exercise plays an important role in improving lung volume and capacities in untrained subjects(Medical students). And that physical activity causes respiratory muscle endurance capacity greater than normal.

V- CONCLUSION

Medical students who had sedentary lifestyles had lower pulmonary function parameters Pursuing a physical activity helped in achieving efficient lung function especially FEV1, which is an essential preventive strategy in this busy age when prevalence of sedentary life style is increasing and so are the associated lifestyle disorders. A continued high physical activity is associated with lower mortality, and delays decline in the pulmonary functions and therefore should be encouraged. This information should prompt medical educators to promote exercise and corporate physical fitness program into medical college curriculum.

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