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A COMPARATIVE STUDY OF LUNG FUNCTIONS TEST BETWEEN ATHLETES AND NON-ATHLETES

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ABSTRACT

The purpose of the study was to compare the lung volumes and capacities between athletes and non athletes. Sixty college going young male subjects (athletes: N=30 and non-athletes: N=30) of 18-25 years were randomly selected from different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India. All the participants were assessed for height, weight and body mass index. Lung functions test was performed with a computerized spirometer following the procedures and predicted values recommended by the American Thoracic Society. Lung functions parameters i.e. forced vital capacity, expiratory reserve volume, inspiratory reserve volume, vital capacity, inspiratory capacity and tidal volume were measured. The independent samples t-test used for data analysis. The level of $p \leq 0.05$ was considered significant. Statistical analysis showed significant differences between athletes and non-athletes of all the lungs function variables. It was observed that all lung function parameters of athletes were higher than non-athletes ($p < 0.05$). It was concluded that athletes have greater lungs functions in comparison with non-athletes. Results of the present study therefore suggest that sporting activity, sports training and exercise may cause an increase in the lungs function which could be due to increased development of respiratory musculature incidental to physical training. This study provides evidence that sporting activity has an influence on the lungs function test.

Keywords: Lungs Function Test, Athlete, Non-athlete, Spirometer.

INTRODUCTION

Respiratory system is an important system of a human body where gaseous exchange takes place with diffusion of enormous amounts of oxygen into the blood during physical activity (Khurana, 2005). The lung function tests, like other physiological tests must be of the utmost importance for measuring the fitness of an individual from a physiological point of view (Astrand and Rodahl, 1970). Lungs function parameters tend to have a relationship with lifestyle such as regular exercise and non-

exercise (Wasserman et al., 1995; Twisk et al., 1998). The apparently simple function of the lung is to deliver O_2 to gas exchanges surface and exhaust CO_2 to atmosphere. Lungs functions test is a powerful tool to measure volumes and capacities of an athlete in physiology lab. In addition to measuring volumes and capacities, it provides information regarding response to training or exercise and monitors the response following respiratory problems including exercise induced broncho spasm (McGraw-Hill's 2001). Due to regular exercise, athletes tend to

have an increase in respiratory capacity when compared to non-exercising individuals. Exercise is 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 are several studies that have shown significant improvement in pulmonary functions as a result of the effect of exercise (Chandran et al., 2000; Shivesh et al., 2007). However, there are studies which show non-significant change in pulmonary functions as an effect of exercise (Hamilton and Andrew 1976; Kuppu and Vijayan 1988). In athletes lung volumes and capacities alters during resting state and intense exercise. Lung function tests provide qualitative and quantitative evaluation of pulmonary function and are therefore of definitive value in the diagnosis and therapy of patients with cardio-pulmonary disorders as well as those with obstructive and restrictive lung disease (Belman and Mittman, 1980; Robinson and Kjeldgaard, 1982). The parameters used to describe lung function are the lung volumes and lung capacities. The pulmonary functional capacities of normal sedentary individuals have been studied extensively in India (Singh, 1959; Rao et al., 1961; Singh, 1967; Jain and Ramiah, 1969; Gupta et al., 1979). Therefore, the purpose of the study was to compare the lung function parameters between athletes and non athletes.

MATERIAL AND METHODS

The present study was conducted on Sixty college going young male subjects (athletes: N=30 and non-athletes: N= 30) of 18-25 years age. The subjects were selected as athletes who

have been participated in inter-university championships and subjects selected as non-athletes who have been not participated any sporting activity. All subjects randomly selected from the different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India. The age of each subject was calculated from the date of birth as recorded in his institute. The height of the subjects was measured with anthropometric rod to the nearest 0.5 cm. The weight of subjects was measured by using portable weighing machine to the nearest 0.5 kg. Body mass index was calculated as body weight adjusted for stature. Lung functions testing were performed with a computerized spirometer following the procedures and predicted values recommended by the American Thoracic Society. All Spirometric measurements were performed under standard conditions of body temperature and ambient pressure and with water vapor saturation with the subjects sitting down and wearing a nose clip. The forced vital capacity, expiratory reserve volume, inspiratory reserve volume, vital capacity inspiratory capacity and tidal volume were measured in each subject and recorded in absolute values. Each subject performed 3 acceptable maneuvers according to the American Thoracic Society recommendations.

Statistical analysis:

The lung functions test were compared in both the athletes and non-athletes groups by the 'Independent samples t' test. Data were expressed as Mean value and SD. Statistical significance was indicated by 'P' value <0.05. Data was analyzed using SPSS Version 16.0 (Statistical Package for the Social Sciences, version 16.0, SPSS Inc, Chicago, IL, USA).

RESULTS

Table 1: Mean, standard deviation and ‘t’ value with statistical significance of age, height, weight and body mass index variables in athletes and non-athletes

Variables	Athletes (N -30)		Non-Athletes (N-30)		t-value
	Mean	SD	Mean	SD	
Age (years)	21.033	2.747	20.633	1.973	0.64
Height (cm)	181.833	4.259	172.733	6.096	6.70*
Weight (kg)	73.066	3.423	73.033	4.230	0.03
Body Mass Index (BMI)	22.104	0.887	24.503	1.344	8.15*

(Significant; *p < 0.05)*indicates significance of the difference between athletes and non- athletes values at p<0.05

The mean and standard deviation of age, height, weight and body mass index variables between athletes and non-athletes are shown in table -1. Athletes significantly possess greater stature and body mass index value than non-athletes. In case of age and body weight difference between athletes and non-athletes group were found to be

non significant. The values presented in table-1 shown the average age value was 21.033 and 20.633, height value was 181.833 and 172.733, weight value was 73.066 and 73.033 and body mass index value was 22.104 and 24.503 of athletes and non-athletes group respectively.

Table 2: Mean, standard deviation and ‘t’ value with statistical significance of forced vital capacity, expiratory reserve volume and inspiratory reserve volume variables in athletes and non-athletes

Variables	Athletes (N -30)		Non-Athletes (N-30)		t-value
	Mean	SD	Mean	SD	
Forced Vital Capacity (liters)	4.940	0.093	3.796	0.394	15.45*
Expiratory Reserve Volume (liters)	1.336	0.080	1.046	0.089	13.13*
Inspiratory Reserve Volume (liters)	3.336	0.171	2.780	0.195	11.73*

(Significant; *p < 0.05)*indicates significance of the difference between athletes and non- athletes values at p<0.05

The mean and standard deviation of forced vital capacity, expiratory reserve volume and inspiratory reserve volume between athletes and non-athletes are shown in table -2. The mean value of forced vital capacity of athletes and non-athletes was 4.940 and 3.796 and the mean value of expiratory reserve volume of athletes and non-athletes group was 1.336 and 1.046 respectively, whereas the mean value of

inspiratory reserves volume of athletes and non-athletes group was 3.336 and 2.780 respectively. The “t” value in case of forced vital capacity was 15.45, expiratory reserve volume was 13.13 for inspiratory reserves volume, it was 11.73. Results indicated that athletes have significantly greater values in forced vital capacity, expiratory reserve volume and inspiratory reserves volume variables than the non-athletes group.

Table 3: Mean, standard deviation and ‘t’ value with statistical significance of vital capacity, inspiratory capacity and tidal volume variables in athletes and non-athletes

Variables	Athletes (N -30)		Non-Athletes (N-30)		t-value
	Mean	SD	Mean	SD	
Vital capacity (liters)	4.726	0.086	3.790	0.286	17.11*
Inspiratory Capacity (liters)	3.580	0.106	2.990	0.263	11.38*
Tidal Volume (mili-litres)	571.000	30.211	479.000	14.936	14.95*

(Significant; *p < 0.05)*indicates significance of the difference between athletes and non- athletes values at p<0.05

Table-3 indicated that the mean value of vital capacity of athletes and non-athletes was 4.726 and 3.790 and the mean value of inspiratory capacity of athletes and non-athletes group was 3.580 and 2.990 respectively, whereas the mean value of tidal volume of athletes and non-athletes group was 571.000 and 479.000 respectively. The “t” value in case of vital capacity was 17.11, inspiratory capacity was 11.38 for tidal volume, it was 14.95. Results indicated that athletes have significantly greater values in vital capacity, inspiratory capacity and tidal volume variables than the non-athletes group.

DISCUSSION

Results obtained from the present study indicated that athletes had a significantly higher forced vital capacity, expiratory reserve volume, inspiratory reserve volume, vital capacity, inspiratory capacity and tidal volume than the non-athletes. These findings are in line with those of reported by many researchers (Adegoke and Arogundade, 2002; Cordain, 1990; Newman et al., 1961, Bloomfield et al., 1985). Adegoke and Arogundade (2002) reported greater lung functions in footballers, volleyball and basketball players when compared to non-athletes. Greater values among the athletes could be explained due to better strengthening of respiratory muscles as a result of strenuous physical training. Cordain (1990) also reported larger lung volumes in swimmers and divers

when compared to normal non-athletes. Many other previous studies (Onadeko et al., 1976; Bjorstrom, 1987) also showed a significantly greater vital capacity in athletes when compared with non-athletes. However, the findings of the present study are in contrast to the findings of the other studies (Hagberg, 1988) which reported no significant differences between athletes and non-athletes. Results from the present study strongly suggest that the intensity or severity of the sports engaged in by the athletes probably determines the extent of strengthening of the respiratory muscles which result in the increase in the lung volumes. There might be increase in the maximal shortening of the inspiratory muscles as an effect of training, which has been shown to improve the lungs function parameters (Fanta et al., 1983). In the Amsterdam Growth and Heart study, physical activity was observed to be positively correlated to changes in forced vital capacity between ages 13-27 years over a period of 15 years (Twisk et al., 1998). This is supported by many other previous studies as well (Armour et al., 1993; Mehrotra et al., 1998; Birkel and Edgren 2000). All pulmonary function variables of athletes measured in this study were above normal limits for the 18-25 year age group. The forced vital capacity of athletes in the present study is 4.940 liters which is greater than the Nigerian athletes studied by the Adegoke and Arogundade (2002) but lower than that of elite European road cyclists (5.91L) studied by the Vrijens et al. (1982) and top South African squash players (6.32L) studied by the Rensburg et al. (1982).

The lung function parameters were found to vary in the different countries and these may be due to the genetic, ethnic and nutritional factors as suggested by Lakhera et al. (1994).

CONCLUSION

The result obtained from the study indicated that there were significant differences in the lung function parameters between athletes and non-athletes. Means of all parameters were significantly higher in athletes than non-athletes. Hence, Conclusion made in this study that, athletes had greater lung capacities in comparison with non-athletes. Results of the present study therefore suggest that sports activity, sports training and exercise may cause an increase in the lungs functions which could be due to increased development of respiratory musculature incidental to physical training or exercise.

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