RESEARCH ARTICLE

THE EFFECT OF RUNNING TRAINING ON PULMONARY FUNCTION TESTS

Background: Sedentary lifestyle and physical inactivity represent the high prevalence and public health concern in developed and developing countries. Exercise when performed regularly has beneficial effects on the various systems of the body. Regular exercise has a favorable influence on pulmonary functions.
Aims & Objective: To study the pulmonary functions in competitive runners and to compare the same with matched sedentary control group.
Materials and Methods: In this study pulmonary functions such as FVC, FEV_1, FEV_1/FVC, MVV, PEFR parameters were studied in 50 competitive runners in the age group of 19- 26 years. These parameters were compared with matched apparently normal healthy sedentary medical students using unpaired t test.
Results: In our study a very highly significant increase was observed in pulmonary function parameters of competitive runners than sedentary controls. Competitive runners had higher mean of percentage value of Forced Vital Capacity (FVC) (P=0.0034) 2.70 ± 0.40, Forced expiratory volume in first second (FEV_1) (P=0.0066) 2.49±0.56, Maximum Voluntary Ventilation (MVV) (P=0.0045) 140.64 ± 20.77 and Peak Expiratory Flow Rate (PEFR) (P=0.0037) 8.35 ± 0.88 than controls. However there was no significant difference in FEV_1/FVC ratio (P=0.1337) between the study groups.
Conclusion: The current study has shown that, there is significant positive relationship between running training and pulmonary function in healthy young men. The improvement in pulmonary function could be due to increased strength of respiratory muscles. So running can be recommended so as to improve the pulmonary function of an individual.
Key Words: Runners; FEV1; FVC; PEFR; Pulmonary Function

Varsha Akhade, NS Muniyappanavar
Department of Physiology, Bidar Institute of Medical Sciences, Bidar, Karnataka, India

Correspondence to: NS Muniyappanavar (drmunins@gmail.com)

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INTRODUCTION

Beneficial effect is seen on various systems of the body due to any type of exercise if performed regularly. These systems are benefited by such exercises by way of improving their functions. When exercising, metabolic activities increase and therefore both the ventilation and the cardiac systems should work harder in order to provide an increased amount of simultaneous ventilation and cardiac output. To do so, an increase in the number of breaths, number of heart beats per minute, tidal volume and stroke volume is necessary.[1]

A spirometer can be used to determine how well the lungs receive, hold, and utilize air. They are also used to monitor and determine the severity of a lung disease and to determine whether the lung disease is restrictive or obstructive (disruption of airflow). After taking a deep breath, a person forcefully breathes out into the spirometer as completely and forcefully as possible. The spirometer measures both the amount of air expelled and how quickly the air was expelled from the lungs. The measurements are then recorded by the spirometer.

There are several studies that have shown significant improvement in pulmonary functions as a result of the effect of exercise.[2,3] However, there are studies which show non -significant change in pulmonary functions as an effect of running.[4-6] Sedentary life styles could be associated with less efficient pulmonary functions and regular running practice could produce a positive effect on the lungs by increasing pulmonary capacity and thereby improving the lung functioning. Physical activity rehabilitation is widely used in patients with pulmonary diseases. Exploration of the relation between running training as a form of exercise and respiratory functions, will aid in understanding how running improves patient's quality of life and in finding a better way to evaluate the effects of rehabilitation.

The present study was therefore designed to study whether running practice has any effect on pulmonary function. In this study, we have compared pulmonary functions of healthy young male runners and those with matched sedentary medical students. This is a cross sectional study of competitive runners who were undergoing training for different periods of time.

MATERIALS AND METHODS

The study was conducted in the department of physiology, Dr. VM Medical College, Solapur after obtaining the institutional ethical clearance. The present study included 50 male competitive runners, aged between 19-26 years, who were residents of Solapur district and were practicing running at Park Stadium Solapur, for about 2-3

hours per day for at least 5 days in a week regularly since 2-6 years. A similar number of age, sex, height and weight matched medical students not directly involved in any kind of sports activity selected as controls. The informed consent was taken after the detailed procedure and purpose of the study was explained.

Those with history of chronic respiratory disorders, cardiovascular disorders, systemic diseases affecting respiratory system and smokers were excluded from the study. A thorough history taking & clinical examination was carried out to rule out the exclusion criteria and the vital data was recorded. Standing Height was measured without foot wear with subjects back in contact with the wall and with both heels together and touching the base of the wall. Weight was recorded with light clothing using a digital weighing machine. Both the height and weight were measured to the nearest 0.1 cm and 0.5 kg respectively.

Pulmonary Function Testing: Spirometry was done on both control and competitive runner groups with Medspiror a portable, computerized pneumotachometer (Manufactured by Medsystems Pvt. Ltd. Chandigarh). The recordings were carried out at an average temperature of 28 degree C between 9am-11am. All the maneuvers were performed with the subjects in sitting position. Thorough instructions were given to each subject regarding the test and sufficient time was provided for them to practice the maneuvers. A soft nose clip was put over the nose to occlude the nostrils and disposable mouthpieces were used to minimize cross infection. Three readings were taken and maximum reading was selected to print.

Statistical Analysis: The data were expressed as mean and standard deviation and student unpaired t-test was applied for comparison between two groups. A p value < 0.05 was considered to be statistically significant.

RESULTS

The recorded anthropometric data in competitive runners and control groups did not show any statistical significance as shown in Table 1. The present study shows that among runners and sedentary controls, competitive runners have significantly higher values of forced vital capacity (FVC) (P=0.0034), Forced expiratory volume in first second (FEV_1) (P=0.0066), and Maximum Voluntary Ventilation (MVV) (P=0.0045) and Peak Expiratory Flow Rate (PEFR) (P=0.0037). There was no significant difference in FEV_1/FVC ratio (P=0.1337) in runners and controls as shown in Table 2.

Table-1: Anthropometric Data

Parameters	Runners (Mean ± SD)	Controls (Mean ± SD)	P value
Age (year)	21.40 ± 2.20	22.02 ± 2.38	0.1793
Height (cm)	167.33 ± 9.58	166.19 ± 4.89	0.4554
Weight (kg)	63.35 ± 9.48	64.66 ± 12.54	0.5570

Table-2: Pulmonary Function Test Parameters Runners and controls

Parameters	Runners (Mean ± SD)	Controls (Mean ± SD)	P value
FVC (L)	2.70 ± 0.40	2.39 ± 0.61	0.0034
FEV_1 (L)	2.49±0.56	2.19±0.52	0.0066
FEV_1/FVC	98.24 ± 4.71	99.28 ± 1.21	0.1337
PEFR (L)	8.35 ± 0.88	7.65 ± 1.41	0.0037
MVV (L)	140.64±20.77	130.23 ±14.51	0.0045

DISCUSSION

Pulmonary function is governed by genetic, environmental and nutritional factors and confirms that physical training during growth help in developing a greater endurance in Respiratory muscles. Lung size may increase by a strenuous and prolonged strength training regimen during adolescence.[6] Our study is in agreement with previous studies and clearly shows that among competitive runners and sedentary controls, runners have statistically highly significant values (P<0.001) of forced vital capacity (FVC), Forced expiratory volume in first second (FEV_1), Maximum Voluntary Ventilation (MVV) and Peak Expiratory Flow Rate (PEFR). There was no significant difference in FEV_1/FVC between two groups.

In the present study, it is observed that there is significant increase in Forced vital capacity in runners than controls, this is in agreement with other studies.[7,8] Muscular exercise increases the rate and depth of respiration and so improves FVC, the consumption of O2 and the rate of diffusion.[9] In the Amsterdam Growth and Heart study, physical activity was observed to be positively correlated to changes in FVC between ages 13-27 years over a period of 15 years.[10]

Forced expiratory volume in first second (FEV_1) was significantly high in runners than controls this in contrast to study done by Khanam AA and et al[11] and this in agreement with other earlier studies[8,12]. Reason for the significant difference in FEV_1 between the two groups is superior expiratory power and overall low resistance to air movement in the lungs.[12,13] Maximum voluntary ventilation (MVV) which depend both on the patency of airways and strength of respiratory musculature was significantly high in runners. MVV improvement might be due to superior expiratory power and overall low resistance to air movement in the lungs. The higher MVV value is advantageous for physical work capacity.[13,14] Other earlier studies also documented increased MVV.[15]

The mean expiratory flow rate (PEFR) of runners was significantly higher than matched control group. The PEFR is an effort dependent parameter emerging from the large airways within about 100–120 ms of the start of the forced expiration.[16,17] PEFR can be therefore, be an easy test for quick assessment of improvement of an overall pulmonary function of the sportsmen.

In our study spirometric measurements, FVC, FEV1, MVV and PEFR were found significantly high in runners than sedentary controls. The probable reason for observation could be that following training there is increased demand for oxygen in the working muscles which stimulates the respiratory centers present in brain stem which send strong signals to inspiratory group of muscles which cause forceful inspiration and expiration. Repeated forceful inspiration and expiration cause increased secretion of surfactant which decreases surface tension in alveoli and decreases physiological dead space this in turn reflects as increase in pulmonary function in runners.

The conflicting finding in some studies may be due to genetic and ethnic factors as suggested by Lakhera and Klain 1995 who compared lung function amongst athletes in different Indianpopulations. The lung function parameters were found to vary in different settings with results suggesting that the size of lung is governed by genetic, environmental and nutritional factors.[18] A continued high physical activity is associated with lower mortality, and delays decline in the pulmonary functions and therefore should be encouraged.[19] Running is the most natural of athletics movements and common aerobic exercise. And have a profound effect on lung functions. Hence results from the present study suggest that running 2-3 hours per day for minimum of 5 days a week for 2-6 years could cause strengthening of respiratory muscles with resultant increase in pulmonary function. Involvement in certain physical activities or sports could help in respiratory muscle strengthening and improvement in pulmonary function.

One limitation of our study is that most of our healthy subjects were from mid to upper socioeconomic strata and only male subjects were included in the study. This shortcoming may affect the generalization of the results to other sections of society. Our study was a cross sectional study. A follow up study with larger sample size is needed.

CONCLUSION

In conclusion, the current study has shown that, there is significant positive relationship between running training and pulmonary function in healthy young men. The improvement in pulmonary function could be due to increased strength of respiratory muscles. So running can be recommended so as to improve the pulmonary function of an individual.

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