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Original Research Article

Effects of Training on Pulmonary Function Test in Long Distance Runners

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Conflict of interest: Nil

Abstract:

Background: Running is one of the most popular exercises practiced across the world. Owing to regular exercise during running, long distance runners usually have increased pulmonary/respiratory capacity compared to non-exercising individuals. The present study was conducted in a tertiary care academic hospital with an aim to assess pulmonary function test in long distance runners.

Methods: A total of 50 long distance runners and 50, age matched individuals with leisure-time physical activity or activities done for less than 20 minutes or less than 3 times/week were included in the study. The PFT was performed by using Medspiror (Computerized spirometry) after reinforcing the method of test to each participant.

Result: All parameters of PFT like forced vital capacity (FVC), forced expiratory volume in 1st second (FEV1), forced expiratory volume in three second (FEV3), peak of expiratory flow rate (PEFR) and FEV1/FVC ratio were significantly high in long distance runners and controls.

Conclusion: Physical exercise in any form has positive effect on respiratory system of an individual. As running improves/enhances vigor of respiratory muscles, it increases the function of pulmonary system. The current study, underscores the importance of regular running to improve the pulmonary function.

Keywords: Long distance runners, pulmonary function test, spirometry, respiratory system.

Introduction

Regular physical exercise in any form has several beneficial effects on the various system of the body. [1] Running is one of the most popular exercises practiced across the world. It has several advantages over different types of physical exercises. It doesn't require any equipment and specialized training. Running can be performed at any time and any place. Regular running is known to reduce the risk of premature death by 25 to 40%. In addition, it is also protective against cancers and cardiovascular disease (CVD). Running also protects an individual from effects of neurological disorders like Alzheimer's and Parkinson's disease. [2, 3] Respiratory function parameters have a relationship with type of lifestyle such as regular exercise and non-exercise.[4] Owing to regular exercise during running, long distance runners usually have increased pulmonary/respiratory capacity

compared to non-exercising individuals. Pulmonary function tests (PFT) is a non-invasive diagnostic modality utilized to describe lung physiology including lung volume and capacities.[5] It is an important tool for investigating and monitoring patients with pulmonary pathologies. Although PFT is well studied in patients with respiratory illnesses, occupational hazards and individuals with sedentary life styles, only few studies are available highlighting PFT in long runners, especially from India. Therefore present study was conducted in a tertiary care academic hospital with an aim to assess PFT in long distance runners.

Material and Methods

The present descriptive cross sectional study was conducted in the Department of Physiology. The study population included a total of 50 long distance runners (running for 2 to 2.5 hours/day with constant pace). A total 50 age matched individuals with leisure-time physical activity or activities done for less than 20 minutes or less than 3 times/week were recruited as controls. Following were inclusion and exclusion criteria

Inclusion criteria

1. Individuals belonging to age group 18-30 years
2. Both sexes
3. Non smokers
4. Non obese
5. Willing to participate in the study

Exclusion criteria

1. Chronic disease
2. Respiratory illness
3. Individual on medication

Participants from both the groups were informed about aim of the study. They were made aware of the procedure by demonstrating the technique. The PFT was carried out as per the standard protocol as suggested by Miller et al.[6] The PFT was performed by using Medspiror (Computerized spirometry) after reinforcing the method of test to each participant. All measurements were obtained between 8 AM to 12 noon to prevent any diurnal variation in pulmonary/lung functions.

Demographic features (age, sex) and anthropometric measurements (height, weight) of each participant of the study were recorded and analyzed. The data was entered in Microsoft Excel and analyzed using SPSS version 19.0 statistical software. The *P* value of < 0.05 was considered as significant.

Results

The gender wise distribution of participants from both the groups (long distance runners and control) is shown in figure 1.

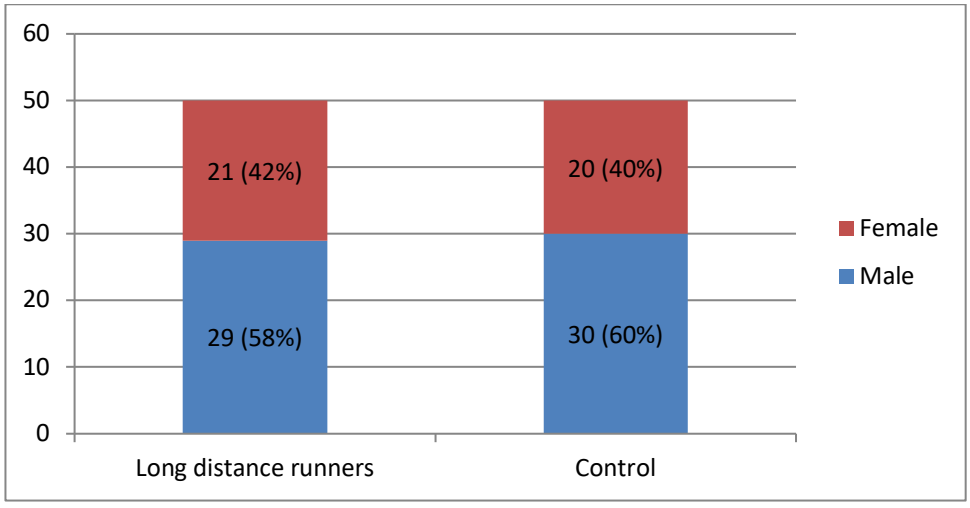

Figure 1: Gender wise distribution of participants.

In long distance runners, a total of 29 (58%) participants were males and 21 (42%) were females whereas 30 (60%) participants from control group were males and 20 (40%) were females. There was no significant difference observed in gender of both the groups (Chi square test, *P* value >0.05). The mean age and anthropometric measurements of both the groups is shown in table 1.

Table 1: Anthropometric measurement of participants

Anthropometric measurement	Group		T value	*P* value
	Long distance runners ± SD	Control ±SD		
Age (in years)	22.02±2.9	22.7±2.2	1.2	>0.05
Weight (in kg)	58.2±1.27	56.3±1.7	1.26	>0.05
Height (cm)	161.8±3	158.2±2.8	1.39	>0.05
Body Mass Index	23.8±1.3	24.2±1.2	1.42	>0.05

As shown in table 1, there was no significant difference observed between variables like age, weight, height and body mass index (BMI) of long distance runners and controls and these variables were comparable.

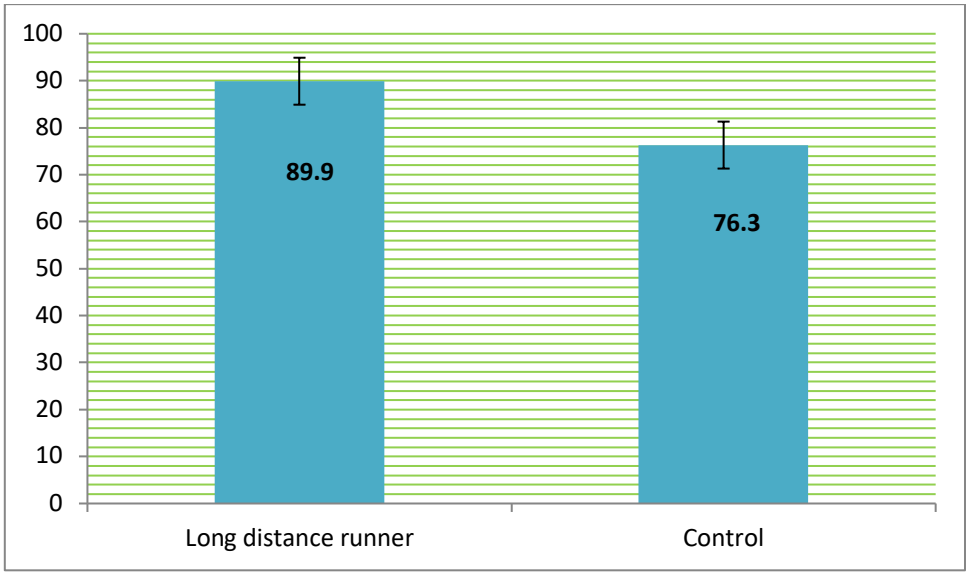

Figure 2: Mean Percentage of Forced vital capacity (FVC)

The mean % of forced vital capacity (FVC) of participants is shown in figure 2, in long distance runners FVC was 89.9(±12.7) whereas for control group it was 76.3(± 7.3). Similarly, as shown in figure 3, mean % of forced expiratory volume in 1st second **(**FEV1) was higher in long distance runners (88.5± 13.9) compared to control group (74.6± 9.6). As shown in figure 4, the mean percentage of forced expiratory volume in three second (%FEV3) was high in long distance runners (87.9 ±14.9) than control group (74.6± 6.7). When the mean percentage of peak of expiratory flow rate (% PEFR) was compared (figure 5), it was high in long distance runners (94.2 ±14.2)) as compared to control group (84.2 ±11.1). Mean % FEV1/FVC ratio (figure 6) was high in long distance runners (95.9±11.9) as compared to control group (83.7 ±9.2).

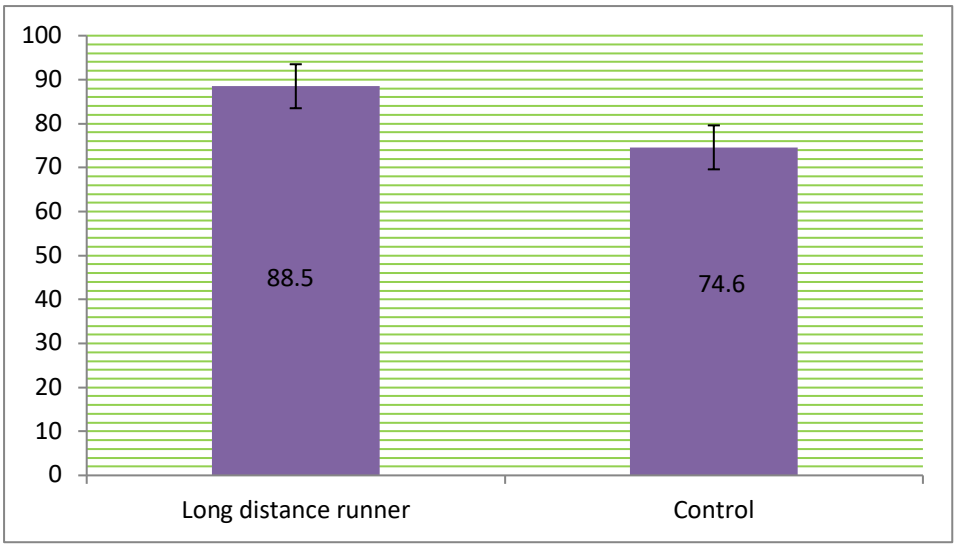

Figure 3: Mean percentage of forced expiratory volume in 1st second (%FEV1)

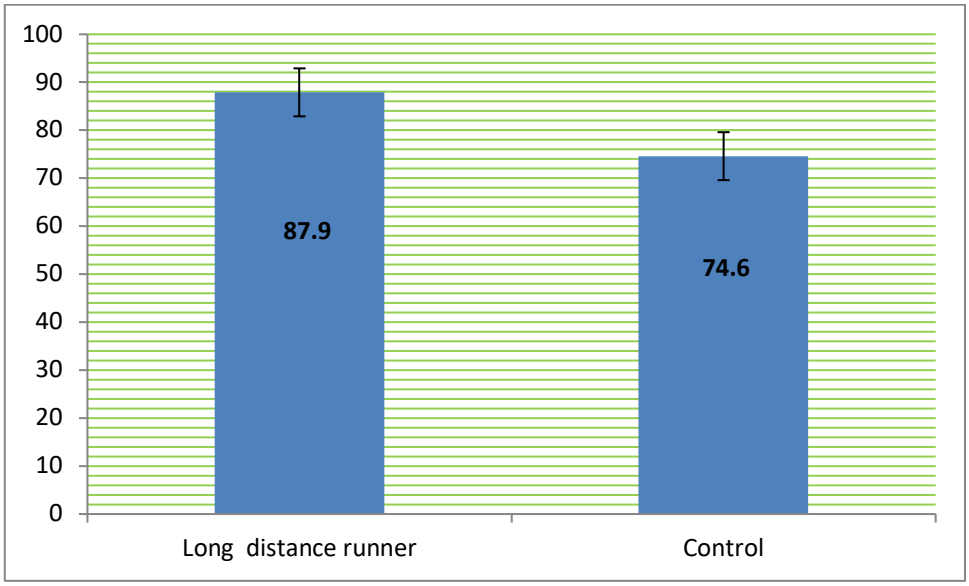

Figure 4: Mean percentage of forced expiratory volume in three second (%FEV3)

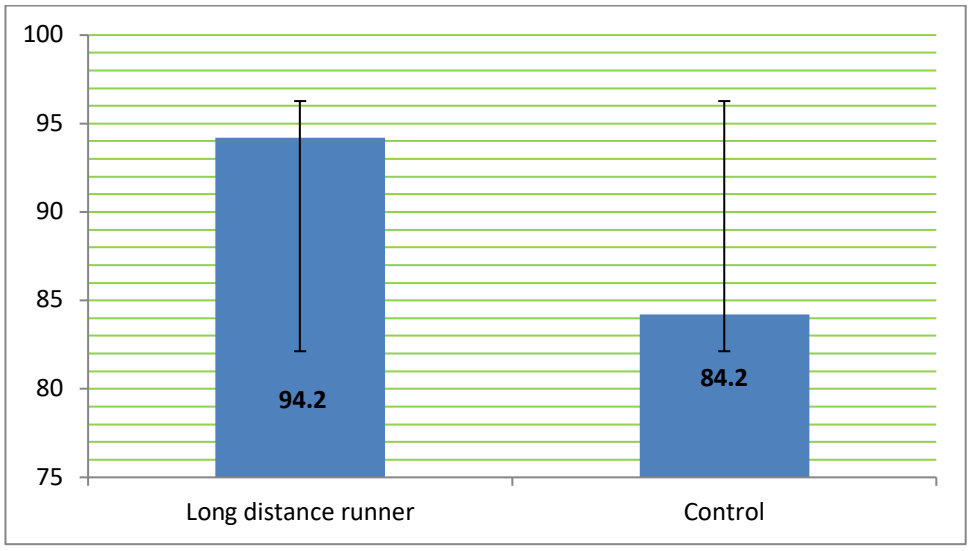

Figure 5: Mean percentage of peak of expiratory flow rate (% PEFR)

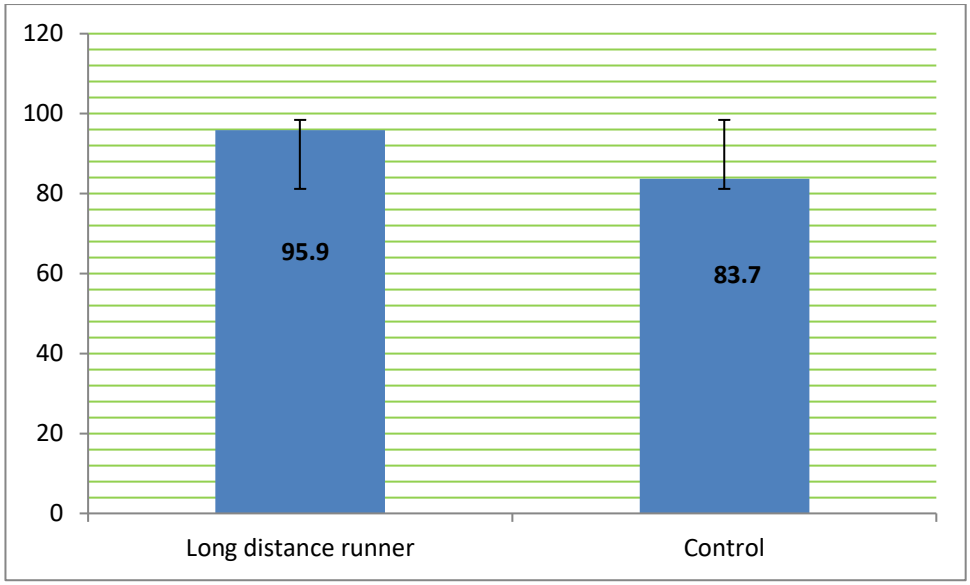

Figure 6: Mean % FEV1/FVC ratio

Table 2: Comparison of pulmonary function tests in long distance runners and controls

Parameter	Group		Unpaired T test
	Long distance runner(± SD)	Control (± SD)	*P* value
FVC	89.9 (12.7)	76.3 (7.3)	<0.05*
FEV1	88.5 (13.9)	74.6 (9.6)	<0.05*
FEV3	87.9 (14.9)	74.6 (6.7)	<0.05*
PEFR	94.2 (14.2)	84.2 (11.1)	<0.05*
FEV1/FVC ratio	95.9 (11.9)	83.7 (9.2)	<0.05*

***statistically significant**

As shown in table 2, all parameters of PFT were significantly high in long distance runners and controls.

Discussion

Multitude of studies have reported pulmonary markers to be affected by type of life style (healthy vs. sedentary). Regular exercise in any form has positive effect on respiratory indices. On the other hand, sedentary life style increases the risk of deterioration of respiratory functions and can result to respiratory illness including chronic obstructive pulmonary disease (COPD).[7]

Spirometry is an invaluable physiological test that aid for screening respiratory health of individual.[6] It provides an important information regarding how an individual inhales or exhales air volumes as a function of time.[6]

In the present study, PFT of long distance runners was evaluated. In agreement with other studies, which evaluated PFT in people who exercised regularly and who had sedentary lifestyle, have statistically significant high values of respiratory indices like FVC, FEV1, FEV3, PEFR and FEV1/FVC. [1, 8, 9] The mean % of FVC of participants in long distance runners FVC was 89.9(±12.7) whereas for control group it was 76.3(± 7.3). This observation is in accordance to that of Akhade et al (2014).[1] FVC is defined as the maximum volume of air expired forcefully and rapidly after a maximal inspiration.[7] As muscular exercise increases the rate and depth of respiration, it improves FVC in addition to the oxygen consumption and the diffusion rate.[10]

The mean % of FEV1 was higher in long distance runners (88.5± 13.9) compared to control group (74.6± 9.6). This observation

is similar to that of Akhade et al and Prakash et al whereas, in contrast to that of Khanam et al. [1,9,11] FVC is the volume of air expired in first second of an FVC maneuver.[1] Higher expiratory power and overall low resistance to air movement in the lungs may reason for difference in FEV1 in long distance runners and control.[1, 9]

In this study, when the mean percentage of peak of expiratory flow rate (% PEFR) was compared, it was high in long distance runners (94.2 ±14.2)) as compared to control group (84.2 ±11.1). Many researchers have highlighted importance of PEFR as an important parameter of PFT. As this parameter measures primarily large airway function, it can be reliably utilized as an important parameter for rapid assessment for respiratory function in athletes.[1]

The FEV1/FVC relationship is a component of most lung function reports and is a predictor of obstructive and restrictive patterns of pulmonary disorders.[6] In this study, the mean % FEV1/FVC ratio was high in long distance runners (95.9±11.9) as compared to control group (83.7 ±9.2).

Conclusion

Physical exercise in any form has positive effect on respiratory system of an individual. As running improves/enhances vigor of respiratory muscles, it increases the function of pulmonary system. The current study, underscores the importance of regular running to improve the pulmonary function.

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