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PULMONARY FUNCTIONS IN INDIAN SPORTSMEN PLAYING DIFFERENT SPORTS

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Abstract : Regular exercise has proved to be beneficial for the human body and the lungs are no exception. The present study was undertaken to assess the relation between the quality of exercise performed and the quantitative effect of these exercises on the lungs. Pulmonary function tests of sportsmen engaged in various sports were compared with each other and with that of the controls. Players playing football (n=18), hockey (n=19), volleyball (n=20), swimming (n=20) and basketball (n=18) were chosen for this study. Medical students (n=20) were chosen as controls. The parameters taken into account in this study were forced vital capacity (FVC), forced expiratory volume (FEV-1), and peak expiratory flow rate (PEFR).

The results indicate that all the sportspersons had a higher values of lung functions compared to the controls. Among the various groups of players chosen for this study, the swimmers showed the maximum increase in their lung functions.

Key words : pulmonary functions FVC FEV-1 PEFR sports

INTRODUCTION

Exercises in the form of sports, aerobics or workouts, if performed regularly have a beneficial effect on the various systems of the body. These systems are benefited by such exercises as the flow of blood is increased to the various organs thereby delivering more nutrients, thus improving their functioning. Special attention is being given to the vital organs of the body like the heart, brain and lungs to know the effect of exercise on these organs. The effect of these organs when they are put to endurance tests has been a subject of discussion in the past. Irrefutable evidence now exists to show that regular physical activity slows the rate of decline of most of the physiological parameters that we associate with health and fitness-viz muscle strength, aerobic capacity, reaction time and joint flexibility (1).

In the present study we have concentrated on the effect of long term stress in the form of exercises and sports activities on the lungs. Sportsmen are known to have power and high degree of

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endurance accompanied by greater flexibility of the joints. Previous studies in this field have shown that sportspersons have higher values of lung volumes in comparison to their control counterparts who are not engaged in any kind of regular physical exercise (2). The aim of this study was not to confirm this fact but the idea was to establish a relationship between the quality of exercise performed and the quantitative effect of these exercises on the lungs. The purpose was to find a specific exercise which has maximum effect on the lungs. Such exercises when undertaken in milder forms could be used in the rehabilitation process for the patients recovering from asthma (3) and other lung diseases. Heir et al have shown that respiratory tract infection was associated with a transient increase in bronchial responsiveness in athletes performing physical training during the symptomatic period of the respiratory illness (4).

METHODS

For this study we chose Indian sportspersons playing hockey (n=19), volleyball (n=20), swimming (n=20), football (n=18) and basketball (n=18). The idea behind choosing these games was that in each case, the type of movement performed are variable and body posture is also quite different. This could play an important role in determining the lung volumes of the players. While in football the main movement is running, in volleyball the movement is jumping vertically upwards. Hockey consists of running in the bend posture while basketball is a mixture of running and jumping. Swimming is performed in the horizontal posture. The swimmers in this study were chosen from K.D Singh Babu Stadium, Lucknow while the rest of the subjects were from Sports College, Lucknow. In sports college, these trainees are given 60-90 minutes training in the morning and 120 min in the evening. Their approximate playing session is for 3-4 hours in a day for 5 days in a week. The swimmers used to practice for 3 hours a day (including 1/2 hr of ground exercises) for 6 days a week. History revealed that all the subjects had been playing for the past 3-4 years with minor individual variations. The subjects chosen were males and on routine examination they were found to be apparently healthy. Male medical students (n=20) who were not directly engaged in any kind of sports activity were selected as controls. The subjects as well as the controls were non-smokers. All the subjects chosen for this study were residents of Lucknow district and therefore their dietary habits were almost the same. The physical parameters of the players like the height, weight and age, which have a role to play in determining the lung volumes, have been tabulated in Table I.

All subjects were summoned for recording their pulmonary functions between 9-11 a.m. in the morning. The pulmonary function tests were performed with the help of a Medspiror, an electronic PFT machine which is a dry type of spirometer. The parameters taken into account in this study were the Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV-1) and Peak Expiratory Flow Rate (PEFR). All the subjects were made familiar to the machine and the objective of the study. They were taught its usage and the readings were recorded after sufficient practice.

TABLE I : Showing physical characteristics of sportspersons.

	Age(yrs) Mean ± S.D	*Height (cms) Mean ± S.D*	*Weight (kgs) Mean ± S.D*
Basketballers	24 ± 3.8	179.2 ± 9.5	64 ± 9.4
Volleyballers	22 ± 2.6	176.8 ± 7.3	68.2 ± 6.2
Swimmers	23 ± 1.8	161.5 ± 11.4	61.7 ± 8.3
Footballers	21 ± 4.6	164.3 ± 8.3	58.3 ± 6.9
Hockey Players	21 ± 3.0	168.1 ± 6.5	62 ± 7.1
Controls	22 ± 1.6	166 ± 10.8	67.5 ± 11.1

TABLE II : Comparison of pulmonary function tests of the players and controls.

	FVC (Lit) Mean ± SD	*FEV-1 (Lit) Mean ± SD*	*PEFR (Lit/sec) Mean ± SD*
Football Players	3.86 ± 0.37*	3.55 ± 0.36*	8.36 ± 0.94*
Hockey Players	3.71 ± 0.39**	3.41 ± 0.37**	8.28 ± 0.82**
Basketball Players	3.77 ± 0.44*	3.44 ± 0.47*	7.97 ± 1.40*
Volleyball Players	3.60 ± 0.49**	3.38 ± 0.45**	8.69 ± 1.2**
Swimmers	4.06 ± 0.57***	3.79 ± 0.64***	9.47 ± 1.59***
Controls	3.20 ± 0.57	2.93 ± 0.56	6.34 ± 1.90

*P < 0.0005; **P <0.005; ***P < 0.0001.

Three readings of all the subjects were taken and the best out of the three were taken into account.

RESULTS

The results of this study have been summarized in Table II. The Forced vital capacity, Forced expiratory volume and the Peak expiratory flow rate of all the subjects and the controls has been given. It is very well evident that all the players had a higher value of lung volumes compared to the lung volumes of the controls.

Comparison of the lung function values among the sportspersons can very well be made. It is evident that the swimmers had the highest value of lung volumes compared to the other players included in this study. Their mean FVC, FEV-1 and PEFR came out to be 4.06 lit, 3.79 lit and 9.47 lit/sec respectively. The footballers had the second best mean values of FVC and FEV-1 of 3.86 and 2.55 lit respectively. On the contrary the volley ball players had the second highest values of PEFR. The P value given below Table II is in comparison to the values of the controls.

DISCUSSION

The results discussed above clearly indicate that all the players had higher values of lung functions compared of the controls, thereby confirming that regular exercise has a facilitating effect on the lungs. Similar results have been obtained

by other workers in this field (5, 6, 7, 8). The possible explanation for this could be that regular forceful inspiration and expiration for prolonged periods during playing, 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 (9) and prostaglandin (10) into the alveolar spaces thereby increasing the lung compliance and decreasing the bronchial smooth muscle tone respectively.

Among all the sportsmen chosen for this study, the swimmers showed the highest value of lung capacities. The possible explanation for this better lung functions could be manifold. Regular swimming practice may tend to alter the elasticity of the lungs and the chest wall which leads to improvement in the lung function of swimmers (11). Swimming differs from the other sports in the following aspects.

1. Swimming is performed in the horizontal position compared to the vertical position in other sports.
2. The external pressure is higher as the density of the surrounding medium is higher than that of air which is the usual external medium in other sports.
3. The ventilation is restricted in every respiratory cycle for one moment or the other, producing a condition of intermittent hypoxia. This intermittent hypoxia sets up the anaerobic process during swimming. The lactic acid levels in the blood go on rising resulting in "Lactic Oxygen deficit" (12). This leads to the stimulation of the respiratory center in the medulla therefore increasing the respiration.

So the respiratory muscles and the diaphragm of the swimmers are required to develop greater pressure as a consequence of immersion in water during the respiratory cycle, thus leading to functionally better respiratory muscles. These factors when combined together, play an important role in developing better lung functions in swimmers compared to the other sportsmen. The fact that footballers had the next best lung volumes could be attributed to the fact that this game involves a lot of power in running at great speed. Compared to the other games included in this study (except swimming) more force has to be generated while running at great speed in the erect posture which is the normal body position in humans.

To explain the difference in the lung volumes in various categories of players, more extensive and detailed research with each group of players is required. There has been a controversy that whether the better lung functions in sportspersons is due to the genetic adaptation or due to the exercise training. Lately the role of genetic influence on the pulmonary capacities has been reported by a couple of authors (13, 14). This study goes on to suggest that regular exercise training has an important role to play in determining and improving lung volumes. Therefore regular swimming exercises, in milder forms could well become a part of the rehabilitation programme of patients recovering from COPD and other lung ailments.

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