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Effect of duration of exercise on the extent of spirometry

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ABSTRACT

Background: Spirometry is one of the most common measures of lung function. A noteworthy amount of research has not been carried out in the context of the athletic population, particularly in respect of the effect of duration of exercise on the extent of spirometry. **Aim and Objective:** The aim of this study was to study the spirometric values in the athletic population and compare the differences in respect to the duration of exercise and to find the magnitude of change in the spirometric measurements such as forced expiratory volume in 1 second (FEV1), functional vital capacity (FVC), and maximal voluntary ventilation (MVV). **Materials and Methods:** A cross-sectional observational study was conducted among the athletic population after taking Institutional Ethics Committee approval. A total of 30 healthy subjects, who were regularly going to the gym for more than 6 months were enrolled in the study after taking informed written consent. **Results:** The duration of exercise had a positive impact on FEV1 and MVV. The duration of exercise had a significant impact on FVC. There was an increase in the value of FEV1 about 7%, FVC about 15%, and MVV about 9% in subjects doing exercise for more than 2 years as compared to subjects doing exercise <2 years. **Conclusion:** The values of FEV1, FVC, and MVV were higher in athletes who were exercising for more than 2 years regularly compared to those who were exercising for <2 years. Interpretation spirometry of athletic patients should be corrected by increasing reference values.

KEY WORDS: Spirometry; Exercise; Forced expiratory volume in 1 second; Functional vital capacity; Maximal voluntary ventilation

INTRODUCTION

Pulmonary function test has a significant role in the screening, determination, and observing of respiratory ailments and is progressively prescribed in essential consideration practice. Pulmonary function parameters have a relationship with exercise and a sedentary way of life.[1,2] Higher pulmonary capacity is seen in athletes due to regular exercise when compared with non-exercising individuals. Many researchers have indicated that the respiratory system can affect the strength and performance of trained athletes.[3,4] In general, pulmonary functions are determined by the strength of the respiratory muscles, thoracic cavity compliance, airway resistance, and lung elastic recoil.[5] Pulmonary function tests in patients with obstructive and restrictive lung diseases provide a qualitative and quantitative evaluation of the respiratory system. The parameters used to describe pulmonary functions are the volume of the lungs and their lung capacities. It is noteworthy that pulmonary volumes and capacities can differ, as shown by physical qualities such as age, height, body weight, and altitude. Ordinary exercise, as in athletes, creates a constructive pulmonary outcome by expanding the respiratory limit and thus improving lung function.

Spirometry is one of the most common pulmonary function tests. It measures the function of the lung, especially the amount (volume) and/or velocity (flow) of air that can be

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inhaled and exhaled. Spirometry is useful in evaluating breathing patterns that identify conditions such as asthma, pulmonary fibrosis, cystic fibrosis, and chronic obstructive pulmonary disease. This is also useful as part of a health monitoring program, through which breathing patterns are can be measured over time.

The spirometry of normal sedentary individuals has been studied broadly in India. A noteworthy amount of research has not been carried out in the context of athletic population, particularly in respect of effect of duration of exercise on extent of spirometry.

Hence, with this background, we conducted this study to study the spirometric values in the athletic population and compare the differences in respect to the duration of the exercise. This study is also aimed to find the magnitude of change in spirometric measurements such as forced expiratory volume in 1 second (FEV1), functional vital capacity (FVC), and maximal voluntary ventilation (MVV) according to the duration of the exercise.

MATERIALS AND METHODS

The present study was conducted through the department of pulmonary medicine of GMERS Medical College and Hospital, Gotri, Vadodara, Gujarat, after taking Institutional Ethics Committee approval. A cross-sectional observational study was conducted among the athletic population. A total of 30 healthy subjects who are regularly going to the gym for more than 6 months were enrolled in the study after taking informed written consent. The subjects were selected at random from the urban population between the ages of 18–60, non-obese, and willing to participate in the study. They were all non-smokers and free of any active or past respiratory diseases. All participants were subjected to spirometry before starting work out using Medikro Spirostar Spirometer. To avoid Diurnal variations, the measurements were taken between 8 am to 11 am. The research subjects who undertook the test were well educated about the device and the test methodology by demonstrating the protocol. Anthropometric data such as height and weight for each subject were measured before the research procedure. Information was collected about personal history, smoking, medicines used, etc., and the family history of any bronchial asthma. Subjects were classified into two groups based on the duration of the exercise. Group 1: Duration of exercise for more than 2 years and Group 2: Duration of exercise for <2 years. Parameters such as FEV1, FVC, and MVV were compared.

Data Analysis

Data entry was done by Microsoft Excel. For quantitative data, the mean standard deviation and standard mean error were calculated. Mean values between the two groups were analyzed using unpaired t-test (one-tailed hypothesis) for the variation in the mean score. The mean difference was used to calculate *P*-value, and if <0.05 was considered significant.

RESULTS

In the present study, 30 healthy non-smoker subjects were included in the study. Out of them 27 were males with a median age 24 and 3 female subjects with median age 23 [Table 1]. As shown in Table 2, the duration of exercise has a positive impact on FEV1. For the comparison, an unpaired t-test was used. It shows a positive trend. (P = –0.85563). As shown in Table 3, the duration of exercise has a significant impact on FVC%. For the comparison, an unpaired t-test was used. It shows a significant P = –0.003013. As shown in Table 4, the duration of exercise has a positive impact on MVV. For the comparison, an unpaired t-test was used. It shows a positive trend (P = –0.084352).

DISCUSSION

The results show that with an increase in the duration of exercise, there is an increase in pulmonary function. This study shows that FVC increases significantly with the increase in the duration of exercise, while MVV and FEV1

Table 1: Subject characteristics

Characteristics	Male	Female	Total
Subjects (*n*)	27	3	30
Age (years)	24 (18–58)	23 (21–38)	23.5 (18–58)
Height (cm)	169.81±6.01	154.66±5.24	168.33±7.48
Weight (kg)	69.29±10.69	63.66±11.08	68.73±10.86

Data presented here are mean±SD. SD: Standard deviation. Age is presented as median (range in years)

Table 2: FEV1% according to the duration of exercise

Duration of exercise	Mean FEV1%
Less than 2 years	97.05±17.46
More than 2 years	104.25±14.21

Data are presented as mean FEV1% ±SD. FEV1: Forced expiratory volume in 1 second

Table 3: FVC% according to the duration of exercise

Duration of exercise	Mean FVC%
Less than 2 years	87.4±11.21
More than 2 years	100.72±15.14

Data are presented as mean FVC % ± SD. FVC: Functional vital capacity

Table 4: MVV according to the duration of the exercise

Duration of exercise	Mean MVV
Less than 2 years	105.775±19.5
More than 2 years	115.015±15.48

Data are presented as mean MVV±SD. MVV: Maximal voluntary ventilation have a positive trend while with an increase in the duration of an exercise.

Similar observations were also seen by Vedala *et al*.[5] They had compared the values of athletic and sedentary populations while we have compared among the athletic populations with <2 year of exercise and more than 2 years of exercise.[5] In their study, the value of FEV1 increased significantly by approximately 20% and of FVC by approximately 10% in the athletic population, consisting of marathon runners running at least 2 km/day for at least 6 months compared to the sedentary population.[5] The mean FVC of the athletic population in the study was 88%, which was comparable with our study with mean FVC of 87.4% of subjects with <2 years of exercise. The mean FEV1 of the athletic population in that study was 86.8% which was lower than our study with a mean FEV1 of 97.05%. In our study, there was a further increase in the value of FEV1 about 7%, FVC about 15%, and MVV about 9% in subjects doing exercise for more than 2 years as compare to subjects doing exercise <2 years. As suggested by researchers by similar studies, it takes almost 8 months to 1 year of regular exercise.[6,7] Physical exercise contributes to improved inspiration and expiration, which, in turn, enhances the breathing muscles. As suggested by Hildebrean *et al*.,[8] maximum inflation and deflation are essential physiological incentives for surfactant release.

The present study also explains that doing regular exercise causes increased thoracic mobility and respiratory muscle strength. As the significant differences have been observed in the athletic population undergoing spirometry, this would have greater chances of giving susceptible results to wrong interpretations because spirometry of the athletic population would be elevated than the normal. Thus, during a respiratory illness, even though their lung capacities and lung volumes could drop, this can be ignored by the physician. This study has few limitations as the athletic population selected for the study was gym-going, we could not include another of form exercise such as running and sports. Another limitation of this study is that it is being carried on a small pool of population. Larger research utilizing a wider range and broad sample size is moreover required.

CONCLUSION

The values of FEV1, FVC, and MVV were higher in athletes who were exercising for more than 2 years on a regular basis compared to those who were exercising for <2 years. Interpretation spirometry of athletic patients should be corrected by increasing reference values.

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