The comparison of the pulmonary functions of the individuals having regular exercises and sedentary individuals.

İrfan Marangoz¹, Zait Burak Aktug²*, Çağrı Çelenk³, Elif Top⁴, Hüseyin Eroglu⁵, Mustafa Akil⁴

¹University of Kahramanmaras Sutcu Imam, Afsin Vocational High School, Kahramanmaras, Turkey
²University of Nigde, School of Physical Education and Sports, Nigde, Turkey
³University of Erciyes, School of Physical Education and Sports, Kayseri, Turkey
⁴University of Usak, Faculty of Sport Sciences, Usak, Turkey
⁵University of Kahramanmaras Sutcu Imam, School of Physical Education and Sports, Kahramanmaraş, Turkey

Abstract

The object of our study is to determine the differences between the pulmonary functions of individuals having regular and long-term exercises, and sedentary individuals. The study included 29 athletes having regular and long-term exercises, and 27 sedentary individuals who are not interested in any sports branches actively. The parameters such as Forced Expiratory Volume in 1st Second (FEV1), Forced Vital Capacity (FVC), Peak Expiratory Flow (PEF), Vital Capacity (VC), and Maximum Voluntary Ventilation (MVV) of the individuals included in the study have been examined and the results have been analysed with MIR MiniSpir (Via del Maggiolino Roma-Italy) Spirometer. The arithmetic means and standard deviations of data have been obtained in the statistical evaluation. As a result of the findings obtained, Independent Samples t-test has been applied. No significant difference has been found among the age, height, body weight, Body Mass Index (BMI), FEV1 and PEF values of the groups at the end of the test (P>0.05); however, a significant difference has been found among MVV, FVC, and VC values (P<0.05). When the results of the study are evaluated in accordance with literature data, it has been found out that no difference is present between the FEV1 and PEF values of individuals having long-term and regular exercises, and sedentary individuals; however, there is a significant difference among MVV, FVC and VC values. Therefore, it has been found out that the pulmonary functions (MVV, FVC, and VC) of individuals having regular exercises have improved better than that of sedentary individuals.

Keywords: Pulmonary Function, Exercise, Sedentary, Athlete

Accepted on January 20, 2016

Introduction

It is clear that respiratory and circulatory systems are in close interaction when they are taken into consideration in terms of exercise effects [1]. The regular and systematic physical exercises are vital for a healthy development [2]. During the exercise, the oxygen need of the muscles is above the standard need. Thus, the respiratory system must adapt to said condition in order to satisfy the required oxygen. However, it is known that the increase level is limited and the limits of the enlargement capacity of breathing muscles and chest wall, and elasticity levels of bronchi, lead to changes in said condition [3]. The amount of oxygen that the individuals use is directly proportional to the amount of energy they generate [4]. During the exercise, oxygen and carbon dioxide values tend to be maintained at an appropriate level without increasing the load on the breathing muscles [5]. In order to satisfy the increasing oxygen need, cardiac pulse is increased [6], the energy consumption of the breathing muscles is decreased, and the signals that will increase the pulmonary functions tend to be minimized. As a result of said effects, the exhaustion that will occur in the breathing muscles is decreased; however, exercise performance is increased [5]. During the exercises, an increase in the consumption rate of O₂ in the metabolism, which is also called MaxVO₂, is experienced. It is indicated that said increase is above 10%. Therefore, it is important to increase the availability of oxygen, in other words, MaxVO₂, during the exercises [7]. It is accepted that the exercise is effective extremely on the circulatory and respiratory systems. The pulmonary capacity of the individual is related to the body structure of the people as well as the oxygen need of the sports branch performed. The respiratory systems of the people who have trained adequately adapt to the increasing oxygen need during the exercise rapidly [8]. Elite endurance athletes have
parallel increases of left atrial pressure (Pla) and right atrial pressure (Pra) at high levels of exercise, whereas less well trained or sedentary subjects have smaller increases in Pra than pulmonary wedge pressure (Ppw) with exercise, which suggests that pericardial constraint is acting in the elite athletes at very high levels of exercise. Further confirmation of this theory is provided by studies with athletic animals in which removal of the the pericardium resulted in increased peak end-diastolic volume, stroke volume and maximal oxygen uptake (6). The pulmonary volumes and capacities of the people differ (age, sex, body surface, exercise condition, athlete and sedentary individuals). Therefore, it is better to evaluate the pulmonary functions of the athletes in accordance with MVV results. Apart from MVV, the rate of FEV/FVC, which is below 80%, is accepted as a problem [9]. The effects of physical activity on the pulmonary functions are tried to be classified as early age, adolescence and adulthood stage. While making the classifications, the effects of the exercises performed in accordance with the branches, on the pulmonary functions must be taken into consideration. The object of our study is to determine the differences between the pulmonary functions of the individuals having regular and long-term exercises, and sedentary individuals in accordance with new literature data.

Materials and Methods

Subjects

The study has included 56 participants, of whom 29 are elite athletes, who have an active sports life and accepted to be included in the study voluntarily, and did not have any neurologic diseases, vestibular-visual disorders in the last one year or did not have any serious lower extremity disabilities in the last 6 months, and have regular and high-level exercises, Table 1 (age 24.31 ± 3.28 years, height 172.10 ± 6.07 cm, body weight 75.75 ± 9.56 kg, body-mass index 25.49 ± 2.01), and 27 sedentary individuals, who are not interested in any sports branch and do not have regular exercises (age 25.18 ± 4.61 years, height 175.51 ± 6.92 cm, body weight 75.92 ± 9.26 kg, body-mass index 24.70 ± 2.91).

Measurement of pulmonary functions

The parameters such as Forced Expiratory Volume in 1st Second (FEV1), Forced Vital Capacity (FVC), Peak Expiratory Flow (PEF), Vital Capacity (VC), and Maximum Voluntary Ventilation (MVV) of the individuals included in the study have been analysed with MIR MiniSpir (Via del Maggiolino Roma-Italy) Spirometer. During the measurement, the subjects were made to grasp the spirometer nozzle completely, and to put on respirator.

Statistical analysis

The analyses have been made by using IBM SPSS 21.0 package program, and the significance level has been determined as P<0.05. The arithmetic means and standard deviations of data have been obtained in the statistical evaluation and then, Independent Samples t-test has been applied to the data.

Results

When the findings of the study have been evaluated, no significant difference has been found between FEV1 and PEF values (P>0.05); however, a significant difference has been found among MVV, FVC, and VC values (P<0.05, Table 2).

Table 1. Demographic data of the participants.

<table>
<thead>
<tr>
<th>Parameters (n=56)</th>
<th>Category</th>
<th>X ± SS</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC (L)</td>
<td>Athlete (n=29)</td>
<td>5.53 ± 0.53</td>
<td>2.23</td>
<td>0.03*</td>
</tr>
<tr>
<td></td>
<td>Sedentary Individual (n=27)</td>
<td>5.11 ± 0.84</td>
<td>-3.43</td>
<td>0.01*</td>
</tr>
<tr>
<td>FEV1 (L)</td>
<td>Athlete</td>
<td>4.55 ± 0.41</td>
<td>-0.75</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Sedentary Individual</td>
<td>4.40 ± 0.71</td>
<td>-0.32</td>
<td>0.79</td>
</tr>
<tr>
<td>PEF (L/s)</td>
<td>Athlete</td>
<td>8.42 ± 2.59</td>
<td>-0.32</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>Sedentary Individual</td>
<td>8.44 ± 1.98</td>
<td>-0.97</td>
<td></td>
</tr>
<tr>
<td>MVV (L/min)</td>
<td>Athlete</td>
<td>114.46 ± 40.11</td>
<td>-3.43</td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>Sedentary Individual</td>
<td>151.34 ± 40.20</td>
<td>-3.43</td>
<td>0.01*</td>
</tr>
<tr>
<td>VC (L)</td>
<td>Athlete</td>
<td>5.86 ± 1.05</td>
<td>3.59</td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>Sedentary Individual</td>
<td>4.81 ± 1.13</td>
<td>-0.32</td>
<td>0.79</td>
</tr>
</tbody>
</table>

*P<0.05, Significant

Discussion

The main function of the respiratory system is to maintain the blood gas levels within fixed limits, and to provide gas exchange between blood and air [9]. In our study, no significant difference has been found between FEV1 and PEF values (P>0.05); however, a significant difference has been found among MVV, FVC, and VC values (P<0.05). The results showed that the FVC, FEV1, MVV ratio were higher in athletes than in the normal sedentary control individuals [10-13]. FVC and MVV findings support our study and could be considered an important finding. Due to increase in pulse volume, less cardiac pulse is required. The increase in pulse volume helps O2, which is required during maximal exercises, to be transferred to the muscles. In the meantime, the increase in pulmonary volume and capacity increases the passing movement of O2 from lungs to the blood [14]. Said increase
may arise from the positive effect of exercise on dynamic pulmonary capacity together with strengthening in the breathing muscles. The performance is directly related to the body structure, sex and age, and also has measurable and improvable characteristics. In order to gain success in any sports branch, the characteristics suitable for the aim must be improved [15]. It is indicated that exercises cause increase in pulmonary functions [16] while aerobic exercises lead to higher level of increase in Forced Vital Capacity values when compared to anaerobic exercises [17]. The majority of the studies performed in order to determine that how the exercise affects the pulmonary parameters, lead to many different opinions regarding the subject [18]. Some studies show that the exercise changes the pulmonary parameters [19], while other studies indicate that although no improvement is observed [20], the exercise generally has positive effect on the pulmonary parameters [21,22].

**Conclusion**

When the results of the study are evaluated together, it has been found out that no difference is present between the FEV1 and PEF values of individuals having long-term and regular exercises, and sedentary individuals; however, there is a significant difference among MVV, FVC and VC values. Therefore, it has been found out that the pulmonary capacities (MVV, FVC, and VC) of individuals having regular exercises have improved better than that of sedentary individuals.

**References**


*Correspondence to:*

Zait Burak Aktuğ
School of Physical Education and Sports
Nigde University
Turkey