Comparison of Respiratory Functions of University Level Male Ball Game Players

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Abstract

The purpose of this study was to compare the respiratory parameters among university level ball game players. A sample of Ninety (N = 90) male ball game players (mean ± SD: age 20.65 ± 1.44 years, height 179.10 ± 7.72 m, weight 69.29 ± 9.38 kg, BMI 21.57 ± 9.36), which includes thirty each volleyball, basketball and football players, who participated in inter – college competitions of Guru Nanak Dev University, Amritsar, India, was selected. All the participants were informed about aim and methodology of the study and they volunteered to participate in this study. The study was conducted on selected respiratory functions i.e. vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity. One way Analysis of Variance (ANOVA) was applied to find out the significance of differences with regard to selected respiratory functions among elite ball game i.e. volleyball, basketball and football players. Scheffe’s post-hoc test (SPHT) was applied to see the direction and significance of differences where ‘F’ value found statistically significant. The level of significance was set at 0.05. While comparing the means, it revealed that basketball players had better vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity than their counterparts; football and volleyball players. Further, significant differences were found between different male ball game i.e. football, basketball & volleyball players with regard to vital capacity (p< 0.05), expiratory reserve volume (p< 0.05), inspiratory reserve volume (p< 0.05), inspiratory capacity (p< 0.05) and forced vital capacity (p< 0.05) respectively.

Keywords: Respiratory Functions, vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity, forced vital capacity.

Introduction

Ball games including volleyball, basketball and football are popular and well- known sport events. For successful participation in these sports besides a high level of technical & tactical skills, each player requires physical, physiological and psychological fitness. The physiological characteristics play an important role for the attainment of high level performance in these sports. Among the various physiological parameters, lungs functions form the basis to undertake sports efforts successfully. The respiratory function tests, like other physiological tests must be of the utmost importance for measuring the fitness of an individual from physiological point of view (Astrand and Rodahl, 1970). Respiratory system is an important system of human body where gaseous exchange takes place with diffusion of enormous amounts of oxygen into the
blood during physical activity (Khurana, 2005). Respiratory function test is one of the most important tools to measure the levels of physical capacity of a population (Singh & Sunderesh, 1979).

In addition to measuring volumes and capacities, it provides information regarding response to training or exercise and monitors the response following respiratory problems including exercise induced bronco spasm (McGraw-Hill’s 2001). Physically fit athletes possess superior respiratory functions relative to less fit subjects (Johnson et al., 1981; Johnson et al., 1991). Respiratory functions increases by training depend upon the specific playing abilities, work style and the severity of the activity. In practice this sort of increase can be seen mainly types of games that require long-term durability performance (Patlar et al., 2000). There are several studies that have shown significant improvement in respiratory functions as a result of the effect of exercise (Chandran et al., 2000; Shivesh et al., 2007).

In athletes respiratory capacities alters during resting state and intense exercise. Respiratory function tests provide qualitative and quantitative evaluation of respiratory functions (Belman and Mittman, 1980; Robinson and Kjeldqard, 1982). The respiratory functional capacities of normal sedentary individuals have been studied extensively in India (Rao et al., 1961; Singh, 1967; Jain and Ramiah, 1969; Gupta et al., 1979). Therefore, the purpose of the study was to compare the respiratory functions among university level ball game players.

Materials and Methods

Subjects: A sample of Ninety (N = 90) male ball game players (mean ± SD: age 20.65 ± 1.44 years, height 179.10 ± 7.72 m, weight 69.29 ± 9.38 kg, BMI 21.57 ± 9.36), which includes thirty each volleyball, basketball and football players, who participated in inter-college competitions of Guru Nanak Dev University, Amritsar, India, was selected. All the participants were informed about aim and methodology of the study and they volunteered to participate in this study. The purposive sampling technique was used to select the subjects.

Methodology:
Height and Weight:
Height measurements were taken by using the standard anthropometric rod (HG-72, Nexgen ergonomics, Canada) to the nearest 0.5 cm. Full attention was given to make sure that players’ body was fully upright and their mandible was parallel to the ground. Taken values recorded in ‘cm’.

The subject’s weight was measured with portable weighing machine to the nearest 0.5 kg. During measurements players were on bare feet and wearing underwear only. Measurements recorded in ‘kg’.

Body Mass Index (BMI):
BMI was calculated by the formula of; Body Mass Index = Weight/Height².

Measurements of Respiratory Functions:
Respiratory functions were measured with a computerized spirometer. Before recording the respiratory function tests, subjects were shown a demonstration of the tests. It was made sure that subject’s vital capacity was measured when the subject was exhaling with maximal speed and effort. Consequently, a minimum of three readings were recorded of each test for every subject.
and the best of the three was considered for having reproducibility and validity of the recorded test. The Respiratory indices like, vital capacity (VC), expiratory reserve volume (ERV), inspiratory reserve volume (IRV), inspiratory capacity (IC) and forced vital capacity (FVC) was taken into consideration for this study.

Statistical Analysis

Values are presented as mean values and SD. One-way analysis of variance (ANOVA) was employed. Following the detection of a significant mean effect, Scheffe’s post-hoc analysis was performed to locate where specific mean differences were laid. Data was analyzed using SPSS Version 16.0 (Statistical Package for the Social Sciences, version 16.0, SPSS Inc, Chicago, IL, USA.

RESULTS

Table 1 Demographic Characteristics of University Level Ball Game Players.

<table>
<thead>
<tr>
<th>Sports Groups</th>
<th>Age (yrs) Mean</th>
<th>SD</th>
<th>Height (m) Mean</th>
<th>SD</th>
<th>Weight (Kg) Mean</th>
<th>SD</th>
<th>BMI Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>21.03</td>
<td>1.40</td>
<td>177.60</td>
<td>7.06</td>
<td>68.03</td>
<td>10.73</td>
<td>21.52</td>
<td>2.81</td>
</tr>
<tr>
<td>Basketball</td>
<td>20.50</td>
<td>1.96</td>
<td>182.10</td>
<td>9.65</td>
<td>72.27</td>
<td>9.91</td>
<td>21.74</td>
<td>2.05</td>
</tr>
<tr>
<td>Volleyball</td>
<td>20.43</td>
<td>0.93</td>
<td>177.50</td>
<td>6.42</td>
<td>67.57</td>
<td>7.47</td>
<td>21.45</td>
<td>2.21</td>
</tr>
<tr>
<td>Total</td>
<td>20.65</td>
<td>1.44</td>
<td>179.10</td>
<td>7.72</td>
<td>69.29</td>
<td>9.38</td>
<td>21.57</td>
<td>2.36</td>
</tr>
</tbody>
</table>

Table 2 Mean and SD values of Variables of Respiratory Functions of University Level Ball Game Players.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Football Mean</th>
<th>SD</th>
<th>Basketball Mean</th>
<th>SD</th>
<th>Volleyball Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital Capacity (Lt)</td>
<td>4.21</td>
<td>0.57</td>
<td>5.42</td>
<td>0.57</td>
<td>4.04</td>
<td>0.32</td>
</tr>
<tr>
<td>Expiratory Reserve Volume (Lt)</td>
<td>1.46</td>
<td>0.30</td>
<td>1.91</td>
<td>0.43</td>
<td>1.52</td>
<td>0.35</td>
</tr>
<tr>
<td>Inspiratory Reserve Volume (Lt)</td>
<td>1.63</td>
<td>0.33</td>
<td>2.47</td>
<td>0.37</td>
<td>1.67</td>
<td>0.28</td>
</tr>
<tr>
<td>Inspiratory Capacity (Lt)</td>
<td>2.73</td>
<td>0.38</td>
<td>3.33</td>
<td>0.25</td>
<td>2.69</td>
<td>0.30</td>
</tr>
<tr>
<td>Forced Vital Capacity (Lt)</td>
<td>5.53</td>
<td>0.24</td>
<td>5.73</td>
<td>0.19</td>
<td>5.55</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Table 1 depicts the demographic characteristics of university level ball game players. Table 2 showed that while comparing the means, it revealed that basketball players had better vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity than their counterparts; football and volleyball players. Football players exhibited better vital capacity and inspiratory capacity than volleyball players. However, better expiratory reserve volume, inspiratory reserve volume and forced vital capacity exhibited by volleyball players than their football counterparts.

Table 3. Analysis of Variance (ANOVA) among University Level Ball Game (Football, Basketball & Volleyball) Players with regards to the Variables of Respiratory Functions.
It is evident from table-3 of Analysis of Variance (ANOVA) results that significant differences were found among university level male ball game i.e. football, basketball & volleyball players with regard to vital capacity \( (p < 0.05) \), expiratory reserve volume \( (p < 0.05) \), inspiratory reserve volume \( (p < 0.05) \), inspiratory capacity \( (p < 0.05) \) and forced vital capacity \( (p < 0.05) \) respectively.

Since the obtained F-values were found significant, therefore, the Post-hoc test (Scheffe’s) was applied to see the direction and significance of difference between paired means of university level male ball game i.e. football, basketball & volleyball players with regards to the variables of respiratory functions. The results of Post-hoc test (Scheffe’s) have been presented in table-4 below.
Table: 4. Comparison of Mean Values of Post-Hoc Test (Scheffe's) among university level ball game (Football, Basketball & Volleyball) players with regards to the variables of Respiratory Functions.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sports Groups</th>
<th></th>
<th></th>
<th>Mean Difference</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Football</td>
<td>Basketball</td>
<td>Volleyball</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vital capacity</td>
<td>4.21</td>
<td>5.42</td>
<td>4.04</td>
<td>0.17</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>5.42</td>
<td>4.04</td>
<td>1.38*</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Expiratory reserve volume</td>
<td>1.46</td>
<td>1.91</td>
<td>1.91</td>
<td>1.52</td>
<td>0.39*</td>
</tr>
<tr>
<td>Inspiratory reserve volume</td>
<td>1.63</td>
<td>2.47</td>
<td>1.63</td>
<td>1.67</td>
<td>0.84*</td>
</tr>
<tr>
<td>Inspiratory capacity</td>
<td>2.73</td>
<td>3.33</td>
<td>2.73</td>
<td>2.69</td>
<td>0.60*</td>
</tr>
<tr>
<td>Forced vital capacity</td>
<td>5.53</td>
<td>5.73</td>
<td>5.53</td>
<td>5.55</td>
<td>0.20*</td>
</tr>
</tbody>
</table>

*Significant at .05 level of Confidence

A glance at table-4 showed that basketball players have exhibited statistically significant (p< 0.05) differences with football and volleyball players on all the selected respiratory functions i.e. vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity. However, football and volleyball players have shown statistically insignificant (p> 0.05) differences on all the selected respiratory functions i.e. vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity. It is concluded that basketball players had better vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity than their counterparts; football and volleyball players. Football players exhibited better vital capacity and inspiratory capacity than volleyball players. However, better expiratory reserve volume, inspiratory reserve volume and forced vital capacity exhibited by volleyball players than their football counterparts.

Discussion

The current study was designed to compare the respiratory functions, including vital capacity (VC), expiratory reserve volume (ERV), inspiratory reserve volume (IRV), inspiratory capacity (IC) and forced vital capacity (FVC) of university level male ball game i.e. football, basketball & volleyball players. The respiratory functions tests are very important in assessing a player’s
level of physiological fitness. Adaptations of respiratory parameters achieved by players vary with the type of sports training involved in each discipline of games.

Respiratory function parameters tend to have a relationship with lifestyle such as regular exercise and non-exercise (Wasserman et al., 1995; Twisk et al., 1998). Previous studies in this field have shown that sportspersons have higher values of respiratory functions in comparison to their control counterparts who are not engaged in any kind of regular physical exercise (Onadeko et al., 1976; Singh et al., 2012). Exercise when performed regularly has benefits on the various systems of the body. Regular exercise has a favorable influence on respiratory functions (Shashikala & Sarath, 2011).

Results of the present study indicated that basketball players had better respiratory functions than their counterparts; football and volleyball players. These differences may be the result of differences in the sporting activity and levels of training. Basketball as a sport may be defined as invasion game of high intensity with considerable stress on system of oxygen delivery (Gore, 2000; Hughes & Bartlett, 2002). Due to regular exercise, athletes tend to have an increase in respiratory capacity, especially when the exercise is strenuous (Adegoke & Arogundade, 2002). Lakhera et al. (1984) observed strenuous training benefits higher respiratory functions by respiratory muscle hypertrophy. Comparatively lower respiratory functions among football and volleyball players as compared to basketball players can be explained on the basis of their physical activity. Volleyball training is considered as less strenuous than physical training of basketball and football. Less strenuous physical training may not perhaps lead to much significant improvement in the respiratory functions (Lakhera et al., 1984).

The vital capacity of ball game players in the present study is greater than the Nigerian players studied by the Adegoke and Arogundade (2002), but lower than that of elite European road cyclists (5.91 L) studied by the Vrijens et al. (1982), and top South African squash players (6.32 L) studied by the Rensburg et al. (1982). These differences may be the result of differences in the sporting activity and levels of training. Study also revealed that football players exhibited better vital capacity and inspiratory capacity than volleyball players. This could be attributed due to the fact that football game involves a lot of power in running at great speed as compared to the other games (Malhotra et al., 1998).

However, better expiratory reserve volume, inspiratory reserve volume and forced vital capacity exhibited by volleyball players than their football counterparts. These differences may be the result of differences of the subject groups and the differences in the levels of training. Hence, results of the present study strongly suggest that, the intensity or severity of the sports engaged by players probably determines the extent of strengthening of the respiratory muscles with a resultant increase with respiratory functions. The observed results of the present study are in agreement with the earlier reports of Lakhera et al. (1984) and Ghosh et al. (1985). The possible explanation for the higher respiratory functions in players was earlier reported by Mehrotra et al. (1998) that regular forceful inspiration and expiration for prolonged periods during playing, leads to the strengthening of the respiratory muscles, both voluntary and involuntary. Furthermore, the differences that were found in the respiratory functions between different ball game players have shown that nature of sports has an impact on respiratory functions.
Conclusion

In conclusion, significant differences were found among university level male ball game i.e. football, basketball & volleyball players with regard to vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity respectively. Basketball players had better vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity and forced vital capacity than their counterparts; football and volleyball players. Football players exhibited better vital capacity and inspiratory capacity than volleyball players. However, better expiratory reserve volume, inspiratory reserve volume and forced vital capacity exhibited by volleyball players than their football counterparts.

References


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