Abstract: The purpose of this study was to compare the selected biomechanical variables between adolescent spiker and libero players in volleyball. The present study was conducted on a sample of thirty eight (N=38) adolescent volleyball players, which includes (Spikers: N₁ = 24) and (Liberos: N₂ = 14) of age group 15-18 years were selected from different schools Punjab, India. The purposive sampling technique was used to select the subjects. All the participants were informed about aim and methodology of the study and they volunteered to participate in this study. The age of the subjects were obtained from the records of their respective schools. The height (cm) and weight (kg) of the subject were measured by standard tools and techniques. The Illinois agility test was used to measure the agility and vertical jump test was used to assess the jumping performance. Medicine ball put test was used to measure the upper-body muscular power and hand grip strength was measured by hand dynamometer with adjustable grip. The independent samples t-test was applied to assess the differences of selected variables between spiker and libero players. Results indicated that spiker players had significantly greater values in height (p<0.05), body weight (p<0.05), vertical jump (p<0.05), right hand grip strength as compared to libero players whereas libero players had significantly better agility(p<0.05) than spiker players. There were no differences in upper-body muscular power measured by medicine ball put test between spikers and libero.

Keywords: Biomechanical variables, spiker, libero, volleyball.

I. INTRODUCTION

Volleyball requires specific biomechanical characteristics of players for elite performance (Fattahi et al., 2014). Volleyball players need high level of strength (jumping ability, explosive power) and agility which play important roles (Vescovi & Muguigan, 2008; Zhang, 2010). Volleyball involves repeated jumping, blocking, spiking, power hitting, and setting which require a high level of strength and power (Lidor & Ziv, 2010; Popadic gacesa et al., 2009). Volleyball requires players to be explosive in the lower limbs muscle power when attacking on offense or blocking on defense (Stojanovic & Kostic, 2002; Sheppard et al., 2007; 2008; 2009). Physical performance requirements for volleyball include high levels of strength in shoulder, elbow and hands, which will be used for spiking, serving and saving ball; strength in knee extension, which will be used of jumping (Zhang, 2010). A volleyball team comprises 12 players with team positions broadly defined as setters, spikers, blockers and libero. Each of these positions plays a specific role in a volleyball match (Gabbett et al., 2006). Liberos as the backline players participate in receive and digging during the match but spikers plays in front of the net, performing spike and block (Duncan et al., 2006). Libero player is a specialist in reception and defense. The libero cannot serve, set inside of the 3 meter line, or spike (Palao et al., 2014). Therefore, the purpose of this study is to compare the selected biomechanical variables between adolescent spicker and libero players in volleyball.

II. MATERIALS AND METHODS

A sample of thirty eight (N=38) adolescent volleyball players, which includes (Spikers: N₁ = 24) and (Liberos: N₂ = 14) of age group 15-18 years were selected from different schools Punjab, India. The purposive sampling technique was used to select the subjects. All the participants were informed about aim and methodology of the study and they volunteered to participate in this study. The age of the subjects were obtained from the records of their respective schools. The height (cm) and weight (kg) of the subject were measured by standard tools and techniques. BMI was calculated by the formula of; Body Mass Index = Weight/Height². The Illinois agility test (Getchell, 1985) was used to measure the agility. The Vertical jump test (Fleishman, 1964) was used to assess jumping performance. Medicine ball put test was used to measure the upper-body muscular power. Hand grip strength was measured by hand dynamometer with adjustable grip.
**III. RESULTS**

Table 1. Demographic Characteristics of Spiker and Libero Players.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Spiker Players (N₁ = 24)</th>
<th>Libero Players (N₂ = 14)</th>
<th>Mean Difference</th>
<th>SEDM</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>175.88 ± 4.23</td>
<td>169.21 ± 5.69</td>
<td>6.67</td>
<td>1.62</td>
<td>4.122*</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>70.67 ± 6.15</td>
<td>63.14 ± 3.57</td>
<td>7.53</td>
<td>1.80</td>
<td>4.172*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.82 ± 1.34</td>
<td>22.10 ± 1.74</td>
<td>0.72</td>
<td>0.50</td>
<td>1.423</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level

Table 1 depicts the demographic characteristics of spiker and libero players. The mean height of spiker players was 175.88 cm and libero players were 169.21 cm. The mean weight of spiker players was 70.67 kg and libero players were 63.14 kg. The mean value of body mass index of spiker players was 22.82 and libero players were 22.10. Results of the study indicated that spiker players had greater height (p<0.05) and body weight (p<0.05) as compared to libero players.

Table 2. Comparison of Agility and Vertical Jump between Spiker and Libero Players.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Spiker Players (N₁ = 24)</th>
<th>Libero Players (N₂ = 14)</th>
<th>Mean Difference</th>
<th>SEDM</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agility (sec)</td>
<td>19.80 ± 0.80</td>
<td>16.84 ± 0.79</td>
<td>2.96</td>
<td>0.27</td>
<td>11.064*</td>
</tr>
<tr>
<td>Vertical Jump (cm)</td>
<td>47.29 ± 1.63</td>
<td>44.07 ± 1.59</td>
<td>3.22</td>
<td>0.54</td>
<td>5.929*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level

Table 2 depicts the comparison of agility and vertical jump between spiker and libero players. Results indicated that libero players had significantly greater values in agility (p<0.05) than spiker player. The spiker players had significantly better vertical jump (p<0.05) as compared to libero players.

Table 3. Comparison of Medicine Ball Put and Handgrip Strength between Spiker and Libero Players.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Spiker Players (N₁ = 24)</th>
<th>Libero Players (N₂ = 14)</th>
<th>Mean Difference</th>
<th>SEDM</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine Ball Put Test (m)</td>
<td>8.27 ± 0.36</td>
<td>8.05 ± 0.45</td>
<td>0.22</td>
<td>0.13</td>
<td>1.702</td>
</tr>
<tr>
<td>Right Handgrip Strength (kg)</td>
<td>28.94 ± 0.38</td>
<td>28.45 ± 0.61</td>
<td>0.49</td>
<td>0.16</td>
<td>3.039*</td>
</tr>
<tr>
<td>Left Handgrip Strength (kg)</td>
<td>27.85 ± 0.51</td>
<td>27.51 ± 0.65</td>
<td>0.34</td>
<td>0.19</td>
<td>1.790</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level

Table 3 depicts the comparison of medicine ball put and hand grip strength between spiker and libero players. Results indicated that spiker players had significantly greater values right hand grip strength (p<0.05) as compared to libero players. There were no significant difference’s found between spikers and liberos in term of medicine ball put test and left hand grip strength.

**IV. DISCUSSION**

In the present study selected biomechanical variables of spiker and libero players have been evaluated and compared. The demographic characteristics of spikers and libero volleyball players show that spiker players were taller and heavier as compared to the libero players. The differences in height could be the result of different technical and tactical demands placed on players in different positions (Duncan et al., 2006). Results of the present study indicated that spiker players had significantly greater values in vertical jump than the libero players. It is suggested that libero players usually do not perform jumps for blocking and spiking (Sheppard et al., 2009), therefore libero had lower vertical jump performance than spikers. These findings are not in line with previous studies (Marques et al., 2009; Duncan et al., 2006) found no differences in vertical jump performance between spikers and libero players. On the other hand, there were no significant difference found between spiker and libero players in upper-body muscular power measured by medicine ball put test. High levels of upper-body muscular power during spiking and serving is an important factor of volleyball players (Gabbett et al., 2006). The study conducted by Mielgo-Ayuso et al. (2015) reported that, the highest upper-body muscular power to be...
present in opposite and outside hitters (known as spikers in the present study) compared to other playing positions. On the other hand, spiker players in the present study had better hand grip strength as compared to libero players. A high level of hand strength to be needed in volleyball players for better spiking (Zhang, 2010).

Results of the present study indicated that libero players had significantly greater agility than the spiker players. These findings are in line with the study of Mielgo-Ayuso et al. (2015), they observed that libero players were the most agile players of the volleyball team.

V. CONCLUSIONS

In conclusion, we found that spiker players were taller and heavier as compared to the libero players. Results of the study revealed that spiker players had better vertical jump, upper-body muscular power and hand grip strength as compared to libero players. On the other hand, libero players had significantly greater agility than the spiker players.

REFERENCES