Body composition of Elite Iranian Soccer Players According to the Playing Position

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ABSTRACT: Body composition is a popular measurement in soccer players. The aim of our study was to assess body composition of elite Iranian soccer players with respect to their playing position. Weight, height and body composition measurements were performed on 220 soccer players, members of the First Iranian National League using standard methods. Mean body mass index (BMI) and fat mass (%) for the goalkeepers (24.17 and 11.45±4.34, respectively) for the defenders (23.72 and 10.78), for the midfielders (22.89 and 9.05) and for the attackers (23.04±1.45, 8.19±2.35, 65.87±6.13, 10.99±2.63 and 4.53±1.69) determined. The goalkeepers had significantly higher body mass (kg), height (cm), BMI, fat mass and fat free mass compared to all other playing positions. Those of defenders were also significantly higher than the midfielders and the attackers (except for fat mass compared to the attackers). This study was the first one to determine body composition measures in elite soccer players of Iranian First National League with respect to their playing position in which the goalkeepers had significantly highest values in all measures. Higher BMI, fat/fat free mass in the goalkeepers and then the defenders compared to the others may reflects their stamina, but further research is needed.

Keywords: Football, BMI, Fat distribution, Iran

INTRODUCTION

Soccer is the world’s most popular sport and rooted everywhere throughout the world. In recent years, sport science has expanded strikingly. The area of sport science is now considered both as an academic discipline and a professional field. Coaches and soccer players are gradually accepting the scientific aspects and by the back of it preparing themselves for competitions. The assessment of body composition in professional soccer players beside fitness measurements are used to determine the extent of athletes’ preparation for competitions and also to evaluate subsequent changes of body composition status after training and dietary interventions. In many countries body composition assessment in elite soccer players is a routine although not done with the same methods and sometimes is performed periodically (Carling & Orhant, 2010; Ostojic, 2003) and sometimes different leagues are compared within one country (Hazir, 2010). Excess fat mass acts as a load in activities in which the body is lifted repeatedly against gravity (Cossio-Bolanos, Portella, Hespahol, Fraser, & de Arruda, 2012). This excess weight has detrimental effects on body movements and actions specific to soccer like jumping to hit or possess the ball. The fat free compartment, which includes lean mass and bone mineral mass, is important for the production of speed, power, and for injury prevention (Cossio-Bolanos, et al., 2012; Pyne, Gardner, Sheehan, & Hopkins, 2006). The body composition measurements in professional soccer players especially with regards to players position in first national football league of several countries has become popular (Carling & Orhant, 2010; Kraemer et al., 2005; Ostojic, 2003; Reilly, Bangsbo, & Franks, 2000; Wittich, Oliveri, Rotemberg, & Mautalen,
Research has proved that there are variations in body fat and body mass estimation in different playing positions and the highest values generally exist in goalkeepers (Carling & Orhant, 2010; Davis, Brewer, & Atkin, 1992; Kraemer, et al., 2005; R Matković et al., 2003; Ramadan & Byrd, 1987; Raven, Gettman, Pollock, & Cooper, 1976; Sporis, Jukic, Ostojic, & Milanovic, 2009; Sutton, Scott, Wallace, & Reilly, 2009; Wittich, et al., 2001), although some researchers conclude that there are not significant differences between different playing positions altogether (Bell & Rhodes, 1975; Cossio-Bolanos, et al., 2012; McIntyre & Hall, 2005). To assess body composition, bioelectrical impedance is generally suggested (Malina, 2007; R Matković, et al., 2003). The two aims of the current study were: First, to determine the body composition in soccer players who play in the premier league clubs in Iran. Second, to determine possible differences in the monitored characteristics related to the position of footballer plays in the game. This type of research is important since there is little scientific information about the anthropometric profile of Iranian soccer players. Coaches would be able to use this information to determine which type of profile is needed for a specific position. It is obvious that players in different positions have different physical and physiological profiles. Experienced coaches would be able to use this information in the process of designing a training program to maximize the fitness development of soccer players with one purpose only, to achieve success in soccer.

METHODS AND SUBJECTS

The body composition of players from the First Professional Iranian Soccer League (premier league) was evaluated only in one season. The assessment took place during the pre-competitive period of season 2012/2013 (summer). All assessments were evaluated in one hour between 8:00 and 9:00 a.m. in a laboratory with controlled temperature (between 20 °C and 24 °C). The evaluation protocol was approved by the ethics committee of the Iranian Football Federation and Tehran University of Medical Sciences. All players were informed about the assessment procedures and signed the consent form. They were fully informed about the nature and demands of the study and were informed that they could withdraw from the study at any time.

10 teams from 18 teams of the Iranian Premier League were randomly selected. From each team 22 players were entered to the study (n=220). Measurements were taken of 220 soccer players during the precompetitive period of season 2012/2013. All the subjects were tested over a period of 20 days, and the tests were performed in the same order. According to the positional roles, the players were categorized as defenders (n=62), midfielders (n=92), attackers (n=50), and goalkeepers (n=16).

Upon entering the laboratory, the subjects' height was measured using a stadiometer (Holtain) to the nearest 0.1 cm while body mass was obtained to the nearest 0.1 kg using a balance beam scale (Seca, Hamburg, Germany). Body composition in soccer players was determined by means of bioelectrical impedance (Tanita BC 418, USA). Fat mass (%), kg) and fat free mass (kg) were analyzed. Tanita BC 418 device can measure distribution of fat in different points (trunk, left-right arm and leg), (Johnson, Naccarato, Corder, & Repovich, 2012). We consider fat distribution in football players and intergroup (related to the position) differences. Measurements were taken with light clothes at the same level of body hydration and fasting state as they were taken in a state of rest.

All results are reported as means and standard deviations (mean ± SD) calculated by conventional procedures unless it stated otherwise. All calculations were performed using Microsoft Excel and Statistical software SSPS 19 (Chicago, IL, USA). A one-way analysis of variance (ANOVA) was used to examine changes in mean values for each specific position of the players. Linear regression was used to determine correlation between variables.

RESULTS

We investigated soccer players of the first division and evaluated all the anthropometric variables in the summer, 2012. The description of results for the sample is represented in Table 1. Data show mean and standard deviation for all players (n=220) and separately for goalkeepers, midfield players, forwards and defenders. According to the p-value of ANOVA in Table 1, except for age, all the variables in four groups of elite soccer players were significantly different.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (n=220) Mean ± SD</th>
<th>Goalkeepers (n=16) Mean ± SD</th>
<th>Defenders (n=62) Mean ± SD</th>
<th>Midfielders (n=92) Mean ± SD</th>
<th>Attackers (n=50) Mean ± SD</th>
<th>NOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>27.56±5.66</td>
<td>26.38±4.00</td>
<td>25.50±3.97</td>
<td>25.56±3.67</td>
<td></td>
<td>0.189</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>75.61±7.59</td>
<td>85.96±5.52</td>
<td>78.34±7.26</td>
<td>72.81±6.03</td>
<td>74.08±7.31</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>180.12±6.03</td>
<td>188.56±3.89</td>
<td>181.58±5.66</td>
<td>178.22±5.26</td>
<td>179.12±5.73</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>BMI</td>
<td>23.25±1.40</td>
<td>24.17±1.41</td>
<td>23.72±1.39</td>
<td>22.89±1.23</td>
<td>23.04±1.45</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Fat mass (kg)</td>
<td>7.81±2.98</td>
<td>9.92±3.72</td>
<td>8.57±3.07</td>
<td>6.72±2.71</td>
<td>8.19±2.35</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Fat free mass (kg)</td>
<td>67.52±7.84</td>
<td>76.06±5.87</td>
<td>69.78±6.07</td>
<td>65.42±8.66</td>
<td>65.87±6.13</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Fat mass (%)</td>
<td>10.15±3.50</td>
<td>11.45±4.34</td>
<td>10.78±3.48</td>
<td>9.05±3.51</td>
<td>10.99±2.63</td>
<td>0.001</td>
</tr>
<tr>
<td>Trunk fat (kg)</td>
<td>4.20±2.17</td>
<td>5.48±2.85</td>
<td>4.67±2.23</td>
<td>3.48±2.01</td>
<td>4.53±1.69</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Right leg fat (kg)</td>
<td>1.16±0.37</td>
<td>1.45±0.40</td>
<td>1.26±0.39</td>
<td>1.01±0.31</td>
<td>1.20±0.33</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Right arm fat (kg)</td>
<td>0.59±0.12</td>
<td>0.71±0.11</td>
<td>0.63±0.12</td>
<td>0.55±0.11</td>
<td>0.58±0.12</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Left leg fat (kg)</td>
<td>1.25±0.34</td>
<td>1.54±0.44</td>
<td>1.33±0.34</td>
<td>1.11±0.30</td>
<td>1.31±0.28</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Left arm fat (kg)</td>
<td>0.61±0.14</td>
<td>0.74±0.13</td>
<td>0.66±0.14</td>
<td>0.56±0.12</td>
<td>0.59±0.13</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Multiple comparisons (Tukey HSD) showed many significant differences (significance level considered p<0.05) between 4 playing positions.

**Body mass**
The goalkeepers had significantly higher body mass compared to other three groups (p<0.0001). That of the defenders was significantly higher than the midfielders and the attackers (respectively p<0.0001, p=0.005). For the attackers higher body mass was assessed compared to the midfielders, but was not significant.

**Height**
The goalkeepers had significantly higher height compared to other three groups (p<0.0001). That of the defenders was significantly higher than the midfielders (p=0.001) and also higher than the attackers, but was not significant in the latter. The Attackers had higher height compared to the midfielders, but was not significant.

**BMI**
The goalkeepers had significantly higher BMI compared to the midfielders and the attackers (respectively p=0.003, p=0.02). That of the defenders was significantly higher than the midfielders and the attackers (respectively p=0.001, p=0.04). BMI was higher in the attackers compared to the midfielders, but was not significant.

**Trunk fat (kg)**
The goalkeepers had significantly higher trunk body fat compared to the midfielders (p=0.003). The defenders had body fat's trunk significantly higher than the midfielders (p=0.003), and that of the attackers was significantly higher than the midfielders (p=0.02).

**Right arm fat (kg)**
The Goalkeepers had significantly higher right arm body fat compared to the midfielders and the attackers (respectively p<0.0001, p=0.001). That of the defenders was significantly higher than the midfielders (p<0.0001).

**Left arm fat (kg)**
The Goalkeepers had significantly higher left arm body fat compared to the midfielders and the attackers (respectively p<0.0001, p=0.001). That of the defenders was significantly higher than the midfielders and the attackers (respectively p<0.0001, p=0.03).
Right leg fat (kg)
The goalkeepers had significantly higher right leg body fat compared to the midfielders (p<0.0001). The defenders had significantly higher right leg body fat compared to the midfielders (p<0.0001), and that of the attackers was significantly higher than the midfielders (p=0.01).

Left leg fat (kg)
The goalkeepers had significantly higher left leg body fat compared to the midfielders (p<0.0001). The defenders had significantly higher left leg body fat compared to the midfielders (p<0.0001), and that of the attackers was significantly higher than the midfielders (p=0.003).

Fat mass (kg)
The goalkeepers had significantly higher fat mass (kg) compared to the midfielders (p<0.0001). The defenders had significantly higher fat mass (kg) compared to the midfielders (p=0.001). The attackers had significantly higher fat mass (kg) than midfielders (p=0.01).

Fat free mass (kg)
The goalkeepers had significantly higher body mass compared to other three groups (p<0.0001). The defenders had significantly higher body mass compared to the midfielders and the attackers (respectively p=0.01, p=0.002).

Fat mass (%)
The goalkeepers had significantly higher fat mass (%) compared to the midfielders (p=0.04). That of the defenders was significantly higher than the midfielders (p=0.01) and had significantly higher fat mass (%) compared to the attackers (p=0.007).

Linear regression between age and some variables is given in Table 2. Indicating a direct association between age and body mass, BMI, fat mass, fat free mass and fat mass percentage.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age N</th>
<th>Pearson coefficient</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass (kg)</td>
<td>220</td>
<td>0.29</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>220</td>
<td>0.33</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Fat Mass (kg)</td>
<td>220</td>
<td>0.41</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Fat Free Mass (kg)</td>
<td></td>
<td>0.16</td>
<td>0.015</td>
</tr>
<tr>
<td>Fat Mass (%)</td>
<td>220</td>
<td>0.37</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

DISCUSSION

This study provides the most comprehensive comparison among the positional roles in elite soccer players. To our knowledge, this is one of the largest studies with regard to sample size (n=220) and the first survey measuring body composition in professional soccer players in Iranian Premier League. The results of this study indicates that there is a strong correlation between body composition and positional roles in elite soccer players. As expected, there is a strong correlation between age and body mass, BMI, fat mass, fat free mass and fat mass percentage. Before analyzing the results of this study, we must pay attention to the features of the samples. Iranian soccer players play in a league composed of 18 soccer clubs. Heterogeneity of players was obvious among teams and team players due to the differences in ethnic groups of population (Iran is a country with ethnic diversity). The average age of elite Iranian soccer players was 25.91±4.07. Except for the age, other variables had significant differences between four position groups. Body composition differences between four groups have been confirmed in previous studies(Carling & Orhalt, 2010; Davis, et al., 1992; Kraemer, et al., 2005; R Matković, et al., 2003; Ramadan & Byrd, 1987; Raven, et al., 1976; Sporis, et al., 2009; Sutton, et al., 2009; Wittch, et al., 2001), although in some other studies body composition differences have not been found(Bell & Rhodes, 1975; Cossio-Bolanos, et al., 2012; McIntyre & Hall, 2005). Body fat percentage in Iranian soccer players was 10.15±3.50. According to other studies (Chin, Lo, Li, & So, 1992; Davis, et al., 1992; R Matković, et al., 2003; Raven, et al., 1976) it seems that body fat percentage about (Preferably below) 10% in professional soccer players is acceptable. Although in some countries body fat percentage up to 15% or more is reported (Bell & Rhodes, 1975; Cossio-Bolanos, et al., 2012; McIntyre & Hall, 2005; R Matković, et al., 2003; Sporis, et al., 2009; Tumilzy, 1993). Type of practice during the season, knowledge of coaches and racial differences determine percentage of body fat (Reilly, et al., 2000; Sutton,
et al., 2009). In Iran body fat percentage of elite soccer players seems reasonable perhaps because of appropriate training level during the season and presence of world-class coaches in recent years. The results of this study indicate that the defenders and the attackers had more similar features except for the weight and BMI. On the other hand the goalkeepers and the midfielders had significant differences compared to the outfield players. Due to special trainings (a part from the team without high running) and relative inactivity in the match, the goalkeepers had high body mass and body fat. The midfielders were the shortest players and with the smallest amount of body fat as compared with the other positional roles. Moreover, the midfielders cover far greater distances as compared with the attackers and the defenders. In the phase of attack, the midfielders take a ball to the opponent’s half, whereas the defenders, in most cases, make a slight shift forward, and the attackers wait for the ball from the midfielders. In the defensive phase, the attackers run (short runs at low intensity), the midfielders run back, and the defenders wait for the opposing players. The specific role of the midfielders in the team could be responsible for their physical characteristics. In this study fat distribution in four points of body is considered, the goalkeepers had highest fat in every four points, while the midfielders had lowest compared to the outfield players. It seems reasonable because the two groups of players have maximum and minimum total body fat. Linear regression between age and some variables is given in Table 2. This indicates that body mass, BMI, fat mass, fat free mass and fat mass percentage increase significantly with age. Increasing percentage of body fat with age seems reasonable.

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REFERENCES