Anthropometric and Physical Fitness Characteristics of University Students

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Abstract

The aim of this study was to analyze the characteristics of body proportions and fitness of male and female university students. A total of 67 subjects participated at the study. Based on ten anthropometric measurements, six proportional ratios were calculated as three fitness tests too. Findings indicate significant differences between groups for four proportional ratios and two physical tests. Additionally, Pearson correlation shows some relationships between ratios and physical fitness characteristics. The results of the study indicate that proportional ratios influence the fitness characteristics by gender.

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1. Introduction

Anthropometric and physical fitness characteristics provide important information about normality of body size, health condition, and body shape (Munoz-Catol et al., 2007; Kurt, Catokkas & Atalog, 2011). Human body proportions give us information about the growth of each body segment. The goal of most studies has been to identify the level of physical fitness characteristics at different ages; to evaluate anthropometric characteristics for talent identification or for the level of body development; to calculate the proportional ratios in predicting some diseases; or to evaluate the harmony of the body. All are important to screening for health risks, especially for

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metabolic and cardiovascular diseases (De Lorenzo et al, 2013; Ashwell&Hsieh, 2005). Additionally, physical activity is an important means to reduce and control weight and diverse health risk factors (Zaccagni, 2014). It is interesting to study some of these characteristics in the students of the faculty of Physical Education and Sports, as they will be the next generation of teachers who will educate the younger generation about having an active lifestyle and good health.

The aim of the present work is to analyze the anthropometrical status, the proportional ratio, and the physical fitness status of the study participants, and ultimately, to find out if there is any correlation between last two variables.

2. Material and methods

2.1. Subjects

The research was carried out on 67 university students from the Faculty of Physical Education and Sports, divided in two groups: 44 male subjects (height=178.70±7.17 cm, weight=72.38±10.82 kg) and 23 female subjects (height=167.28±8.18 cm, weight=57.65±8.94 kg). We mention that for our research the purpose of the study was explained to all participants and obtained the written consent from each subject.

2.2. Procedures

Anthropometrical measurements for the assessment of physical status included ten measurements: standing height, weight, sitting height, arm span, chest and waist circumferences, biacromial and bicristal diameter, body mass index, and body fat index.

Each subject was measured in accordance with the standard methods proposed by the International Society for the Advancement of Kinanthropometry (ISAK, 2001) for:

- Basic measurement (height, sitting height and weight). Equipment used included a stadiometer and a weighing scale. Height characteristics were measured to the nearest 0.1cm, and mass characteristic was measured in kg.
- Girths (chest and waist circumference). Both were measured with anthropometric tape and expressed in cm.
- Breadths (biacromial and bicristal diameter), measured in cm with a large sliding caliper.

Arm span was measured from fingertip to fingertip while standing with the back to a flat wall and arms stretched with palms facing the investigator. The equipment required consisted of a tape measure on the wall, measured in cm. The body mass index (BMI) was calculated according to the formula weight (kg)/total height 2 (m²), and indicates the ratio between the weight and height of a person. The body fat index was calculated by using the Bioelectrical Impedance (BI) methods, measured with an Omrom BF306 Hand-Held Body Fat Monitoring device. Body fat was expressed as a percentage of body weight (%).

Based on recorded measures within somatic anthropometry we determine a series of anthropometric indices, including proportional ratios for assessing the harmony of the physical status (Cordun, 2009).

To evaluate the proportion between trunk and limb, the trunk index was calculated (sitting height/heightx100). This index is known as sitting height-to-height ratio (SHR). References (Saxena, 2003) for documenting the size of the trunk length were: <51cm = short; between 51.1-53cm = medium; >53.1 = large (for men) and <52cm =short; between 52.1-54 cm = medium; > 54.1 = large (for women).

The following proportional ratios between different measurements of the body were calculated:

- Arm span-to-height ratio (AHR) by formula (%): $\text{arm span}/\text{height} \times 100$  
- Biacromial to height ratio (BaHR) by formula (%): $\text{biacromial diameter}/\text{height} \times 100$  
- Bicristal to height ratio (BcHR) by formula (%): $\text{bicristal diameter}/\text{height} \times 100$  
- Chest to height ratio (CHR) by formula (%): $\text{chest circumference}/\text{height} \times 100$  
- Waist to height ratio (WHR) by formula (%): $\text{waist circumference}/\text{height} \times 100$

The subjects performed three physical fitness tests to assess flexibility, abdominal strength, and right and left hand strength (McKenzie, 2005).
Sit and reach test. The participants were asked to reach forward from sitting on the floor with shoes off, and push the fingers along the bench as far as possible. The best score from three attempts was recorded (cm).

Sit Ups Test. From lying on the floor with knees bent, feet flat on the floor and arms folded across the chest, subjects were asked to rise to the 90° degree position and return to the floor. The number of executions in 30 seconds was registered.

Handgrip Strength Test. To assess grip strength, subjects used a Baseline 200 Pound Hydraulic Hand Dynamometer device. From standing against the wall with the execution arm flexed at 90° degrees and the dynamometer vertically above the head, students were asked to grip as hard as possible. The final resistance of the dynamometer was measured. The same action was repeated with the other hand (kg/f).

2.3. Statistical analyses

The analysis was carried out using Statistical Package for Social Sciences (SPSS) version 20.0 for IBM. Means and standard deviations were obtained for anthropometric variables and proportional ratios by gender. A comparison of means of proportional ratios between the sexes was carried out using a t-test. Statistical significance was set at p<0.05. The relationships between proportional ratios and physical fitness characteristics were determined using Pearson product moment correlation coefficient. The correlation was high when r>0.50, moderate when 0.30<r>0.50 and low when r<0.30.

3. Results and discussions

In the present study, the anthropometrics of the students from the faculty of Physical Education and Sports have not been evaluated in relation to their status as athletes or non-athletes, but were compared by gender. Table 1 shows the descriptive statistics for anthropometric variables. This study indicates the existence of differences among height, weight, BMI, body fat index, sitting height, arm span, chest, waist and biacromial diameter between gender groups.

The stature of our subjects is characterized as medium, between 170- and 180 cm for male and between 160- and 170 cm for female. It is considered that stature best describes individual development; all other anthropometric measurements can be related to this (Cordun, 2009). For the adult populations, weight is stable and genetic characteristics influence the evolution of every person. In our study, students showed healthy, normal BMI with a mean of 22.55±2.54% for males and 20.47±1.95% for females, in accordance with the BMI classification made by the World Health Organization (WHO, 1990). As we can see, the women have a higher body fat percentage (23.80±1.96) relative to men (14.65±6.48). Gallagher et al (2000) consider a level of body fat between 21- and 33%
healthy for females and between 8- and 19% healthy for males. In accordance with the American Council of Exercise (2009), students are characterized to be athletes if they have a body fat percent between 14- and 20% for males and between 18- and 24%, a medium body fat percent, for females. The sitting height from the present study was higher compared with similar studies from Nigeria (Musa et al, 2012), Portugal (Barosso et al, 2005) and the United Kingdom (Pheasant, 1998). For female students, mean sitting height was similar to that of the European population, and higher than that of Nigerian students. Arm span was related to stature, and the differences showed that arm span exceeded stature by 1.14 cm for the male group, and arm span was less than stature by 1.46 cm for the female group. Cordun (2009) appreciated that for the male population the arm span is higher by 4 cm than stature, while for the female population it is a little bit lower than or similar to stature. In other studies, the arm span was nearly 3.3 cm longer than the body height for the white male population (Steele and Chevier, 1990) and nearly 2.5 cm greater than body height for females (Mohanty et al, 2001). For the Montenegrin students population, Bjelica et al (2012) found that arm span exceeded body height by 2.5 cm in males, while it was 0.24 cm less than the body height in females. Chest circumference for our female students was appreciatively similar to other studies (Danborno & Oyito, 2007; Rilling et al, 2009). The values of waist circumference are considered normal for our study. The four-years study of Grapper et. al (2013) in students from the US and Canada concluded that a large waist circumference, 88.0 cm for females and 102.0 for males, is associated with some diseases. Between genders, the biacromial diameter has different values and bicristal diameter is similar.

Table 2 shows that SHR and BcHR registered a significant difference between gender groups. Compared with the results of Kurt, Catokkas & Atalog (2011), for both genders are higher than for Turkish students. The normal value of BcHR is between 18- and 23% for males and 18 - and 20% for females. For sports activities, especially for strength sports as judo, boxing, weightlifting or wrestling, BcHR must be as small as possible (Cordun, 2009).

<table>
<thead>
<tr>
<th>Proportional ratios</th>
<th>Gender</th>
<th>Mean±SD</th>
<th>Gender</th>
<th>Mean±SD</th>
<th>Mean Diff.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHR</td>
<td>M</td>
<td>53.00±2.74</td>
<td>F</td>
<td>54.61±2.42</td>
<td>-1.612</td>
<td>-2.374</td>
<td>0.021*</td>
</tr>
<tr>
<td>BaHR</td>
<td>M</td>
<td>23.74±1.43</td>
<td>F</td>
<td>22.05±1.51</td>
<td>1.690</td>
<td>4.503</td>
<td>0.000*</td>
</tr>
<tr>
<td>BcHR</td>
<td>M</td>
<td>18.21±1.33</td>
<td>F</td>
<td>19.21±1.65</td>
<td>-0.997</td>
<td>-2.669</td>
<td>0.010*</td>
</tr>
<tr>
<td>AHR</td>
<td>M</td>
<td>100.55±2.07</td>
<td>F</td>
<td>99.70±1.60</td>
<td>0.847</td>
<td>1.711</td>
<td>0.092</td>
</tr>
<tr>
<td>CHR</td>
<td>M</td>
<td>52.74±4.13</td>
<td>F</td>
<td>51.53±3.05</td>
<td>1.205</td>
<td>1.232</td>
<td>0.222</td>
</tr>
<tr>
<td>WHR</td>
<td>M</td>
<td>46.36±4.24</td>
<td>F</td>
<td>43.09±3.40</td>
<td>3.270</td>
<td>3.194</td>
<td>0.002*</td>
</tr>
</tbody>
</table>

Table 3. Coefficient of correlation between physical fitness and proportional racion (for male)

<table>
<thead>
<tr>
<th>Physical fitness</th>
<th>SHR</th>
<th>BaHR</th>
<th>BcHR</th>
<th>AHR</th>
<th>CHR</th>
<th>WHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>.266</td>
<td>.213</td>
<td>.186</td>
<td>.526*</td>
<td>.018</td>
<td>.361</td>
</tr>
<tr>
<td>Abdominal strength</td>
<td>.352*</td>
<td>.026</td>
<td>.167</td>
<td>.045</td>
<td>.037</td>
<td>.016</td>
</tr>
<tr>
<td>Hand strength (right)</td>
<td>.063</td>
<td>-.332</td>
<td>.204</td>
<td>.179</td>
<td>.200</td>
<td>-.428*</td>
</tr>
<tr>
<td>Hand strength (left)</td>
<td>.057</td>
<td>.203</td>
<td>.150</td>
<td>.250</td>
<td>.193</td>
<td>-.112</td>
</tr>
</tbody>
</table>

It has been shown that male students have a significantly greater BcHR than female students. In general, arm span is greater than height in the case of males and equal or less than height in females. Between our groups, no difference has been found between genders. In both men and women, waist and waist-to-hip ratio increase with age and body weight Cordun, 2009. A useful index to identify high metabolic risk in overweight people is the WHR which can be used to manage body weight. The female students group is characterized as being extremely slim, and male group as healthy. Both genders are considered seriously overweight when WHR exceeds 58.0.

The findings of the present study indicated a correlation between anthropometric dimensions and physical fitness characteristics (Table 3). A moderately positive correlation is noted between abdominal strength and SHR for male
students. For females, a highly positive correlation was found between flexibility and BaHR, and right hand strength is moderately negatively correlated with BcHR.

4. Conclusions

It may be concluded from the present study that:
- Proportional ratios had the characteristics of a normal population, or of an athlete population, and indicated that the students are healthy, with normal anthropometric variables.
- The proportional ratio BaHR has a moderate positive correlation with flexibility, and BcHR has a moderately negative correlation with handgrip strength (right hand) in female students.
- The group of male students obtained a moderately negative correlation between SHR and abdominal strength.

References