Prediction of body fat through body adiposity index and bioelectrical impedance analysis in a sample of physically active Mexican students

Palabras clave: con el AIB. Conclusión: En los estudiantes universitarios mexicanos físicamente activos evaluados, el IAC presentó baja concordancia del %GC medido

Abstract. Objective: To compare the body fat percentage %BF predicted through the body adiposity index (BAI) BAI in a sample of physically active Mexican college students, using bioelectrical impedance analysis (BIA) as reference method. Methods: 78 volunteered university students (20.67 ± 1.69 yrs.) partake in study considered as highly active; the %BF determined by BAI was performed using Inbody 720; BAI was calculated by anthropometric assessment from hip and height measures as follows: BAI=

Introduction

According with the National Health and Nutrition 2012 in Mexico the prevalence of obesity (body mass index e» 30) was 24% in women and 20.4% in man between the ages of 20-29 years old and the prevalence of abdominal obesity (waist circumference e» 88 cm) showed 63.6% in women and 43.9% in man (ENSANUT, 2012). There is evidence of obesity in young adults has been related to sedentary lifestyle and metabolic risk factors for cardiovascular disease and type 2 diabetes (Sacheck et al., 2011), Ureña Bonilla, Blanco Romero, & Salas Cabrera, 2015, Práxedes Retos, 34, 2018 (2º semestre)- 128 -

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Mexican young adults. Therefore, to diminish this feature the study was designed to verify the prediction of %BF estimated through the BAI and BIA in a Sample of Physically Active Mexican College Students.

Methods

Participants and setting

Participants were recruited on basis of advertisements in the Faculty of Sport of the Autonomous University of Baja California. Each participant was given an appointment for ask for general information, applying a questionnaire to determine the physical activity level, participants were instructed to wear a short, a t-shirt, and remove any metal and jewelry from their persons also before the of body composition testing session the participants were asked not doing any physical exercise 24 h before the test, maintaining good hydration and do not drink 4 h prior the test, perform the last defecation and/or urination 30 min before the start of test scheduled, do not eating food 4 h before the test, in case of women it was not considered the date appointment with the estrogenic phase of their menstrual cycle; the testing session was developed in the Laboratory of Human Motricity Biosciences of the Faculty of Sports, Autonomous University of Baja California.

In order to estimate the physical activity level the short format (Spanish version) of the international physical activity questionnaire IPAQ (Craig et al., 2011) was used. The short IPAQ allows categorical and continuous measurements of physical activity realized in the past 7 days, the continuous score allows the estimation of the weekly energy expenditure expressed in MET minutes/week (Metabolic Equivalent Task-Minutes). This is obtained by multiplying the value of energy expenditure for the given physical activity in MET by the weekly frequency (days per week) and the time in minutes (minutes per day). According to this questionnaire, all types of walking are given an average MET value of 3.3, all moderate intensity physical activity is valued at 4 and vigorous intensity physical activity is valued at 8. The categorical score classifies individual into three categories; ‘Inactive’, ‘Moderately active’ and ‘Highly active’, as inclusion criteria only subjects who achieve highly active category were included in the study.

This research was cross-sectional analytical study where participants were measured only one time. In total seventy eight college students volunteered to partake in study with a mean age of 20.67±1.69 yrs. The present study followed the ethical principles regarding human experimentation proposed by the Helsinki declaration (Puri et al., 2009); all the subjects provided a written consent in order to participate in the experimentation proposed by the Helsinki declaration (Puri et al., 2009); the testing session was done in the Laboratory of Human Motricity Biosciences of the Faculty of Sports, Autonomous University of Baja California. Each testing session the participants were asked not doing any physical exercise 24 h before the test, in case of women it was not considered the date appointment with the estrogenic phase of their menstrual cycle; the testing session was developed in the Laboratory of Human Motricity Biosciences of the Faculty of Sports, Autonomous University of Baja California.

Analysis

Statistical analyses were performed using statistical software (MedCalc version 11.5.1, Mariakerke, Belgium) and SPSS for Windows version 20 (IBM Corporation, New York, USA). Mean (M) and (±SD) standard deviation were obtained to calculate the dependent variables. Statistical significance was set at p < 0.05. The BIA was used as the «reference method» to determine %BF. Pearson’s correlation coefficient was used to evaluate the association between body fat assessed by BAI and %BF assessed bioelectrical impedance.

A paired sample t-test for each sex was used to test differences in mean %BF obtained with BAI and BIA methods. Lin’s concordance correlation coefficient was used to assess the reproducibility between body fat assessed bioelectrical impedance (Liu, 1989); Lin’s strength of agreement was considered as poor (< 0.90), moderate (0.90 - 0.95), substantial (0.95 - 0.99), and almost perfect (>0.99) (Lin, 1989; McBride, 2005). The plot of the differences between BIA and BAI was studied by the Bland–Altman procedure (Bland & Altman, 1986).

Results

Descriptive statistics for the sample are shown in table 1. The correlation of %BF between bioelectrical impedance and the estimated by body adiposity were r = 0.81, p < 0.01 in man and r = 0.69, p < 0.001 in women. Paired t-test in man showed a significant mean difference in %BF between methods (p = 0.001). The bias of the BIA was 5.77±4.2 % (C95% = 4.40 to 7.14), indicating that the BIA method measured lower %BF than the BIA. Paired t-test in women did not show a significant difference between BIA and BIA methods.

Table 1. Descriptive statistics for the sample (n = 78).

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (±SD)</th>
<th>M (±SD)</th>
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<tbody>
<tr>
<td>Age (yrs.)</td>
<td>20.56 ± 2.47</td>
<td>19.70 ± 2.47</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>172.70 ± 6.36</td>
<td>159.9 ± 6.35</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>74.95 ± 13.32</td>
<td>63.07 ± 14.95</td>
</tr>
<tr>
<td>Hip circumference (cm)</td>
<td>79.97 ± 10.17</td>
<td>73.24 ± 11.33</td>
</tr>
<tr>
<td>%BF (BAI)</td>
<td>24.37 ± 4.40</td>
<td>30.55 ± 5.28</td>
</tr>
<tr>
<td>%BF (BIA)</td>
<td>19.11 ± 6.92</td>
<td>29.70 ± 7.90</td>
</tr>
</tbody>
</table>

Figure 1. Agreement limits of Bland-Altman between the percent of body fat in man measured by BIA and estimated by BAI. The Bland-Altman plot depicts BAI underestimating %BF in relation to the “reference method” BIA.

Figure 2. Agreement limits of Bland-Altman between the percent of body fat in women measured by BIA and estimated by BAI. The Bland-Altman plot depicts BAI underestimating %BF in relation to the “reference method” BIA.
not show significant difference ($p = 0.355$).

Lin’s concordance correlation coefficient was considered poor in man (rc = 0.49). The Bland-Altman plot (Figure 1) showed BAI underestimating %BF in relation to the BIA.

Lin’s concordance correlation coefficient was considered poor in women (rc = 0.63). The Bland-Altman plot (Figure 2) showed BAI underestimating %BF in relation to the BIA.

Discussion

The aim of this study was to compare the body fat percentage %BF predicted through the body adiposity index (BAI) BAI in a sample of physically active Mexican college students, using bioelectrical impedance analysis (BIA) as reference method, the correlations of %BF between BIA and the estimated by BAI were $r = 0.81$, $p < 0.001$ in man and $r = 0.69$, $p < 0.001$ in women. BAI presented low agreement with %BF measured by BIA; therefore, BAI is not recommended for %BF prediction in this sample studied.

From the point of view of body composition assessment, ethnicity is a factor that influences the body fat, anthropometric profile and shape of an individual (Carroll et al., 2008, Hebden et al., 2012) regarding this BAI was validated with data from Mexican American adults (Bergman et al., 2011, Carroll et al., 2008), refers than male and female Hispanic individuals with similar ages have been observed to have a lower height and weight than other ethnicity groups, in spite of the sample in our study were young Mexican the data showed than BAI index was ineffective in predicting %BF. On this topic Lutoslawska et al. 2014, have repeated poor correlation coefficient in Lin’s concordance between %BF and BAI in physical education students from Poland. However, a study performed in a sample of Central American physical education students BAI presented low agreement with BF% measured by DXA (Carpio-Rivera et al. 2015). Regarding the assessment of obesity amongst physical education teachers previous studies has been reported 82.3% of combined overweight and obesity using BMI and abdominal obesity was 43.5% in males and 29.4% in females, those resulted were even higher than the Mexican national average (Hall et al. 2009, Hall et al. 2012), by other hand results of studies do not reflect accuracy of %BF assessed with anthropometric measurements in active and sedentary university students (Brooks et al., 2007, Ode et al., 2007, Esco et al., 2011).

Although BAI has been reported to be effective in predicting %BF in some populations and appeared to be of potential interest as a measure of %BF in obesity populations (Gupta & Kapoor, 2014, Kanehisa & Fukunaga, 2013, Ejtahed et al., 2014), in clinical practices, specially nutrition and physical exercise area, clinicians should pay attention when perform the BAI and interpret the %BF, due the accuracy in physically active people (Ode et al., 2007, Esco et al., 2011). The present study is limited by the sample size, restricted to Mexican young physically active people, also because of the cross-sectional design we cannot infer causality, despite of these limitations our data seem to be of importance in may contribute to better understand intervention strategies for weight loss and prevention of weight regain in young due inappropriate dietary habits, distorted body image and lack physical activity in college students (Donnelly et al., 2009); by other hand to our knowledge, there is a lack references than report the validation of the BAI in predicting %BF in Mexican population.

Conclusions

In summary, based on these results the BAI showed poor concordance, low accuracy, precision and is not recommended method when estimating %BF in a sample of physically active Mexican College Students. In the future will be appropriated more representative studies to clarify the cutoffs, accuracy and association of Body Adiposity Index according with age, sex, metabolic risk factors, health behaviors and other indicator of morbidity.

References


