



ADULT CARDIOLOGY – ORIGINAL ARTICLE

## Body adiposity index in Colombian elite athletes: A comparison between the body mass index and other measures



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### KEYWORDS

Physical activity;  
Cardiology;  
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### Abstract

**Purpose:** To evaluate the correlations between body adiposity index and other adiposity indexes such as body mass index, hip and waist circumference, waist-to-hip ratio,  $\Sigma 6$  skinfold-thickness and percentage body fat in Colombian elite athletes.

**Methods:** A cross-sectional study was conducted in 149 elite athletes from Colombia (mean age:  $26.3 \pm 6.5$  years; height:  $169.2 \pm 10.1$  cm; body mass:  $66.1 \pm 12.8$  kg; body mass index  $22.9 \pm 3.0$  kg m<sup>-2</sup>), body adiposity index, body mass index, waist-to-hip ratio, percentage body fat,  $\Sigma 6$  skinfold-thickness and waist circumference were also measured.

**Results:** To select an optimal surrogate for adiposity, we examined the correlation between body adiposity percentage as measured by BIA and several variables, including body adiposity index, body mass index,  $\Sigma 6$  skinfold-thickness, percentage body fat and waist-to-hip ratio. The regression procedure showed that there was a significant relationship between the body adiposity index and BF% ( $R^2 = 0.407$ ,  $p < 0.01$ ). Bland–Altman plot showed that the limits of agreement (95% confidence intervals) between the BF% and body adiposity index ranged between 15.53 and 2.26%, and there was a significant positive association between the difference and mean of the 2 methods ( $\rho = 0.607$ ,  $p < 0.01$ ).

**Conclusion:** The adiposity indexes that include the percentage body fat and body adiposity index could be used as indicators to evaluate the corporal composition in both sport practice and research.

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**PALABRAS CLAVE**

Actividad física;  
Cardiología;  
Obesidad

## Índice de adiposidad corporal en deportistas de élite de Colombia: una comparación entre el índice de masa corporal y otras medidas

**Resumen**

**Objetivo:** Evaluar la correlación entre el índice de adiposidad corporal y otros índices de adiposidad como el índice de masa corporal, la circunferencia de cintura, la circunferencia de cadera, la relación cintura-cadera, la sumatoria de pliegues cutáneos ( $\Sigma 6$ ) y el porcentaje de grasa corporal en atletas de élite colombianos.

**Métodos:** Estudio descriptivo y transversal en 149 atletas de élite de Colombia (edad  $26,3 \pm 6,5$  años; estatura:  $169,2 \pm 10,1$  cm; peso corporal:  $66,1 \pm 12,8$  kg; índice de masa corporal  $22,9 \pm 3,0$   $\text{kg}\cdot\text{m}^{-2}$ ). El índice de adiposidad corporal, circunferencia de cintura, circunferencia de cadera, porcentaje de grasa corporal y la  $\Sigma 6$  pliegues cutáneos, se midieron como indicadores de adiposidad.

**Resultados:** Los resultados de la regresión muestran una relación significativa entre el índice de adiposidad corporal con el porcentaje de grasa corporal ( $R^2 = 0,407$ ;  $p < 0,01$ ). La gráfica de Bland-Altman mostró que los límites de acuerdo (intervalos de confianza del 95%) entre el índice de adiposidad corporal y el porcentaje de grasa corporal oscilaron entre 15,53 y 2,26%. Una asociación positiva y significativa fue observada entre la diferencia y la media de los 2 métodos ( $\rho \text{ spearman} = 0,607$ ;  $p < 0,01$ ).

**Conclusión:** Los índices de adiposidad que incluyen el índice de adiposidad corporal y el porcentaje de grasa corporal podrían ser indicadores para evaluar la composición corporal, tanto en la práctica del deporte como en la investigación.

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**Introduction**

The assessment of body fat percentage (BF%) in athletic populations is important in numerous circumstances, such as determining the outcomes of strength and conditioning programs and evaluating overall physical fitness and health status.<sup>1</sup> Numerous tools and methodologies have been developed to measure body composition including laboratory methods and field methods. Four commonly used laboratory methods include hydrodensitometry (underwater weighing), air displacement plethysmography (Bod Pod, Life Measurement Instruments, Concord, CA), isotope dilution, and dual-energy X-ray absorptiometry (DXA). Field methods include bioelectrical impedance analysis (BIA), near-infrared interactance (NIR), skinfolds, and anthropometric circumference measurement.<sup>2</sup> Although highly accurate, these methods are often too costly, time consuming, and not readily available to practitioners. Fortunately, there are other techniques that predict adiposity in field settings, such as skinfold techniques, body mass index (BMI), PB%, waist circumference (WC), waist-to-hip ratio (W/H) and bioelectrical impedance analysis.<sup>1-5</sup> However, applied prediction methods have the risk of providing inaccurate individual estimations and are often impractical because of issues with intra- and interrater reliability, technician error, and the inability to evaluate a large group in a short time.<sup>1</sup>

Recently, the body adiposity index (BAI) was created as a clinical alternative to BMI, with all the associated benefits, i.e., reliability and rapid calculation.<sup>6</sup> The BAI index showed a high correlation with body fat measurements performed with DXA (the dual-energy X-ray absorptiometry).<sup>6</sup> The DXA is the gold-standard method to measure PB% in

clinical methods. However, there are no studies exploring the use of the BAI specifically in Latin American athletes. This is an important area of research because negative body image and eating disorders are prevalent in this group.<sup>1</sup>

The aim of this study was to evaluate the correlation between BAI, and other adiposity indexes such as BMI, WC, W/H and PB% in Colombian elite athletes.

**Methods and subjects****Subjects and procedure**

A cross-sectional study in 149 Colombian elite athletes from the Indervalle (*Instituto Nacional de Deportes, Educación Física y Recreación del Valle del Cauca*) that competed between 2008 and 2012 was performed. The subjects in the study group were 22–35 years old with a mean age  $\pm$  SD of  $26.3 \pm 6.5$ , and had at least 3 years of active participation in elite sports (karate, wrestling, atheism, swimming, rowing, fencing, skating, shot put, and soccer). The study followed the guidelines and regulations governing research on humans (Resolución 008430 de 1993 del Ministerio de Salud de Colombia). Thus, after being clarified the purpose of the research and the procedures to which athletes would be submitted, all of them signed an informed consent form approved by the research ethics committee of the School of Sport Sciences of USTA and INDERVALLE. Exclusion criteria were diagnosed inflammatory or metabolic diseases (diabetes, thyroid gland disease, any other endocrine disorders, autoimmune diseases, any chronic inflammation and neoplastic disease). All variables were measured by a Level 2

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