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# Anthropometric Characteristics, Somatotype and Body Composition: Differences between Cuban and Mexican Olympic and Non-Olympic Track and Field Athletes

## Características Antropométricas, Somatotipo y Composición Corporal: Diferencias entre Deportistas Olímpicos y No Olímpicos Cubanos y Mexicanos de Pista y Campo

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**SUMMARY:** The study of body composition and somatotype in Olympic athletes is essential for understanding their performance and providing reference models that help sports professionals optimize nutritional and training strategies aimed at reaching a high level of athletic performance. This study aimed to compare the anthropometric characteristics of Olympic and non-Olympic athletes from various athletics disciplines. A total of 131 international athletes from Cuba and Mexico (57 Cubans and 74 Mexicans), including 79 Olympians, were evaluated using 43 anthropometric variables according to the standards of the International Society for the Advancement of Kinanthropometry (ISAK). The results showed significant differences in bone mass (BM) between Olympic and non-Olympic athletes ($U = 354.0$, $p = 0.02$), with Olympic athletes presenting higher values. No significant differences were found in muscle mass and body fat percentage ($p > 0.05$), although Olympic athletes tended to show higher values in muscle mass, without reaching statistical significance. The chi-square analysis revealed a significant association between sex and Olympic status ($\chi^2 = 5.18$, $p = 0.023$), with women being more likely to be Olympians (OR = 2.33, 95 % CI: 1.12, 4.87). These findings highlight the importance of anthropometric characteristics in sports performance and how they vary according to competitive category, sex, and athletic level.

**KEY WORDS: Kinanthropometry; Anthropometry; Body composition; Somatotype; Athletic performance; Track and field.**

## INTRODUCTION

Olympic athletes represent a unique group within high-performance athletes, characterized by extremely demanding training regimens designed to reach the world podium every four years (Giovanelli *et al*., 2024). Among the factors that determine their performance, such as physical training and psychological regulation (Pagani & Lucini, 2009), optimal body composition plays a crucial role, as its assessment not only allows monitoring the effectiveness of training regimens but also optimizes performance according to the specific demands of each sport discipline (Portal *et al*., 2010; Santos *et al*., 2014).

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An adequate body composition is directly associated with improvements in cardiorespiratory fitness (Högström *et al*., 2012) and muscle strength (Silva *et al*., 2011). On the other hand, extreme fluctuations in body mass, such as those caused by severe dehydration or eating disorders, can lead to significant health complications (Sundgot-Borgen *et al*., 2013). In this regard, excess body fat not only negatively impacts athletic performance (Malina, 2007) but is also associated with a lower power-to-weight ratio, reduced acceleration, and increased energy expenditure (Svantesson *et al*., 2008). In contrast, insufficient muscle mass poses significant health risks (Sundgot-Burgen & Garthe, 2011; Ackerman *et al*., 2019).

Muscle quantity and distribution play a key role in athletic performance, particularly in sports disciplines that require speed, strength, and power, and are determining factors in athletes' ability to reach high levels of competition (Thomas *et al*., 2016; Kendall *et al*., 2017).

In this context, athletic performance has often been associated with certain characteristics and anthropometric profiles (Castañeda-Babarro *et al*., 2024). In team sports such as volleyball, higher performance has been associated with lower body fat levels, greater muscle mass, and height (Mielgo-Ayuso *et al*., 2017). Similarly, in individual sports such as swimming (Dos Santos *et al*., 2021), cycling (van der Zwaard *et al*., 2019), judo (Giudicelli *et al*., 2021), and running (Dessalew *et al*., 2019; Alvero-Cruz *et al*., 2020), a similar relationship between performance and these same parameters has been observed.

Regardless of the sport modality, it has been shown that inadequate body composition not only affects performance but also increases the likelihood of injuries (Yáñez-Sepúlveda *et al*., 2021).

Morphological characteristics are also fundamental to athletic performance. Body shape not only influences the improvement of movement technique but also provides a foundation for specific physical fitness. In athlete selection, it is observed how their physical characteristics align with the "model" somatic pattern for each discipline, based on the proportions and traits observed in elite athletes (Slankamenac *et al*., 2021; Rivera-Kofler *et al*., 2024).

In the field of Kinanthropometry, one of the key aspects related to athletic performance is the study of somatotype, which analyzes adiposity, musculoskeletal development, and linearity in relation to stature (Charzewski *et al*., 1991; Malina *et al*., 2004). The most commonly used method to assess anthropometric somatotype is the Heath & Carter (1967) method, which classifies individuals according to their predominant physical characteristics.

The somatotype is defined as a quantitative expression of morphological configuration, composed of three components classified as endomorphy, mesomorphy, and ectomorphy (Carter, 2002). According to thetheoretical framework of Heath and Carter (Carter, 1990), the physical properties of the human body are not assigned to a single somatotype, but each individual has a specific proportion of these three body types, influenced by both genetic and environmental factors (Malkin *et al*., 2006; Wilber & Pitsiladis, 2012). Despite its relevance, comparative studies between anthropometric and somatotype variables in Olympic and non-Olympic track and field athletes have not been conducted to date. For this reason, the objective of this study was to compare anthropometric differences between both groups and explore how variations in their structure and body composition may influence their ability to compete at the highest athletic level.

## MATERIAL AND METHOD

**Study Design.** This descriptive cross-sectional study was conducted through a single visit by the participants to the evaluation site for data collection. The study design was based on the guidelines of the Strengthening Reporting of Observational Studies in Epidemiology (STROBE) (Vandenbroucke *et al*., 2014; Elm *et al*., 2007).

**Setting.** The study integrated information from two databases. The first data collection was conducted before the participation of Cuban athletes in the Olympic Games, with authorization from the Cuban Institute of Sports Medicine (IMD). The second database was generated during the XXIV Central American and Caribbean Athletics Championship, held in Morelia, Michoacán, Mexico. This protocol was approved by the Biosafety, Research, and Ethics Committees of the University of Guadalajara (CEI062020-01) and registered in clinicaltrials.gov (NCT 06416124). All participants provided written informed consent, adhering to the ethical principles outlined in the Declaration of Helsinki (World Medical Association, 2013).

**Participants.** The study included 131 athletes, of whom 57 were Cuban and 74 were Mexican, all with experience in international competitions. Among the Cubans, all were Olympic participants, having earned a total of 32 medals: 16 gold, 10 silver and 6 bronze, distributed across the Olympic Games, World Championships (WCH), and Pan American Games (PG). On the other hand, the Mexican athletes, 22 of whom were Olympic participants, accumulated a total of 13 medals: 2 gold, 7 silver, and 4 bronze. In total, the 131 athletes earned 45 international medals (18 gold, 17 silver, and 10 bronze). The participants were classified into seven groups: Sprints (100m, 110m hurdles, 200m, 400m, 400m hurdles), Middle Distance (800 m, 1500 m), Long Distance (3000 m, 3000m steeplechase, 5000 m, 10,000 m), Endurance (20k race walk, half marathon), Combined Events (Heptathlon, Decathlon), Jumps (pole vault, high jump, long jump, triple jump), and Throws (hammer throw, javelin).

**Inclusion and Exclusion Criteria.** Mexican and Cuban athletes who attended the evaluation area were included in the study. Exclusion criteria included inappropriate clothing or refusal to sign the informed consent form.

**Variables.** Forty-three anthropometric variables were analyzed following the guidelines of the International Society for the Advancement of Kinanthropometry (ISAK) (Esparza *et al.*, 2019). Measurements were taken at least twice, or three times in case of discrepancies, using the mean or median for analysis. The technical error of measurement (TEM) intra-evaluator was 5.04 % for skinfolds and 0.93 % for other variables.

Data Sources and Measurements. Measurements were taken after a 7-10 hour fast and at least 12 hours after the last exercise session. All evaluations were conducted by certified anthropometrists at levels 2 and 3. The instruments used included:

- Body mass: SECA® 874 digital scale (Hamburg, Germany).
- Stature and sitting height: SECA® 217 stadiometer (Hamburg, Germany).
- Skinfolds: Harpenden® caliper (West Sussex, United Kingdom).
- Girths: Rosscaft® flexible tape measure (Surrey, Canada).
- Lengths: SmartMet® segmometer (Jalisco, Mexico).
- Bone breadths: SmartMet® large sliding caliper (Jalisco, Mexico).

All instruments were calibrated before each evaluation session.

**Anthropometric Profile.** Composite variables were created from the collected data, including the five-way fractionation method of body composition according to Ross and Kerr (1991) and the calculation of somatotype using the Heath and Carter method (Carter, 2002).

**Study Sample.** A non-probability convenience sampling method was used, including 79 Olympic athletes, representative of the elite Cuban and Mexican athletes.

**Statistical Methods.** To determine the normality of the data, the Kolmogorov-Smirnov test was applied. Since the data did not follow a normal distribution, the median and interquartile range (IQR) were used as measures of central tendency and dispersion. Differences between sports events were assessed using the Kruskal-Wallis test with a post hoc Dunn analysis, while differences between sexes were analyzed with the Mann-Whitney U test. All statistical tests were performed using IBM SPSS Statistics software, version 23.0 (IBM Corp., Armonk, N.Y., USA), with a significance level of ≤ 0.05.

Table I. Descriptive characteristics of track and field athletes stratified by sex and competition level.

| Variable | Level | Sex | Median | IQR | Min | Max |
|---|---|---|---|---|---|---|
| | Oly | M | 22.9 | (19.9-25.9) | 10.6 | 38.3 |
| Age (years) | | F | 21.7 | (18.9-23.8) | 14.0 | 40.0 |
| | nOly | M | 22.2 | (19.8-24.5) | 17.9 | 35.6 |
| | | F | 24.6 | (20.0-27.0) | 18.0 | 29.0 |
| | Oly | M | 70.3 | (64.0-76.0) | 46.0 | 99.2 |
| Body mass (kg) | | F | 58.8 | (54.4-63.3) | 40.2 | 85.4 |
| | nOly | M | 75.0 | (68.6-86.3) | 52.6 | 135.0 |
| | | F | 57.5 | (53.5-66.0) | 42.1 | 95.2 |
| | Oly | M | 178.3 | (173.0-183.6) | 159.0 | 194.0 |
| Stature (cm) | | F | 167.5 | (163.4-171.4) | 149.8 | 182.5 |
| | nOly | M | 181.2 | (174.4-185.8) | 169.1 | 194.0 |
| | | F | 166.0 | (161.8-172.0) | 156.0 | 184.1 |
| | Oly | M | 91.8 | (89.2-93.5) | 73.0 | 105.3 |
| Sitting height (cm) | | F | 87.5 | (85.4-89.5) | 77.0 | 93.4 |
| | nOly | M | 92.2 | (89.4-95.2) | 86.8 | 102.0 |
| | | F | 85.7 | (84.1-88.3) | 79.0 | 93.7 |
| | Oly | M | 22.2 | (21.3-23.4) | 17.5 | 28.4 |
| BMI (kg/m$^2$) | | F | 20.6 | (19.8-21.9) | 17.2 | 27.4 |
| | nOly | M | 23.2 | (21.2-24.9) | 18.4 | 38.0 |
| | | F | 21.6 | (18.9-23.1) | 16.2 | 33.8 |

Min = minimum; Max = maximum; BMI = body mass index; IQR = interquartile range; F = female; M = male; nOly = non-Olympic athlete; Oly = Olympic athlete.

## RESULTS

Table I presents the descriptive characteristics of the track and field athletes included in the study, stratified by sex and competition level.

Table II shows the differences in anthropometric characteristics between male Olympic and non-Olympic athletes.

Differences were observed in body fat percentage (BF %) (U = 443.0, p = 0.17, ES = -0.21), fat mass (BF kg) (U = 525.0, p = 0.68, ES = 0.06), muscle mass (MM %) (U = 473.0, p = 0.31, ES = 0.16), muscle mass (MM kg) (U = 413.0, p = 0.08, ES = 0.26), bone mass (BM %) (U = 113.0, p = 0.09, ES = 0.37), and bone mass (BM kg) (U = 354.0, p = 0.02*, ES = 0.37). In general, Olympic athletes exhibited higher values in most body components, particularly in muscle and bone mass. Differences were found in mesomorphy levels (U = 408.0, p = 0.07, ES = 0.27), with Olympic athletes showing higher values, indicating greater muscular development (Table II).

The differences in anthropometric characteristics between female Olympic and non-Olympic athletes are shown in Table III. Overall, the results do not show

Table II. Differences in anthropometric characteristics between Olympic and non-Olympic male athletes.

| | Olympic (n = 20) | | | | Not Olympic (n = 56) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Skinfolds (mm)** | **Median** | **IQR** | **Min** | **Max** | **Median** | **IQR** | **Min** | **Max** | **U** | ***p*-value** | **ES** |
| Triceps | 7.0 | (5.3-9.2) | 3.6 | 24.4 | 6.3 | (5.0-8.4) | 3.2 | 24.2 | 523.0 | 0.67 | -0.07 |
| Subscapular | 8.4 | (7.0-9.5) | 5.0 | 30.0 | 8.0 | (7.0-9.5) | 5.0 | 15.0 | 493.0 | 0.43 | -0.12 |
| Biceps | 3.4 | (3.0-4.5) | 2.0 | 9.2 | 3.2 | (3.0-4.0) | 2.0 | 8.0 | 478.0 | 0.33 | 0.15 |
| Supraspinal | 6.2 | (4.8-7.8) | 3.4 | 29.0 | 6.3 | (5.0-7.7) | 3.4 | 18.0 | 514.0 | 0.59 | -0.08 |
| Abdominal | 8.0 | (6.3-11.3) | 4.6 | 43.0 | 8.5 | (6.8-11.9) | 4.6 | 22.3 | 418.0 | 0.10 | -0.25 |
| Thigh | 9.0 | (6.2-13.4) | 3.6 | 30.8 | 7.25 | (6.0-10.0) | 3.6 | 23.6 | 536.0 | 0.78 | -0.04 |
| Calf | 5.6 | (4.4-8.2) | 2.5 | 29.0 | 5.0 | (4.3-6.0) | 2.5 | 20.0 | 509.0 | 0.56 | -0.09 |
| **Breadths (cm)** | | | | | | | | | | | |
| Humerus | 6.8 | (6.2-7.2) | 5.30 | 8.30 | 6.8 | (6.3-7.2) | 5.2 | 8.2 | 388.0 | 0.04* | 0.31 |
| Femur | 9.7 | (9.0-10.3) | 7.50 | 12.0 | 9.5 | (9.0-10.0) | 7.6 | 10.8 | 345.0 | 0.01* | 0.38 |
| **Girths (cm)** | | | | | | | | | | | |
| Relaxed arm | 26.7 | (24.0-29.5) | 19.5 | 48.5 | 27.3 | (25.0-30.0) | 20.8 | 35.1 | 527.0 | 0.70 | 0.06 |
| Flexed arm | 29.3 | (26.8-33.8) | 21.2 | 51.3 | 30.4 | (27.6-32.5) | 22.3 | 37.7 | 504.0 | 0.51 | 0.10 |
| Forearm | 24.5 | (23.1-28.2) | 18.7 | 39.1 | 25.4 | (23.4-26.6) | 18.4 | 31.5 | 370.0 | 0.03* | 0.34 |
| Chest | 88.2 | (81.8-96.8) | 75.4 | 128.5 | 91.6 | (85.8-96.1) | 75.6 | 105.6 | 453.0 | 0.21 | 0.19 |
| Mid-thigh | 53.2 | (49.1-56.8) | 42.1 | 77.0 | 51.5 | (48.6-55.2) | 36.0 | 65.6 | 421.0 | 0.10 | 0.25 |
| **Body components** | | | | | | | | | | | |
| BF (%) | 18.4 | (17.3-22.6) | 15.9 | 28.3 | 20.0 | (18.7-21.3) | 16.0 | 27.4 | 443.0 | 0.17 | 0.21 |
| BF (kg) | 14.7 | (12.1-16.6) | 11.0 | 38.2 | 13.9 | (12.9-15.4) | 10.8 | 19.4 | 525.0 | 0.68 | 0.06 |
| MM (%) | 52.6 | (48.2-55.6) | 42.2 | 61.7 | 51.0 | (49.4-52.4) | 42.2 | 58.7 | 473.0 | 0.31 | 0.16 |
| MM (kg) | 40.2 | (32.9-48.4) | 19.8 | 83.3 | 36.4 | (31.9-38.8) | 19.3 | 53.9 | 413.0 | 0.08 | 0.26 |
| BM (%) | 12.6 | (11.5-13.0) | 10.5 | 13.7 | 11.7 | (11.1-12.1) | 8.9 | 13.8 | 113.0 | 0.09 | 0.37 |
| BM (kg) | 8.6 | (8.0-9.8) | 5.8 | 13.5 | 8.1 | (7.3-8.7) | 4.6 | 10.9 | 354.0 | 0.02* | 0.37 |
| MBR | 4.8 | (3.8-5.1) | 3.4 | 6.2 | 4.4 | (4.2-5.0) | 3.4 | 6.5 | 539.0 | 0.81 | 0.04 |
| Σ 6 skinfolds | 34.9 | (31.2-41.4) | 24.8 | 145.8 | 39.6 | (34.3-43.2) | 24.8 | 67.5 | 455.0 | 0.22 | -0.19 |
| Σ 8 skinfolds | 40.2 | (37.7-50.7) | 30.4 | 145.8 | 48.6 | (41.8-54.3) | 28.2 | 98.5 | 416.0 | 0.09 | -0.26 |
| Endomorphy | 1.5 | (1.3-1.9) | 1.1 | 5.6 | 1.8 | (1.5-2.1) | 1.1 | 3.5 | 456.0 | 0.22 | -0.19 |
| Mesomorphy | 5.6 | (4.1-6.3) | 2.4 | 11.1 | 4.7 | (4.3-5.4) | 1.8 | 7.5 | 408.0 | 0.07 | 0.27 |
| Ectomorphy | 2.7 | (1.9-3.3) | 0.1 | 5.1 | 2.9 | (2.5-3.5) | 0.7 | 5.6 | 481.0 | 0.35 | -0.14 |

BF = body fat; BM = bone mass; MBR = muscle-bone ratio; MM = muscle mass; IQR = interquartile range; ES = Cohen's d effect size *: Significant at the ≤ 0.05 level significant differences in the anthropometric characteristics between female Olympic and non-Olympic athletes. However, some trends are observed, such as slightly higher muscle mass in Olympic athletes (MM %) (U = 329.0, p = 0.45, ES = 0.12); (MM kg) (U = 353.0, p = 0.72, ES = 0.06). A difference is also observed in mesomorphy levels (U = 310.0, p = 0.28, ES = 0.17).

The chi-square test revealed a significant association between sex and Olympic status ($\chi^2$ = 5.18, df = 1, p = 0.023). Women were significantly more likely to be Olympic athletes compared to men, with an odds ratio of 2.33 (95 % CI: 1.12, 4.87). These findings suggest a higher likelihood of female participation in the Olympic Games.

Table III. Differences in anthropometric characteristics between Olympic and non-Olympic female athletes

| | Olympic (n = 25) | | | | Not Olympic (n = 30) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Skinfolds (mm)** | **Median** | **IQR** | **Min** | **Max** | **Median** | **IQR** | **Min** | **Max** | **U** | ***p*-value** | **ES** |
| Triceps | 8.2 | (7.09.4) | 5.0 | 24.4 | 9.5 | (7.3-11.5) | 4.8 | 24.2 | 302.0 | 0.22 | -0.20 |
| Subscapular | 9.0 | (7.0-10.5) | 5.8 | 30.0 | 8.4 | (7.0-9.9) | 5.4 | 15.0 | 325.0 | 0.40 | 0.13 |
| Biceps | 3.6 | (3.0-4.6) | 2.0 | 9.2 | 4.0 | (3.1-5.0) | 2.2 | 8.0 | 319.0 | 0.34 | -0.15 |
| Supraspinal | 6.5 | (6.0-8.2) | 4.0 | 29.0 | 7.4 | (6.6-9.8) | 3.8 | 18.0 | 312.0 | 0.29 | -0.17 |
| Abdominal | 9.6 | (7.4-15.0) | 6.0 | 43.0 | 11.5 | (8.5-16.9) | 5.2 | 22.3 | 306.0 | 0.24 | -0.19 |
| Thigh | 11.5 | (9.4-15.3) | 6.4 | 30.8 | 11.4 | (9.3-14.9) | 6.2 | 23.6 | 351.0 | 0.69 | 0.07 |
| Calf | 6.8 | (5.5-11.0) | 4.8 | 29.0 | 6.4 | (5.0-8.7) | 3.6 | 20.0 | 315.0 | 0.31 | 0.16 |
| **Breadths (cm)** | | | | | | | | | | | |
| Humerus | 6.2 | (6.0-6.6) | 5.3 | 7.9 | 6.2 | (6.1-6.5) | 5.2 | 7.5 | 366.0 | 0.89 | 0.02 |
| Femur | 9.1 | (8.8-9.6) | 7.5 | 11.4 | 9.0 | (8.5-9.4) | 7.6 | 10.4 | 301.0 | 0.21 | 0.20 |
| **Girths (cm)** | | | | | | | | | | | |
| Relaxed arm | 25.0 | (23.3-27.2) | 19.5 | 37.2 | 24.9 | (23.5-26.8) | 20.8 | 34.5 | 374.0 | 0.99 | 0.00 |
| Flexed arm | 27.3 | (25.6-29.6) | 21.2 | 38.0 | 26.8 | (25.2-28.1) | 22.3 | 35.8 | 326.0 | 0.41 | 0.13 |
| Forearm | 23.2 | (22.4-23.9) | 18.7 | 28.7 | 23.3 | (22.2-23.8) | 18.4 | 29.2 | 368.0 | 0.91 | 0.02 |
| Chest | 84.0 | (80.0-88.1) | 75.4 | 102.2 | 84.9 | (82.6-87.4) | 75.6 | 97.9 | 332.0 | 0.47 | -0.11 |
| Mid-thigh | 51.8 | (48.9-55.2) | 42.5 | 74.0 | 50.9 | (48.4-52.1) | 41.3 | 65.6 | 305.0 | 0.24 | 0.19 |
| **Body components** | | | | | | | | | | | |
| BF (%) | 25.0 | (22.7-28.0) | 18.4 | 37.5 | 26.0 | (24.2-27.8) | 20.0 | 34.5 | 356.0 | 0.76 | -0.05 |
| BF (kg) | 15.3 | (12.4-17.1) | 9.8 | 35.5 | 15.0 | (12.8-17.2) | 10.6 | 26.3 | 362.0 | 0.83 | -0.03 |
| MM (%) | 46.6 | (43.5-48.7) | 39.5 | 55.4 | 45.7 | (43.8-47.3) | 34.8 | 54.7 | 329.0 | 0.45 | 0.12 |
| MM (kg) | 27.5 | (23.6-30.8) | 16.0 | 49.5 | 26.5 | (24.4-29.6) | 16.3 | 46.7 | 353.0 | 0.72 | 0.06 |
| BM (%) | 11.7 | (11.2-12.5) | 10.3 | 14.6 | 11.0 | (10.2-11.7) | 9.5 | 12.5 | 33.0 | 0.07 | 0.48 |
| BM (kg) | 6.4 | (5.8-6.9) | 4.3 | 9.5 | 6.1 | (5.6-7.0) | 4.0 | 9.4 | 315.0 | 0.32 | 0.16 |
| MBR | 4.3 | (3.8-4.7) | 2.8 | 5.6 | 4.4 | (4.0-4.7) | 3.3 | 5.5 | 352.0 | 0.71 | -0.06 |
| Σ 6 skinfolds | 54.0 | (45.0-65.2) | 34.4 | 182.0 | 57.1 | (45.2-66.5) | 34.4 | 108.6 | 356.5 | 0.76 | -0.05 |
| Σ 8 skinfolds | 57.6 | (49.2-76.8) | 37.4 | 191.2 | 69.6 | (53.7-85.3) | 37.2 | 119.8 | 316.5 | 0.33 | -0.16 |
| Endomorphy | 2.5 | (1.9-3.0) | 1.5 | 7.3 | 2.6 | (2.1-3.2) | 1.4 | 4.6 | 342.0 | 0.59 | -0.09 |
| Mesomorphy | 4.1 | (2.9-5.0) | 1.1 | 8.7 | 3.5 | (3.0-4.3) | 1.0 | 6.6 | 310.0 | 0.28 | 0.17 |
| Ectomorphy | 2.6 | (2.1-4.4) | 0.5 | 5.4 | 2.8 | (2.4-3.6) | 0.7 | 5.2 | 340.0 | 0.56 | -0.09 |

BF = body fat; BM = bone mass; MBR = muscle-bone ratio; MM = muscle mass; IQR = interquartile range; ES = Cohen's d effect size

## DISCUSSION

The main findings of this study reveal that male athletes showed significant differences in humeral and femoral diameters, forearm girth, and bone mass, while no significant differences were found in the anthropometric characteristics evaluated between female athletes, whether Olympic or non-Olympic, across different disciplines. This finding could be attributed to the fact that non-Olympic female athletes also competed at the international level, participating in events such as the Pan American Games and World Championships, despite not being part of the Olympic Games. This may have influenced the results obtained.

Regarding the significant differences between groups, it was observed that the bone mass in men was significantly higher in Olympic athletes compared to non-Olympic athletes. This result aligns with previous studies, which indicate that higher lean mass and bone mineral density are characteristics that favor the expression of strength and power (Schipilow *et al*., 2013; Stock *et al*., 2017). Conversely, athletes with less body fat and a lower body fat percentage may sustain effort more effectively than those with a higher amount of non-functional mass, thanks to a lower relative workload and potentially a more efficient thermoregulatory system (Dervis *et al*., 2016). In our study, no differences were observed in fat mass between Olympic and non-Olympic athletes, indicating that, regardless of the category, athletes had an optimal body composition for high performance. This is relevant because a high proportion of body fat is associated with a low power-to-weight ratio, lower acceleration, and higher energy expenditure (Svantesson *et al*., 2008). Although athletic performance has frequently been related to anthropometric parameters (Bonilla *et al*., 2022; Ramos-García *et al*., 2023; Castañeda-Babarro *et al*., 2024), any advantage derived from better body composition seems to be mediated by the individual's overall sporting ability, as familiarity with a movement pattern promotes more efficient muscle activation and a lower relative workload (Krakauer *et al*., 2019).

Regarding somatotype, no significant differences were found between Olympic and non-Olympic athletes, both in men and women. This result could be explained by the high competitive level of non-Olympic athletes, who participate in World Cups, Pan American, and Central American tournaments. Thus, the training status and the stage of the season the athlete is in seem to be better predictors of body composition than participation in the Olympic Games (Cullen *et al*., 2022). Several studies have noted that the diversity of somatotypes among athletes depends primarily on the sport they practice (Baranauskas *et al*., 2024). For example, speed and strength sports such as weightlifting, rowing, swimming, and combat sports tend to present a mesomorphic predominance (Kutseryb *et al*., 2017). The characteristics of each sport influence athletic ability, ease of gaining muscle or fat and physical endurance (González Macías & Flores, 2024). In our study, Olympic athletes competed in both sprint, jump, and throwing events, as well as endurance events (middle-distance, long-distance, and endurance). In both groups, for both men and women, a mesomorphic somatotype predominated, more strongly marked in males.

Regarding body composition assessment, it is important to note that all available techniques have certain limitations. For example, the reliability of skinfold thickness measurement depends on the skill of the technician and the brand of the caliper (Giovanelli *et al*., 2024). However, these limitations were taken into account in our study, as all measurements were performed by certified anthropometrists, and all instruments were calibrated before each evaluation session to minimize variability and potential errors.

It is important to highlight that we did not have sufficient data from all sports disciplines nor an adequate sample size in some of them, which limits the generalizability of the results.

In conclusion, only men showed significant differences in some anthropometric parameters between Olympic and non-Olympic athletes, while women had a higher likelihood of being Olympic athletes compared to men.

**HERRERA-AMANTE, C.A.; CARVAJAL-VEITÍA, W.; RAMOS-GARCÍA, C. O.; GARCIA-CARRILLO, E.; CORTÉS-ROCO, G.; OLIVARES-ARANCIBIA, J.; AGUILERA-MARTÍNEZ, N. & YÁÑEZ-SEPÚLVEDA, R.** Características antropométricas, somatotipo y composición corporal: diferencias entre deportistas olímpicos y no olímpicos cubanos y mexicanos de pista y campo. *Int. J. Morphol., 43(3)*:816-822, 2025.

**RESUMEN:** El estudio de la composición corporal y somatotipo de los atletas olímpicos es fundamental para entender su rendimiento y proporcionar modelos de referencia que ayuden a los profesionales del deporte a optimizar las estrategias nutricionales y de entrenamiento dirigidas a alcanzar un alto nivel deportivo. Este trabajo tuvo como objetivo comparar las características antropométricas de atletas olímpicos y no olímpicos de distintas disciplinas del atletismo. Se evaluaron 131 atletas internacionales de Cuba y México (57 cubanos y 74 mexicanos), incluidos 79 olímpicos, utilizando 43 variables antropométricas según los estándares de la Sociedad Internacional para el Avance de la Cineantropometría (ISAK). Los resultados mostraron diferencias significativas en la masa ósea (BM) entre atletas olímpicos y no olímpicos (U = 354,0, p = 0,02), con los olímpicos presentando mayores valores. No se encontraron diferencias significativas en masa muscular y porcentaje de grasa corporal (p > 0,05), aunque los olímpicos presentaron valores superiores en masa muscular, sin alcanzar significancia estadística. El análisis de chi-cuadrado reveló una asociación significativa entre sexo y estatus olímpico ($\chi^2$ = 5,18, p = 0,023), siendo las mujeres más propensas a ser olímpicas (OR = 2,33, IC 95 %: 1,12, 4,87). Estos hallazgos subrayan la importancia de las características antropométricas en el rendimiento deportivo y cómo varían según la categoría competitiva, el sexo y el nivel deportivo.

**PALABRAS CLAVE: Cineantropometría; Antropometría; Composición corporal; Somatotipo; Rendimiento atlético; Atletismo.**

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