Mediterranean Journal of Nutrition and Metabolism 17 (2024) 241–254
DOI:10.3233/MNM-240038
IOS Press


# Exploring body composition and somatotype profiles among youth professional soccer players

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Received 31 May 2024
Accepted 12 July 2024
Pre-press 9 August 2024
Published 13 September 2024

**Abstract**.
**OBJECTIVE:** This study aimed to analyze the body composition and somatotype of professional soccer players, investigating variations across categories and playing positions.
**METHODS:** An observational, cross-sectional, and analytical study was conducted with 51 male professional soccer players in the U-19 and U-20 categories. Data about sex, age, height, and weight were collected between March and May 2023.

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Body composition analysis utilized the ISAK protocol for the restricted profile, while somatotype categorization employed the Heath and Carter formula. Statistical analysis was performed using IBM SPSS Statistics V.26, which involved the application of Mann-Whitney and Kruskal-Wallis tests to discern differences in body composition variables and proportionality based on categories and playing positions. The Dunn test further identified specific positions exhibiting significant differences.
**RESULTS:** The study encompassed 51 players, highlighting meaningful differences in body composition. The average body mass in kg was 75.8 (±6.9) for U-20 players and 70.5 (±6.1) for U-19 players. The somatotype values were 2.6-4.6-2.3 for U-20 players and 2.5-4.3-2.8 for U-19 players, with a predominance of muscle mass in all categories, characterizing them as balanced mesomorphs.
**CONCLUSIONS:** Body composition and somatotype findings underscore distinctions in body mass across categories and playing positions, with notably higher body mass and muscle mass predominance in elevated categories. However, the prevailing skeletal muscle development establishes a significant semblance with the recognized somatotype standard for soccer.

Keywords: Anthropometry, somatotypes, soccer, body composition, young adult

## 1. Introduction

In the realm of sports medicine, understanding the intricate relationship between body composition and athletic performance is pivotal. The analysis of body composition involves dissecting body mass into its constituent components [1], playing a crucial role in determining athletic potential and success in sports. This assessment of anthropometric and physiological characteristics, combined with factors such as technical proficiency, physical fitness, functional capabilities, and psychosocial attributes, forms a holistic approach to optimizing athletic performance [2, 3].

Soccer is recognized as one of the most intricate and globally pervasive sports, demanding attention due to its intermittent nature involving alternating efforts of varied intensity, accompanied by pauses and incomplete recoveries [4, 5]. Coaches, physical trainers, and athletes increasingly acknowledge the importance of maintaining optimal physical conditions tailored to meet the dynamic requirements of soccer development [6–8].

Professional soccer players often go through changes in body composition during the season, switching from more fat mass to more lean mass [9, 10], which is crucial for improving recovery time and fatigue resistance [11, 12]. Although these variations are caused by training frequency and are directly associated with body components, it has been shown that there is no relationship between changes in performance, specifically in power or sprint, when training with eccentric overload is performed [13].

Maintaining the correct levels of body composition can be challenging. It has been observed that young professional soccer players tend to have higher levels of perfectionism level [14] and a worse body image representation compared to sedentary controls, despite having better fitness [15]. These alterations in body image can be detrimental, promoting incorrect dietary behaviors and potentially leading to eating disorders [16, 17]. Soccer players, like all athletes, are exposed to alterations in their nutritional status due to inadequate nutrition, which affects their energy requirements [18–20], Therefore, it is necessary to control caloric demand, considering the in-season and off-season stages.

Studies suggest that body fat levels are inversely correlated with aerobic fitness and sprint scores, while deviations in BMI and the percentage of fat and lean mass may influence injury risks in young professional soccer players [21, 22]. Consequently, monitoring body composition helps to achieve greater control of the players' performance and evaluate the effectiveness of the training program executed [23].

As Velarde-Sotres et al. emphasized, monitoring and controlling body composition in sports is crucial for energy provision, temperature regulation, and nutrient transport, with lean mass playing a significant role in influencing performance factors and minimizing injury risk [24].

The diverse roles in soccer—Forward, Midfielder, Goalkeeper, and Defense—contribute to varying energy demands that influence body composition [25, 26]. Anthropometric and body composition indicators not only impact specific player attributes but also play a crucial role in distinguishing between successful and less successful young players, alongside motor coordination and physical performance measures [27, 28]. A study comparing professional soccer players from Chile and international references revealed differences specific to player positions in fat mass and height [29], underscoring the importance of position-specific considerations to understand the physical profiles of athletes. Professional-level matches showcase distinctions in the distance covered and sprint frequency among positions, with midfielders covering greater distances, defenders less, and forwards engaging in more sprints [30]. Wong et al. examined the FIFA World Cups and highlighted differences in height, weight, and BMI across playing positions, reinforcing the notion of individual physiological demands and anthropometric prerequisites for specific roles [31, 32].

The somatotype quantifies the current shape and composition of the human body, serving as a key indicator of physical structure [33, 34]. Somatotypes, categorized into endomorph, mesomorph, and ectomorph, provide insights into relative fatness, musculoskeletal robustness, and thinness, respectively, offering valuable information about individuals' body composition and physical characteristics [35–37]. Derived by Carter into thirteen subcategories, each somatotype reflects the dominance and relationship between its components [38]. The ideal somatotype for soccer athletes varies based on sports requirements and playing positions. Several authors assert a balanced mesomorph as the most predominant somatotype in soccer [39–41], while Pfirrman et al. [42] and Peroni et al. [43] identify ectomorphs as having the highest susceptibility to various types of injuries. Understanding these somatotype nuances contributes to tailoring training and injury prevention strategies for soccer players.

This research aims to analyze the body composition and somatotype of male professional soccer players in Guayaquil, Ecuador. Given the scarcity of national studies classifying body composition and somatotype based on playing position and U categories, this work endeavors to contribute valuable data through kinanthropometry. The information gathered is expected to enhance our understanding of distinct body composition profiles and somatotypes associated with each playing position, ultimately informing more targeted nutritional and training interventions tailored to individualized needs for preventing injuries and improving sports performance.

## 2. Materials and methods

### 2.1. Study participants

The study followed an observational, cross-sectional and analytical design. Data were collected between March and May 2023 in Guayaquil, Ecuador. Fifty-one male players from the Barcelona Sporting Club of Guayaquil participated voluntarily, categorized as U-19 ($n = 27$; $17.63 \pm 0.742$ years) and U-20 ($n = 24$; $21.04 \pm 2.758$ years). It is noteworthy that in our country, there are players who play in categories older than their chronological age; they are commonly selected due to their performance or potential as soccer players. That is why, in the data obtained, the best athletes signed by the club were considered. To provide a precise definition, the U-19 category typically includes players who are 18 years old or younger, while the U-20 category generally consists of players who are 19 years old or younger. However, due to exceptional performance and potential, some players are allowed to compete in higher age categories. The "soccer age" categorization is based on the player's age at a specific cut-off date, often at the start of the competition year. This can result in some players appearing younger or older than the typical age range for their category. For example, the mean age of 21 in the U-20 category includes players who have turned 20 during the year but are still eligible to compete until the end of the season.

The inclusion criteria were as follows: age belonging to the U-19 or U-20 categories, able to conclude a regular training or a match. Exclusion Criteria: players currently experiencing injuries or traumas that prevent them from participating in regular training and matches; the presence of significant pathologies, chronic diseases, or any condition that could significantly impact their performance. The study design and all ethical aspects were evaluated by the Research Center on Motor Activities (CRAM) Scientific Committee (Protocol n.: CRAM-030-2023, 15/03/2023). Participants and legal representatives of minors provided voluntary informed consent, aligning with international bioethical standards as per the Declaration of Helsinki Statement of 2008, updated in Fortaleza, October 2013.

### 2.2. Material

Body mass index (BMI), body composition (muscle mass, bone mass, fat mass, and residual mass), and somatotype were calculated using ISAK METRY software. Somatotype, which categorizes body types, was classified into three categories: endomorph (high fat), mesomorph (muscular), and ectomorph (slim). Anthropometric instruments included a SECA 874 dr weighing machine, SECA 213 portable stadiometer, CESCORF skinfold caliper, LUFKIN anthropometric tape, CESCORF pachymeter, demographic pencil, NUTRI TOOLS anthropometric drawer, 2.00 m gigantograph for measuring wingspan, and square.

### 2.3. Anthropometric assessment

Anthropometric measurements were taken by a single evaluator, an anthropometrist certified by the International Society for the Advancement of Kinanthropometry (ISAK) following the ISAK protocol [44]. Anatomical points were identified and marked on the right side of the athlete. Considering these markings, the anthropometric variables were measured in triplicate, and the median value was used for analysis. Measurements were taken in the morning, after urinary emptying, and on an empty stomach, with participants barefoot and wearing minimal clothing. The restricted profile included 21 measurements encompassing body mass, height, arm span, sitting height, and skinfolds such as bicipital, tricipital, subscapular, supraespinal, ileocrestal, abdominal, front thigh, and calf. Perimeters of the relaxed arm, flexed arm, waist, hips, middle thigh, calf, and diameters of the humerus, bistyloid, and femur were also included. The measurements obtained allow the components of body composition to be established through predictive equations, using the method proposed by Heath and Carter for the somatotypic categorization of the athlete [38]. In the somatochart, the athlete's somatotype is represented using X and Y coordinates: X axis (ectomorphy – endomorphy) and Y axis [2 x mesomorphy – (endomorphy+ectomorphy)]. The results are plotted on scales from –8 to 8 for the X coordinate and –10 to 16 for the Y coordinate. The region of the somatochart where the point is located determines the somatotypic characterization.

A digital data sheet or proforma sequentially recorded information following superior and inferior anatomical positions.

### 2.4. Statistical analysis

Version 26 of Statistics Software Package R (SPSS® Inc., Chicago, IL, USA), was used, and Excel was utilized for graphical representations. Data were stratified by category and playing position. Descriptive statistics were presented as mean (±) and standard deviation (SD). Non-parametric tests were used because several variables did not follow a normal distribution. The Mann-Whitney U test compared body composition and proportionality variables between categories and playing positions. The Kruskal-Wallis test analyzed differences in main body composition variables between playing positions in each category. When significant, Dunn's test identified specific position pairs with differences. The significance level ($\alpha$) was set at 0.05 with 95% confidence intervals (CI) in all measures, adjusted for multiple comparisons using Bonferroni correction.

## 3. Results

The statistical evaluation identified 51 participants, with 24 belonging to the U-20 category and 27 to the U-19 category. Significant differences between the U-19 and U-20 categories were observed in body mass ($p = 0.006$),

Table 1
Comparison of Anthropometric and Body Composition Characteristics Between U-19 and U-20 Soccer Players

| Category | U-20 Mean (SD) n=24 | U-19 Mean (SD) n=27 | *p*-value* |
|---|---|---|---|
| Age (years) | 21.0 (2.7) | 17.6 (0.7) | |
| Body mass (kg) | 75.8 (6.9) | 70.5 (6.1) | 0.006 |
| Size (cm) | 178.6 (6.6) | 177.0 (6.4) | 0.33 |
| BMI (kg/m2) | 23.7 (1.9) | 22.4 (1.5) | 0.04 |
| Muscle mass (kg) | 34.8 (4.5) | 32.3 (2.7) | 0.01 |
| Muscle Mass (%) | 45.4 (4.8) | 46.0 (1.8) | 0.48 |
| Fat Mass (kg) | 18.6 (4.6) | 17.6 (3.5) | 0.43 |
| Adipose Mass (%) | 24.3 (6.7) | 24.8 (3.8) | 0.35 |
| Residual mass (kg) | 10.4 (3.6) | 9.0 (2.1) | 0.11 |

*Corresponding to the Mann-Whitney U test with a significance level of 0.05.

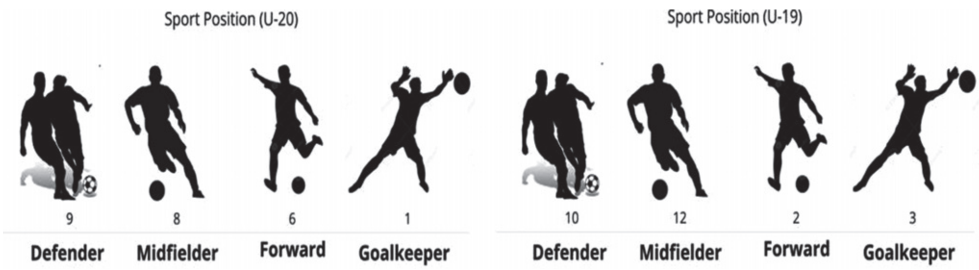


Fig. 1. Distribution of Players by Sport Position in U-19 and U-20 Categories.

BMI ($p = 0.04$), and muscle mass ($p = 0.01$). Anthropometric characteristics of the participants, namely, age, body mass, height, BMI, age, and body composition, are expressed in Table 1, categorized by age group (U-19 and U-20). Further, Fig. 1 reports the division based on the sport position.

A detailed analysis of these variables by category and position notably shows that Defenders had significantly higher body mass ($p = 0.04$), while Midfielders had both body mass ($p = 0.04$) and height ($p = 0.02$) in the U-20 category. Forwards and Goalkeepers did not show significant differences between categories (Table 2).

The Kruskal-Wallis test was employed to explore differences in main body composition variables (body mass, muscle mass, and fat or adipose mass) between playing positions in each category. As outlined in Table 3, the post-hoc Dunn test of multiple comparisons assessed the specific differences among the played roles. There was no significant difference in the U-20 category. The fat mass (%) for this category is illustrated in Fig. 2. The U-19 category showed significant statistical differences between playing positions for body mass, muscle mass (%), and fat mass (kg, %) (Table 3 and Fig. 3).

Goalkeepers exhibited higher body mass than midfielders, lower muscle mass than defenders, and higher fat mass (33.3 %) compared to players in other positions.

As shown in Fig. 3, the goalkeepers are heavier, and the defenders and forwards have similar percentages of muscle mass.

**Somatotype classification**

In the latter part of our study, we concentrated on evaluating the somatotype of the participants as specified by the ISAK protocol. The results of this evaluation highlighted the different somatotype classifications among the

Table 2
Comparison of Anthropometric and Body Composition Characteristics by Playing Position Between U-19 and U-20 Soccer Players

| Category | U-20 Mean (SD) | U-19 Mean (SD) | *p*-value* |
|---|---|---|---|
| Defenses (19) | | | |
| Body mass (kg) | 76.0 (6.2) | 70.1 (5.2) | 0.04 |
| Size (cm) | 181.1 (6.0) | 178.5 (6.2) | 0.49 |
| BMI (kg/m2) | 23.1 (1.1) | 22.0 (1.4) | 0.13 |
| Muscle mass (kg) | 36.6 (3.7) | 33.0 (2.9) | 0.06 |
| Muscle Mass (%) | 48.1 (2.9) | 47.1 (1.1) | 0.31 |
| Fat Mass(kg) | 17.0 (2.7) | 16.1 (2.1) | 0.66 |
| Fat Mass (%) | 22.6 (4.3) | 23.0 (2.6) | 0.07 |
| Residual mass (kg) | 10.0 (2.7) | 9.1 (1.7) | 0.40 |
| Midfielders (20) | | | |
| Body mass (kg) | 73.7 (5.7) | 68.4 (5.9) | 0.04 |
| Size (cm) | 179.9 (5.6) | 174.0 (6.3) | 0.02 |
| BMI | 22.7 (1.8) | 22.5 (1.8) | 0.91 |
| Muscle mass (kg) | 32.7 (.15) | 31.1 (2.6) | 0.23 |
| Muscle Mass (%) | 44.3 (5.3) | 45.6 (1.7) | 0.85 |
| Fat Mass(kg) | 18.4 (1.9) | 17.2 (2.7) | 0.18 |
| Fat Mass (%) | 25.1 (3.5) | 25.2 (3.5) | 0.20 |
| Residual mass (kg) | 10.5 (4.7) | 9.3 (2.4) | 0.57 |
| Forwards (8) | | | |
| Body mass (kg) | 76.5 (8.6) | 71.5 (2.3) | 0.42 |
| Size (cm) | 172.7 (6.5) | 177.8 (0.2) | 0.64 |
| BMI | 25.5 (1.4) | 22.6 (0.6) | 0.07 |
| Muscle mass (kg) | 34.7 (4.6) | 33.6 (1.6) | 0.64 |
| Muscle Mass (%) | 45.4 (3.9) | 47.0 (0.7) | 0.42 |
| Fat Mass(kg) | 19.3 (7.2) | 17.3 (3.6) | 0.85 |
| Fat Mass (%) | 25.2 (8.6) | 24.2 (4.3) | 1,00 |
| Residual mass (kg) | 10.5 (3.9) | 9.0 (3.1) | 0.64 |
| Goalkeepers (4)** | | | |
| Body mass (kg) | 87.9 | 80.0 (2.8) | 0.50 |
| Size (cm) | 180.5 | 183.7 (4.4) | 1,00 |
| BMI | 26.9 | 23.6 (0.3) | 0.50 |
| Muscle mass (kg) | 35.6 | 34.8 (1.5) | 1,00 |
| Muscle Mass (%) | 40.0 | 43.3 (1.5) | 0.50 |
| Fat mass (kg) | 29.3 | 25.1 (1.2) | 0.50 |
| Fat Mass (%) | 33,3 | 31.4 (0.4) | 0.50 |
| Residual mass (kg) | 11.2 | 7.4 (1.1) | 0.50 |

*Corresponding to the U test with a significance level of 0.05. **In U-20 there is only one goalkeeper, so SD is not calculated.

players. According to the Kruskal-Wallis test, neither of the two categories demonstrated significant differences in somatotype between players in different playing positions ($p > 0.05$). (Table 4 and Figs. 4 and 5).

The average somatotype of the players in the U-20 and U-19 categories was categorized as balanced mesomorph, characterized by dominant mesomorphy while endomorphy and ectomorphy were similar (differing by

Table 3
Comparison of Body Mass, Muscle Mass, and Fat Mass Among Different Playing Positions in U-19 and U-20 Soccer Players

| Category | Variables | Defenders[1] Mean (SD) | Midfielders[2] Mean (SD) | Forwards[3] Mean (SD) | Goalkeeper[4] Mean (SD) | *p*-value* | Dunn test |
|---|---|---|---|---|---|---|---|
| U-20 | Body mass (kg) | 76.0 (6.2) | 73.7 (5.7) | 76.5 (8.6) | 87.9 ** | 0.305 | NS |
| | Muscle mass (kg) | 36.6 (3.7) | 32.7 (5.1) | 34.7 (4.6) | 35.6 ** | 0.527 | NS |
| | Muscle mass (%) | 48.1 (2.9) | 44.3 (5.3) | 45.4 (3.9) | 40.4 ** | 0.080 | NS |
| | Fat mass (kg) | 17.0 (2.7) | 18.4 (1.9) | 19.3 (7.2) | 29.3 ** | 0.199 | NS |
| | Fat mass (%) | 22.6 (4.3) | 25.1 (3.5) | 25.2 (8.6) | 33.3 ** | 0.221 | NS |
| U-19 | Body mass (kg) | 70.1 (5.2) | 68.4 (5.9) | 71.5 (2.3) | 80.0 (2.8) | 0.039 | $0.025^{1-4}$ $0.004^{2-4}$ |
| | Muscle mass (kg) | 33.0 (2.9) | 31.1 (2.6) | 33.6 (1.6) | 34.8 (1.5) | 0.115 | NS |
| | Muscle mass (%) | 47.1 (1.1) | 45.6 (1.7) | 47.0 (0.7) | 43.5 (1.5) | 0.01 | $0.023^{2-1}$ $0.005^{4-1}$ $0.021^{4-3}$ |
| | Fat mass (kg) | 16.1 (2.1) | 17.2 (2.7) | 17.3 (3.6) | 25.1 (1.2) | 0.041 | $0.003^{1-4}$ $0.023^{2-4}$ |
| | Fat mass (%) | 23.0 (2.6) | 25.2 (3.5) | 24.2 (4.3) | 31.4 (0.4) | 0.028 | $0.003^{1-4}$ $0.023^{2-4}$ |

*Corresponding to the Kruskall-Wallis test with a significance level of 0.05. **In U-20 there is only one goalkeeper, so SD is not calculated.

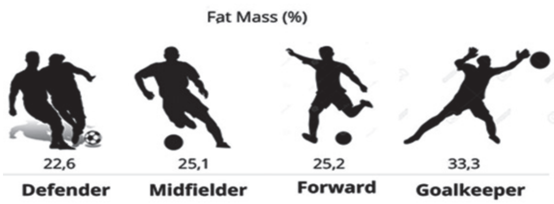


Fig. 2. Fat Mass Percentage by Sport Position in U-20 Soccer Players.

no more than 0.5). This classification applied to all playing positions except for goalkeepers. Players exhibited moderate skeletal muscle development, with values ranging from 3 to 5.5. Additionally, low endomorphy and ectomorphy values (less than 3) indicated minimal subcutaneous fat and prominent muscle and bone contours.

Moreover, the anthropometric characteristics, body composition and somatotype of all participants are detailed in the supplementary material (S1).

## 4. Discussion

The primary objective of this study was to analyze the body composition and somatotype of youth professional soccer players in Guayaquil, categorized by U-19 and U-20 groups and playing positions. As a sport with diverse demands, soccer necessitates multifaceted considerations for reaching optimal performance levels, with anthropometry playing a pivotal role [45]. The anthropometric assessment becomes crucial in tailoring training programs and understanding the distinctive physical attributes associated with different playing positions [46].

In the general analysis of body composition variables across U categories, significant differences were spotted in body and muscle mass, irrespective of playing position. Notably, the U-20 category consistently demonstrated

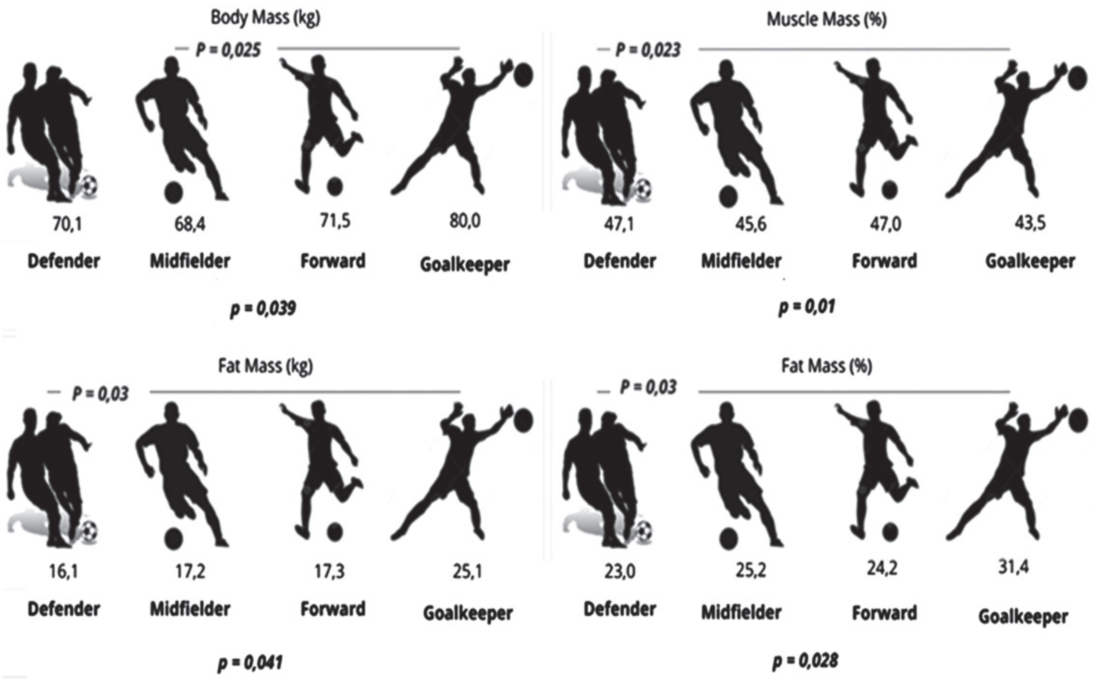


Fig. 3. Comparison of Body Mass, Muscle Mass, and Fat Mass Among Different Playing Positions in U-19 Soccer Players.

Table 4
Comparison of Somatotype Characteristics Among Different Playing Positions in U-19 and U-20 Soccer Players

| Category | Variables | Defenders Mean (SD) | Midfielders Mean (SD) | Forwards Mean (SD) | Goalkeeper Mean (SD) | *p*-value* |
|---|---|---|---|---|---|---|
| U-20 | Endomorph | 2.6 (0.8) | 2.6 (0.9) | 2.4 (0.9) | 5.0** | 0.40 |
| | Mesomorph | 4.1 (1.7) | 5.1 (0.9) | 4.4 (1.4) | 5.3** | 0.23 |
| | Ectomorph | 2.3 (0.0) | 2.3 (0.9) | 2.5 (1.3) | 1.1** | 0.52 |
| U-19 | Endomorph | 2.6 (0.8) | 2.4 (0.9) | 2.6 (0.7) | 2.0 (0.4) | 0.85 |
| | Mesomorph | 4.6 (0.7) | 4.2 (1.1) | 4.8 (0.1) | 3.7 (0.8) | 0.35 |
| | Ectomorph | 2.5 (0.6) | 3.0 (1.1) | 2.4 (1.0) | 3.3 (1.1) | 0.65 |

*Kruskal-Wallis Test for independent samples. **In U-20 there is only one goalkeeper, so SD is not calculated.

favorable outcomes in these variables. Similar results were found in a study by Bernal-Orozco et al. [2] at the Guadalajara Sports Club, aligning with our results and emphasizing the significance of the U-20 category in exhibiting higher body mass and muscle mass. Similarly, Hernández-Jaña et al. [47] studied a group of Chilean soccer players and corroborated these trends, revealing that the U-20 category tends to exhibit values comparable to elite categories, differentiating them from younger counterparts. This phenomenon may be due to the growth spurt still needing to be completed in 19-year-old males, considering that some parameters like bone density [48] and strength [49] achieve their peak around 20–30 years old.

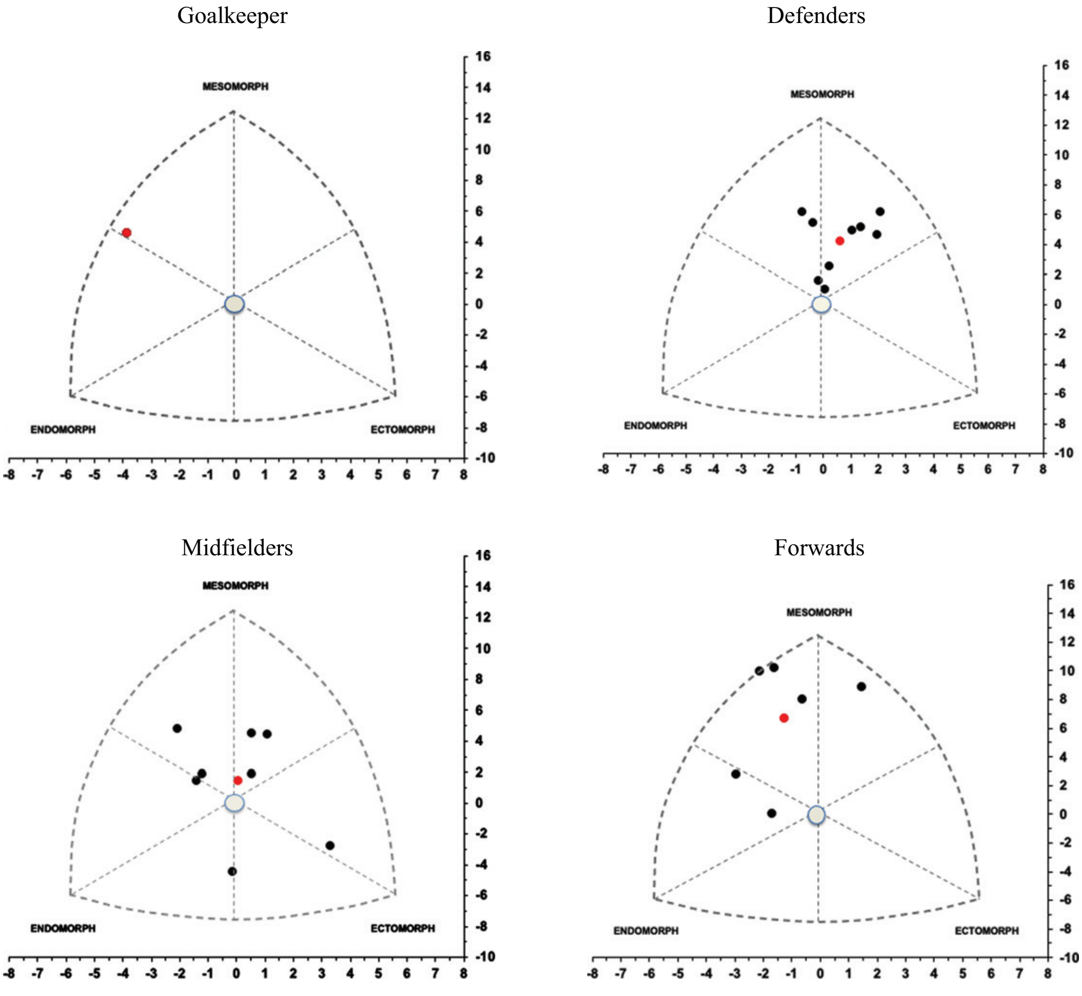


Fig. 4. Somatotype Distribution of U-20 Soccer Players by Playing Position.

A distinct observation emerged in the analysis of goalkeepers, where no significant differences in body composition were noted between the U-20 and U-19 categories. Nevertheless, within the U-19 category, goalkeepers exhibited higher values in both fat and body mass percentages. These outcomes resonate with prior studies conducted in Ecuador by Quiroz-Brunes et al. [50] and Alvarado et al. [8], reinforcing the pattern that goalkeepers tend to exhibit higher fat mass percentages and body mass compared to other positions. These findings are consistent with broader research by Gjonbalaj et al. [51] and Mevaloo et al. [52], establishing goalkeepers as players with a higher fat mass percentage. This could be explained by the physical demands required for the goalkeeper role. It has been shown that an elite Premier League goalkeeper has an average gap in daily energy expenditure of 600 kcal per day compared to other players in the same team [53].

An intriguing revelation surfaced in midfielders, particularly in the U-20 category, where higher body mass and height were observed compared to their U-19 counterparts. Additionally, the U-20 midfielders displayed the highest fat mass percentage within their category. These findings deviate from some existing studies, such as those conducted by Gjonbalaj et al. [51] and Mevaloo et al. [52], which traditionally identify goalkeepers as having the highest fat mass percentages.

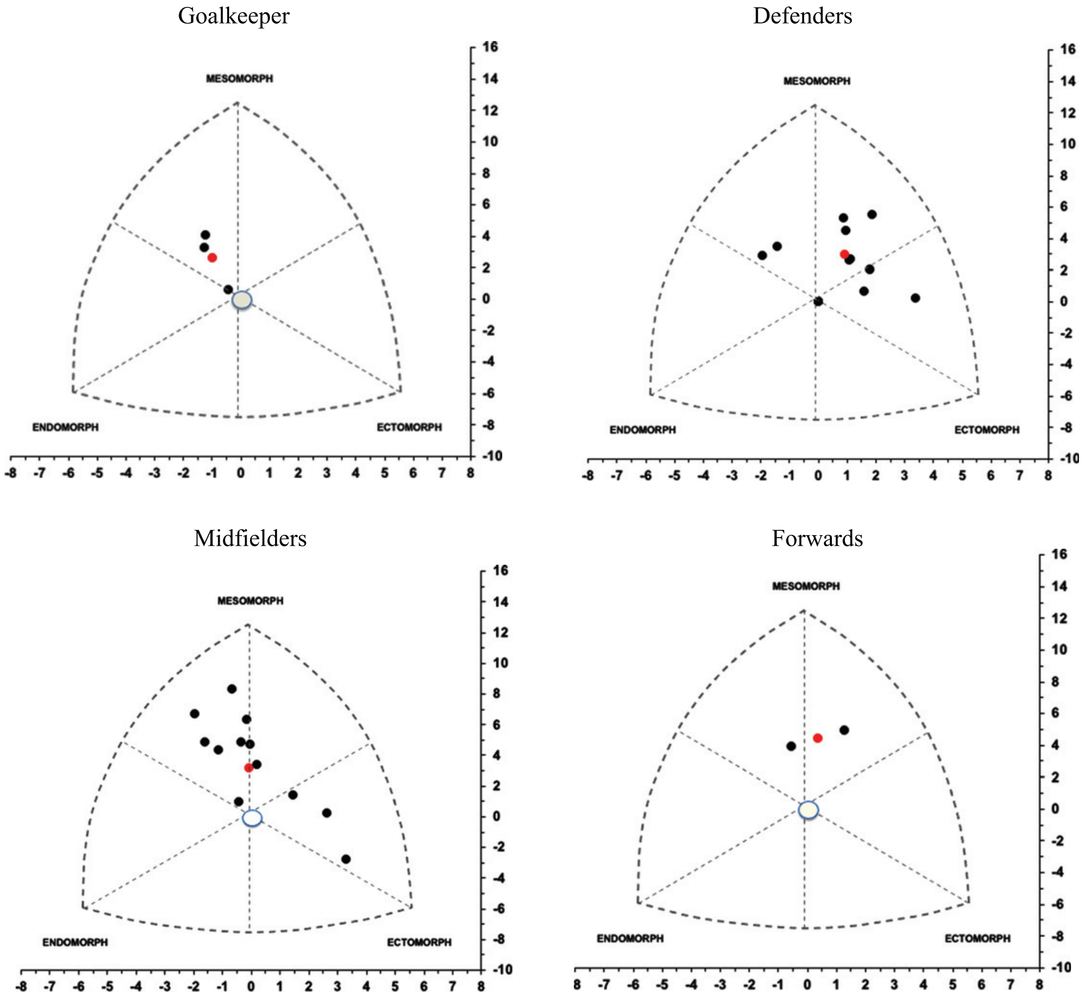


Fig. 5. Somatotype Distribution of U-19 Soccer Players by Playing Position.

Examining the somatotypes depicted in Figs. 4 and 5, it becomes apparent that both U categories and playing positions maintain a balanced mesomorph somatotype on average, indicating a prevalence of mesomorphism in physical characteristics. Our results align with those of Hazir [54] and Sebastiá-Rico et al. [55], supporting the notion that the balanced mesomorph somatotype prevails in professional soccer players.

Despite the valuable insights garnered, the study faced limitations, primarily stemming from the sample size constraints. This was particularly evident in the U-20 category, where only one goalkeeper was available, affecting the generalizability of the findings. Consequently, in-depth analyses between playing positions in this category were hindered. However, significant findings were achieved within the U-19 category, which are consistent with the broader range of literature.

The insights derived from body composition and anthropometric variables extend beyond performance indicators. They offer valuable insights into athletes' health and nutritional needs and provide a basis for tailored, individualized training programs for injury prevention and sports performance improvement [56]. The results of this research add to the developing comprehension of the interplay between anthropometry and the physical and physiological demands of soccer at the youth-professional level.

## 5. Conclusion

The comprehensive analysis of body composition among soccer players revealed more pronounced variations based on playing positions than within U categories. Notably, goalkeepers consistently exhibited higher fat mass than other playing positions, aligning with established patterns observed in prior studies. Regardless of the U category and playing position, the prevailing somatotype observed was a balanced mesomorph, underscoring the uniformity in physical characteristics among soccer players.

When stratified by playing positions, anthropometric analysis emerges as a valuable tool for monitoring athlete health and gaining deeper insights into individualized training and nutritional requirements. Recognizing the distinct physical demands of each playing position allows for more targeted and tailored approaches to optimizing player performance.

A longitudinal approach could be considered in future research endeavors, spanning the entire soccer season. This extended timeline would provide a more nuanced understanding of how different stages and training intensities throughout the season may influence the body composition of soccer athletes. Such investigations could yield valuable information for devising season-specific training and nutritional strategies tailored to the evolving needs of players. Overall, the current study contributes to the evolving body of knowledge in sports medicine, emphasizing the importance of individualized approaches to injury prevention and for the improvement of sports performance of soccer players.


## Funding statement

This research received no external funding.


## Conflicts of interest

The authors declare no conflict of interest.

## Author contributions

Conceptualization, G.M., R.Z-V, E.F-T., A.C. and A.L.; methodology, A.V-S., F.R. and X.W.; data curation, E.M-P., C.P-L. and P.L; writing-original draft preparation, R.Z-V., C.P-L., B.T., F.R., A.C. and X.W.; writing—review and editing, G.M., A.L, R.Z-V. and E.F-T. All authors have read and agreed to the published version of the manuscript.

## Institutional review board statement

The study was designed and approved by the Research Center on Motor Activities (CRAM) Scientific Committee (Protocol n.: CRAM-030-2023, 15/03/2023).

## Informed consent statement

Participants and legal representatives of minors provided voluntary informed consent, aligning with international bioethical standards as per the Declaration of Helsinki Statement of 2008, updated in Fortaleza, October 2013.

## Supplementary materials

The supplementary materials is available in the electronic version of this article: https://dx.doi.org/10.3233/MNM-240038.

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