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# Anthropometric Profiles of the Female Spanish Professional Football League First Division

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## ABSTRACT

**Background:** Anthropometric profiles can contribute to the understanding of a soccer player's fitness.

**Aims:** The aim of this study was to establish the anthropometric characteristics and their relationship with the demarcation of Spanish female first division players in the Women's Professional Football League.

**Methods:** Thirty-eight Spanish First Division female football players (24.1±4.206) years of age, height (165.545±6.059 cm) and weight (60.038±5.17), according the International Society for Advancement in Kinanthropometry, Body weight, Height, Arm and leg circumferences, Skinfold thicknesses were performed three times by an expert in kinanthropometry techniques (accredited level 2) in accordance with ISAK recommendations. Body composition was calculated according to the indications of the Spanish Group of Kinanthropometry. All analyses were performed using R with R commander.

**Results:** Regarding height, goalkeepers were the tallest ($p>0.0301$). The height of the defenders was greater than that of the forwards ($p>0.0303$). The thigh crease of the defenders was greater than that of the forwards ($p>0.0134$). The biileocrestal diameter was greater in midfielders than in forwards ($p>0.0463$). The muscle percentage of female forwards was higher than that of female defenders ($p>0.0304$).

**Conclusion:** In conclusion, our study of female soccer players showed some significant differences in height, thigh crease and biileocrestal diameter between the different demarcations that may favor the playing role with which they are associated.

**Keywords:** Anthropometry, Soccer, female soccer players; First Division of Women's Professional Soccer; Demarcation.

## Introduction

Kinanthropometry measures the physical characteristics of athletes to obtain information on body composition, somatotype, and proportionality[1]. This discipline is considered a subject of human biology or physical anthropology[2] and can also be used for detecting sports talents, studying the growth and maturation, the response to training and monitoring of athletes who must follow a specific diet[1]. The physiological function of athletes is an adaptation as a result of intensive training, which has a marked influence on their kinanthropometry[3].

Football is the world's most popular sport[4,5] and is characterized as a complex contact sport with high physical, technical, tactical and physiological demands[6], requiring moments of explosive gestures, like jumping, kicking, tackling, turning, sprinting and changing pace, all of which are enhanced by muscular strength training[7]. Despite the first Fédération Internationale de Football Association (FIFA) Women's World Cup taking place in 1991[8], women's football importance has grown exponentially[9].

The most important anthropometric parameters are height, weight, head circumference, body mass index (BMI), body circumferences to assess for adiposity (waist, hip, and limbs), and skinfold thickness[10]. These morphometric characteristics and the somatotype could be used as guides and markers of a given sport and method of training[11].In the case of football, it is known that body mass should be monitored since adequate levels of fat allow players to move more efficiently during training and matches[12] or that muscle mass should also be observed, as inadequate training loads may exert undesirable changes on the athletic factors such as speed, strength, power and injury risk[13]. Thus, anthropometric profiles can contribute to understanding a football player's suitability. This will explain why the morphological characteristics of players have become a significant field of interest for both trainers and sports scientists[14]. In line with the above mentioned, it is well-known that the somatotype is able to explain from 25 to 60% difference during the physical test[15].

Several studies on male football players have underlined the existence of a dominant somatotype according to their playing level and position in both amateur and professional athletes[16–18]. Although the studies that have explored this characterization in female football players are few[19–23], most of them corroborated the existence of anthropometric differences between the playing positions. However, there is not a detailed anthropometric characterization of first division Spanish female football players from the Spanish Women's Professional Football League.

This study aimed to establish anthropometric characteristics and their relationship with the playing position of first division Spanish female football players from the Spanish Women's Professional Football League.

## Methods

PARTICIPANTS

Thirty-eight Spanish First Division female football players (25,1±4,8 years old, 165.55±6.06 cm) participated in the research and were studied at one time points during the pre season. The sampling method employed in this study was a purposive sampling technique. All female football players participated voluntarily, were informed about the purpose of the study, and gave their written consent.

ANTHROPOMETRIC MEASUREMENTS

The procedure was performed in accordance with the recommendations of the Spanish Group of Kinanthropometry in its 2008 consensus document[24] and the International Society for Advancement in Kinanthropometry (ISAK).

Body weight was measured to the nearest of 0.1 kg using a calibrated electronic digital scale (Seca 769, Hamburg, Germany). Height was measured with an accuracy of 0.1 cm using a wall mounted stadiometer (Seca 220, Hamburg, Germany). Arm and leg perimeters were obtained (in a relaxed 90° position) with an accuracy of ± 1 mm using a tape (Seca 212. Hamburg, Germany). Skinfold thicknesses (abdominal, suprailiac, tricipital, subscapular, thigh, and leg) were measured with a Harpenden calliper (Holtain skinfold calliper, Crosswell, UK). Measurements were taken three times by an expert in kinanthropometry techniques (accredited level 2) who had previously shown a test–retest reliability of $r > 0.9$, in accordance with the recommendations of the ISAK[25]. Body composition was calculated according to the indications of the Spanish Group of Kinanthropometry in its 2008 consensus document[24].

STATISTICAL ANALYSIS

All Statistical analyses were carried out using R (R Core Team, 2017) with R commander[26–28]. A significance level a priori was set at $\alpha = 0.05$. Data distribution was evaluated using Shapiro-Wilk statistics. Descriptive statistics are cited as means ± standard deviations in the case of normal distribution and as a median and interquartile range in the case of non-normal distribution for each of the variables calculated. A one way ANOVA of some variables was used to compare playing positions in the case of normal distribution and a nonparametric Kruskal-Wallis test in the case of non-normal distribution. Multiple comparisons one tailed Tukey's test to compare playing positions pairwise in case of normal distribution and a one-tailed Dunn's test in case of non-normal distribution.

## Results

The height was significantly different among the positions, by being the goalkeepers the tallest ones (p-value=0.0301). Among quasi significant variables, a multiple pairwise comparison was performed. The defenders' height was significantly higher than strikers' height (p-value=0.0303). These results are shown in Table 1:

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**Table 1.** Results obtained for all the variables evaluated according to playing position.

| Variables | Total n= 38 | Defenders n= 15 | Strikers n= 9 | Midfield n= 10 | Goalkeepers n=4 | p-value |
|---|---|---|---|---|---|---|
| Age (years) | 24.8 ±4.206 | 24.187 ±4.618 | 26.176 ±4.038 | 24.787 ±3.801 | 24.605 ±4.923 | 0.749 |
| Weight (kg) | 60.038 ±5.17 | 61.68 ±5.292 | 57.856 ±5.579 | 59.23 ±4.886 | 60.81 ±3.68 | 0.337 |
| Height (cm) | 165.545 ±6.059 | 167.919 ±5.886 | 161.822 ±5.083 | 163.7 ±5.736 | 169.638 ±4.482 | **0.0301*** |
| Body mass index (kg/m2) | 21.928 ±1.795 | 21.87 ±1.49 | 22.13 ±2.33 | 22.12 ±1.75 | 21.2 ±2.2 | 0.837 |
| Body fat mass (cm) (Faulkner) | 6.79 ±1.538 | 7.215 ±1.122 | 6.292 ±1.892 | 6.747 ±1.695 | 6.425 ±1.817 | 0.526 |
| Body fat mass (cm) (Carter) | 11.292 ±2.073 | 11.85 ±1.683 | 10.699 ±2.315 | 11.182 ±2.127 | 10.808 ±2.991 | 0.575 |
| Muscle mass (kg) | 23.109 ±2.094 | 22.884 ±2.084 | 23.162 ±2.467 | 23.045 ±1.927 | 23.993 ±2.26 | 0.837 |
| Bone mass (kg) | 9.898 ±1.868 | 9.98 (9.413-10.33) | 9.48 (9.06-9.65) | 9.32 (8.61-10.14) | 9.94 (9.87-9.99) | 0.2997 |
| Muscle percentage (%) | 38.579 ±2.874 | 37.15 ±2.342 | 40.12 ±3.522 | 38.996 ±2.71 | 39.425 ±1.504 | **0.0698*** |
| Fat percentage (%) (Carter) | 11.223 ±1.868 | 11.661 ±1.145 | 10.768 ±2.448 | 11.286 ±2.084 | 10.448 ±2.345 | 0.578 |
| Fat percentage (%) (Faulkner) | 18.717 ±2.444 | 19.2 ±2.057 | 18.368 ±2.703 | 18.758 ±2.342 | 17.585 ±3.837 | 0.670 |
| Bone percentage (%) | 15.178 (14-16.25) | 16.16 (15.3-16.57) | 16.27 (14.97-17.48) | 16.165 (15.33-16.52) | 16.42 (15.96-16.84) | 0.8377 |
| Ectomorphy | 2.425 ±0.996 | 2.559 ±0.872 | 2.153 ±1.135 | 2.224 ±0.916 | 3.04 ±1.336 | 0.426 |
| Endomorphy | 5.045 ±0.809 | 5.138 ±0.621 | 5.018 ±0.724 | 5.139 ±0.907 | 4.52 ±1.402 | 0.585 |
| Mesomorphy | 3.779 ±1.019 | 3.459 ±0.682 | 4.349 ±1.139 | 4.014 ±0.9949 | 3.11 ±1.392 | **0.0813*** |

** Bold p-values are less than 0.1.*

The defenders' thigh fold was significantly higher than strikers' thigh fold (p-value=0.0134). The biileocrestal diameter was significantly higher in midfielders than in strikers (p-value=0.0463). The strikers' muscle percentage was significantly higher than defenders' one (p-value=0.0304). These results are shown in Table 2:

**Table 2.** Perimeters, Diameters and Folds obtained according to playing position.

| Variables | Total n= 38 | Defenders n= 15 | Strikers n= 9 | Midfield n= 10 | Goalkeepers n=4 | p-value |
|---|---|---|---|---|---|---|
| AP thoracic diameter | 35.5 (34.3-36.725) | 36.6 (34.525-37.05) | 35.2 (33.6-36.15) | 35.45 (34.525-36.3) | 35.43 (35.03-35.78) | 0.5337 |
| Wrist diameter | 5.2 (5.1-5.388) | 5.15 (5.05-5.275) | 5.25 (5.2-5.3) | 5.2 (5.2-5.3625) | 5.325 (5.188-5.463) | 0.3725 |
| Biacromial diameter | 36.319 ±2.222 | 36.86 ±2.353 | 35.28 ±2.384 | 36.16 ±2.142 | 37.005 ±0.885 | 0.365 |
| Biileocrestal diameter | 25.404 ±1.795 | 25.667 ±1.906 | 24.089 ±1.783 | 25.97 ±1.205 | 26.05 ±1.698 | **0.0795*** |
| Femoral Diameter | 8.93 ±0.431 | 9.053 ±0.27 | 8.933 ±0.507 | 8.83 ±0.49 | 8.708 ±0.61 | 0.433 |
| Humeral Diameter | 6.1 ±0.28 | 6.0833 ±0.272 | 6.2 ±0.331 | 6.06 ±0.296 | 6.038 ±0.16 | 0.675 |
| Ankle Diameter | 6.963 ±0.3111 | 6.993 ±0.371 | 6.883 ±0.2680 | 7.015 ±0.322 | 6.89 ±0.105 | 0.761 |
| Transverse Thoracic Diameter | 28.772 ±1.835 | 29.063 ±1.92 | 27.81 ±1.553 | 29.18 ±2.141 | 28.83 ±0.635 | 0.354 |
| Thigh Fold | 9.484 (6.413-11.95) | 11 (9.5-12.4) | 5.9 (4.6-8.2) | 7.5 (6.38-11.3) | 8.335 (6.93-9.98) | **0.0713*** |
| Biceps Fold | 6.5 (5-8.275) | 7.5 (5.7-8.75) | 6.2 (4.1-6.8) | 7.4 (5.725-7.875) | 5 (3.78-6.3) | 0.2308 |
| Abdominal Fold | 16.293 ±4.737 | 17.297 ±4.444 | 15.756 ±6.317 | 15.85 ±3.515 | 14.848 ±5.636 | 0.757 |
| Iliocrestal Fold | 15.04 ±5.078 | 15.207 ±4.568 | 13.922 ±5.929 | 16.59 ±5.708 | 14.848 ±5.636 | 0.592 |
| Medial thigh Fold | 21.831 ±6.008 | 22.427 ±4.38 | 21.172 ±9.133 | 21.95 ±6.386 | 20.783 ±2.513 | 0.949 |
| Subscapular Fold | 9.258 ±2.179 | 9.687 ±2.339 | 9.911 ±1.706 | 8.46 ±1.54 | 8.345 ±3.569 | 0.340 |

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| Variables | Total n= 38 | Defenders n= 15 | Strikers n= 9 | Midfield n= 10 | Goalkeepers n=4 | p-value |
|---|---|---|---|---|---|---|
| Supraspinal Fold | 12.851 ±4.898 | 13.107 ±4.659 | 11.811 ±5.02 | 13.89 ±5.464 | 11.638 ±5.353 | 0.782 |
| Triceps Fold | 12.362 ±3.732 | 12.96 ±3.148 | 11.667 ±2.453 | 12.78 ±5.04 | 10.64 ±5.059 | 0.660 |
| Perimeter arm relaxed | 27.932 ±1.398 | 27.68 ±1.192 | 27.989 ±1.382 | 28.01 ±1.67 | 28.558 ±1.775 | 0.737 |
| Perimeter arm contracted | 26.551 ±1.714 | 26.313 ±1.288 | 26.644 ±1.995 | 26.745 ±2.015 | 26.75 ±2.28 | 0.926 |
| Wrist perimeter | 14.411 ±0.599 | 14.3 ±0.509 | 14.256 ±0.725 | 14.68 ±0.655 | 14.503 ±0.373 | 0.369 |
| Mid-sternal perimeter | 85.196 ±4.016 | 86.529 ±4.378 | 84.922 ±3.049 | 83.86 ±4.693 | 84.45 ±2.073 | 0.429 |
| Abdominal Perimeter | 69.522 ±2.977 | 69.67 ±2.769 | 69.689 ±4.014 | 69.25 ±2.807 | 69.27 ±2.529 | 0.983 |
| Gluteal Perimeter | 92.18 ±3.381 | 92.32 ±3.521 | 91.272 ±3.594 | 92.6 ±3.56 | 92.653 ±2.681 | 0.836 |
| 1-cm Thigh perimeter | 57.606 ±3.017 | 57.86 ±2.112 | 56.789 ±3.408 | 58.445 ±3.282 | 56.39 ±4.637 | 0.551 |
| Mid-thigh perimeter | 50.438 ±2.723 | 50.723 ±1.987 | 50.044 ±3.633 | 50.67 ±3.084 | 49.673 ±2.723 | 0.874 |
| Leg perimeter | 34.161 ±2.068 | 34.223 ±2.178 | 33.772 ±2.42 | 34.695 ±1.748 | 33.465 ±1.941 | 0.710 |
| Ankle perimeter | 21.072 ±1.05 | 21.09 ±1.035 | 20.817 ±1.299 | 21.445 ±0.995 | 20.643 ±0.47 | 0.497 |

** Bold p-values are less than 0.1. Perimeters an diameters expressed in cm, Folds expressed in mm.*

## Discussion

This study aimed to evaluate the anthropometric profile of 38 football female players from first division of the Spanish Women's Professional Football League.

Different researchers have found a significant variation in the stature of female players, with mean heights ranging from 158.1 to 169.7 cm[29]. The mean height of our female soccer players (165.545±6.059 cm) is significantly higher than the height mean from a previous study performed with 100 elite Spanish female soccer players (161.3±0.66 cm)[30] (p-value=0.0002). In this study, the goalkeepers' height was significantly higher than the other ones. These results are in line with previous studies which described a higher height in goalkeepers from an American Division I college[31] and Norwegian[32] female soccer players. Furthermore, among the other ones, the defenders' height was higher than strikers' height. Although height does not appear to preclude a player from becoming successful, its influence (by being taller) may benefit some playing positions, e.g., goalkeepers, midfielders and strikers[29]. Recently, some author reported that taller midfielders outperformed in terms of goals, assists, attempts, shots blocked, and defending blocks[33].

Increased fat mass is generally known to impair performance, whereas increased muscle mass can encourage the development of strength and power, both of which are vital for player performance[34–36]. In our study, the defenders' thigh fold was higher than strikers' leg fold. The thigh skinfold is typically used for measuring body fat and has proven to be able to predict the fat-free mass in female athletes[37]. Moreover, the strikers' muscle percentage was significantly higher than defenders' one. Both findings are coherent with a recent study which asserts that strikers tend to perform most high to very high intensity activity comparted to the other playing positions[38]. Thus, they need to perform the most contact situations, to jump, to head the ball, but also execute the most maximal sprints and for longer periods of time[39]. The finding associated with the thigh skinfold must be considered with caution since the skinfold calipers tend to overestimate thigh subcutaneous fat thickness in people with higher fat levels compared to other techniques like ultrasound imaging[40].

The biileocrestal diameter was significantly higher in midfielders than in strikers. This finding is related to the kinanthropometrical definition of strikers, as they are prone to have high thigh and leg perimeters, as well as a high femur bicondylar diameter and a low biileocrestal, a set of factors that favor running, particularly in those who base their success on speed; these are the most demanded variables in this position by teams that prefer to play counterattacking.

The findings of this study have practical applications in both clinical and training settings. Clinically, understanding the anthropometric profiles of female football players can aid in the development of personalized training and rehabilitation programs. For instance, knowing that strikers tend to have higher muscle percentages and lower thigh skinfolds can help clinicians design targeted strength and conditioning programs to enhance performance and reduce injury risk. Additionally, the identification of specific anthropometric characteristics associated with different playing positions can inform the selection and development of players, ensuring that they are physically suited to their roles on the field. In training settings, coaches can use these insights to optimize training regimens, focusing on the development of physical attributes that are most beneficial for each position. This tailored approach can lead to improved performance, reduced injury rates, and overall better team outcomes.

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Although our sample is representative of the study population, as evidenced by the consistency of our findings with previous research on elite Spanish female soccer players, the relatively small sample size (n=38) may limit the generalizability of the results. Future studies with larger sample sizes are needed to further validate these findings

## Conclusions

In conclusion, our study of female football players showed some significant differences in height, thigh fold and biileocrestal diameter between the different playing positions that may favour the playing role with which they are associated.

## Conflicts of Interest Statement

The authors have no conflicts of interest to declare

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