applied sciences

MDPI

Article

Anthropometric Values in Spanish Elite Soccer: Differences between Divisions and Playing Positions

Mireia Porta [1,2,3,4], Jaime Sebastiá-Rico [4,5,6,*], José Miguel Martínez-Sanz [6,7], Carlos Contreras [4,8], Raquel Vaquero-Cristóbal [9] and Pablo A. López-Cáceres [4,10]

1 FC Barcelona Medical Department, FC Barcelona, 08014 Barcelona, Spain; m.porta.oliva@gmail.com
2 Catalan School of Kinanthropometry, (ECCS) INEFC, 08038 Barcelona, Spain
3 Faculty of Food Technology, Autonomous University of Barcelona (UAB), 08193 Bellaterra, Spain
4 Association of Dietitians-Nutritionists of Spanish Soccer Teams (ADNEFE), 50008 Zaragoza, Spain; cjcontreras@ucam.edu (C.C.); pablo@ndsalud.es (P.A.L.-C.)
5 Area of Nutrition, University Clinic of Nutrition, Physical Activity and Physiotherapy (CUNAFF), Lluís Alcanyís Foundation—University of Valencia, 46020 Valencia, Spain
6 Food and Nutrition Research Group (ALINUT), University of Alicante, 03690 Alicante, Spain; josemiguel.ms@ua.es
7 Nursing Department, Faculty of Health Sciences, University of Alicante, 03690 Alicante, Spain
8 Faculty of Health Sciences, Catholic University of San Antonio of Murcia (UCAM), 30107 Murcia, Spain
9 Faculty of Sports Sciences, University of Murcia, 30720 San Javier, Spain; raquel.vaquero@umu.es
10 Area of Nutrition Medical Services, RC Recreativo de Huelva, S.A.D., 21001 Huelva, Spain
* Correspondence: jaime.sebastia@fundacions.uv.es

Featured Application: This research shows the results of the body composition of male soccer players from different divisions of Spanish soccer, differentiated in turn by the different playing positions which, until now, had not been analyzed. These results could be a guide for the medical and technical staff when focusing and individualizing training objectives to achieve maximum performance.

Abstract: Body composition is an important factor in a soccer player's performance, and anthropometry is one of the most widely used methods of measurement. The physical demands of Spanish soccer have evolved over time, so the ideal body composition requirements must be adapted to the present day. The aim of this study was to describe the anthropometric and body composition profiles of professional soccer players in the second, second B, and third divisions during the 2019–2020 season in order to compare the anthropometric parameters of players among positions and competitive divisions. A cross-sectional study was conducted to determine differences in kinanthropometric and derived variables in a sample of Spanish soccer players. A total of 615 soccer players from the second (116 players), second B (310 players), and third (189 players) divisions participated in this study. After comparing the groups according to the playing position and category, it was observed that at higher levels of play, soccer players show lower values of fat mass (FM) and higher values of muscle mass (MM) and bone mass (BM); at lower levels of play, soccer players show more anthropometric differences between playing positions. Lastly, the somatotype of the elite soccer player is balanced mesomorphic, with higher levels of mesomorphy at higher levels of play. In summary, this is the first study to evaluate the body composition of the different Spanish soccer divisions.

Keywords: football; soccer; body composition; anthropometry; somatotype; fat mass

Citation: Porta, M.; Sebastiá-Rico, J.; Martínez-Sanz, J.M.; Contreras, C.; Vaquero-Cristóbal, R.; López-Cáceres, P.A. Anthropometric Values in Spanish Elite Soccer: Differences between Divisions and Playing Positions. *Appl. Sci.* **2023**, *13*, 11441. https://doi.org/10.3390/app132011441

Academic Editor: Mark King

Received: 2 October 2023
Revised: 13 October 2023
Accepted: 17 October 2023
Published: 18 October 2023

1. Introduction

In soccer, athletes cover an average total distance during a full game (90 min plus extra time for overtime) of about 8–14 km and are characterized by a highly variable pattern of actions such as walking, jogging, running at high and low speed, sprinting, moving backwards, kicking, jumping or tackling [1–3]. As the physical demands of soccer players have evolved over time and are now more demanding, this implies different body composition characteristics than decades ago [4,5].

Factors that can influence the body composition of soccer players are diverse. Among them are playing position, ethnicity, food habits, individual physiology, playing style and training volume [1,6,7]. The playing position or playing style can be a determining factor, as the physical demands and determining actions during competitions are different, for example, the height of a goalkeeper, the speed required by a midfielder, or the physical strength needed by a central defender to stop the opposing team. Eating habits and training volume, taking into account the energy intake and expenditure involved, can influence fat mass (FM) and muscle mass (MM) [1]. Finally, the ethnicity and individual physiology of each player are also factors to consider, as some ethnic groups may have a greater genetic predisposition to accumulate fat in certain areas of the body, which could affect players' body composition [1,6].

In fact, there is no single ideal value for the different body compartments, since, depending on the measurement method and/or playing position, they may vary [1,8–10]. Sebastiá-Rico et al. [8,9] recently published two studies on the assessment of body composition in professional male soccer players, where the differences between different measurement methods (including anthropometry) and different playing positions were analyzed. However, there is little scientific literature that includes values of fat-free mass (FFM) or parameters such as the sum of skinfolds or the musculoskeletal index to provide useful data [11–14].

Growth development and talent detection of an athlete can be determined through different measurement methods, the most widely used being anthropometry [15]. Anthropometry refers to the different measurements of the size and proportions of the human body by which, through equations, it is possible to obtain an estimate of the percentage of FM, and by derivation, the FFM [15–17]. One of the institutions whose work is the dissemination of anthropometry is the International Society for the Advancement of Kinanthropometry (ISAK), which was founded as an organization whose scientific and professional work relates to kinanthropometry [18]. In addition, anthropometric techniques stand out among the various methods for assessing body composition because of their low cost, good reproducibility and ease of application [15]. In fact, skinfold measurements and their summation seem to be the least affected by controlling factors (food intake, hydration status, and daily activity) compared to other measurement methods [19].

Another of the most relevant tools in the study of body composition through anthropometry is the somatotype, defined as the quantification of the shape and composition of the human body through the numerical qualification of three components, using different anthropometric equations and measurements [20]. Derived from the somatotype, the somatocard is the expression of the three components (endomorphy, mesomorphy and ectomorphy) in a graphic representation. It is useful in the field of sports to be able to place the somatotype of the athlete being evaluated against the somatotype of the sport he/she practices, based on a comprehensive collection of data. In fact, due to the easy visual interpretation of the somatocard, it is frequently used in soccer teams to detect the differences in the somatotype of the players of the same squad, and thus be able to customize a diet or training style in those players who require it [15,20,21].

Although this study focuses on the use of anthropometry, there are two methods frequently used in soccer to assess body composition: bioimpedance and dual X-ray densitometry. Bioimpedance is a non-invasive and easy-to-apply method based on measuring the body's resistance to the flow of electric current, while dual X-ray densitometry is an indirect method used to measure MM, FM, and bone mineral density through photon attenuation [9]. Spain's professional soccer league and its national team are considered among the best in the world [22]. However, there are few published studies that evaluate the body composition of these players through anthropometry [6,23–25]. Therefore, there is a need to have a description of the Spanish soccer player at the kinanthropometric level in the different levels of play.

The aim of this study was to describe the anthropometric and body composition profiles of professional soccer players in the second, second B, and third divisions during the 2019–2020 season in order to compare the anthropometric parameters of players between positions and competitive divisions. Consequently, the initial hypotheses were:

Hypothesis (H1). *Higher-category soccer players will have lower values for FM and sum of skinfold, and higher values for MM and bone mass (BM).*

Hypothesis (H2). *At lower competition levels, there will be more differences between playing positions.*

2. Materials and Methods

2.1. Study Design

A cross-sectional study was conducted to determine differences in kinanthropometric and derived variables in a sample of Spanish soccer players. Prior to the start of the study, the Ethics Committee of the University of Valencia (code: 1534145) approved the research design, in accordance with the World Medical Association codes and the Helsinki declaration. In addition, the study design as well as the development of the manuscript followed the STROBE statement [26].

The research population was chosen by means of a non-probabilistic convenience sampling among the Spanish soccer teams that had a dietitian-nutritionist as part of the medical staff. In addition, the DN was part of the Association of Dietitians-Nutritionists of Spanish Soccer Teams (ADNEFE). Sampling was non-probabilistic by convenience, with the minimum sample size calculated with RStudio statistical software (v.3.15.0; RStudio Inc., Boston, MA, USA). The significance level was set a priori at $\alpha = 0.05$. The standard deviation (SD) was set according to the percentage of FM from previous studies (SD = 0.91) [23]. With an estimated error (d) of 0.16%, the sample size needed was 116 subjects.

2.2. Participants

Participants came from 31 Spanish soccer teams (7 second division, 14 second B division, and 10 third division). A total of 615 players participated in this study, consisting of 116 players from the second division (mean age: 26.96 $\pm$ 4.60 years), 310 from the second B division (mean age: 25.09 $\pm$ 5.14 years), and 189 from the third division (mean age: 24.27 $\pm$ 5.34 years). The criteria for inclusion in the study were as follows: (a) be a healthy subject with medical authorization for the practice of federated sport; (b) belong to a team of the second, second B, or third division of the Spanish league; (c) being federated in soccer; (d) training a minimum of 5 days per week; (e) measurements taken between September and October, during the competitive phase. The exclusion criteria for the study were: (a) being injured at the time of the evaluations; (b) having been injured one month before the evaluations; (c) measurements performed by anthropometrists not accredited by ISAK, since the ISAK method is widely recognized for its standardization and rigorous quality control, which guarantees the reliability of the anthropometric measurements used in this research. All players were previously informed of the objectives and method of the research, signing informed consent forms before starting the research.

2.3. Procedure

The evaluations were conducted during the training schedule of each team. On the evaluation days, it was not necessary for the players to have performed high-intensity exercises the previous day, nor was it necessary for them to have performed training or stretching on the same day. All the players were familiar with the testing procedures, having performed them regularly as part of their testing routines. To ensure standardization of test administration throughout the study period, players fasted prior to any exercise.

2.4. Anthropometric Measurements

Kinanthropometric measurements were taken according to the ISO 7250-1:2017 [27] and the International Society for the Advancement of Kinanthropometry (ISAK) standard [18]. The measurements taken were as follows: four basic measurements (body mass, height, sitting height, and arm span), eight skinfolds (biceps, triceps, subscapular, iliac crest, supraspinale, abdominal, thigh, and calf), three diameters (humerus, bi-styloid, and femur) and six girths (arm relaxed, arm flexed and tensed, waist, hips, thigh, and calf). The anthropometric method used to measure body weight was a SECA 862 scale (SECA, Hamburg, Germany) with 100 g accuracy. A SECA 217 detachable portable stadiometer (SECA, Germany) with 1 mm accuracy was used to measure height and sitting height; an Avanutri wingspan meter (Avanutri, Três Rios, Brazil) was used to measure arm span; a CESCORF inextensible metal tape (CESCORF, Porto Alegre, Brazil) was used to measure girths; and a Slimguide caliper (Creative Health Products, Ann Arbor, MI, USA) of 0.5 mm precision was also used. All kinanthropometric measurements were measured two or three times by an anthropometrist level 1 and 2 accredited by ISAK, depending on whether the technical error of measurement (TEM) between the first two measurements was greater than 5% in skinfolds and 1% for the rest of the measurements, taking the mean or median, respectively, for subsequent analysis. The intra-evaluator TEM was 0.03% for the basic measurements, 2.24% for the skinfolds, and 0.36% for the girths, and its correlation coefficient with an expert anthropometrist level 4 was 0.99 for the basic measurements, 0.91 for the skinfolds, and 0.99 for the girths. This ensures that the data collected are as accurate and consistent as possible, which in turn guarantees the validity of the research results and allows for accurate interpretation of the differences observed between measurements. The temperature of the room where the measurements were taken was standardized at 24 °C, and all measurements were taken from 09:00 to 11:00.

Body composition was determined using the equations described in the consensus document of the Spanish Group of Kinanthropometry of the Spanish Federation of Sports Medicine [15], following the four-component model (MM, FM, BM and residual mass (RM)). The following equations were used: (1) Carter [28], Faulkner [29], and Willmore [30] equations to calculate FM expressed in percentage; (2) Lee's equation [31] to calculate MM expressed in kg; and (3) Rocha's equation [32] to calculate BM expressed in kg. At the same time, the sum of 3, 6, and 8 skinfolds was used, and adipose tissue through Kerr's equation [33] as well as two health indices were calculated: waist-to-height ratio and fat distribution index. The technical errors of measurement were 7.5% for skinfolds and 1.5% for the rest of the measurements.

Somatotype was estimated following the Heath–Carter method, establishing the three Carter components (endomorph, mesomorph, and ectomorph, separately) and representing those results in a somatotype chart. The somatotype chart is the graphical representation of the somatotype where the rating of the three components of the somatotype is plotted in a two-dimensional chart [20].

2.5. Statistical Analysis

The normality of the data was assessed using the Kolmogorov–Smirnov test, as well as the study of skewness, kurtosis, and variance, showing that the data followed a normal distribution, which allowed application of parametric tests for the analysis. An ANOVA analysis was performed to determine the differences in anthropometric and derived variables, depending on the division and the interactions of the covariable position included in an ANCOVA test. A subsequent Bonferroni post hoc analysis was performed. Partial eta squared ($\eta 2$) was used to define the effect size (ES), defined as small ($ES \geq 0.10$), moderate ($ES \geq 0.30$), large ($ES \geq 1.2$) or very large ($ES \geq 2.0$), with an error of $p < 0.05$ [34]. A value of $p < 0.05$ was set to determine statistical significance. Statistical analyses were performed with the SPSS statistical package (v.25.0; SPSS Inc., Chicago, IL, USA).

3. Results

Descriptive statistics (mean ± SD) for all kinanthropometric and derived variables according to the division of play, as well as the differences between groups and the effect of the covariable position in the field, can be observed in Table 1. Significant differences were found in triceps (p = 0.000), biceps (p = 0.000), iliac crest (p = 0.000), supraspinale (p = 0.003), abdominal (p = 0.000), thigh (p = 0.001) and calf (p = 0.001) skinfolds; arm flexed and tensed (p = 0.000), hips (p = 0.000), thigh middle (p = 0.020) girths; humerus (p = 0.000), bi-styloid (p = 0.000) and femur (p = 0.000) breadths; the sum of three and six skinfolds (p = 0.000); corrected arm (p = 0.002), corrected thigh (p = 0.001) girths and the sum of corrected girths (0.002); the percentage of FM according to Carter (p = 0.000), Faulkner (p = 0.001), and Willmore (p = 0.000); FM in kg according to Willmore (p = 0.003); the percentage of adipose tissue according to Kerr (p = 0.000); MM in kg (p = 0.010); BM (in percentage and kg) (p = 0.000); mesomorphy (p = 0.000); Z sum of skinfolds (p = 0.000); waist-to-hip ratio (p = 0.000); and fat distribution index (p = 0.006).

When the covariate position was included, significant differences were found in the following variables: body mass (p = 0.000); stretch stature (p = 0.002); triceps (p = 0.001) and supraspinale (p = 0.023) skinfolds; arm relaxed (p = 0.004), arm flexed and tensed (p = 0.007), hips (p = 0.036), and thigh middle (p = 0.006) girths; humerus (p = 0.000) and bi-styloid (p = 0.013) breadths; corrected arm (p = 0.005) and corrected thigh (p = 0.003) girths; the sum of corrected girths (p = 0.012); FM in kg according to Carter (p = 0.006), Faulkner (p = 0.003) and Willmore (p = 0.012); adipose tissue in kg (p = 0.007); MM (p = 0.042); BM (p = 0.018); BMI (p = 0.035); and fat distribution index (p = 0.042).

Pairwise comparisons after Bonferroni adjustment regarding the anthropometric and derived variables depending on division can be seen in Table 2. The second-division players showed significantly lower triceps, iliac crest, supraspinale, abdominal, and leg skinfolds than the second B and/or third-division players (p = 0.009 to 0.000). The second B division players showed significantly lower triceps and abdominal skinfolds than the third-division players (p = 0.024 to 0.000), while the third-division players showed a significantly lower supraspinale skinfold than the second B division players (p = 0.012). For the biceps skinfold, the third-division players showed the lowest values, followed by the second B division players and second-division players (p = 0.009 to 0.000). The second-division players showed significantly higher values of arm flexed and tensed, hips, thigh middle, and corrected arm and corrected thigh girths than the second B and/or third-division players (p = 0.035 to 0.000). The second-division players also showed significantly higher values of humerus, bi-styloid, and femur breadths than the second B and/or third-division players (p = 0.000), while the third-division players showed significantly higher values of humerus and bi-styloid breadths than the second B division players (p = 0.006–0.002). The second-division players showed lower values for the sum of three and six skinfolds than the second B and third-division players (p = 0.015–0.000) and higher values for the sum of corrected girths than the third-division players (p = 0.002).

The second-division players showed the lowest values for the percentage of FM according to Carter, Faulkner, and Willmore equations (p = 0.015–0.000), the percentage of adipose tissue according to Kerr (p = 0.008–0.000), and FM in kg according to the Willmore equation (p = 0.018–0.003) compared the second B and third-division players. The second-division players showed higher values of MM in kg than the third-division players (p = 0.007) and BM in kg and percentage than the second B and third-division players (p = 0.028 to 0.000). It was also found that the third-division players showed higher values of percentage of BM than the second B division players (p = 0.037). The second-division players also showed higher values of mesomorphy compared to the second B and third-division players (p = 0.000).

Table 1. Anthropometric and derived variables of soccer players by division, including position covariate main effects and intersection.

Variables	Second Division (Mean ± SD)	Second B Division (Mean ± SD)	Third Division (Mean ± SD)	Division			Division with Position as a Covariable		
				F	*p*	η2	F	*p*	η2
Body mass (kg)	75.91 ± 6.86	74.57 ± 6.87	74.27 ± 7.00	2.18	0.113	0.004	3.66	0.000	0.187
Stretch stature (cm)	181.03 ± 6.20	179.90 ± 6.38	179.59 ± 5.88	2.04	0.131	0.002	2.86	0.002	0.153
Triceps skinfold (mm)	5.54 ± 1.75	5.84 ± 2.31	6.67 ± 2.08	11.58	0.000	0.115	3.10	0.001	0.163
Subscapular skinfold (mm)	7.64 ± 1.61	7.77 ± 1.61	7.61 ± 1.40	0.61	0.542	0.012	0.65	0.783	0.039
Biceps skinfold (mm)	4.60 ± 2.10	3.91 ± 1.86	3.38 ± 0.97	13.06	0.000	0.043	1.09	0.370	0.064
Iliac crest skinfold (mm)	7.54 ± 2.08	8.88 ± 3.27	9.52 ± 3.07	9.70	0.000	0.028	0.79	0.654	0.116
Supraspinale skinfold (mm)	6.19 ± 1.94	6.84 ± 2.27	6.23 ± 1.99	5.91	0.003	0.066	2.09	0.023	0.047
Abdominal skinfold (mm)	8.09 ± 2.29	9.40 ± 3.62	10.33 ± 3.91	14.15	0.000	0.052	1.38	0.187	0.08
Thigh skinfold (mm)	8.02 ± 2.45	8.73 ± 2.73	9.34 ± 3.09	7.60	0.001	0.038	1.44	0.159	0.083
Calf skinfold (mm)	4.49 ± 1.21	4.92 ± 1.45	5.15 ± 1.74	6.62	0.001	0.051	1.70	0.076	0.097
Arm relaxed girth (cm)	30.75 ± 1.84	30.34 ± 1.64	30.21 ± 2.21	2.46	0.087	0.035	2.60	0.004	0.141
Arm flexed and tensed girth (cm)	33.98 ± 1.92	32.95 ± 1.81	32.76 ± 2.17	12.06	0.000	0.046	2.47	0.007	0.135
Waist girth (cm)	78.89 ± 3.31	77.89 ± 3.53	77.30 ± 4.32	2.71	0.068	0.011	1.63	0.094	0.093
Hip girth (cm)	99.26 ± 4.29	95.23 ± 3.71	95.50 ± 4.74	17.10	0.000	0.024	1.95	0.036	0.109
Thigh middle girth (cm)	54.72 ± 2.88	54.52 ± 3.10	53.72 ± 2.94	3.95	0.020	0.030	2.49	0.006	0.135
Calf girth (cm)	37.63 ± 1.99	37.18 ± 3.00	37.27 ± 1.99	1.28	0.278	0.001	0.80	0.640	0.048
Humerus breadth (cm)	7.36 ± 0.47	6.88 ± 0.44	7.03 ± 0.35	39.32	0.000	0.106	3.58	0.000	0.184
Bi-styloid breadth (cm)	5.92 ± 0.35	5.69 ± 0.38	5.87 ± 0.50	10.59	0.000	0.087	2.27	0.013	0.125
Femur breadth (cm)	10.22 ± 0.48	9.79 ± 0.48	9.77 ± 0.65	23.67	0.000	0.035	1.16	0.318	0.068
Sum of three skinfolds (cm)	18.57 ± 6.18	25.06 ± 7.55	25.67 ± 8.22	37.21	0.000	0.028	1.01	0.439	0.060
Sum of six skinfolds (cm)	39.97 ± 7.86	42.97 ± 9.63	44.49 ± 10.98	7.73	0.000	0.047	1.47	0.148	0.084
Sum of eight skinfolds (cm)	53.03 ± 9.81	56.20 ± 12.12	57.04 ± 14.07	2.49	0.084	0.040	1.34	0.205	0.078
Corrected arm girth (cm)	29.11 ± 2.05	28.53 ± 1.78	28.17 ± 2.13	6.55	0.002	0.067	2.58	0.005	0.139
Corrected thigh girth (cm)	52.18 ± 2.70	51.75 ± 3.10	50.83 ± 2.94	6.66	0.001	0.056	2.70	0.003	0.145
Corrected calf girth (cm)	36.22 ± 2.00	35.60 ± 3.05	35.72 ± 1.99	2.37	0.094	0.002	0.78	0.656	0.047
Sum of corrected girths (cm)	117.59 ± 5.50	116.18 ± 6.44	114.12 ± 9.34	6.32	0.002	0.042	2.30	0.012	0.127
Fat mass (Carter) (kg)	5.16 ± 0.88	5.31 ± 1.01	5.42 ± 1.14	2.17	0.115	0.017	2.51	0.006	0.136
Fat mass (Carter) (%)	6.79 ± 0.83	7.10 ± 1.01	7.26 ± 1.15	7.73	0.000	0.047	1.47	0.148	0.084
Fat mass (Faulkner) (kg)	7.59 ± 1.02	7.74 ± 1.25	7.84 ± 1.38	1.31	0.271	0.006	2.70	0.003	0.145
Fat mass (Faulkner) (%)	9.98 ± 0.82	10.35 ± 1.14	10.50 ± 1.24	7.57	0.001	0.031	1.14	0.333	0.067
Fat mass (Willmore) (kg)	5.79 ± 1.43	6.30 ± 1.57	6.44 ± 1.83	5.79	0.003	0.025	2.30	0.012	0.126
Fat mass (Willmore) (%)	7.59 ± 1.53	8.41 ± 1.73	8.61 ± 2.03	12.01	0.000	0.047	1.50	0.136	0.086
Adipose tissue (Kerr) (kg)	14.90 ± 2.08	15.24 ± 2.35	15.45 ± 2.49	1.98	0.139	0.023	2.46	0.007	0.134
Adipose tissue (Kerr) (%)	19.64 ± 2.12	20.43 ± 2.44	20.80 ± 2.59	8.27	0.000	0.063	1.50	0.136	0.086
Muscle mass (Lee) (kg)	35.34 ± 3.05	34.60 ± 3.94	33.95 ± 3.18	4.71	0.010	0.027	1.90	0.042	0.107
Muscle mass (Lee) (%)	46.49 ± 2.17	46.44 ± 3.90	45.70 ± 2.36	2.94	0.054	0.022	0.97	0.480	0.057
Bone mass (Rocha) (kg)	13.23 ± 1.22	12.35 ± 1.27	12.55 ± 1.42	11.19	0.000	0.033	2.17	0.018	0.120
Bone mass (Rocha) (%)	17.60 ± 1.13	16.61 ± 1.30	17.04 ± 1.61	13.07	0.000	0.046	1.51	0.131	0.087
Residual mass (kg)	13.21 ± 3.50	12.62 ± 4.26	12.37 ± 3.50	0.76	0.470	0.002	1.72	0.073	0.097
Residual mass (%)	17.24 ± 3.21	16.81 ± 4.54	16.60 ± 3.67	0.42	0.660	0.001	0.82	0.619	0.049
Endomorphy	2.24 ± 0.41	2.34 ± 0.54	2.38 ± 0.53	2.70	0.068	0.015	0.84	0.601	0.050
Mesomorphy	5.48 ± 0.98	4.65 ± 1.05	4.80 ± 0.89	22.12	0.000	0.034	1.55	0.116	0.089
Ectomorphy	2.75 ± 0.73	2.74 ± 0.70	2.74 ± 0.74	0.03	0.972	0.002	0.98	0.471	0.058
Z sum of six skinfolds	−2.33 ± 0.20	−2.25 ± 0.25	−2.21 ± 0.28	7.73	0.000	0.047	1.47	0.148	0.084
Body mass index (kg/m^2)	23.14 ± 1.46	23.01 ± 1.34	23.00 ± 1.48	0.43	0.653	0.004	1.96	0.035	0.110
Waist-to-hip ratio	0.80 ± 0.03	0.82 ± 0.03	0.81 ± 0.04	9.31	0.000	0.012	0.99	0.454	0.059
Fat distribution index	0.83 ± 0.16	0.83 ± 0.21	0.90 ± 0.21	5.19	0.006	0.067	1.90	0.042	0.107

Pairwise comparisons after Bonferroni adjustment regarding the anthropometric and derived variables depending on division and position can be seen in Table 3. No significant differences were found between any playing positions for second-division players, except for BMI, where midfielders showed significantly lower values than goalkeepers (p = 0.047). This was also the case for the second B division, except for stretch stature, where midfielders showed significantly better values than defenders (p = 0.026) and goalkeepers (p = 0.017). More differences were found in the third division, with forwards showing higher values than midfielders for body mass (p = 0.000), stretch stature (p = 0.011), arm relaxed girth (p = 0.013), arm flexed and tensed girth (p = 0.028), thigh middle girth (p = 0.005), humerus breadth (p = 0.016), corrected thigh girth (p = 0.007), sum of corrected girths (p = 0.004), FM (Carter) (kg) (p = 0.005), FM (Faulkner) (kg) (p = 0.000), FM (Willmore) (kg) (p = 0.018), adipose tissue (Kerr) (kg) (p = 0.023), MM (Lee) (kg) (p = 0.009), RM (kg) (p = 0.027), and BMI (p = 0.007). Also, forwards showed higher values than defenders for body mass (p = 0.005), stretch stature (p = 0.047), and FM (Faulkner) (kg) (p = 0.025). Midfielders showed lower values compared to goalkeepers for body mass (p = 0.017), stretch stature (p = 0.036), and BM (p = 0.017).

Table 2. Post hoc comparison of anthropometric and derived variables between division groups with significant differences in the ANOVA.

Variables	Second Division vs. Second B Division			Second Division vs. Third Division			Second B Division vs. Third Division		
	Mean Difference ± SD	p Value	95% CI	Mean Difference ± SD	p Value	95% CI	Mean Difference ± SD	p Value	95% CI
Triceps skinfold (mm)	−0.30 ± 0.24	0.647	−0.87; 0.28	−1.13 ± 0.26	0.000	−1.75; −0.51	−0.83 ± 0.21	0.000	−1.35; −0.32
Biceps skinfold (mm)	0.69 ± 0.23	0.009	0.14; 1.24	1.21 ± 0.24	0.000	0.63; 1.80	0.53 ± 0.17	0.006	0.12; 0.93
Iliac crest skinfold (mm)	−1.34 ± 0.42	0.005	−2.36; −0.32	−1.98 ± 0.45	0.000	−3.06; −0.90	−0.64 ± 0.31	0.122	−1.39; 0.11
Supraspinale skinfold (mm)	−0.65 ± 0.24	0.019	−1.22; −0.08	−0.04 ± 0.26	1.000	−0.65; 0.58	0.61 ± 0.21	0.012	0.11; 1.12
Abdominal skinfold (mm)	−1.31 ± 0.39	0.002	−2.25; −0.38	−2.24 ± 0.42	0.000	−3.25; −1.23	−0.92 ± 0.35	0.024	−1.76; −0.09
Thigh skinfold (mm)	−0.70 ± 0.31	0.074	−1.46; 0.05	−1.31 ± 0.34	0.000	−2.13; −0.50	−0.61 ± 0.28	0.089	−1.28; 0.06
Calf skinfold (mm)	−0.43 ± 0.17	0.031	−0.84; −0.03	−0.66 ± 0.18	0.001	−1.09; −0.22	−0.22 ± 0.15	0.405	−0.59; 0.14
Arm flexed and tensed girth (cm)	1.03 ± 0.25	0.000	0.44; 2.63	1.21 ± 0.26	0.000	0.59; 1.84	0.18 ± 0.21	1.000	−0.32; 0.69
Hip girth (cm)	4.02 ± 0.70	0.000	2.35; 5.69	3.76 ± 0.75	0.000	1.94; 5.57	−0.26 ± 0.50	1.000	−1.47; 0.94
Thigh middle girth (cm)	0.20 ± 0.41	1.000	−0.79; 1.19	1.00 ± 0.40	0.035	0.05; 1.95	0.80 ± 0.37	0.092	−0.09; 1.68
Humerus breadth (cm)	0.48 ± 0.05	0.000	0.35; 0.61	0.33 ± 0.06	0.000	0.19; 0.46	0.15 ± 0.05	0.006	−0.27; −0.03
Bi-styloid breadth (cm)	0.23 ± 0.06	0.000	0.09; 0.38	0.06 ± 0.06	1.000	−0.10; 0.21	−1.78 ± 0.05	0.002	−0.30; −0.05
Femur breadth (cm)	0.43 ± 0.07	0.000	0.27; 0.60	0.45 ± 0.07	0.000	0.28; 0.63	0.02 ± 0.06	1.000	−0.13; 0.17
Sum of three skinfolds (cm)	−6.49 ± 0.83	0.000	−8.48; −4.49	−7.10 ± 0.91	0.000	−9.28; −4.92	−0.62 ± 0.74	1.000	−2.39; 1.16
Sum of six skinfolds (cm)	−3.00 ± 1.06	0.015	−5.55; −0.45	−4.52 ± 1.15	0.000	−7.29; −1.76	−1.52 ± 0.90	0.275	−3.69; 0.64
Corrected arm girth (cm)	0.58 ± 0.24	0.057	−0.01; 1.16	0.94 ± 0.26	0.001	0.32; 1.56	0.36 ± 0.21	0.261	−0.15; 0.87
Corrected thigh girth (cm)	0.42 ± 0.41	0.887	−0.55; 1.40	1.34 ± 0.39	0.002	0.41; 2.28	0.92 ± 0.36	0.035	0.05; 1.79
Sum of corrected girths (cm)	1.41 ± 1.05	0.537	−1.11; 3.92	3.47 ± 1.00	0.002	1.05; 5.88	2.06 ± 0.93	0.083	−0.18; 4.30
Fat mass (Carter) (%)	0.31 ± 0.11	0.015	−0.58; −0.05	−0.47 ± 0.12	0.000	−0.77; −0.18	−0.16 ± 0.09	0.275	−0.39 ± 0.07
Fat mass (Faulkner) (%)	0.37 ± 0.12	0.010	−0.67; 0.07	−0.52 ± 0.13	0.000	−0.84; −0.19	−0.15 ± 0.11	0.528	−0.42; 0.12
Fat mass (Willmore) (kg)	−5.04 ± 0.18	0.018	−0.94; −0.06	−0.65 ± 0.20	0.003	−1.12; −0.18	−0.15 ± 0.16	1.000	−0.54; 0.25
Fat mass (Willmore) (%)	−0.82 ± 0.20	0.000	−1.30; −0.34	−1.02 ± 0.22	0.000	−1.54; −0.50	−0.20 ± 0.18	0.811	−0.63; 0.23
Adipose tissue (Kerr) (%)	−0.79 ± 0.26	0.008	−1.43; −0.16	−1.16 ± 0.29	0.000	−1.85; −0.47	−0.37 ± 0.22	0.305	−0.91; 0.17
Muscle mass (Lee) (kg)	0.74 ± 0.47	0.361	−0.40; 1.87	1.39 ± 0.45	0.007	0.30; 2.48	0.65 ± 0.42	0.368	−0.36; 1.67
Bone mass (Rocha) (kg)	0.88 ± 0.19	0.000	0.43; 1.33	0.68 ± 0.20	0.003	0.19; 1.18	−0.20 ± 0.16	0.666	−0.59; 0.19
Bone mass (Rocha) (%)	0.99 ± 0.20	0.000	0.51; 1.46	0.56 ± 0.21	0.028	0.04; 1.07	−0.43 ± 0.17	0.037	−0.82; −0.02
Mesomorphy	0.82 ± 0.13	0.000	0.52; 1.13	0.67 ± 0.14	0.000	0.35; 1.00	0.67 ± 0.14	0.000	0.35; 1.00
Z sum of six skinfolds	−0.08 ± 0.03	0.015	−0.14; −0.01	−0.11 ± 0.03	0.000	−0.19; −0.04	−0.04 ± 0.02	0.275	−0.09; 0.02

Table 3. Post hoc comparison in anthropometric and derived variables according with division and position.

Variable	Position Comparisons		Mean Difference ± SD	p Value	95% CI
Second division					
Body mass index (kg/m²)	Midfielders	Goalkeepers	−4.10 ± 1.52	0.047	−8.16; −0.04
Second B division					
Stretch stature (cm)	Midfielders	Defenders	−4.53 ± 1.56	0.026	−8.70; −0.35
	Midfielders	Goalkeepers	−6.76 ± 2.24	0.017	−12.73; −0.79
Third division					
Body mass (kg)	Forwards	Midfielders	10.65 ± 2.31	0.000	4.48; 16.82
	Forwards	Defenders	8.06 ± 2.36	0.005	1.75; 14.36
	Midfielders	Goalkeepers	−8.39 ± 2.78	0.017	−15.80; −0.99
Stretch stature (cm)	Forwards	Midfielders	6.37 ± 2.02	0.011	0.99; 11.75
	Forwards	Defenders	5.55 ± 2.06	0.047	0.05; 11.04
	Midfielders	Goalkeepers	−6.73 ± 2.42	0.036	−13.19; −0.27
Arm relaxed girth (cm)	Forwards	Midfielders	1.78 ± 0.57	0.013	0.26; 3.29
Arm flexed and tensed girth (cm)	Forwards	Midfielders	1.74 ± 0.61	0.028	0.12; 3.37
Thigh middle girth (cm)	Forwards	Midfielders	3.11 ± 0.91	0.005	0.67; 5.55
Humerus breadth (cm)	Forwards	Midfielders	0.40 ± 0.13	0.016	0.05; 0.75
Corrected thigh girth (cm)	Forwards	Midfielders	2.99 ± 0.90	0.007	0.57; 5.40
Sum of corrected girths (cm)	Forwards	Midfielders	7.08 ± 2.02	0.004	1.68; 12.47
Fat mass (Carter) (kg)	Forwards	Midfielders	1.15 ± 0.34	0.005	0.25; 2.04
Fat mass (Faulkner) (kg)	Forwards	Midfielders	1.66 ± 0.40	0.000	0.58; 2.73
	Forwards	Defenders	1.20 ± 0.41	0.025	0.10; 2.30
Fat mass (Willmore) (kg)	Forwards	Midfielders	1.56 ± 0.52	0.018	0.18; 2.93
Adipose tissue (Kerr) (kg)	Forwards	Midfielders	2.21 ± 0.76	0.023	0.19; 4.23
Muscle mass (Lee) (kg)	Forwards	Midfielders	3.79 ± 1.17	0.009	0.66; 6.93
Bone mass (Rocha) (kg)	Midfielders	Goalkeepers	−1.60 ± 0.53	0.017	−3.02; −0.19
Residual mass (kg)	Forwards	Midfielders	3.65 ± 1.26	0.027	0.27; 7.02
Body mass index (kg/m²)	Forwards	Midfielders	1.60 ± 0.48	0.007	0.31; 2.88

The percentile analysis of the measurements included in the study depending on the division can be observed in Table 4.

Table 4. Percentiles of anthropometric and derived variables of soccer players according to the division.

Percentile	10	20	30	40	50	60	70	80	90	100
Second division										
Body mass (kg)	66.57	69.00	72.45	74.88	76.00	77.12	80.17	82.50	84.13	90.90
Stretch stature (cm)	172.00	175.76	178.00	180.00	180.90	182.10	185.49	186.06	190.00	193.00
Triceps skinfold (mm)	3.20	3.80	4.21	4.96	5.40	6.00	6.40	7.32	8.06	9.40
Subscapular skinfold (mm)	5.80	6.28	7.00	7.08	7.45	7.82	8.40	8.86	9.52	13.30
Biceps skinfold (mm)	2.60	2.80	3.01	3.20	3.70	4.12	6.07	7.00	7.75	10.50
Iliac crest skinfold (mm)	4.97	5.70	6.20	7.00	7.10	7.82	8.79	9.52	10.60	13.40
Supraspinale skinfold (mm)	4.27	4.60	5.00	5.40	5.80	6.00	6.59	7.52	8.86	14.90
Abdominal skinfold (mm)	5.80	6.10	6.60	6.88	7.45	8.10	8.98	10.10	11.53	14.80
Thigh skinfold (mm)	5.20	6.00	6.22	7.00	7.60	8.24	9.19	10.10	11.29	14.40
Calf skinfold (mm)	3.20	3.60	3.80	4.00	4.20	4.52	4.80	5.20	6.00	10.10
Arm relaxed girth (cm)	28.24	29.16	29.92	30.16	30.60	31.20	31.50	32.20	33.12	35.70
Arm flexed and tensed girth (cm)	31.43	32.50	33.09	33.50	34.00	34.40	34.80	35.38	36.27	40.00
Waist girth (cm)	74.09	75.86	77.49	78.62	79.30	80.00	80.55	81.38	82.41	87.80

Table 4. *Cont.*

Percentile	10	20	30	40	50	60	70	80	90	100
Hip girth (cm)	93.00	95.36	96.95	99.10	99.90	100.98	101.51	102.16	105.00	109.20
Thigh middle girth (cm)	50.64	52.00	53.22	54.16	55.00	55.62	56.08	56.84	58.50	62.50
Calf girth (cm)	35.00	35.98	36.60	37.10	37.65	38.02	38.70	39.30	40.16	42.20
Humerus breadth (cm)	6.70	7.00	7.10	7.20	7.30	7.40	7.60	7.70	7.97	8.80
Bi-styloid breadth (cm)	5.50	5.60	5.70	5.80	6.00	6.00	6.10	6.12	6.30	7.40
Femur breadth (cm)	9.60	9.80	10.00	10.20	10.20	10.30	10.50	10.60	10.90	11.40
Sum of three skinfolds (cm)	10.80	12.28	13.61	16.72	18.25	20.20	21.80	24.44	26.73	34.10
Sum of six skinfolds (cm)	30.14	33.34	34.92	37.16	38.95	40.74	44.77	46.80	49.81	64.40
Sum of eight skinfolds (cm)	40.70	44.08	47.65	49.16	51.60	56.22	57.97	60.06	64.85	80.30
Corrected arm girth (cm)	26.30	27.34	27.96	28.51	28.95	29.56	30.23	30.62	31.85	34.54
Corrected thigh girth (cm)	48.26	49.53	50.69	51.57	52.40	53.01	53.78	54.07	55.26	60.55
Corrected calf girth (cm)	33.56	34.50	35.23	35.59	36.23	36.63	37.13	37.90	38.84	41.01
Sum of corrected girths (cm)	109.30	112.83	114.27	116.46	118.33	119.61	120.68	122.29	124.45	131.87
Fat mass (Carter) (kg)	4.01	4.41	4.71	4.91	5.07	5.25	5.54	5.88	6.22	7.83
Fat mass (Carter) (%)	5.75	6.09	6.26	6.49	6.68	6.87	7.29	7.50	7.82	9.35
Fat mass (Faulkner) (kg)	6.26	6.75	7.09	7.35	7.54	7.74	7.95	8.42	9.02	10.37
Fat mass (Faulkner) (%)	8.99	9.33	9.49	9.64	9.84	10.09	10.39	10.72	11.02	12.53
Fat mass (Willmore) (kg)	3.97	4.60	5.14	5.44	5.67	5.98	6.23	6.60	7.70	10.75
Fat mass (Willmore) (%)	5.79	6.21	6.65	7.06	7.47	7.71	8.30	9.01	9.47	12.84
Adipose tissue (Kerr) (kg)	12.00	13.29	13.71	14.11	14.52	15.27	15.78	16.58	17.58	20.94
Adipose tissue (Kerr) (%)	17.00	17.90	18.49	18.70	19.22	19.83	20.70	21.47	22.84	25.03
Muscle mass (Lee) (kg)	31.23	33.01	33.68	34.37	35.15	36.36	37.16	38.03	38.77	42.93
Muscle mass (Lee) (%)	43.50	44.50	45.13	45.76	46.28	46.86	47.76	48.63	49.52	51.65
Bone mass (Rocha) (kg)	11.82	12.17	12.53	12.93	13.24	13.50	13.86	14.31	14.81	16.39
Bone mass (Rocha) (%)	16.30	16.68	16.99	17.27	17.55	17.86	18.03	18.41	18.99	21.20
Residual mass (kg)	8.77	10.31	11.30	12.09	12.47	13.85	15.30	16.42	17.80	22.14
Residual mass (%)	13.22	14.76	15.82	16.61	17.27	18.03	18.38	19.44	21.30	25.74
Endomorphy	1.73	1.87	2.04	2.12	2.22	2.30	2.45	2.56	2.72	3.48
Mesomorphy	4.33	4.72	4.91	5.13	5.47	5.65	6.02	6.38	6.79	8.09
Ectomorphy	1.76	2.13	2.44	2.64	2.84	2.96	3.16	3.37	3.71	5.01
Z sum of six skinfolds	−2.58	−2.50	−2.46	−2.40	−2.35	−2.31	−2.21	−2.15	−2.08	−1.71
Body mass index (kg/m^2)	21.42	22.06	22.37	22.72	22.96	23.39	23.71	24.26	24.93	29.07
Waist-to-hip ratio	0.76	0.77	0.78	0.79	0.79	0.81	0.81	0.81	0.83	0.87
Fat distribution index	0.63	0.69	0.74	0.78	0.82	0.86	0.92	0.97	1.04	1.31
Second B division										
Body mass (kg)	65.50	68.34	70.80	72.70	74.30	76.00	78.00	80.58	84.00	95.90
Stretch stature (cm)	172.00	174.00	176.00	178.00	180.00	181.50	184.00	185.26	188.00	197.00
Triceps skinfold (mm)	3.00	3.50	4.44	5.00	5.90	6.40	7.00	7.44	8.74	14.80
Subscapular skinfold (mm)	6.00	6.50	7.00	7.40	7.60	8.00	8.50	9.00	9.80	15.00
Biceps skinfold (mm)	2.33	2.50	3.00	3.00	3.20	3.58	4.00	5.00	6.94	12.50
Iliac crest skinfold (mm)	5.40	6.00	6.99	7.42	8.10	9.00	10.10	11.20	13.00	20.50
Supraspinale skinfold (mm)	4.50	5.00	5.40	6.02	6.50	7.00	7.50	8.50	9.50	16.60
Abdominal skinfold (mm)	5.80	6.46	7.00	7.60	8.60	9.50	10.31	11.50	14.91	23.00
Thigh skinfold (mm)	5.73	6.40	7.00	7.70	8.25	9.00	9.80	11.00	12.44	21.00
Calf skinfold (mm)	3.50	3.80	4.00	4.40	4.65	5.00	5.50	6.00	6.60	12.70
Arm relaxed girth (cm)	28.20	28.90	29.48	30.00	30.50	30.90	31.20	31.58	32.20	36.10
Arm flexed and tensed girth (cm)	30.50	31.30	32.10	32.60	33.00	33.40	33.90	34.58	35.04	38.90
Waist girth (cm)	73.56	74.80	76.00	76.84	77.50	78.26	79.50	80.98	82.38	93.90
Hip girth (cm)	90.86	92.00	92.80	93.82	94.90	95.96	97.02	98.00	100.58	107.00
Thigh middle girth (cm)	50.46	52.02	53.00	53.80	54.70	55.46	56.20	57.08	58.19	62.60
Calf girth (cm)	34.70	35.42	36.20	36.70	37.00	37.20	37.82	38.40	39.70	70.60

Table 4. *Cont.*

Percentile	10	20	30	40	50	60	70	80	90	100
Humerus breadth (cm)	6.30	6.60	6.70	6.80	6.90	7.00	7.10	7.20	7.40	7.80
Bi-styloid breadth (cm)	5.20	5.40	5.50	5.60	5.70	5.70	5.80	6.00	6.20	7.50
Femur breadth (cm)	9.16	9.40	9.50	9.70	9.90	10.00	10.00	10.20	10.40	11.30
Sum of three skinfolds (cm)	17.30	19.00	20.00	21.50	23.50	25.06	27.26	30.48	36.04	53.00
Sum of six skinfolds (cm)	32.03	34.56	37.12	39.50	41.25	43.50	47.00	50.38	55.49	81.90
Sum of eight skinfolds (cm)	42.80	46.15	49.00	51.40	54.25	56.76	61.01	65.16	73.14	103.30
Corrected arm girth (cm)	26.27	27.01	27.50	28.05	28.50	28.94	29.40	29.93	30.84	35.63
Corrected thigh girth (cm)	47.92	49.19	50.14	51.40	52.16	52.48	53.30	54.07	55.60	60.12
Corrected calf girth (cm)	33.15	33.85	34.51	35.02	35.31	35.74	36.34	36.79	38.09	69.50
Sum of corrected girths (cm)	108.58	111.88	112.91	114.71	115.96	117.20	118.84	120.53	123.68	151.60
Fat mass (Carter) (kg)	4.24	4.48	4.69	4.91	5.24	5.45	5.66	6.03	6.52	10.63
Fat mass (Carter) (%)	5.95	6.22	6.49	6.74	6.92	7.16	7.52	7.88	8.42	11.19
Fat mass (Faulkner) (kg)	6.33	6.67	6.95	7.19	7.64	7.92	8.23	8.64	9.42	13.56
Fat mass (Faulkner) (%)	9.15	9.39	9.62	9.84	10.19	10.43	10.76	11.22	12.02	14.27
Fat mass (Willmore) (kg)	4.66	5.04	5.36	5.70	6.12	6.38	6.81	7.30	8.34	14.31
Fat mass (Willmore) (%)	6.48	6.98	7.48	7.80	8.16	8.50	9.08	9.70	10.82	15.07
Adipose tissue (Kerr) (kg)	12.51	13.24	13.86	14.31	14.89	15.64	16.30	17.01	18.15	24.60
Adipose tissue (Kerr) (%)	17.65	18.30	18.78	19.56	20.39	21.02	21.59	22.27	23.80	28.34
Muscle mass (Lee) (kg)	30.50	31.73	32.80	33.68	34.40	35.11	35.82	36.71	38.39	63.87
Muscle mass (Lee) (%)	43.07	44.32	45.17	45.64	46.15	46.63	47.21	48.22	49.62	79.53
Bone mass (Rocha) (kg)	10.67	11.09	11.55	12.13	12.45	12.75	13.09	13.39	14.14	15.76
Bone mass (Rocha) (%)	15.06	15.48	15.86	16.22	16.64	16.98	17.30	17.59	18.11	23.69
Residual mass (kg)	8.38	9.96	10.73	11.51	12.62	13.22	14.48	15.39	17.48	26.06
Residual mass (%)	12.82	14.49	15.20	16.13	16.77	18.26	19.07	19.80	20.86	27.17
Endomorphy	1.70	1.91	2.04	2.15	2.28	2.45	2.56	2.72	3.08	3.88
Mesomorphy	3.46	4.00	4.21	4.41	4.65	4.91	5.10	5.36	5.77	10.86
Ectomorphy	1.79	2.07	2.36	2.56	2.72	2.93	3.15	3.40	3.66	4.52
Z sum of six skinfolds	−2.53	−2.47	−2.40	−2.34	−2.30	−2.24	−2.15	−2.06	−1.93	−1.26
Body mass index (kg/m^2)	21.47	21.83	22.21	22.54	22.90	23.23	23.75	24.14	24.76	27.46
Waist-to-hip ratio	0.78	0.79	0.80	0.81	0.82	0.82	0.83	0.84	0.85	0.91
Fat distribution index	0.59	0.67	0.72	0.78	0.82	0.85	0.91	0.98	1.14	1.87
Third division										
Body mass (kg)	65.60	69.20	70.90	72.40	73.30	75.40	78.20	80.10	83.10	93.50
Stretch stature (cm)	172.10	175.00	176.30	178.00	180.00	181.00	182.50	184.00	187.00	194.80
Triceps skinfold (mm)	4.00	5.00	5.28	6.00	6.50	7.00	7.50	8.74	9.50	14.50
Subscapular skinfold (mm)	6.00	6.50	7.00	7.04	7.50	7.80	8.20	8.50	9.50	12.50
Biceps skinfold (mm)	2.40	2.58	2.80	3.00	3.00	3.50	4.00	4.02	4.91	6.50
Iliac crest skinfold (mm)	6.00	6.88	7.20	8.46	9.10	10.00	11.00	12.00	13.62	20.50
Supraspinale skinfold (mm)	4.20	4.72	5.00	5.40	5.80	6.20	6.62	7.40	8.88	14.00
Abdominal skinfold (mm)	6.00	7.00	7.60	8.40	9.00	10.46	12.04	14.48	16.00	23.10
Thigh skinfold (mm)	5.56	6.50	7.40	8.00	8.90	10.00	10.84	11.80	13.00	21.00
Calf skinfold (mm)	3.32	3.64	4.00	4.44	5.00	5.20	6.00	6.38	7.00	14.50
Arm relaxed girth (cm)	27.68	28.76	29.20	29.70	30.05	30.58	31.40	32.00	33.00	37.40
Arm flexed and tensed girth (cm)	30.30	31.04	31.70	32.00	32.55	33.20	33.98	34.50	35.50	40.20
Waist girth (cm)	71.91	73.94	75.23	76.32	77.00	77.76	78.84	80.68	82.89	91.30
Hip girth (cm)	90.00	91.52	93.80	94.44	95.30	96.52	98.20	99.64	101.63	110.60
Thigh middle girth (cm)	49.50	51.40	52.00	53.20	53.95	54.60	55.20	56.06	57.66	60.70
Calf girth (cm)	34.65	35.36	36.40	36.88	37.45	37.80	38.29	38.70	39.93	42.30
Humerus breadth (cm)	6.60	6.80	6.80	6.94	7.00	7.10	7.20	7.30	7.50	8.00
Bi-styloid breadth (cm)	5.30	5.50	5.60	5.80	5.80	5.90	6.02	6.10	6.30	9.50
Femur breadth (cm)	9.26	9.40	9.60	9.70	9.90	9.90	10.00	10.20	10.40	11.00

Table 4. *Cont.*

Percentile	10	20	30	40	50	60	70	80	90	100
Sum of three skinfolds (cm)	17.06	18.54	20.16	21.66	23.80	26.00	29.42	32.96	36.96	52.00
Sum of six skinfolds (cm)	32.50	35.20	37.00	40.40	42.00	45.80	49.30	53.50	60.00	83.00
Sum of eight skinfolds (cm)	41.20	46.20	47.70	50.50	54.00	58.20	63.85	69.50	76.05	107.50
Corrected arm girth (cm)	25.64	26.50	27.16	27.52	28.02	28.50	29.20	29.92	30.77	35.26
Corrected thigh girth (cm)	46.78	48.25	49.21	50.04	51.01	51.65	52.32	53.21	54.66	57.68
Corrected calf girth (cm)	33.00	34.02	34.70	35.34	35.73	36.05	36.76	37.31	38.34	41.04
Sum of corrected girths (cm)	106.58	108.69	110.90	113.49	114.73	116.12	117.76	119.34	122.59	130.31
Fat mass (Carter) (kg)	4.18	4.51	4.73	4.95	5.20	5.40	5.86	6.28	7.15	10.01
Fat mass (Carter) (%)	6.00	6.28	6.47	6.83	7.00	7.40	7.77	8.21	8.89	11.31
Fat mass (Faulkner) (kg)	6.40	6.71	7.05	7.27	7.61	7.88	8.31	9.08	9.70	12.36
Fat mass (Faulkner) (%)	9.15	9.47	9.76	9.94	10.16	10.53	10.99	11.60	12.35	14.31
Fat mass (Willmore) (kg)	4.39	5.00	5.28	5.66	6.08	6.42	7.26	7.88	9.25	13.47
Fat mass (Willmore) (%)	6.39	6.93	7.23	7.74	8.33	8.88	9.50	10.39	11.43	15.23
Adipose tissue (Kerr) (kg)	12.67	13.31	13.85	14.55	15.15	15.67	16.38	17.78	19.07	24.11
Adipose tissue (Kerr) (%)	17.55	18.57	19.27	20.17	20.65	21.00	22.17	22.90	24.17	28.95
Muscle mass (Lee) (kg)	30.28	31.21	32.25	32.98	33.60	34.51	35.48	36.43	38.11	44.41
Muscle mass (Lee) (%)	42.78	43.85	44.33	45.10	45.60	46.36	46.79	47.73	49.05	51.91
Bone mass (Rocha) (kg)	10.86	11.47	11.84	12.19	12.48	12.91	13.36	13.71	14.31	17.53
Bone mass (Rocha) (%)	15.31	15.89	16.48	16.81	17.21	17.36	17.71	18.02	18.50	25.71
Residual mass (kg)	8.47	10.18	10.99	11.55	12.41	12.92	13.88	14.67	15.59	29.76
Residual mass (%)	12.50	14.08	15.45	16.28	17.07	17.67	17.99	18.66	20.05	32.81
Endomorphy	1.80	1.96	2.08	2.16	2.26	2.43	2.60	2.79	3.15	3.94
Mesomorphy	3.78	4.05	4.37	4.61	4.79	5.03	5.27	5.51	5.88	6.96
Ectomorphy	1.85	2.10	2.33	2.51	2.75	2.89	3.11	3.29	3.71	5.28
Z sum of six skinfolds	−2.52	−2.45	−2.40	−2.32	−2.28	−2.18	−2.09	−1.98	−1.82	−1.23
Body mass index (kg/m^2)	21.36	21.82	22.19	22.63	22.99	23.28	23.65	24.19	25.17	26.62
Waist-to-hip ratio	0.76	0.77	0.79	0.80	0.81	0.82	0.83	0.84	0.86	0.92
Fat distribution index	0.66	0.73	0.78	0.80	0.86	0.91	0.97	1.04	1.18	1.61

4. Discussion

This is the first study that evaluates and compares body composition between the different Spanish soccer divisions and playing positions through anthropometry. The main findings of this work were as follows: (1) second-division players showed lower values for FM, adipose tissue, and sum of three and six skinfolds, while their values for BM and mesomorphy were higher than the rest of the divisions; (2) third-division players showed lower values for MM and sum of corrected girths compared to the second division, although they showed higher values in the percentage of BM than the second B division; (3) for soccer players in lower divisions, there are more anthropometric differences between playing positions.

4.1. Body Composition Values

In soccer, it is important to know and monitor a player's body composition as dietary intake can have a significant impact, which, in turn, can affect performance [1]. In relation to FM, it will allow players to move optimally on the field with adequate values, since it has been observed that players with lower FM values and higher aerobic capacity travel at greater speed during competition. In addition, higher FM values have been shown to be negatively associated with sprint speed in tests of 20 m distances [35–38]. In addition, a recent study associated elevated FM with lower muscle oxygen saturation, which alters the ability to withstand repeated bouts of high velocity [39]. However, MM will be associated with training loads, where insufficient or excessive loads could affect agility, speed, strength, and muscle hypertrophy or even increase the risk of injury [1,11,40]. Recently, Ayotte et al. [41] examined the effect of strength training-induced MM gain on aerobic capacity in 11 elite soccer players. The results of the study revealed that the increase in MM resulting from strength training did not have a negative impact on their aerobic capacity; on the contrary, an improvement in aerobic capacity was observed [41]. Supporting these results, it was observed in intercollegiate soccer players that improving lean body mass and decreasing FM could be beneficial for jumping and sprinting performance in soccer, although excessive body weight can negatively affect jumping and sprinting performance [42]. For a sports dietitian-nutritionist, it is essential to have the correct knowledge of the body composition of their players as it will serve as a tool to adjust dietary intake, hydration, and supplementation throughout the season [1,8,9].

The physical demands of soccer players have increased over the decades, so players require different body composition characteristics [4]. There are few scientific studies already published that analyze the body composition of soccer players in Spanish leagues through anthropometry using a strong methodology [6,23–25], with values of the sum of six skinfolds (triceps, subscapular, supraspinale, abdominal, mid-thigh, and calf) from 47.45 $\pm$ 7.70 mm to 57.0 $\pm$ 8.6 mm; FM percentage of 8.2 $\pm$ 0.91% (Carter, [28]), 10.99 $\pm$ 1.02% (Faulkner, [29]), and 7.01 $\pm$ 0.65% (Yuhasz, [43]) depending on the equation used; and a percentage and weight of MM of 47.96 $\pm$ 0.87% (Matiegka, [44]) and 36.33 $\pm$ 3.12 kg, respectively. In our study, all divisions showed lower values for the sum of six skinfolds and the percentage of FM through the Carter and Faulkner equations [28,29], although both the percentage and weight of MM were lower. However, it should be noted that the equation we used in the study was that of Lee, so to properly compare our results with the scientific literature, it would be necessary to use the same anthropometric equations to avoid misinterpretation. Therefore, it can be interpreted that, at least, the trend in FM and skinfold sum values has decreased over time due to a number of interrelated factors. Advances in sports training methods have led to more specialized programs focused on physical performance, while increased attention to sports nutrition has allowed for in-season dietary optimization, including the use of dietary supplements that can affect body composition such as creatine [1,5,10].

Recently, two systematic reviews with meta-analyses were published, where it was verified that body composition in male professional soccer players from all leagues in the world should by differentiated by the three main methods of measurement (anthropometry, bioimpedance, and dual X-ray absorptiometry) [9], while another study focused on ascertaining the differences in body composition between the different playing positions in this population [8]. Comparing the results of our study with the anthropometric values of the first-mentioned article [9], the body mass (75.60 kg) and stretch stature (179.01 cm) values are similar. However, in that study, the FM was 11.16% for the Faulkner equation and 8.19% for the Carter equation, and the mean weight of the FM was 14.72 kg, higher values compared to our research in all the divisions evaluated [9]. The same is applicable to the sum of six skinfolds (52.18 mm) and the sum of eight skinfolds (59.93 mm). This could be justified by including studies since 2000 in this systematic review with meta-analysis, remembering that the body composition of the elite soccer player has evolved over time towards a body with lower FM values [4]. In addition, although these are references of professional soccer players, they were included from multiple countries, and there may be differences in economic inversion, ethnicity, or in the volume of exercise and competitions during the competitive season that may affect the body composition of the soccer player [22]. Our study involved soccer players from the Spanish league, a country with one of the highest Union of European Football Associations (UEFA) rankings, so it is reasonable to assume that there is a high physical demand and economic inversion to optimize the performance of soccer players and, therefore, for them to reach an optimal body composition [22].

Regarding the second systematic review with meta-analysis [8], significant differences were observed between playing positions, where the goalkeeper position showed the greatest height, age, total weight, sum of six skinfolds, and MM; defenders showed the greatest age and MM (next to goalkeepers); midfielders showed the lowest height, total weight, and MM; forwards were the youngest and had the lowest sum of skinfolds and lowest MM (next to midfielders); and no significant differences were observed in somatotype, weight, and percentage of FM. However, in our study, the differences between playing positions were most notable in the third division, where forwards showed higher weight, stretched stature, and FM weight according to the Faulkner equation than defenders. They also showed higher weight, stretched stature, sum of corrected circumferences, FM weight according to the Faulkner, Carter, and Willmore equations, adipose tissue weight according to the Kerr equation, MM weight according to the Lee equation, residual mass weight, and BMI than midfielders. Lastly, midfielders showed lower weight, stretched stature, and BM weight than goalkeepers. In contrast to the study by Sebastiá-Rico et al., practically no differences were observed in the second division and second B division. This could be due to what was mentioned above in relation to the longevity of the included studies and that, since the second division and second B division have a higher competitive level than the third division, it seems plausible that the soccer players, regardless of the playing position, show a homogeneous and optimal value of body composition [4]. However, it is not possible to arrive at a clear conclusion as to the reason for this.

Finally, comparing our own results, it is worth highlighting the anthropometric differences shown by the second-division players compared to the rest of the divisions, who showed lower values for the sum of three and six skinfolds, the percentage of FM according to the Carter, Faulkner, and Willmore equations, the weight of FM according to the Willmore equation, and the percentage of adipose tissue according to the Kerr equation. In addition, they showed higher values of mesomorphy and the percentage and weight of BM compared to the other divisions. This is consistent with the fact that, as the level of play and physical demand increases, anthropometric values must be adjusted to optimal values in order for players to perform adequately, in this case resulting in lower values of FM and higher values of MM and BM [1,8,9]. Lastly, the second-division soccer players also showed higher values for the sum of corrected circumferences and MM weight compared to the third-division soccer players, demonstrating once again the importance of achieving high MM values in modern soccer at the professional level [8,9,41] (Figure 1).

4.2. Somatotype Values

In relation to somatotype, similar values were observed for endomorphy and ectomorphy, although second-division players showed higher values of mesomorphy (5.48 $\pm$ 0.98) than second B division (4.65 $\pm$ 1.05) or third-division (4.80 $\pm$ 0.89) players. However, all three divisions' players showed a balanced mesomorphic somatotype. These results coincide with the two systematic reviews with meta-analyses that evaluated body composition in professional soccer players, with endomorphy, ectomorphy, and mesomorphy values of 2.32, 2.32, and 5.15 [9] and 2.31, 2.30, and 5.06 [8]. Furthermore, in previous studies that analyzed somatotypes in different categories of elite soccer in other countries, the same results were observed as in our work, where soccer players with a higher level of play reached higher values in mesomorphy while maintaining similar values of endomorphy and ectomorphy [45,46].

4.3. Application Percentiles

Due to the variability that exists among body dimensions in the population due to factors such as age, gender, ethnicity, physical exercise, and diet [21], percentiles can be a useful statistical tool for assessing and comparing anthropometric, body composition, and somatotype measurements in a specific population [21,47]. Percentiles represent the value below which a certain percentage of the population falls in a given measure, where the 50th percentile is the median and divides the population into two equal parts, serving as a reference for the population under evaluation [21]. These can be applied for the evaluation of physical performance or the monitoring of the body composition of a given soccer player or group of players with respect to the reference we show from our data in Spanish soccer. This tool does not provide information on health or sports performance, so its interpretation should be taken with caution depending on the anthropometric variable with which to compare [8,9]. FM estimation with different formulas cannot be compared [8,9,47], so it is necessary to have a percentile table, as was included in the current study, to determine the equivalences between methods.

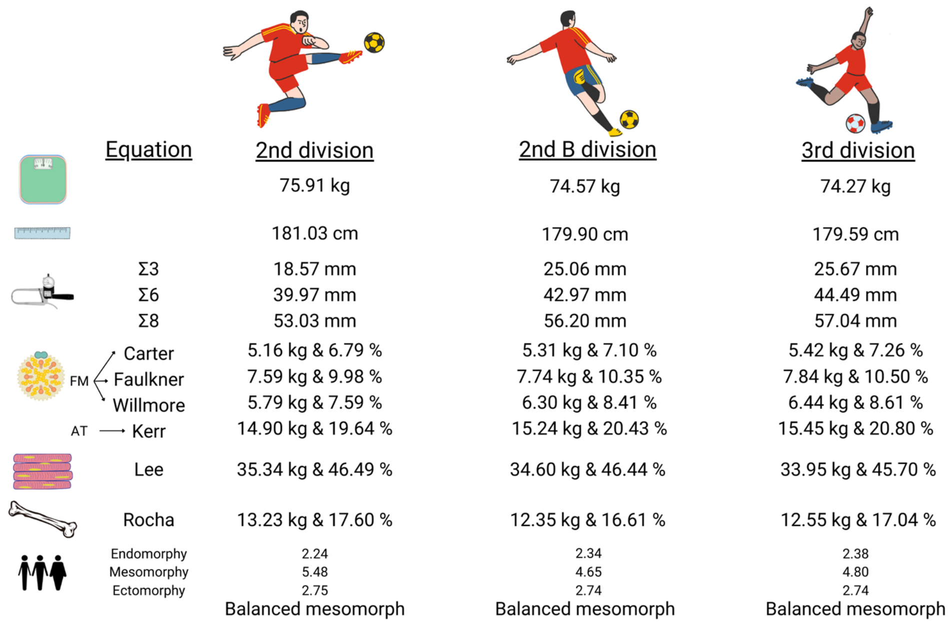

Figure 1. Mean anthropometric values differentiated by competitive level. FM = fat mass; AT = adipose tissue.

In summary, percentiles can be used by coaching and medical staff to evaluate a player's individual progress over time. For example, if a player is in the 50th percentile for MM and, after a period of training, his position moves to the 90th percentile, this indicates a significant improvement in his MM, allowing coaching staff to tailor training programs more accurately.

4.4. Limitations

This study has limitations. First, other factors, such as the rest or physical performance of the players, were not taken into account. Another limitation is related to the sample size, as not all clubs in the divisions could be included in the study. This is due, on the one hand, to the fact that the participation of anthropometrists was voluntary; on the other hand, it should be noted that not all soccer teams have a professional who performs anthropometric measurements. Despite this, and the limitations of our study, our research aims to be the first study to propose a range of indicative values for anthropometric measurements in male soccer players in the different Spanish professional and semi-professional divisions.

4.5. Practical Application

This study contributes to the literature on the anthropometric profiles of professional and semi-professional soccer players in the Spanish leagues, especially with regard to the elite level of the subjects in combination with the large sample size. The information from this study may be useful as a reference for coaching and medical staff to optimize training and monitor body composition during the season and/or in situations of sports injuries. Although most studies focus on values such as height, weight, and FM, in our research, we provide other body compartments such as MM, BM, RM, and adipose tissue, in addition to describing all skinfolds, girths, and breadths collected by the ISAK protocol and values such as somatotype or skinfold summation.

5. Conclusions

This anthropometric work offers helpful information to assist medical-technical staff to properly evaluate the anthropometric values of elite male soccer players, concluding the following: (1) at higher levels of play, soccer players show lower values of FM and higher values of MM and BM; (2) at lower levels of play, soccer players show more anthropometric differences between playing positions; (3) the somatotype of the elite soccer player is balanced mesomorphic, with higher levels of mesomorphy at higher levels of play.

Author Contributions: Conceptualization, M.P., J.S.-R. and J.M.M.-S.; data curation and analysis, M.P., J.S.-R. and R.V.-C.; project administration, M.P., C.C. and J.M.M.-S.; writing—original draft preparation, J.S.-R. and R.V.-C.; writing—review and editing, M.P., J.S.-R., C.C., P.A.L.-C., R.V.-C. and J.M.M.-S.; visualization and supervision, M.P., C.C., P.A.L.-C. and J.M.M.-S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University of Valencia (file No. 1534145).

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available in the tables of this article, as well as on request from the corresponding author.

Acknowledgments: The authors acknowledge the cooperation of the persons who assisted in the body composition measurements following the established protocol: R.L., M.G., L.R., N.G., L.C., G.G., J.G., T.V., M.P., C.C., J.P., K.D.S., M.J.L., P.L., A.M., M.A., R.B., S.P., A.C., A.G., A.L., S.L., A.M., F.P.N. and A.T. All of them belong to the Association of Dietitians-Nutritionists of Spanish Soccer Teams (ADNEFE) as a member of the Board of Directors or as a full member.

Conflicts of Interest: All authors of the work declare that they have no conflicts of interest.

Abbreviations

ADNEFE: Association of Dietitians-Nutritionists of Spanish Soccer Teams; BM: bone mass; FFM: fat-free mass; FM: fat mass; ISAK: International Society for the Advancement of Kinanthropometry; MM: muscle mass; TEM: technical error of measurement.

References

1. Collins, J.; Maughan, R.J.; Gleeson, M.; Bilsborough, J.; Jeukendrup, A.; Morton, J.P.; Phillips, S.M.; Armstrong, L.; Burke, L.M.; Close, G.L.; et al. UEFA Expert Group Statement on Nutrition in Elite Football. Current Evidence to Inform Practical Recommendations and Guide Future Research. *Br. J. Sports Med.* **2021**, *55*, 416. [CrossRef]
2. Anderson, L.; Orme, P.; Di Michele, R.; Close, G.L.; Morgans, R.; Drust, B.; Morton, J.P. Quantification of Training Load during One-, Two- and Three-Game Week Schedules in Professional Soccer Players from the English Premier League: Implications for Carbohydrate Periodisation. *J. Sports Sci.* **2016**, *34*, 1250–1259. [CrossRef] [PubMed]
3. Dolci, F.; Hart, N.H.; Kilding, A.E.; Chivers, P.; Piggott, B.; Spiteri, T. Physical and Energetic Demand of Soccer: A Brief Review. *Strength Cond. J.* **2020**, *42*, 70–77. [CrossRef]
4. Wallace, J.L.; Norton, K.I. Evolution of World Cup Soccer Final Games 1966-2010: Game Structure, Speed and Play Patterns. *J. Sci. Med. Sport* **2014**, *17*, 223–228. [CrossRef]
5. Silva, J.R. The Soccer Season: Performance Variations and Evolutionary Trends. *PeerJ* **2022**, *10*, e14082. [CrossRef]
6. López Cáceres, P.A.; Chena Sinovas, M.; Asín Izquierdo, I.; Moreno Ortega, A.; Moreno Rojas, R.; López Cáceres, P.A.; Chena Sinovas, M.; Asín Izquierdo, I.; Moreno Ortega, A.; Moreno Rojas, R. Efecto de Factores Contextuales En La Composición Corporal de Jugadores Profesionales de Fútbol. Un Estudio Retrospectivo. *Nutr. Hosp.* **2019**, *36*, 1324–1331. [CrossRef]
7. Sutton, L.; Scott, M.; Wallace, J.; Reilly, T. Body Composition of English Premier League Soccer Players: Influence of Playing Position, International Status, and Ethnicity. *J. Sports Sci.* **2009**, *27*, 1019–1026. [CrossRef]
8. Sebastiá-Rico, J.; Martínez-Sanz, J.M.; González-Gálvez, N.; Soriano, J.M. Differences in Body Composition between Playing Positions in Men's Professional Soccer: A Systematic Review with Meta-Analysis. *Appl. Sci.* **2023**, *13*, 4782. [CrossRef]
9. Sebastiá-Rico, J.; Soriano, J.M.; González-Gálvez, N.; Martínez-Sanz, J.M. Body Composition of Male Professional Soccer Players Using Different Measurement Methods: A Systematic Review and Meta-Analysis. *Nutrients* **2023**, *15*, 1160. [CrossRef] [PubMed]

10. Abreu, R.; Figueiredo, P.; Beckert, P.; Marques, J.P.; Amorim, S.; Caetano, C.; Carvalho, P.; Sá, C.; Cotovio, R.; Cruz, J.; et al. Portuguese Football Federation Consensus Statement 2020: Nutrition and Performance in Football. *BMJ Open Sport Exerc. Med.* **2021**, *7*, e001082. [CrossRef] [PubMed]
11. Bernal-Orozco, M.F.; Posada-Falomir, M.; Quiñónez-Gastélum, C.M.; Plascencia-Aguilera, L.P.; Arana-Nuño, J.R.; Badillo-Camacho, N.; Márquez-Sandoval, F.; Holway, F.E.; Vizmanos-Lamotte, B. Anthropometric and Body Composition Profile of Young Professional Soccer Players. *J. Strength Cond. Res.* **2020**, *34*, 1911–1923. [CrossRef] [PubMed]
12. Tornero-Aguilera, J.F.; Villegas-Mora, B.E.; Clemente-Suárez, V.J. Differences in Body Composition Analysis by DEXA, Skinfold and BIA Methods in Young Football Players. *Children* **2022**, *9*, 1643. [CrossRef]
13. Stanković, M.; Čaprić, I.; Đorđević, D.; Đorđević, S.; Preljević, A.; Koničanin, A.; Maljanović, D.; Nailović, H.; Muković, I.; Jelaska, I.; et al. Relationship between Body Composition and Specific Motor Abilities According to Position in Elite Female Soccer Players. *Int. J. Environ. Res. Public Health* **2023**, *20*, 1327. [CrossRef] [PubMed]
14. Oliveira, R.; Francisco, R.; Fernandes, R.; Martins, A.; Nobari, H.; Clemente, F.M.; Brito, J.P. In-Season Body Composition Effects in Professional Women Soccer Players. *Int. J. Environ. Res. Public Health* **2021**, *18*, 12023. [CrossRef]
15. Alvero Cruz, J.R.; Cabañas, M.D.; Herrero de Lucas, A.; Martinez Riaza, L.; Moreno Pascual, C.; Porta Manzañido, J.; Sillero Quintana, M.; Sirvent Belando, J.E. Protocolo de Valoración de La Composición Corporal Para El Reconocimiento Médico-Deportivo. Documento de Consenso Del Grupo Español de Cineantropometría (GREC) de La Federación Española de Medicina Del Deporte (FEMEDE). Versión 2010. *Arch. Med. Deporte* **2010**, *27*, 330.
16. Chena Sinovas, M.; Pérez-López, A.; Álvarez Valverde, I.; Bores Cerezal, A.; Ramos-Campo, D.J.; Rubio-Arias, J.A.; Valadés Cerrato, D. Influencia de La Composición Corporal Sobre El Rendimiento En Salto Vertical Dependiendo de La Categoría de La Formación y La Demarcación En Futbolistas. *Nutr. Hosp.* **2015**, *32*, 299–307. [CrossRef]
17. Reilly, T.; Bangsbo, J.; Franks, A. Anthropometric and Physiological Predispositions for Elite Soccer. *J. Sports Sci.* **2000**, *18*, 669–683. [CrossRef]
18. Isak-¿Qué Es ISAK? Available online: https://www.isak.global/WhatIsIsak/#GoToKina (accessed on 22 May 2022).
19. Kasper, A.M.; Langan-Evans, C.; Hudson, J.F.; Brownlee, T.E.; Harper, L.D.; Naughton, R.J.; Morton, J.P.; Close, G.L. Come Back Skinfolds, All Is Forgiven: A Narrative Review of the Efficacy of Common Body Composition Methods in Applied Sports Practice. *Nutrients* **2021**, *13*, 1075. [CrossRef]
20. Carter, J.E.L. *The Heath-Carter Anthropometric Somatotype-Instruction Manual*; University SDS: San Diego, CA, USA, 2002.
21. Cabañas, M.D.; Esparza, F. *Compendio de Cineantropometría*; CTO Editorial: Madrid, Spain, 2009.
22. Clasificación Masculina. Available online: https://www.fifa.com/es/fifa-world-ranking/origin1904-p.cxm.fifa.com/fifa-world-ranking/men (accessed on 8 July 2023).
23. Casajús, J.A. Seasonal Variation in Fitness Variables in Professional Soccer Players. *J. Sports Med. Phys. Fit.* **2001**, *41*, 463–469.
24. Lago-Penas, C.; Rey, E.; Lago-Ballesteros, J.; Dominguez, E.; Casais, L. Seasonal Variations in Body Composition and Fitness Parameters According to Individual Percentage of Training Completion in Professional Soccer Players. *Int. Sport. J.* **2013**, *14*, 205–215.
25. Manuel Vega, J.; Gonzalez-Artetxe, A.; Ander Aguinaco, J.; Los Arcos, A. Assessing the Anthropometric Profile of Spanish Elite Reserve Soccer Players by Playing Position over a Decade. *Int. J. Environ. Res. Public Health* **2020**, *17*, 5446. [CrossRef]
26. Vandenbroucke, J.P.; von Elm, E.; Altman, D.G.; Gøtzsche, P.C.; Mulrow, C.D.; Pocock, S.J.; Poole, C.; Schlesselman, J.J.; Egger, M.; Strobe Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and Elaboration. *PLoS Med.* **2007**, *4*, e297. [CrossRef]
27. *ISO 7250-1:2017*; Basic Human Body Measurements for Technological Design—Part 1: Body Measurement Definitions and Landmarks. Spanish Association for Standardization: Madrid, Spain, 2017.
28. Carter, J. The Physical Structure of Olympic Athletes—Part I—The Montreal Olympic Games Anthropometrical Project. *Br. J. Sports Med.* **1982**, *16*, 267.
29. Faulkner, J.A. Physiology of Swimming. *Res. Q. Am. Assoc. Health Phys. Educ. Recreat.* **1966**, *37*, 41–54. [CrossRef]
30. Wilmore, J.H.; Behnke, A.R. An Anthropometric Estimation of Body Density and Lean Body Weight in Young Men. *J. Appl. Physiol.* **1969**, *27*, 25–31. [CrossRef]
31. Lee, R.C.; Wang, Z.; Heo, M.; Ross, R.; Janssen, I.; Heymsfield, S.B. Total-Body Skeletal Muscle Mass: Development and Cross-Validation of Anthropometric Prediction Models. *Am. J. Clin. Nutr.* **2000**, *72*, 796–803. [CrossRef]
32. Stewart, A.; Marfell-Jones, M.; Olds, T. *International Standards for Anthropometric Assessment*; International Society for the Advancement of Kinanthropometry: Lower Hutt, New Zealand, 2011; ISBN 978-0-620-36207-8.
33. Ross, W.D.K. Fraccionamiento de La Masa Corporal: Un Nuevo Método Para Utilizar En Nutrición Clínica y Medicina Deportiva. *Apunt. Med. Esport.* **1991**, *28*, 175–188.
34. Hopkins, W.G.; Marshall, S.W.; Batterham, A.M.; Hanin, J. Progressive Statistics for Studies in Sports Medicine and Exercise Science. *Med. Sci. Sports Exerc.* **2009**, *41*, 3–12. [CrossRef] [PubMed]
35. Radzimiński, Ł.; Szwarc, A.; Padrón-Cabo, A.; Jastrzębski, Z. Correlations between Body Composition, Aerobic Capacity, Speed and Distance Covered among Professional Soccer Players during Official Matches. *J. Sports Med. Phys. Fit.* **2020**, *60*, 257–262. [CrossRef] [PubMed]

36. Figueiredo, D.H.; Dourado, A.C.; Stanganelli, L.C.R.; Gonçalves, H.R. Evaluation of Body Composition and Its Relationship with Physical Fitness in Professional Soccer Players at the Beginning of Pre-Season. *Retos Nuevas Tend. Educ. Fís. Deporte Recreación* **2021**, *40*, 117–125. [CrossRef]
37. Campa, F.; Semprini, G.; Júdice, P.B.; Messina, G.; Toselli, S. Anthropometry, Physical and Movement Features, and Repeated-Sprint Ability in Soccer Players. *Int. J. Sports Med.* **2019**, *40*, 100–109. [CrossRef] [PubMed]
38. Nikolaidis, P.T.; Ruano, M.a.G.; de Oliveira, N.C.; Portes, L.A.; Freiwald, J.; Leprêtre, P.M.; Knechtle, B. Who Runs the Fastest? Anthropometric and Physiological Correlates of 20 m Sprint Performance in Male Soccer Players. *Res. Sports Med.* **2016**, *24*, 341–351. [CrossRef]
39. Vasquez-bonilla, A.A.; Rojas-Valverde, D.; Timon, R.; Olcina, G. Influence of Fat Percentage on Muscle Oxygen Uptake and Metabolic Power during Repeated-Sprint Ability of Footballers. *Apunt. Sports Med.* **2022**, *57*, 100395. [CrossRef]
40. Suarez-Arrones, L.; Lara-Lopez, P.; Maldonado, R.; Torreno, N.; Hoyo, M.D.; Nakamura, F.Y.; Salvo, V.D.; Mendez-Villanueva, A. The Effects of Detraining and Retraining Periods on Fat-Mass and Fat-Free Mass in Elite Male Soccer Players. *PeerJ* **2019**, *7*, e7466. [CrossRef] [PubMed]
41. Ayotte, B.; Carey, V.; Charron, J.; Ibo, J.; Ferland, P.-M.; Comtois, A.S. Increase In Body Mass Do Not Negatively Affect Aerobic Capacity in Elite Male Soccer Players: 67. *Med. Sci. Sports Exerc.* **2021**, *53*, 21. [CrossRef]
42. Ishida, A.; Travis, S.K.; Stone, M.H. Associations of Body Composition, Maximum Strength, Power Characteristics with Sprinting, Jumping, and Intermittent Endurance Performance in Male Intercollegiate Soccer Players. *J. Funct. Morphol. Kinesiol.* **2021**, *6*, 7. [CrossRef]
43. Yuhasz, M.S. *The Effects of Sports Training on Body Fat in Man with Predictions of Optimal Body Weight*; University of Illinois at Urbana-Champaign: Champaign, IL, USA, 1962.
44. Matiegka, J. The Testing of Physical Efficiency. *Am. J. Phys. Anthropol.* **1921**, *4*, 223–230. [CrossRef]
45. Zuniga Galaviz, U.; Osorio Gutierrez, A.; Toledo Dominguez, I.d.J.; Herrera Perea, R. Somatotype of Mexican Soccer Players from Different Competition Level. *Retos-Nuevas Tend. Educ. Fis. Deporte Recreacion* **2018**, *34*, 100–102. [CrossRef]
46. Hazir, T. Physical Characteristics and Somatotype of Soccer Players According to Playing Level and Position. *J. Hum. Kinet.* **2010**, *26*, 83–95. [CrossRef]
47. Vaquero-Cristóbal, R.; Albaladejo-Saura, M.; Luna-Badachi, A.E.; Esparza-Ros, F. Differences in Fat Mass Estimation Formulas in Physically Active Adult Population and Relationship with Sums of Skinfolds. *Int. J. Environ. Res. Public Health* **2020**, *17*, 7777. [CrossRef]