

Original article

Anthropometric characteristics, somatotype and dietary patterns in youth soccer players



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ABSTRACT

Objective: To determine the morphological characteristics, fat mass, somatotype and dietary patterns of youth soccer players from an amateur Spanish team.

Method: Height, weight, diameters, circumferences and skinfolds from sixteen youth soccer players were measured. Body fat percentage and somatotype were calculated. They completed the Kidmed questionnaire to analyze dietary patterns. Descriptive statistics (mean \pm standard deviation) were used.

Results: The global body fat percentage was 9.16 ± 2.12 and the somatotype (2.56–3.73–2.77). The sum of the six skinfolds was 62.6 ± 2.7 mm. The sum of the eight skinfolds was 80.7 ± 3.1 mm. 75% of athletes consumed a fruit daily, 18.75% took a second fruit each day. 43.75% of players took vegetables once a day, 18.75% ate vegetables more than once a day.

Conclusion: Body fat percentage, the sum of the six skinfolds, the sum of the eight skinfolds and somatotype results are in agreement with previous studies where youth non-professional soccer players were analyzed. Other studies have obtained lower values in body fat percentage or in sum of six skinfolds due to they have evaluated professional soccer players. Anthropometric measures would be important to prescribed personalized diet and training plans.

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Características antropométricas, somatotipo y patrones alimentarios en jugadores jóvenes de fútbol

RESUMEN

Objetivo: Determinar las características morfológicas, la masa grasa, el somatotipo y los patrones alimentarios de jugadores de fútbol jóvenes de un equipo amateur.

Método: Se midieron la altura, el peso, los diámetros corporales, las circunferencias y los pliegues cutáneos de 16 jugadores. Se calcularon el porcentaje de grasa corporal y el somatotipo. Se administró el cuestionario Kidmed con objeto de conocer el patrón alimentario. Se utilizaron métodos estadísticos descriptivos (media \pm desviación estándar).

Resultados: El porcentaje global de grasa corporal fue 9.16 ± 2.12 y el somatotipo (2.56–3.73–2.77). El sumatorio de 6 pliegues fue 62.6 ± 2.7 mm y el sumatorio de 8 fue 80.7 ± 3.1 mm. El 75% de los futbolistas consumía una fruta diaria y el 18.75% tomaba una segunda pieza de fruta. El 43.75% de los jugadores tomaba una ración de vegetales cada día y el 18.75% comía vegetales más de una vez al día.

Conclusiones: Los resultados del porcentaje de grasa, del sumatorio de 6 pliegues, de 8 pliegues cutáneos y del somatotipo son similares a los obtenidos en estudios previos. Otras investigaciones encontraron un porcentaje de grasa inferior y un menor valor para el sumatorio de 6 pliegues debido a que analizaron jugadores profesionales. Las mediciones antropométricas son importantes para prescribir planes de alimentación y entrenamiento personalizados.

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Características antropométricas, somatotipo e padrões alimentares em jovens atletas de futebol

R E S U M O

Palavras-chave:

Futebol
Antropometria
Somatotipo
Padrões alimentares
Gordura corporal
Dobras cutâneas
Esportes de equipe

Objetivo: Determinar as características morfológicas, massa gorda, somatotipo e padrões alimentares de jovens jogadores de futebol de uma equipe amadora espanhola.

Métodos: Foram medidos altura, peso, diâmetros, circunferências e dobras cutâneas de dezesseis jovens jogadores de futebol. A porcentagem de gordura corporal e o somatotipo foram calculados. Eles completaram o questionário Kidmed para analisar padrões alimentares. Foram utilizadas estatísticas descritivas (média \pm desvio padrão).

Resultados: A porcentagem de gordura corporal foi de 9.16 ± 2.12 e o somatotipo ($2.56-3.73-2.77$). A soma das seis dobras cutâneas foi 62.6 ± 2.7 mm. A soma das oito dobras cutâneas foi 80.7 ± 3.1 mm. 75% dos atletas que consumiam diariamente uma fruta, 18.75% ingeriam uma segunda fruta por dia. 43.75% dos jogadores ingeriam legumes uma vez por dia, 18.75% comiam vegetais mais que uma vez por dia.

Conclusão: A porcentagem de gordura corporal, a soma das seis dobras cutâneas, a soma das oito dobras cutâneas e os resultados somatotípos estão de acordo com estudos prévios em que foram analisados jovens jogadores de futebol não profissionais. Outros estudos obtiveram valores mais baixos na porcentagem de gordura corporal ou na soma de seis dobras cutâneas devido a terem avaliado jogadores profissionais de futebol. Medidas antropométricas seriam importantes para prescrever uma dieta personalizada e planos de treinamento.

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Introduction

From long time ago, it is well known that body composition plays an important role in sport performance, specifically in the physical status. Consequently body composition has been studied in different sports such as basketball,¹ rugby² or soccer³ in order to analyze athletes status. Numerous methods to evaluate body composition in athletes have been developed for instance anthropometric analysis,² bioelectrical impedance analyzer³ or dual-energy X-ray absorptiometry.⁴ Anthropometry is the study of the size, the form, the proportionality, the composition, the biological maturation and the body function of humans. This technique allows relating corporal measures in form, proportions and compositions with a specific sport function in athletes.⁵ Anthropometry sizes body weight, height, wingspan, skinfolds, perimeters, diameters and lengths. From these data, it is possible to obtain information about body fat mass, body composition and somatotype.⁶ Somatotype method is used to analyze body composition in humans which is classified in three different component mesomorphy (related to muscle mass), endomorphy (related to fatness) and ectomorphy (related to linearity and slenderness).⁷

Especially in soccer, anthropometry techniques have been widely used in last times. A study⁸ analyzed anthropometric characteristics and somatotype of young players at different ages (14–18 years) from teams of the First Macedonian league ($n = 486$) and compared the results with data from general population. Obtaining players at 14 years showed significant lower values of muscle and fat mass. They also discovered that in all age soccer groups mesomorphy component of the somatotype dominated. Furthermore, athletes presented smaller values of the fat and endomorphic component and greater muscle and mesomorphic component in comparison with general population. Another research⁹ identified anthropometric and somatotype characteristics of Italian young players ($n = 112$). The mean results showed a high muscular and low adipose profile. They found differences in playing position between anthropometric data and somatotype value. Based on these studies, it seems clear that soccer players present different anthropometric and somatotype profiles to the general population and these values could change depending on the playing position.

Casajús¹⁰ evaluated fifteen players from the Spanish First Division to analyze seasonal variations in anthropometric variables from the beginning to the middle of the season. Significant variations (mean \pm standard deviation) were found in fat percent ($8.6 \pm 0.91\%$ versus $8.2 \pm 0.91\%$) and in the sum of six skinfolds (57.0 ± 8.67 mm versus 52.9 ± 8.61 mm). Another paper¹¹ analyze the dietary intakes and anthropometric profiles got the least percentage of body fat ($11.3 \pm 1\%$) where found in players that consumed significantly less fat in their diet, an adequate carbohydrate ingestion for athletes ($52.2 \pm 5\%$ of energy intake), nothing of alcohol and micronutrients intakes above the dietary reference values. So it seems that dietary habits could affect to body composition and consequently influencing to sport performance. Additionally, a previous investigation² found eighteen rugby players with body composition values away from the recommended body composition profile at the preseason. After applied personalized plans of diet and training, changes in body composition were reported at the end of the season. Obtaining data close to reference values of professional players.

Obviously, several methods have been developed to analyze dietary habits in athletes weigh food intakes, food frequency questionnaires, 24 h count questionnaires or specific nutritional questionnaires. One of them is Kidmed questionnaire, this method evaluate the adherence to the Mediterranean diet (MD), a well-known healthy dietary pattern. One study¹² evaluated the relations between Kidmed results and anthropometric characteristics in ninety elite women paddlers. A medium or excellent adherence was observed. However, useful nutritional information was obtaining from this questionnaire, such as the fact that 20% of paddlers ate sweets more than once a day or that 33% didn't eat nuts.

The purposes of this research were to determine the morphological characteristics, fat body mass, somatotype and dietary patterns of youth soccer players from an amateur Spanish team.

Method

Subjects

A total of sixteen players from a U-19 amateur Spanish team voluntary participated at the age of 16–18 years, with an average

Table 1
Mean \pm standard deviations of anthropometric data.

Variables	Goalkeeper (n=2)	Defenders (n=3)	Fullbacks (n=2)	Midfielders (n=6)	Strikers (n=3)	Global average (n=16)
Height (cm)	174.95 \pm 1.48	180.00 \pm 5.54	174.35 \pm 0.91	173.93 \pm 7.61	175.50 \pm 3.77	175.54 \pm 5.54
Weight (kg)	83.00 \pm 2.97	67.40 \pm 5.46	57.55 \pm 6.71	69.25 \pm 11.66	72.16 \pm 6.13	69.70 \pm 10.17
Wrist diameter (cm)	5.24 \pm 0.29	5.68 \pm 0.07	5.66 \pm 0.08	5.35 \pm 0.35	5.43 \pm 0.16	5.45 \pm 0.28
Humerus diameter (cm)	6.63 \pm 0.12	6.92 \pm 0.34	6.35 \pm 0.14	6.21 \pm 0.39	6.33 \pm 0.22	6.43 \pm 0.39
Femur diameter (cm)	9.67 \pm 0.53	9.34 \pm 0.18	8.91 \pm 0.16	9.19 \pm 0.44	9.02 \pm 0.27	9.21 \pm 0.39
Arm relaxed circumference (cm)	32.2 \pm 0.3	26.9 \pm 2.0	24.2 \pm 1.1	27.1 \pm 1.50	29.0 \pm 0.4	27.7 \pm 2.5
Arm tensed circumference (cm)	34.2 \pm 0.3	29.3 \pm 1.9	26.6 \pm 0.5	28.6 \pm 1.1	31.0 \pm 0.6	29.6 \pm 2.4
Thigh circumference (cm)	59.7 \pm 2.5	50.8 \pm 2.3	46.6 \pm 1.0	51.7 \pm 4.1	50.7 \pm 1.9	51.6 \pm 4.4
Calf circumference (cm)	39.6 \pm 0.6	35.4 \pm 1.3	33.6 \pm 0.9	37.9 \pm 3.7	36.3 \pm 0.8	36.8 \pm 2.9
Hip circumference (cm)	103.9 \pm 5.6	92.2 \pm 4.6	84.5 \pm 0.7	95.7 \pm 6.5	92.7 \pm 5.8	94.1 \pm 7.1
Waist circumference (cm)	82.0 \pm 0.8	73.4 \pm 3.5	68.1 \pm 4.1	75.6 \pm 5.1	78.3 \pm 4.2	75.6 \pm 5.4
Biceps skinfold (mm)	8.5 \pm 2.1	4.8 \pm 1.1	3.5 \pm 1.4	5.1 \pm 2.4	6.0 \pm 2.0	5.4 \pm 2.2
Triceps skinfold (mm)	16.2 \pm 1.1	7.6 \pm 2.6	6.0 \pm 0.0	9.1 \pm 2.1	9.5 \pm 2.8	9.4 \pm 3.4
Subscapular skinfold (mm)	13.5 \pm 3.5	9.2 \pm 2.2	9.1 \pm 4.1	10.0 \pm 3.4	9.7 \pm 1.5	10.1 \pm 2.9
Supraespinale skinfold (mm)	11.7 \pm 3.2	5.0 \pm 1.0	4.1 \pm 1.9	7.0 \pm 3.3	7.8 \pm 2.6	7.0 \pm 3.3
Supracrestal skinfold (mm)	17.4 \pm 3.7	14.6 \pm 9.7	7.4 \pm 0.9	12.2 \pm 4.4	12.2 \pm 1.9	12.7 \pm 5.1
Abdominal skinfold (mm)	23.2 \pm 1.1	12.3 \pm 7.5	8.5 \pm 2.1	12.5 \pm 4.9	13.4 \pm 3.3	13.5 \pm 5.8
Thigh skinfold (mm)	22.2 \pm 3.9	11.3 \pm 1.5	8.7 \pm 1.8	15.2 \pm 4.2	12.0 \pm 4.3	13.9 \pm 5.0
Calf skinfold (mm)	12.0 \pm 1.4	8.0 \pm 1.7	5.6 \pm 0.9	9.5 \pm 3.6	7.2 \pm 3.7	8.6 \pm 3.2

Data for 16 soccer players.

of 17.38 \pm 0.92 years. They had trained for \sim 1.5 h/day, 4 day/week (including a weekly competitive match) during the previous year. All players were regularly involved in competitive seasons. The distribution in different position in the field was goalkeeper (n=2), defenders (n=3), fullbacks (n=2), midfielders (n=6) and strikers (n=3). They delivered informed written consents which had been signed by their parents.

Experimental design

The anthropometric characteristics measured were height, weight, three diameters (wrist, biepicondylar humerus and femur), six circumferences (arm relaxed and tensed, thigh, calf, hip and waist perimeter) and eight skin folds (biceps, triceps, subscapular, abdominal, thigh, calf, supraspinale and supracrestal). Data were obtained following the standard techniques for the International Society for the Advancement of Kinanthropometry (ISAK).^{13–15} Carter's equation was used to determine body fat percentage.¹⁶ Somatotype was calculated according to Carter and Heath method.^{7,17} Data were collected after the last competitive match at the end of the season.

Kidmed questionnaire¹⁸ determines the MD adherence. This questionnaire includes sixteen items on a yes/no scale. Affirmative answers from questions related with positive aspects of MD add one point (questions 1–5,7–11,13,15). Affirmative answers related with negative aspects of MD subtract one point (questions 6,12,14,16). The final punctuation is known as the Kidmed Index which can be classified in three different categories:

- Final punctuation \geq 8: high adherence.
- Final punctuation 4–7: medium adherence.
- Final punctuation \leq 3: low adherence.

Anthropometric data were collected by a high trained technician, certified with ISAK level I. The weight was collected using an electronic weighing machine (Tanita UM-076). Height was measured with a stadiometer (Seca). The skinfolds were measured with a slim guide skinfold caliper. Bone breadths and body perimeters were also collected with validated material (an anthropometric tape and a small electronic sliding caliper, precision 0.01 mm). The experimental protocol was written following the ethics rules from Helsinki Declaration. All experimental procedures were in accordance with the Pablo de Olavide University Ethical Committee rules.

Statistical analysis

SigmaPlot 13 version (Systat software) was used for Statistical Analyses. Descriptive statics (mean \pm standard deviation) were reported for the different parameters analyzed. Statistical differences between different positions of the players in the soccer field were not evaluated because there is insufficient statistical power to detect differences due to the sample size.

Results

In Table 1 can be observed mean values and standard deviations of anthropometric data obtained from players studied. Values in function of different positions are also shown in Table 1.

Results obtained of dietary patterns analysis can be observed in Fig. 1. These data were shown on percentage scale. 75% of players consumed a fruit daily, 18.75% took a second fruit each day. 43.75% took vegetables once a day, 18.75% ate vegetables more than once a day. 31.25% of athletes evaluated went more than once a week to a fast-food restaurant.

Kidmed Indexes were: goalkeeper (7.00 \pm 1.41), defenders (5.33 \pm 5.03), fullbacks (5.50 \pm 0.70), midfielders (6.83 \pm 2.22), strikers (5.33 \pm 3.78) and global players sample (6.12 \pm 2.77).

Table 2 shows results of somatotype analyses, the sum of six skinfolds, the sum of eight skinfolds and body fat percentage.

Somatotype classifications were goalkeepers (endomesomorph), defenders (meso-ectomorph), fullbacks (meso-ectomorph), midfielders (balance mesomorph), strikers (balance mesomorph) and global players sample (balance mesomorph). These results can be observed in Fig. 2.

Discussion

The global fat percentage obtained in players was 9.16 \pm 2.12%. The average somatotype was (2.56-3.73-2.77). Dietary patterns analysis showed variables nutritional habits, outstanding that 75% took one fruit each day, 18.75% of players consumed more than one fruit and only 18.75% ate more than one vegetable each day. These data show that many players may present inadequate nutritional habits.

Perroni et al.⁹ explored the differences in anthropometric and somatotype characteristics among categories, subcategories and playing position in Italian young soccer players (n=112). When we compared our somatotype results with the age categories

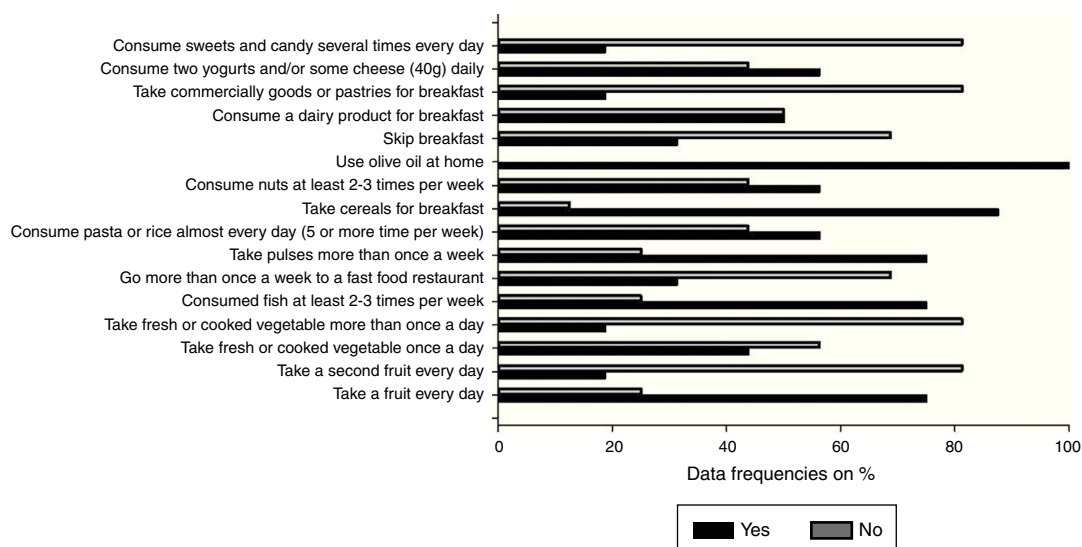


Fig. 1. Yes/no answers to sixteen Kidmed items. Values are exposed on percentage. Data for sixteen soccer players studied.

Table 2 Mean ± standard deviations of somatotype data, sum of skinfolds and body fat percentage.

Variable	Goalkeepers (n=2)	Defenders (n=3)	Fullbacks (n=2)	Midfielders (n=6)	Strikers (n=3)	Global average (n=16)
Somatotype						
Endomorphy	4.10 ± 0.00	2.00 ± 0.70	1.80 ± 0.70	2.55 ± 0.89	2.63 ± 0.23	2.56 ± 0.91
Mesomorphy	5.40 ± 0.42	3.36 ± 0.96	2.70 ± 0.14	3.71 ± 0.59	3.73 ± 0.25	3.73 ± 0.89
Ectomorphy	0.95 ± 0.07	3.83 ± 1.51	4.50 ± 1.13	2.51 ± 0.64	2.30 ± 0.26	2.77 ± 1.29
Σ 6 skinfolds (mm)	99.0 ± 5.1	53.4 ± 2.7	42.1 ± 2.0	63.4 ± 2.9	59.6 ± 2.4	62.6 ± 2.7
Σ 8 skinfolds (mm)	124.9 ± 5.2	72.8 ± 3.5	53.0 ± 2.1	80.8 ± 3.2	77.7 ± 2.6	80.7 ± 3.1
Body fat %	12.99 ± 0.75	8.20 ± 1.42	7.01 ± 0.94	9.25 ± 1.90	8.85 ± 1.06	9.16 ± 2.12

Data for sixteen soccer players. Sum of 6 skinfolds (triceps, subscapular, supraespinale, abdominal, thigh and calf skinfolds). Sum of 8 skinfolds (biceps, triceps, subscapular, supraespinale, supracrestal, abdominal, thigh and calf skinfolds).

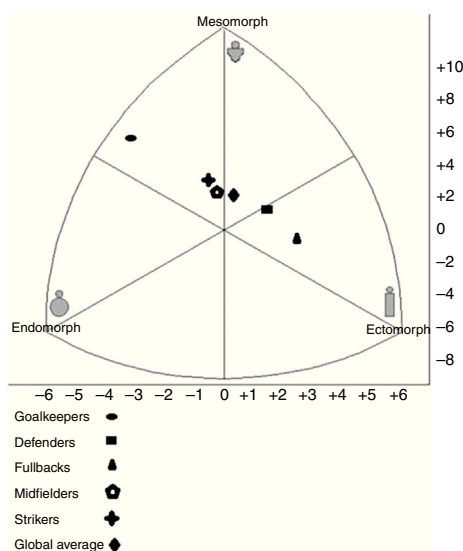


Fig. 2. Somatotype components (endomorph, mesomorph and ectomorph) representation. Somatoplots of goalkeepers, defenders, fullbacks, midfielders, strikers players and global average.

corresponding to the same age Allievi "A" (16 years) and "Juniore" (older than 17 years), it is possible to observed similar somatotype values components (endomorph, mesomorph and ectomorph). They found significant differences among goalkeepers and the other player's position in endomorphy in according with our discoveries where the goalkeepers endomorphy value was the highest. Significant differences were obtained among goalkeepers and with

defenders (all kind of defenders) and midfielders in ectomorph component. While we have observed ectomorphy values in agreement with this theory. Basing on these similarities, it seems that the results obtained in the current study would possibly obtain in a higher sample of players.

Another investigation⁸ analyzed changes in the anthropometric characteristics and somatotype in youth Macedonian soccer players. To evaluate body composition, they have used the Matiegka's formulas in contrast with our study where the Carter's equation has been used to determine fat percentage. This could explain the differences in fat percentage found in the previous study: players aged sixteen years (14.71 ± 1.47%), players aged seventeen years (14.64 ± 1.46%) and players aged eighteen years (14.38 ± 1.42%) compared with the fat percentage obtained in the present paper (9.16 ± 2.12%). Additionally, lower values in some skinfolds (biceps, triceps, thigh, subscapular, calf and abdominal) in sixteen, seventeen and eighteen players from this previous study in comparison with the results of data from athletes of this study. Another study¹⁰ determined seasonal variations in anthropometric data from Spanish professional soccer team (n=15). They recollected anthropometric data at the beginning of competitive season and at in the middle. In the second examination, these soccer players presented the sum of six skinfolds 52.9 ± 8.61 mm, a body fat percentage 8.2 ± 0.91% and a somatotype values: endomorphy (2.4 ± 0.52), mesomorphy (4.8 ± 0.88) and ectomorphy (2.3 ± 0.73). These values are lower than the results of the current study and indicate a better body composition. We speculate that these differences could be explained by the degree of sport professionalism due to in the previous research professional players were evaluated while we analyzed amateur players.

Another investigation¹⁹ evaluated anthropometric characteristics from Chilean professional soccer players ($n=406$). They observed differences in height, weight and fat mass in players from different positions and as result each player has his specific position in function of his body composition. Slightly lower values were observed in the sum of six skinfolds in this previous study in comparison with the data from the present study. However, it is probable that the professional level of these players could have influenced in these better results. Goalkeepers present significantly higher values for the sum of six skinfolds as this idea has been mentioned before in this paper. Additionally, a recent paper²⁰ described somatotype profiles of Chilean professional male soccer players ($n = 100$) (23 ± 4.4 years). As in the present study, goalkeepers showed the highest weigh. They also found that each position presented a different dispersion to the medium somatotype. This information must be taken in consideration in order to morphologic optimization in a specific position in the field.

To asses dietary habits in ninety elite women paddlers, they self-completed Kidmed questionnaire.¹² 85.56% of the paddlers took one fruit each day, 53.33% consumed a second fruit daily. 76.67% took vegetables once a day and 30% ate more than one ration a day. Any athlete analyzed went to a fast food restaurant. 90% of paddlers consumed dairy products for breakfast. While the answers to Kidmed questions in the current study are closer to another previous studies^{21–23} which analyzed Mediterranean diet adherence in youth general population. Possibly, dietary patterns of players evaluated in the present study are not completely adequate for athlete population because their answers are not similar to answers observed in athletes evaluated with the same method.¹⁴ Nutritional directions could be really useful to improve body composition and probably soccer performance.

The discoveries would be of interest to coaches and medical services of young soccer teams. Anthropometric measures and dietary patterns tests would be necessary in order to prescribe personalized training and diet plans in youth soccer players from a non-professional teams.

We admit that the study has limitations, the mean is that we cannot measure significant anthropometric differences in players position due to the sample size. Other limitations would be that we only have studied Spanish amateur male soccer players so consequently, we cannot extrapolate our results to all soccer players or team sports.

Body fat percentage, the sum of six skinfolds, the sum of eight skinfolds and somatotype results are in agreement with previous studies where youth non-professional soccer players were analyzed. Other studies have obtained lower values in body fat percentage or in the sum of six skinfolds due to they have evaluated professional soccer players. Anthropometric measures would be important to prescribed personalized diet and training plans.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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