ANTHROPOMETRICAL CHARACTERISTICS AND SOMATOTYPE OF YOUNG SOCCER PLAYERS AND THEIR COMPARISON WITH THE GENERAL POPULATION

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ABSTRACT: In soccer, most studies have been conducted on elite adult players and there is less information about young, non-elite players. The objectives of this project were twofold: to evaluate the changes in the anthropometric characteristics and the somatotype of soccer players across different ages and to compare these characteristics to those of the general population (Basque and U.S.A. standards).The study population was formed of 203 soccer players, aged 14 to 19 years. Height, weight, B.M.I., skinfolds, diameters and circumferences were measured in order to calculate the body composition and somatotype. Boys aged 14 and 15 were shorter and leaner than the remainder of players. From age 16 onwards there was no differences in the measurements, implying that the subjects attained adult stature at age 16. The trunk-to-limb-fat ratio increased across the age groups, as happens in the general population; however, in soccer players this was due to a decrease in limb fat rather than an increase in the truncal fat.Soccer players showed a mainly mesomorphic somatotype, with the exception of the 14 year-old individuals who presented a greater ectomorphy compared to the adult players.The comparison with the general population showed that soccer players were taller and heavier, though this may due to a selection process favoring boys with these characteristics. Young soccer players were taller and bigger than boys of the same age in the general population; this may be due to a selection process towards larger and stronger boys.

KEY WORDS: soccer, young, anthropometry, somatotype, growth, age

INTRODUCTION

Soccer is a complex sport. Apart from the psychology and the tactical intelligence of the player, his or her physiological characteristics play an essential role, particularly strength, speed, agility and the speed of reaction. These anaerobic features are in some way related to the height and the weight of the athletes, particularly in young individuals and, in recent years, there has been a tendency to recruit taller and heavier players [26]. Elite adult soccer players have an average height of 182-186 cm and a weight of 75-80 kg; these observations have been made in Danish [1], Italian [3] and German players [6].

Comparing results in younger players is not an easy task because there are large differences between the different age groups. Furthermore, differences in size have been observed between elite and non-elite groups.

Elite soccer players around 12 years of age are 154-155 cm tall, with a weight of 42-43 kg, whereas non-elite boys are slightly shorter (148-150 cm) and lighter (39-40 kg). At the age of 14, the height of elite players is 172-173 cm and the weight is 57-59 kg. For the non-elite players these measurements are 166 cm and 53 kg respectively [12,13]. Professional soccer players aged 18 are 177 cm tall and weigh 70-71 kg [5,20].

It is important to determine the body composition of athletes because the body components (bone, muscle and fat) are related to performance. Leg muscle strength is related to muscle size; in elite Canadian soccer players belonging to the under-16 and under-18 national selections, leg muscle strength was greater in the older group; however, when it was expressed as a ratio to body mass or to lean body mass, most of the difference disappeared [16]. Meanwhile, fat mass is the most significant negative factor related to performance (speed, power and endurance) in young soccer players [9].

Regarding somatotype, elite soccer players show a predominance of mesomorphy. Thus, adult elite soccer players have an average somatotype of 3-5-2.5 [23,29]. In younger players, mesomorphy is already the principal component [28], although ectomorphy is greater in children than in adults [17].

Most of the relevant studies have been based on elite or professional soccer players, and there is little research about young, non-elite soccer players. The participants of the present study were young

soccer players between 14 and 20 years of age, belonging to a non-professional soccer club, which is the largest club in the local area. This study had two principal objectives: the first was to describe the anthropometric differences between the non-elite soccer players in the different age groups; and the secondly was to compare the anthropometric measurements with those of the general population matched for age.

MATERIALS AND METHODS

Subjects. A total of 203 soccer players belonging to the Getxo Arenas Club (Bizkaia, Spain) participated in this study (mean age: 16.48 ± 2.63 years). The participants were divided into 6 groups: the 14, 15, 16, 17, 18 and 19 year-old groups, with mean ages of 14.60 ± 0.23 (n = 43), 15 ± 0.33 (n = 58), 16.48 ± 0.23 (n = 26), 17.45 ± 0.66 (n = 29), 18.49 ± 0.67 (n = 32) and 19.50 ± 0.80 (n = 15) years, respectively.

Measurements were taken in December; this is 4 months into the soccer season. Players aged 14 to 18 trained three times per week and the oldest team trained four times per week. For all the footballers, the training sessions lasted for about 90 minutes and they played one match a week. All participants came from the same urban area, and they were all Caucasian and of the same ethnic origin.

The protocol was approved by the Clinical Research Ethics Committee of Cruces Hospital (Bizkaia). All players and their parents or tutors were fully informed and gave their consent in writing. The measurements were performed according to the ethical standards of the Helsinki Declaration.

Anthropometry. Height was measured to the nearest 0.1 cm (Añó Sayol, Barcelona, Spain), body weight to the nearest 0.1 kg (Añó Sayol, SL, Barcelona, Spain). The Body Mass Index (B.M.I.) was calculated from height and body weight ($kg \cdot m^{-2}$).

Skinfold thickness (mm, to the nearest 0.1 mm) was obtained at six sites: triceps, subscapular, abdominal, suprailiac, thigh and lower leg, using a skinfold caliper (Harpenden, England).These measurements were analyzed individually and also as the sum of the six measurements (sum of skinfolds).

The amount of fat in the extremities (limb-fat) was calculated as the sum of the skinfolds of the extremities: triceps + thigh + lower leg. The amount of fat in the trunk (trunk-fat) was calculated from the sum of the subscapular, abdominal and suprailiac skinfolds. These values were used to define the distribution of the adipose tissue. We also analyzed the trunk-to-limb-fat ratio (limb fat/trunk fat), as has been performed in other studies [15,18].

The circumferences of the upper arm, thigh and lower leg (in cms, to the nearest 0.1 cm) were measured using a tape measuring (Lufkin, Germany). Four diameters (in cms) were obtained using a caliper (Harpenden, England): biepicondylar of the humerus (elbow), bistyloid of the wrist, biepycondilar of the femur (knee) and bimaleolar of the ankle.

All measurements were taken following the guidelines outlined by the ISAK (International Society for the Advancement of Kinanthropometry) by the same researcher, who holds an ISAK Level 2 accreditation.

Body composition and somatotype. The fat, bone and muscle components of the body were calculated, as weights (kg) and percentages, using the following formulae as it has been explained elsewhere [11]: Faulkner's formula was used to estimate the fat percentage: fat percentage = the sum of four skinfolds (tricipital + subscapular + suprailiac + abdominal)•0.153+5.783.

Fat mass (kg) = fat percentage•body weight•100^{-1}

The bone weight was calculated using Rocha's equation: bone weight (kg) = 3.02•(height^2•bistyloid diameter•biepicondylar diameter of femur•400)$^{0.712}$, where the height and diameters are measured in meters.

Bone percentage (%) = bone weight•100•body weight^{-1}

Residual weight (kg) = total weight•24.1•100^{-1}.

The muscle weight (kg) was estimated using Matiegka's formula: muscle weight = total weight-(fat weight + bone weight + residual weight).

Muscle percentage (%) = muscle weight•100•body weight^{-1}

The endomorphy, mesomorphy and ectomorphy components of the somatotype were also calculated. Traditionally, the three-number

TABLE I. DIFFERENCES IN WEIGHT (kg), HEIGHT (cm) AND B.M.I. BETWEEN SOCCER PLAYERS BY AGE GROUP AND COMPARISON WITH THE GENERAL POPULATION [22]. THE VALUES ARE SHOWN AS THE MEAN ± STANDARD DEVIATION.

	Age group (years)					
	14	15	16	17	18	19
	Soccer players					
Weight	59.24±8.5[a]*	66.93±9.2[b]*	73.21±8.9*	74.36±9.3*	72.75±8.0	73.89±5.6
Height	169.78±5.3[a]*	174.56±7.0[b]*	177.21±7.3*	178.03±6.8*	176.19±6.0	179.30±5.2
B.M.I.	20.47±1.9[a]	21.93±2.5[c]	22.92±1.4	23.09±1.7	23.37±1.5	22.96±1.2
	General Population					
Weight	56.95±10.2	60.31±9.2	65.41±8.7	70.23±10.3	-	-
Height	165.53±8.2	168.17±7.2	172.34±6.4	174.23±6.2	-	-
B.M.I.	20.66±3.0	21.57±3.2	21.99±2.5	23.13±3.2	-	-

B.M.I. = Body mass index ($kg \cdot m^{-2}$)
Differences between soccer players: [a] - 14 years vs 15, 16, 17, 18 and 19 year-old groups, $p<0.001$, [b] - 15 years vs 17, 18 and 19 years, $p<0.01$
[c] - 15 years vs 18 years, $p<0.05$
Comparison between the soccer players and the general population: *$p<0.05$

somatotype rating is plotted on a two-dimensional somatochart using X and Y coordinates derived from the rating. The coordinates are calculated as follows:

X = ectomorphy - endomorphy

Y = 2 x mesomorphy - (endomorphy + ectomorphy)

General population. The height, weight, B.M.I., two circumferences (arm and leg), two diameters (elbow and knee) and the three components of the somatotype of the soccer players were compared to the values in children of the same age (14-17 years old), living in a similar urban area [25].

The height, weight and B.M.I. were also compared to the U.S.A. standards [30] as has been performed by other authors [17].

Statistical Methods. The data were analyzed using the SPSS® Version 11.5 statistical package. Individual age groups were evaluated using a one-way analysis of the variance (ANOVA). Scheffé's test was used as a post-hoc test when equal variances were assumed and the Games-Howell test when equal variances could not be assumed.

RESULTS

DIFFERENCES BETWEEN SOCCER PLAYERS

Anthropometry. Players aged 14 years were the shorter and lighter than all the other groups ($p<0.001$). Their B.M.I. was also the lowest (Table 1). The weight of the 15 year-old group was lower than the 17, 18 and the 19 year-old groups ($p<0.01$) and their B.M.I. was lower than the 18 year-old group ($p<0.05$).

All the circumferences and the diameters of the wrist, elbow and ankle were significantly smaller in the 14 year-old group compared to all the other age groups (Table 2). The circumference of the thigh was also significantly smaller in the 15 year-old group compared to the 17, the 18 and the 19 year-old groups ($p<0.01$).

The subscapular skinfold was smaller in the 14 year-old group compared to the 15 and 19 year-old group, $p<0.05$ (Table 3). Apart from that specific site, the soccer players of the 19 year-old group had the smallest skinfold thicknesses; this was statistically significant compared to the 14, 15 and 16 year-old groups at the tricipital and lower leg sites ($p<0.05$).

The limb and trunk fat showed an inverse pattern: the limb fat was lowest in the 19 year-old group, $p<0.05$ (Table 4), whereas the trunk fat was lowest in the boys aged 14 years and increased with age. Boys aged 16 had a larger skinfold sum compared to the older soccer players ($p<0.05$).

The trunk-to-limb-fat ratio was the lowest in the 14 year-old group ($p<0.05$) and was the highest in the 19 year-old group (Table 4).

Body composition. Looking at the weight of the body components in Fig. 1, it may be observed that players of 14 years of age had the lowest weight for each component ($p<0.01$). The 15 year-old boys had a lower muscle and residual weight compared to the 17, 18 and 19 year-old groups ($p<0.01$).

Regarding the percentages of the different components of the body, boys aged 14 had the highest bone percentages compared to all the other groups ($p<0.05$). Fig. 2 shows that the 15 year-old group also had significantly higher bone percentages compared to older boys (aged 16, 17 and 18). Soccer players aged 14 had the lowest muscle percentage of all age groups. The fat percentage did not change significantly across the different age groups.

Somatotype. The ectomorphy, mesomorphy and endomorphy scores are shown in Table 5. All the age groups had predominance of mesomorphy. The youngest players had the highest ectomorphy scores. We can also represent these data and the data from the general population on the somatochart (Fig. 3).

TABLE 2. CIRCUMFERENCES AND DIAMETERS (MEAN ± STANDARD DEVIATION) IN SOCCER PLAYERS BY AGE GROUP AND IN THE GENERAL POPULATION [22].

		Age group (years)					
		14	15	16	17	18	19
		Soccer players					
Circumference (cm)	arm	27.33±2.5[a]	29.22±2.7	30.32±2.0	30.83±2.2	30.57±1.6	30.8±1.6
	thigh	50.66±4.0[a]	54.05±4.4[b]	55.28±2.7	57.38±3.3	56.61±2.3	56.89±2.2
	leg	35.23±2.3[a]*	36.56±2.5*	37.60±3.1*	38.09±2.4*	37.77±2.3	37.57±1.7
Diameters (cm)	wrist	5.36±0.4[a]	5.57±0.3	5.58±0.3	5.59±0.3	5.56±0.3	5.56±0.3
	elbow	6.59±0.4[a]*	6.78±0.3*	6.84±0.3	6.88±0.5*	6.88±0.4	6.92±0.5
	knee	9.59±0.4	9.85±0.4	9.85±0.5*	9.86±0.6*	9.80±0.4	9.80±0.3
	ankle	7.29±0.5[a]	7.53±0.4	7.61±0.4	7.60±0.4	7.25±0.3	7.53±0.4
		General Population					
Circumference (cm)	arm	26.88±3.0	27.97±2.6	28.66±2.6	30.53±2.3	-	-
	leg	34.60±2.4	35.70±2.9	36.57±2.5	37.29±2.7	-	-
Diameters (cm)	elbow	6.36±0.5	6.52±0.5	6.73±0.5	6.68±0.4	-	-
	knee	9.67±0.9	9.79±0.8	10.08±0.6	10.27±0.8	-	-

Differences between soccer players: [a] - 14 years vs 15, 16, 17, 18 and 19 year-old groups, circumferences $p<0.001$ and diameters $p<0.05$, [b] - 15 years vs 17, 18 and 19 years, $p<0.01$

Comparison between the soccer players and the general population: *$p<0.05$

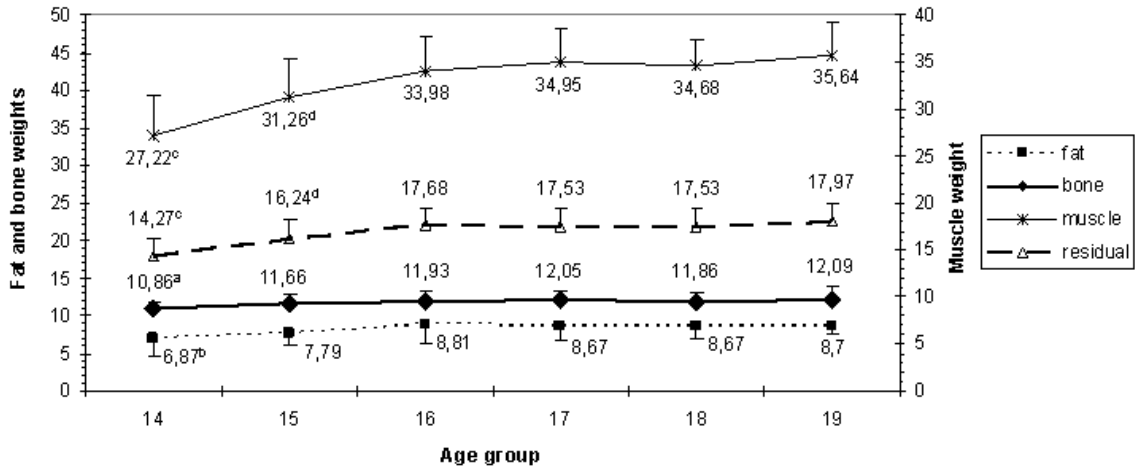

FIG. 1. BODY COMPOSITION OF SOCCER PLAYERS BY AGE. THE MEANS AND STANDARD DEVIATIONS OF THE FAT, BONE AND MUSCLE WEIGHTS (kg) ARE SHOWN.

a - 14 years vs 16 and 17 years, $p<0.05$, b - 14 years vs 15, 17 and 18 years, $p<0.01$, c - 14 vs 16, 17, 18 and 19 years, $p<0.001$, d - 15 vs 14, 16, 17, 18 and 19 years, $p<0.01$

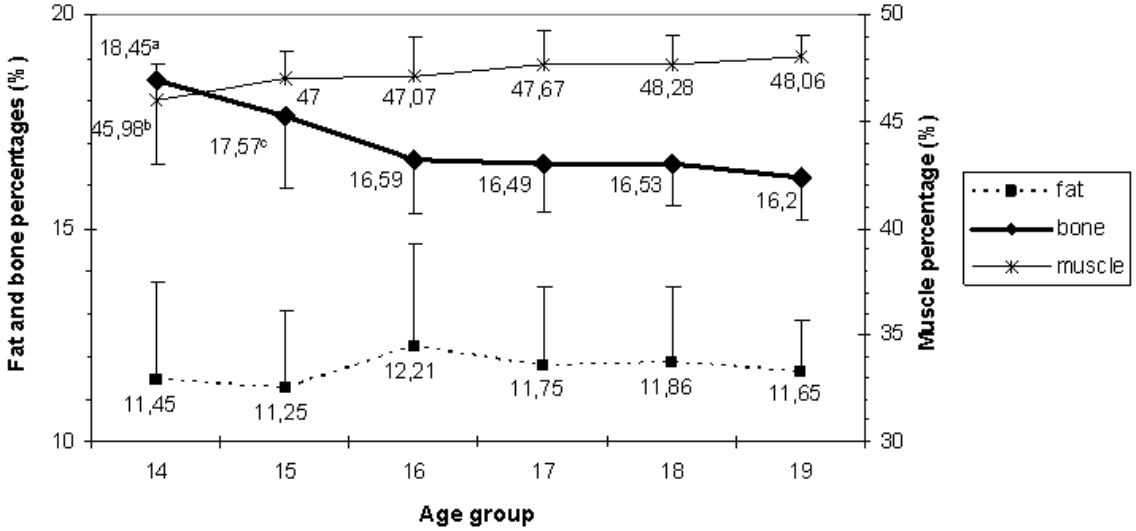

FIG. 2. BODY COMPOSITION OF SOCCER PLAYERS OF DIFFERENT AGES. THE MEAN AND STANDARD DEVIATION OF THE FAT, BONE AND MUSCLE PERCENTAGES ARE SHOWN.

a - 14 years vs 16, 17, 18 and 19 years, $p<0.05$, b - 14 years vs 15, 17, 18 and 19 years, $p=0.01$, c - 15 years vs 16, 17, 18 and 19 years, $p<0.05$

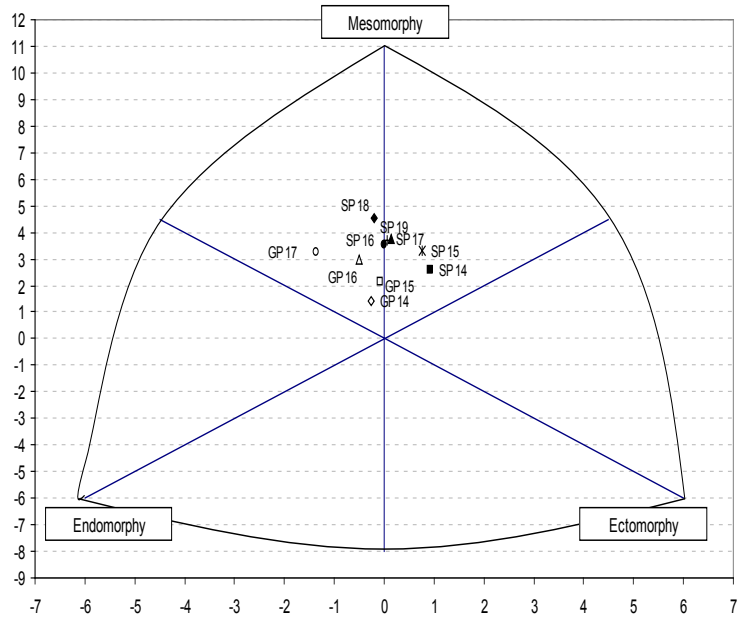

FIG. 3. SOMATOCHART OF THE SOCCER PLAYERS AND THE GENERAL POPULATION [25].

SP = soccer players, GP= general population. Followed by the number corresponding to the age group (i.e. SP 14 = soccer players aged 14).

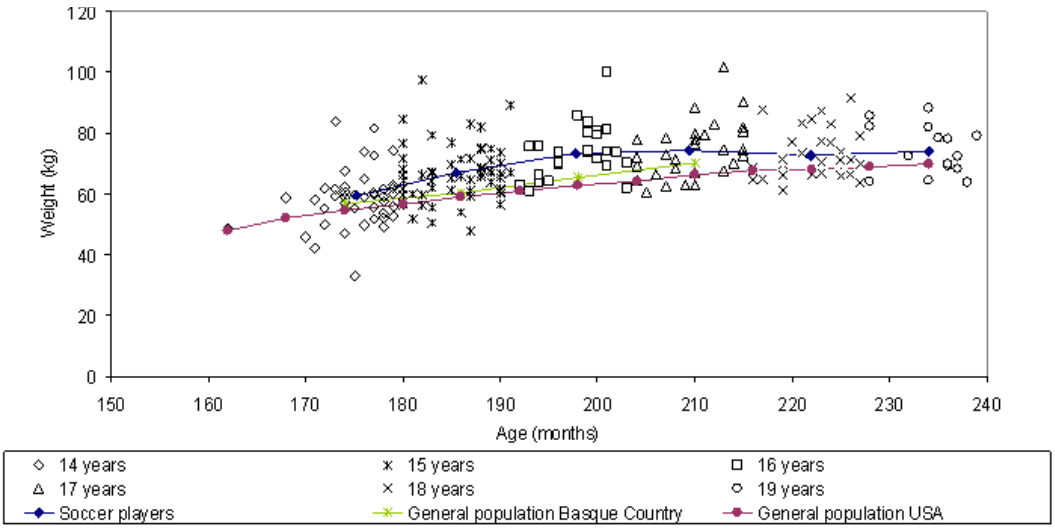

FIG. 4. WEIGHT (kg) OF THE SOCCER PLAYERS AND THE GENERAL POPULATIONS IN THE BASQUE COUNTRY [25] AND THE U.S.A. [30]. Age is shown in months as a continuous variable

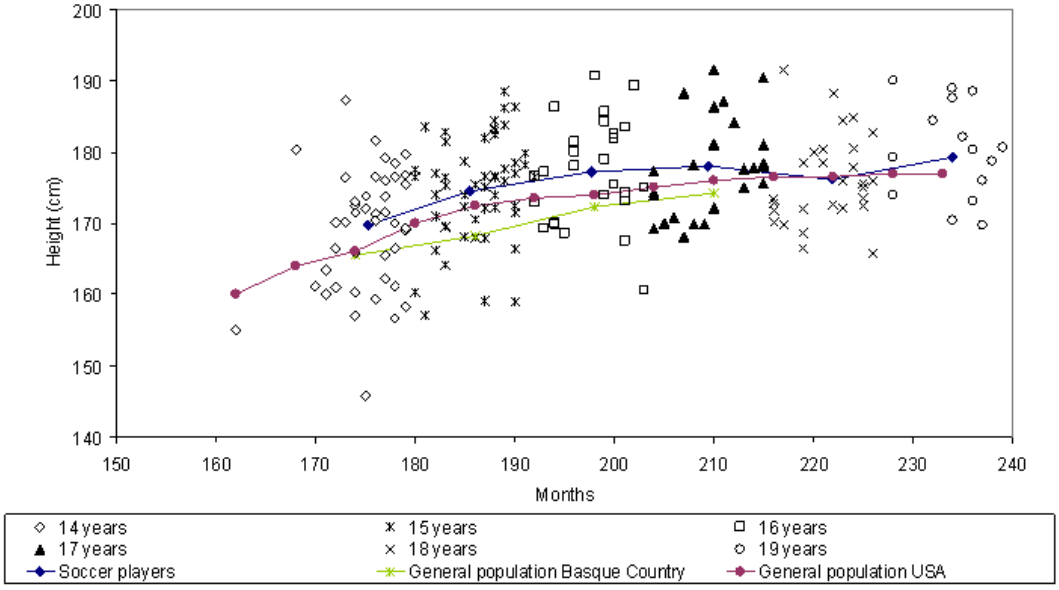

FIG. 5. HEIGHT (cm) OF THE SOCCER PLAYERS AND THE GENERAL POPULATIONS OF THE BASQUE COUNTRY [25] AND THE U.S.A. [30]. Age is shown in months as a continuous variable

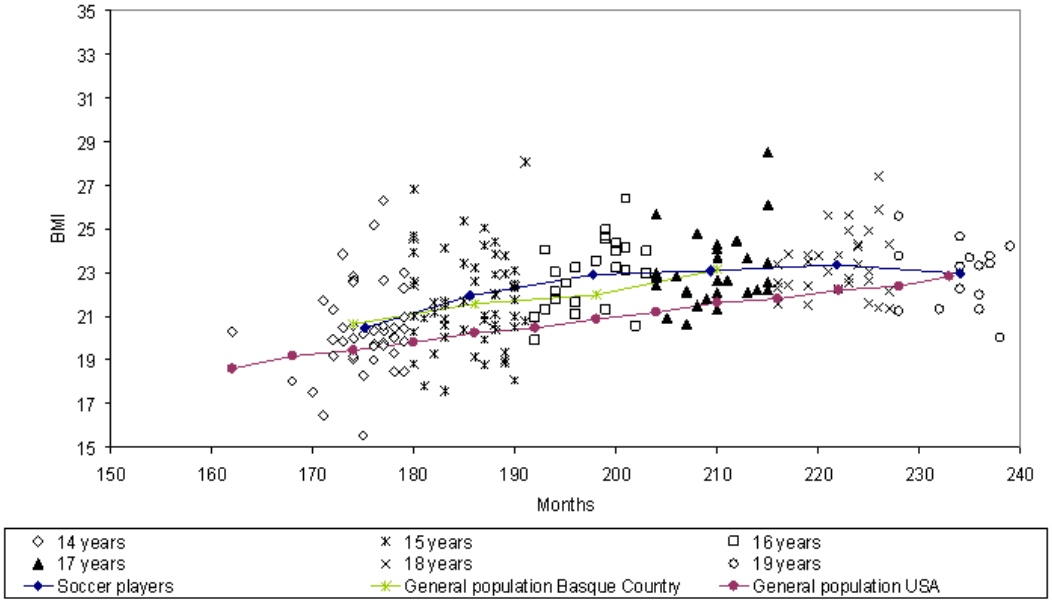

FIG. 6. B.M.I. ($kg \cdot m^{-2}$) OF THE SOCCER PLAYERS AND THE GENERAL POPULATIONS OF THE BASQUE COUNTRY [25] AND THE U.S.A. [30]. Age is shown in months as a continuous variable

TABLE 3. INDIVIDUAL SKINFOLDS (mm) (MEAN ± STANDARD DEVIATION) OF SIX SITES IN SOCCER PLAYERS BY AGE GROUP AND THEIR COMPARISON WITH THE GENERAL POPULATION [22].

	Age group (years)					
	14	15	16	17	18	19
	Soccer players					
Tricipital	10.39±4.0*	9.34±2.8*	10.94±3.8*	10.94±3.8*	10.10±3.1	8.66±2.4[b]
Subscapular	7.45±2.2[a]*	8.12±2.5*	9.08±3.2*	9.08±3.2*	9.12±2.6	8.57±1.5
Abdominal	12.40±6.8	12.05±5.1	15.34±6.9	13.02±5.6	13.92±5.6	11.67±3.8
Suprailiac	6.87±2.9*	7.05±2.6*	8.61±3.5*	8.61±3.5*	7.26±1.5	6.52±1.7
Thigh	14.79±6.7	13.91±4.0	15.43±6.2	15.43±6.2	14.95±5.1	12.71±4.7
Leg	9.97±4.4	8.59±2.4	9.13±3.4	9.13±3.4	7.77±1.9	6.55±1.5[c]
	General Population					
Tricipital	12.31±1.6	12.18±1.7	10.93±1.6	12.41±1.5	-	-
Subscapular	11.34±1.3	12.34±1.5	12.98±1.2	12.78±1.9	-	-
Suprailiac	9.70±1.8	9.00±1.9	9.62±1.8	12.29±1.8	-	-

Differences between soccer players: [a] - 14 years vs 15 and 19 years, $p<0.05$, [b] - 19 years vs 16 years, $p<0.05$, [c] - 19 years vs 14, 15 and 16 years, $p<0.05$,
Comparison between the soccer players and the general population: *$p<0.05$

COMPARISON TO THE GENERAL POPULATION

The data that we have used for the comparison were measured in boys aged 14 to 17 from a similar Basque urban area [25]. We found that soccer players were taller and heavier than their counterparts in the general population (Table 1). However, there were no differences in the B.M.I.

TABLE 4. INDIVIDUAL SKINFOLDS (mm) (MEAN ± STANDARD DEVIATION) AT SIX SITES IN SOCCER PLAYERS BY AGE GROUP. THE FINAL COLUMN SHOWS THE TRUNK-TO-LIMB-FAT RATIO (TRUNK-FAT/LIMB-FAT).

Age group	Limb fat	Trunk fat	Sum of skinfolds	Trunk/Limb fat ratio
14	35.19±14.21	26.70±11.3	61.91±24.7	0.7619±0.15[a]
15	31.86±8.39	27.32±9.68	59.06±17.05	0.8673±0.16
16	35.66±12.8	33.04±12.83	74.01±27.24[b]	0.9341±0.17
17	32.52±9.03	31.15±10.59	64.06±17.41	0.9678±0.23
18	32.82±7.84	29.68±6.33	62.50±12.33	0.9424±0.23
19	27.79±6.57[c]	29.67±7.84	54.47±9.89	1.0153±0.21

Trunk-fat= subscapular + abdominal + suprailiac, Limb-fat= tricipital + thigh + lower leg
[a] - 14 years vs 16, 17 and 19 years, $p<0.05$
[b] - 16 years vs 19 years, $p<0.05$
[c] - 19 years vs 14 and 16 years, $p<0.05$.

All soccer player groups had larger elbow diameters compared to the general population (Table 2). Players aged 16 and 17 also had larger knee diameters. The circumference of the calf was also larger in the soccer players of 14, 15, 16 and 17 years of age.

The data from the general population included the tricipital, suprascapular and suprailiac skinfolds. The values of these three measurements were lower in the soccer players of all age groups (Table 3).

With regard to the somatotype, the endomorphy score was lower in the players compared to the general population (Table 5), with all the differences being statistically significant. From the somatochart, it may also be observed that soccer players tend to have higher mesomorphy and ectomorphy scores whereas boys from the general population have higher endomorphy scores (Fig. 3).

We compared the data from this group of soccer players to data drawn from the reports of a larger general population in the U.S.A. [30], as has been performed by other authors [17]. As shown in Fig. 4, 72%, 84%, 91%, 86%, 68% and 53% respectively of the 14, 15, 16, 17, 18 and 19 year-old soccer players were above the mean weight of the general population in the U.S.A., and

TABLE 5. SCORES (MEAN ± STANDARD DEVIATION) OF THE THREE COMPONENTS OF THE SOMATOTYPE OF SOCCER PLAYERS BY AGE AND THE SCORES FOR THE GENERAL POPULATION [22].

	Age group (years)					
	14	15	16	17	18	19
	Soccer players					
Endomorphy	2.46±0.96*	2.30±0.74*	2.64±0.97*	2.47±0.72*	2.56±0.50	2.38±0.51
Mesomorphy	4.20±0.82	4.34±1.11	4.40±1.01	4.41±0.98	4.72±0.80	4.26±0.85
Ectomorphy	3.38±1.07[a]	3.06±1.14	2.64±0.9*	2.61±0.76	2.36±0.76	2.44±0.64
	General Population					
Endomorphy	3.51±1.69	3.22±1.40	3.35±1.57	3.90±1.70	-	-
Mesomorphy	4.08±1.27	4.26±1.32	4.59±1.17	4.84±1.49	-	-
Ectomorphy	3.24±1.36	3.14±1.25	2.84±1.16	2.53±1.21	-	-

Differences between soccer players:
[a] - 14 years vs 16, 17, 18 and 19 years, $p<0.05$,
Comparison between the soccer players and the general population: *$p<0.05$

62%, 70%, 61%, 58%, 50% and 68% of the same age groups were above the mean height of the general population (Fig. 5). For the B.M.I., these percentages were 72%, 79%, 92%, 86%, 78% and 66%, respectively.

DISCUSSION

The study populations in the papers published in the field of anthropometry and somatotype in soccer players are very often drawn from elite groups of players; however, the majority of young individuals in this and other sports are non-elite players. A very interesting aspect of the present study is that the measurements were taken in a large group of soccer players from a non-elite but high-level football club; these results may serve as a template for comparison with other young players of the same level.

We observed that players aged 14, compared to all other age groups (15 years to 19 years), were smaller regarding height, weight, B.M.I, the wrist, elbow and ankle diameters, and the arm, thigh and lower leg circumferences.

The 15 year-old footballers had smaller measurements than the soccer players aged 17, 18 and 19. We may therefore conclude that boys aged 14 and 15 have not finished their growth process. From age 16 onwards, the progression of the growth in height, for example, decreases, suggesting that these soccer players have reached the height, weight, diameters and circumferences of adult soccer players. This pattern of growth is similar to the growth of boys in the general population [24].

Nonetheless, when we compared soccer players to boys of the Basque general population [25], we observed that active boys were bigger taller and had larger diameters. They were also heavier and taller than the U.S.A. standards [30]. Larger measurements in soccer players compared to the general population have also been observed by other authors [17].

Some studies suggest an increase in stature with regular physical activity [14,21]; however, it should be noted that the differences observed were relatively small and the selection of subjects and their maturity status at the time of training or at the time of making the comparisons were not controlled.

Furthermore, many studies have revealed that physical activity does not affect body measurements, growth-velocity, bone maturation [2,7,19] or adult height [19].

These selected boys may be bigger due to an early maturation process and/or genetic predisposition. Moreover, chronological age within the same year of birth has been observed to be an important factor [4]. In this respect, approximately 70% of all the players participating in the present study had been born in the first half of the year. Trainers and coaches may therefore be showing a preference for larger boys due to the advantage of their physique; this is logical, as larger boys are faster and stronger, both of which are important characteristics in certain sports. As a matter of fact, around the time of puberty, parameters associated with physical maturity such as height and size are important to determine the success of a soccer player [8]. However, the implication of this general idea is twofold:

1.- It should be kept in mind that the aim of the training process at young ages is to learn the technique, tactics and rules of the sport and to improve the physical condition of the player. The main objective should be the promotion of equal opportunities for all and not always winning the matches or leagues.

2.- If the aim of a particular soccer club is to select talented young boys to get them into the elite older team, they should be aware that boys who are taller, heavier, faster and stronger at young ages, who are described as talented, may not show such a difference in talent when their peers catch up on growth.

The amount of fat in the body is important from the physiological point of view of exercise, as higher fat percentages correlate with a poorer physical performance [10]. In this respect, the average fat percentages of the soccer players was appropriate for their level and age, which is around 10-12% [26]; however, the individual measures should be taken into account for the day-to-day work and training.

The fat distribution is also an interesting parameter to consider with regard to growth and the fat mass. Soccer players aged 16 had the greatest fat mass but, in the general population, the subscapular and the abdominal skinfolds have been found to be larger during the adolescence [18].

During puberty and adolescence, the limb fat decreases while trunk fat increases until adulthood [18,24]. The soccer players in the present study also follow this tendency up to the age of 17, after which both the limb fat and the trunk fat show a decline. Calculation of the trunk-fat-to-limb-fat ratio thus showed an increased with age as it does in the general population [18,28]. In the general population, this is caused by an increase in the trunk fat with age whilst, in the soccer players, this was caused by a decrease in the limb fat, particularly in the lower limbs, which could be due to their training programs and the matches they play.

Regarding the somatotype, the major component of these soccer players was mesomorphy. In this, as in many sports, speed, power, strength and velocity are essential features, and mesomorphy has been also observed as the major component of somatotype in elite players [22]. The 14 year-old group had the highest ectomorphy of all age groups. This higher ectomorphy is due to a lower weight with respect to height. This finding has been also been reported in the general population [25] and in young soccer players [28].

When we compared the somatotype of soccer players with that of the general population, the most striking difference was in the endomorphy, which is a correlate for the amount of fat. Soccer players of all age groups had lower endomorphy scores than the general population. This is an important issue nowadays due to the cause-effect relationship between the lack of physical activity and chronic diseases such as obesity and the metabolic syndrome that has been observed in many research studies [27].

CONCLUSIONS

In conclusion, young soccer players were taller and bigger than boys of the same age in the general population, though this may be due to a selection process towards larger and stronger boys. This should be taken into account by the technical staff of the soccer teams; they should not necessarily exclude smaller boys as these latter individuals may have a late maturation. On the other hand soccer players were leaner, had smaller amount of fat and more muscle; this may be due to the effect of regular training. This is another important aspect as one of the major current health issues is obesity and its related disorders; a means to fight obesity is an adequate nutrition and physical activity.

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