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Original scientific paper

DIFFERENCES IN SOMATOTYPE COMPONENTS BETWEEN YOUNG FOOTBALL PLAYERS AND NON-ATHLETES AGED 14–18 YEARS

Behar MALIQI, Liridon BEKOLLI, Arsim QIRIQI, Naser RASHITI, Labinot RAMADANI

[1] University of Prishtina, Faculty of Physical Education and Sports, Kosov
Corresponding author: liridon.bekolli@uni-pr.edu

Abstract

Somatotype is an important indicator of body morphological structure and its functional adaptation to specific physical demands. The developmental period between 14 and 18 years represents a critical phase characterized by significant changes in body composition, making this age range particularly relevant for comparative research among adolescents with different lifestyles. The aim of this study was to determine statistically significant differences in somatotype components—endomorphism, mesomorphism, and ectomorphism—between young football players and their non-athletic peers aged 14 to 18 years. The study was conducted on a total sample of 400 participants, divided into two equal groups: 200 young football players and 200 students not involved in organized sports activities. For each age group (14–18 years), 40 participants from both groups were included. Anthropometric measurements were performed according to a standardized protocol, and somatotype components were calculated using the Carter and Heath (1990) method. Statistical analysis was carried out using Student's t-test for independent samples, following prior verification of data normality with the Kolmogorov–Smirnov test. The results indicated that football players exhibited significantly lower endomorphism values compared to non-athletes across all age categories ($p < 0.01$), suggesting a lower percentage of body fat. Significantly higher mesomorphism values among football players were observed from the age of 16 onwards ($p < 0.01$), reflecting increased muscle mass associated with systematic training and sports maturation. Ectomorphism demonstrated variable differences, with football players showing higher values at ages 14, 15, and 18, which may be related to sports selection processes and the functional demands of football. These findings confirm the hypothesis that organized sports participation has a significant impact on the morphological development of adolescents and highlight the somatotype profile as an important basis for the selection and guidance of young athletes.

Keywords: somatotype, morphological characteristics, young football players

Introduction

In modern sports science, increasing attention is given to morphological characteristics that can directly influence sports performance, adaptation to the training process, and the selection of young athletes. One of the most widely used methodological approaches for assessing morphological characteristics is somatotyping, that is, the classification of body structure according to three basic components: endomorphism (relative body fatness), mesomorphism (muscular and skeletal development), and ectomorphism (linearity of the body) (Carter & Heath, 1990). Somatotype represents not only a description of external body appearance but also carries important functional significance related to energy metabolism, physiological efficiency, and motor abilities (Beunen & Malina, 1995). Research indicates that different sports favor specific somatotype profiles. Football, as an intermittent aerobic–anaerobic sport, requires an optimal balance between pronounced mesomorphism and low endomorphism

(Malina et al., 2004). Such morphological profiles contribute to enhanced agility, explosiveness, and endurance, particularly among young players during critical developmental stages. A study conducted in Kosovo examined differences in Body Mass Index (BMI) and aerobic capacity between midfield and forward football players. The results revealed significant differences in active BMI and aerobic performance, suggesting that positional roles are associated with distinct morphological and physiological profiles. These findings highlight the importance of position-specific training and player development strategies (Heta, G., Rashiti, N., et al., 2020). The developmental period between 14 and 18 years is characterized by substantial biological and hormonal changes that significantly affect body structure and composition. In this context, it is essential to examine how organized sports participation influences somatotype components in adolescents compared to their peers who are not engaged in regular sports activities. Previous studies have consistently shown that football players tend to exhibit lower endomorphism and higher mesomorphism, particularly in late adolescence, as a result of long-term training and sport-specific selection processes (Rogol et al., 2000). Considering these factors, there is a clear need for a systematic comparative analysis of somatotype components in young football players and non-athletes across different stages of adolescent development. Therefore, the aim of this study is to determine statistically significant differences in somatotype components—endomorphism, mesomorphism, and ectomorphism—between young football players and non-athletes aged 14 to 18 years.

Methods

Sample of Respondents

The study was conducted on a total sample of 400 participants, divided into two main groups: athletes (young football players) and non-athletes (students). The athlete group consisted of 200 young football players aged 14 to 18 years who regularly trained and competed in clubs participating in the First Football League of the Republic of Kosovo. The non-athlete group consisted of 200 students of the same chronological age (14–18 years) who were not involved in any organized sports activities and represented the general population of students attending regular primary and secondary education. For each age category (14 to 18 years), 40 participants were included in each group, ensuring a balanced and comparable sample structure. This distribution provided a solid basis for comparing somatotype characteristics according to age and level of sports participation.

Protocols and Equipment

The study was conducted at the National Center for Sports Medicine (NCSM) in Pristina, a leading national institution with professional and technical expertise in monitoring the health status and functional capacities of registered athletes in the Republic of Kosovo. The center is equipped with modern diagnostic and testing equipment, staffed by qualified medical and technical personnel, and has extensive experience in conducting sports medical assessments for both youth and adult athletes. All measurements were performed by highly qualified, trained, and experienced technicians. Body height and body mass were measured using a stadiometer (Seca, Leicester, United Kingdom) and an electronic scale (HD-351, Tanita, Illinois, USA), respectively. Skinfold thicknesses were measured with a John Bull caliper, circumferences with a standard flexible measuring tape, and bone diameters with a sliding caliper (GPMc). In addition to body height and mass, the following anthropometric measurements were recorded: two diameters (elbow and knee), two circumferences (upper arm and lower leg), and four skinfolds (triceps, suprailiac, subscapular, and lower leg). Based on these anthropometric

measurements, somatotype components—endomorphism, mesomorphism, and ectomorphism—were calculated according to the method of Carter and Heath (1990), using the Somatotype V.1.2.5 software.

Statistical Data Processing

Descriptive and inferential statistics were used to process and analyze the data. The basic statistical analysis included calculations of the arithmetic mean (M) and standard deviation (SD) to describe the central tendencies and the variability of the examined variables. To assess the statistical significance of differences between the two independent groups (football players and non-athletes), Student's t-test for independent samples was applied. Prior to conducting the t-test, the assumption of normal data distribution was verified using the Kolmogorov–Smirnov test. All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences), version 26.0, with the significance level set at $p < 0.05$.

Results

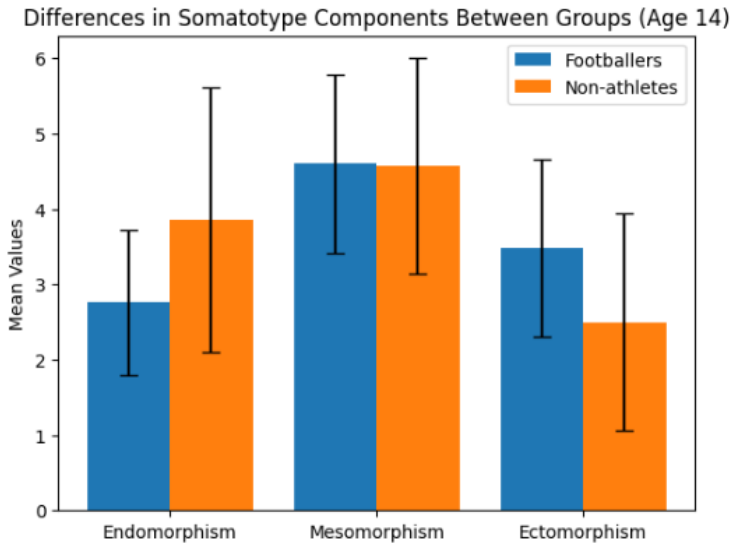
To determine statistically significant differences in somatotype components (endomorphism, mesomorphism, and ectomorphism) between young football players and their non-athletic peers, Student's t-test for independent samples was applied. This test allows for the assessment of differences between the means of two independent groups and is valid under the assumptions of normal data distribution and homogeneity of variances, both of which were verified prior to analysis. The analysis (Table 1) revealed a statistically significant difference in endomorphism. Non-athletes exhibited higher mean values (M = 3.86; SD = 1.76) compared to football players (M = 2.76; SD = 0.96), with t(60.42) = –3.47 and p = 0.001. This indicates that young football players have a significantly lower level of body fat, which is consistent with their higher levels of physical activity and participation in sports training that promotes adipose tissue reduction.
For the mesomorphism component, no statistically significant difference was observed between the groups (football players: M = 4.60; SD = 1.19; non-athletes: M = 4.57; SD = 1.43), with t(75.50) = 0.10; p = 0.924. This suggests similar levels of muscle development in both groups, which may be influenced by individual variations in biological maturity and hormonal status that can mask the effects of sports training on mesomorphism in this age range.
In contrast, a statistically significant difference was found in ectomorphism. Football players displayed higher values (M = 3.48; SD = 1.18) compared to non-athletes (M = 2.50; SD = 1.44), with t(75.11) = 3.33; p = 0.001. This indicates that football players tend to have a more linear body structure and lower body mass relative to their height, likely due to the high energy demands and morphological selection specific to football.
In summary, the results indicate that organized sports participation, specifically football, has a significant impact on adolescent body structure. This is primarily manifested through reduced endomorphic characteristics and enhanced ectomorphic traits. Such somatotype profiles align with the functional demands of football and may serve as valuable criteria for athlete selection and the planning of training programs.

Table 1. Differences in Somatotype Components Between Young Football Players and Non-Athletes Aged 14 Years

Variables	Footballers		Non-athletes		t	df	Sig.
	Mean	SD	Mean	SD			
Endomorphism	2.76	0.96	3.86	1.76	-3.47	60.42	**0.001**
Mesomorphism	4.60	1.19	4.57	1.43	0.10	75.50	0.924
Ectomorphism	3.48	1.18	2.50	1.44	3.33	75.11	**0.001**

Consistent with the analysis for 14-year-old participants, significant differences in somatotype components were also observed among 15-year-old respondents. The difference in endomorphism was particularly pronounced, with football players showing significantly lower values (M = 2.54; SD = 0.78) compared to non-athletes (M = 3.56; SD = 1.77), $t(53.72) = -3.32$; $p = 0.002$. These results confirm the previously observed pattern among 14-year-olds, indicating that regular participation in sports activities is associated with reduced body fat in adolescents. Regarding mesomorphism, no statistically significant difference was found between the two groups (football players: M = 4.18; SD = 1.05; non-athletes: M = 3.84; SD = 1.47), $t(70.44) = 1.17$; $p = 0.244$. Although athletes showed a slight increase in mesomorphism, these values suggest that muscle mass in this age group does not differ significantly in relation to sports activity, possibly due to individual variations in biological maturity or the incomplete manifestation of training effects at this stage. More pronounced differences were observed in ectomorphism. Football players exhibited significantly higher values (M = 3.59; SD = 1.02) compared to their non-athletic peers (M = 2.81; SD = 1.51), $t(68.50) = 2.69$; $p = 0.009$. This finding indicates that young football players tend to develop a body structure characterized by increased linearity and lower adipose tissue accumulation, consistent with the specific energetic and morpho-functional demands of football.

Overall, these results highlight the continuity of somatotype differences favoring athletes and demonstrate that the effects of systematic sports participation on body structure are evident and consolidated by age 15. The influence of sports activity manifests primarily through reduced endomorphic traits and enhanced ectomorphic characteristics, which has important implications for athlete selection, training design, and monitoring of adolescent development.



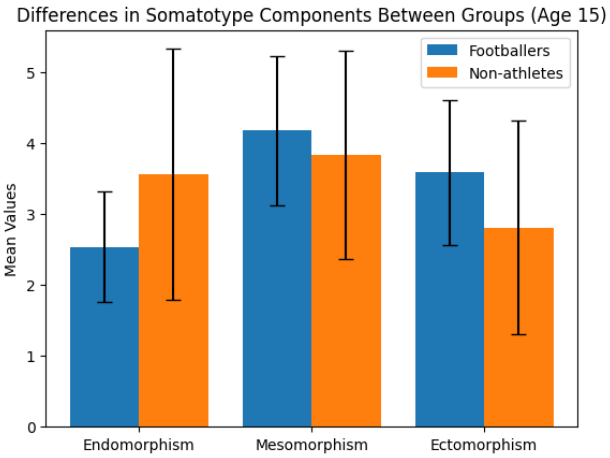
The results indicate statistically significant differences in somatotype components between football players and non-athletes aged 14. Non-athletes exhibit higher values of endomorphism, suggesting a greater level of body fat, whereas footballers show higher values of ectomorphism, reflecting a leaner and more linear physique. No significant differences were observed in mesomorphism, indicating a similar level of muscular development between the two groups.

Table 2. Differences in Somatotype Components Between Young Football Players and Non-Athletes Aged 15 Years

Variables	Footballers		Non-athletes		t	df	Sig.
	Mean	SD	Mean	SD			
Endomorphism	2.54	0.78	3.56	1.77	-3.32	53.72	**0.002**
Mesomorphism	4.18	1.05	3.84	1.47	1.17	70.44	0.244
Ectomorphism	3.59	1.02	2.81	1.51	2.69	68.50	**0.009**

The analysis of somatotype components among 16-year-old participants revealed statistically significant differences in two of the three examined dimensions. Football players exhibited

significantly lower endomorphism values (M = 2.63; SD = 0.77) compared to non-athletes (M = 3.49; SD = 1.46), with $t(59.07) = -3.31$; $p = 0.002$, indicating a highly significant difference. This confirms that, at this age, football players have a lower percentage of body fat, reflecting higher levels of physical activity, metabolic adaptation, and diet regulation typical of athletes undergoing systematic training. A statistically significant difference was also observed in mesomorphism in favor of football players (M = 5.04; SD = 1.16) compared to non-athletes (M = 3.79; SD = 1.88), with $t(64.92) = 3.61$; $p = 0.001$. This indicates more pronounced muscular development among athletes, consistent with expectations for this age group, where long-term training effects and pubertal hormonal changes begin to manifest. Increased mesomorphism in football players reflects the adaptive morphological response to the demands of football, which requires high levels of strength, explosiveness, and motor efficiency. In contrast, ectomorphism did not show a statistically significant difference between the two groups (football players: M = 2.77; SD = 1.01; non-athletes: M = 2.65; SD = 1.31; $t = 0.47$; $p = 0.638$). This suggests that linearity of the body (height relative to mass) is not a defining characteristic of athletes in this age category; rather, morphological development at this stage focuses on increased muscle mass rather than pronounced linearity. Overall, a shift from a predominantly ectomorphic profile to a more mesomorphic-dominant somatotype is observed in 16-year-old football players, reflecting the adaptive morpho-functional response to long-term training. At the same time, low endomorphism persists, maintaining an optimal somatotype for football performance.



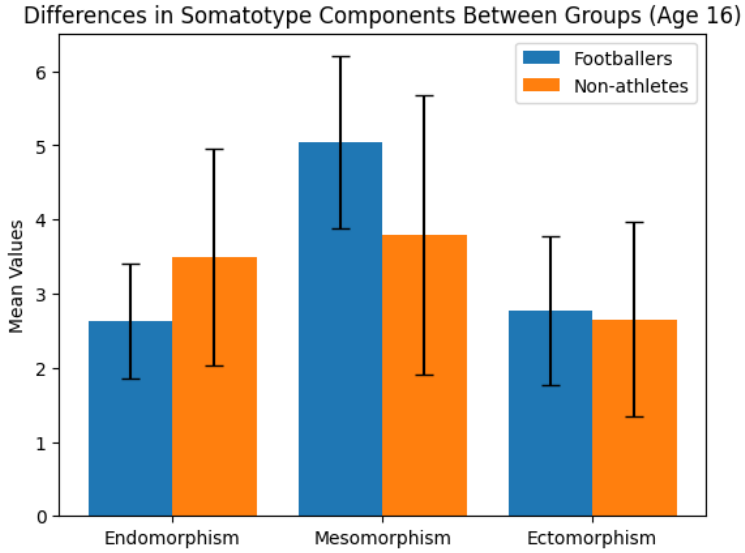
The results for 15-year-old participants also demonstrate statistically significant differences in somatotype components between footballers and non-athletes. Non-athletes show higher values of endomorphism, indicating a greater level of body fat, whereas footballers exhibit higher ectomorphism, reflecting a leaner body structure. No significant differences were found in mesomorphism, suggesting comparable muscular development between the two groups.

Table 3. Differences in Somatotype Components Between Young Football Players and Non-Athletes Aged 16 Years

Variables	Footballers		Non-athletes		t	df	Sig.
	Mean	SD	Mean	SD			
Endomorphism	2.63	0.77	3.49	1.46	-3.31	59.07	**0.002**
Mesomorphism	5.04	1.16	3.79	1.88	3.61	64.92	**0.001**
Ectomorphism	2.77	1.01	2.65	1.31	0.47	73.12	0. 38

The analysis of somatotype components in 17-year-old participants revealed significant differences in two of the three dimensions, indicating a more clearly defined morphological profile in football players during late adolescence. The most pronounced difference was observed in endomorphism, where football players exhibited significantly lower values (M = 2.51; SD = 0.78) compared to non-athletes (M = 3.55; SD = 1.61), with $t(56.42) = -3.67$; $p = 0.001$. This finding is consistent with trends observed in younger age groups and demonstrates the continuous effect of sports participation on reducing adipose tissue in young athletes, as a result of high energy demands, adaptive metabolism, and the controlled lifestyle characteristic of football. A statistically significant difference was also found in mesomorphism ($t(71.44) =$

2.83; $p = 0.006$), with football players showing higher mean values (M = 4.80; SD = 1.21) than non-athletes (M = 3.89; SD = 1.65). This indicates increased muscle mass and pronounced morphological robustness in athletes, reflecting the cumulative effect of long-term training, biological maturity, and adaptation to the physical demands of the sport. By age 17, the effects of systematic training are stabilized and sufficiently manifested in the somatotype structure. No statistically significant difference was observed in ectomorphism ($t = 0.81$; $p = 0.421$), with similar values in both groups (football players: M = 2.85; non-athletes: M = 2.64). This suggests that body linearity, which was more prominent in younger athletes, is no longer a dominant somatotype trait in this age group. Instead, the mesomorphic profile becomes the key characteristic in football players, while ectomorphic traits align more closely with those of non-athletes, consistent with post-pubertal morphological stabilization. In summary, 17-year-old football players exhibit a clearly defined somatotype profile characterized by lower body fat and greater muscle mass compared to non-athletes. These features represent morpho-functional adaptations to the specific demands of football and serve as indicators of training quality and morphological selection.



The results for 16-year-old participants indicate significant differences in somatotype components between footballers and non-athletes. Non-athletes demonstrate higher endomorphism, suggesting greater body fat accumulation, while footballers exhibit significantly higher mesomorphism, reflecting enhanced muscular development. No statistically significant differences were observed in ectomorphism, indicating a similar level of linearity between the two groups.

Table 4. Differences in Somatotype Components Between Young Football Players and Non-Athletes Aged 17 Years

Variables	Footballers		Non-athletes		t	df	Sig.
	Mean	SD	Mean	SD			
Endomorphism	2.51	0.78	3.55	1.61	-3.67	56.42	0.001
Mesomorphism	4.80	1.21	3.89	1.65	2.83	71.44	0.006
Ectomorphism	2.85	0.80	2.64	1.46	0.81	60.46	0.421

The analysis of somatotype components among 18-year-old participants revealed statistically significant differences in two of the three components, reflecting a tendency for the morphological profile of football players to stabilize by the end of adolescence.The most pronounced difference was observed in endomorphism. Football players exhibited significantly lower values (M = 2.39; SD = 0.70) compared to non-athletes (M = 3.54; SD = 1.46), with $t(55.98) = -4.52$; $p < 0.001$. This difference is not only statistically significant but also morphologically relevant, indicating a high deg ree of body fat regulation in athletes. At this age, the cumulative effects of continuous sports participation on body composition are fully

evident, explaining the markedly low level of endomorphism. Regarding mesomorphism, football players showed higher mean values (M = 4.66; SD = 1.21) compared to non-athletes (M = 4.04; SD = 1.64), with $p = 0.058$. Although this does not reach conventional statistical significance ($p < 0.05$), it indicates a tendency toward greater muscle mass in athletes, consistent with trends observed in previous age categories. Biological maturity and sport-specific training contribute to the development of a more pronounced mesomorphic profile, which becomes dominant by this age. In terms of ectomorphism, football players demonstrated significantly higher values (M = 2.99; SD = 0.98) compared to non-athletes (M = 2.28; SD = 1.40), with $t(69.65) = 2.64$; $p = 0.010$. This suggests that a degree of body linearity is retained in football players even after the completion of puberty. This may reflect positional selection within the team for roles that require explosiveness, agility, and efficient movement, characteristics typically associated with a more elegant and dynamic build. In summary, 18-year-old football players exhibit a well-defined somatotype profile characterized by significantly lower endomorphism, moderately increased mesomorphism, and pronounced ectomorphism. These differences reflect the specific physical and functional demands of football and represent the cumulative effect of long-term organized sports training and the selective processes inherent in competitive football.

Table 5. Differences in somatotype components between young football players and non-athletes aged 18 years

Variables	Footballers		Non-athletes		t	df	Sig.
	Mean	SD	Mean	SD			
Endomorphism	2.39	0.70	3.54	1.46	-4.52	55.98	**0.000**
Mesomorphism	4.66	1.21	4.04	1.64	1.92	71.61	0.058
Ectomorphism	2.99	0.98	2.28	1.40	2.64	69.65	**0.010**

The analysis of somatotype components in 18-year-old respondents revealed statistically significant differences in two of the three components, reflecting a stabilized morphological profile in football players at the end of adolescence.

Endomorphism: Football players showed significantly lower values (M = 2.39; SD = 0.70) compared to non-athletes (M = 3.54; SD = 1.46), $t(55.98) = -4.52$; $p < 0.001$. This indicates a substantially lower level of body fat among football players, consistent with the cumulative effects of long-term sports training, high energy expenditure, and controlled lifestyle. Mesomorphism: Football players exhibited slightly higher values (M = 4.66; SD = 1.21) than non-athletes (M = 4.04; SD = 1.64), $t(71.61) = 1.92$; $p = 0.058$. Although this difference did not reach conventional statistical significance, it shows a trend toward increased muscle mass, reflecting the adaptation to physical demands and sports specificity. Ectomorphism: Football players had significantly higher values (M = 2.99; SD = 0.98) compared to non-athletes (M = 2.28; SD = 1.40), $t(69.65) = 2.64$; $p = 0.010$. This indicates a maintained tendency toward linear body structure, which is beneficial for agility, speed, and movement efficiency in football.

In 18-year-old football players, a well-defined somatotype profile is established, characterized by low endomorphism, moderately increased mesomorphism, and pronounced ectomorphism, reflecting the long-term effects of organized training, morphofunctional adaptation, and selection in football.

Discussion

The present study investigated the differences in somatotype components (endomorphism, mesomorphism, and ectomorphism) between young football players and their non-athlete peers aged 14 to 18 years. The results demonstrate that organized sports activity, specifically football,

has a significant impact on the morphological development of adolescents. Consistently across all age groups, football players exhibited lower endomorphism compared to non-athletes. This trend reflects a reduced percentage of body fat, which is expected due to the high physical demands, frequent training sessions, and active lifestyle inherent to football. These findings are in agreement with previous research, which indicates that athletes involved in endurance- and strength-based sports tend to have lower fat accumulation compared to their sedentary peers (Beunen & Malina, 1995; Malina et al., 2004). Regarding mesomorphism, differences between athletes and non-athletes became more pronounced from the age of 16 onward. Football players at ages 16–18 displayed higher mesomorphic values, reflecting greater muscular development and skeletal robustness. This is consistent with the adaptive response to long-term training, hormonal changes during puberty, and the specific physical requirements of football, which demands strength, power, and explosiveness (Rogol et al., 2000). In earlier adolescence (14–15 years), mesomorphism did not significantly differ, likely due to individual variations in biological maturity and the incomplete expression of training effects at younger ages. Ectomorphism showed a variable pattern. Football players had higher ectomorphic values at ages 14, 15, and 18, indicating a tendency toward a more linear body structure and lower body mass relative to height. These traits support agility, speed, and energy efficiency in football. Between ages 16 and 17, ectomorphism was less pronounced, suggesting a temporary morphological shift toward mesomorphic dominance as a result of pubertal growth and muscle development. This dynamic aligns with the functional demands of football, where both linearity and muscularity are advantageous at different stages of adolescent development (Heta et al., 2020). Overall, the findings confirm the hypothesis that participation in organized sports significantly influences adolescent somatotype, producing a profile characterized by low endomorphism, increased mesomorphism, and adaptive ectomorphism. These results have practical implications for talent identification, training program design, and the monitoring of morphological development in young athletes.

Conclusion

Young football players aged 14–18 years demonstrate significantly lower endomorphism compared to non-athletes, indicating reduced body fat and the positive effects of regular training.
Mesomorphism is significantly higher in football players from the age of 16 onward, reflecting muscular development and adaptation to sport-specific demands.
Ectomorphism is higher in younger (14–15) and older (18) football players, indicating a functional tendency toward linearity that supports agility and endurance.
The somatotype profile of young football players reflects long-term morphofunctional adaptation to football and provides a useful tool for selection, training planning, and monitoring athlete development.
These findings underline the importance of organized sports participation during adolescence for optimal morphological and functional development.

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