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Original scientific paper

DIFFERENCES IN SOMATOTYPE COMPONENTS ACCORDING TO AGE IN KOSOVO FOOTBALL PLAYERS AGED 14–18 YEARS

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Abstract

Somatotype is a key indicator of morphological profiles in adolescent athletes, reflecting both biological maturation and training adaptation. This study analyzed changes in endomorphy, mesomorphy, and ectomorphy in 200 Kosovo youth football players aged 14–18 years, divided into five age groups. Anthropometric measurements were performed using standardized protocols, and somatotype was assessed with the Carter and Heath method. One-way ANOVA and post hoc LSD tests identified age-related differences. Endomorphy remained stable across all age groups, suggesting effective regulation of body fat. Mesomorphy peaked at age 16, reflecting pubertal hormonal effects and cumulative football training, while ectomorphy was higher in younger players and decreased with age, indicating a shift toward a more muscular body structure. These findings underscore the importance of somatotype in monitoring athlete development and provide practical guidance for talent identification, individualized training, and long-term development strategies in youth football.

Keywords: somatotype, morphological development, football players, adolescents, body structure

Introduction

The development of body structure during adolescence is a complex biological process influenced by genetic, endocrine, environmental, and behavioral factors. In young athletes, morphological profiles emerge from the interaction between intrinsic biological maturation and extrinsic sport-specific training stimuli. Sports with high energy demands, such as football, tend to produce distinctive somatotype profiles that enhance performance (Carter & Heath, 1990; Malina et al., 2004). Football requires a combination of aerobic and anaerobic endurance, explosive power, agility, and coordination, favoring a mesomorphic body type with relatively low endomorphy (Norton & Olds, 2001). Previous studies in Kosovo adolescents have highlighted morphological differences by gender and positional roles. Rashiti et al. (2024) reported that boys exhibit greater height, foot length, and lower leg circumference, while girls show larger thigh circumference and higher skinfold thickness. Heta et al. (2020) found that midfielders and forwards differ in Body Mass Index and aerobic capacity, reflecting position-specific morphological and physiological profiles. These findings underscore the importance of understanding somatotype in the context of training adaptation, talent identification, and monitoring biological maturation. Somatotype, as conceptualized by Sheldon and refined by Carter and Heath (1990), classifies body composition through three components: endomorphy (relative fatness), mesomorphy (muscular and skeletal robustness), and ectomorphy (body linearity). Investigating age-related differences in these components among adolescent football players can provide valuable insights into the developmental patterns that support performance and long-term athlete development. (Rashiti et al., 2024) The aim of this study was to determine gender differences in some anthropometric measures among adolescents aged 14–15 years in the Republic of Kosovo. The sample consisted of 1000 students (500 boys and 500 girls). Twelve anthropometric variables were measured according to IBP methodology. The data were

analyzed using basic statistics and the Student's t-test in SPSS. The results showed significant gender differences in several anthropometric characteristics between boys and girls. Accordingly, the aim of this study was to examine age-related differences in somatotype components among Kosovo football players aged 14–18 years, analyzing changes in endomorphy, mesomorphy, and ectomorphy across age groups and identifying critical phases of morphological transformation during adolescence.

Sample of respondents

The research was conducted on a total sample of 200 respondents, athletes (young football players) aged 14 to 18, who regularly train and compete in clubs competing in the First Football League of the Republic of Kosovo.
For each age category (from 14 to 18 years), 40 football player respondents were included, which allows for a balanced and comparable sample structure. This distribution provides a quality basis for comparing somatotype characteristics depending on age.

Sample of Respondents

The study was conducted on a total sample of 200 respondents, consisting of young male football players aged 14 to 18 years who regularly train and compete in clubs participating in the First Football League of the Republic of Kosovo.
For each age category (14–18 years), 40 football players were included, resulting in a balanced and comparable sample structure. This distribution provides a solid basis for examining and comparing age-related differences in somatotype characteristics.

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 Kosovo. The center is equipped with modern diagnostic and testing instruments, staffed by qualified medical and technical personnel, and has extensive experience in conducting sports-medical assessments for both youth and senior 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). Skinfolds were measured with a John Bull caliper, while circumferences were determined with a standard elastic measuring tape, and diameters with a slide caliper (GPMc).
In addition to body height and mass, the following anthropometric measures 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 measurements, the somatotype components (endomorphism, mesomorphism, and ectomorphism) were calculated using the method of Carter and Heath (1990) and the Somatotype V.1.2.5 software.

Statistical Data Processing

Both descriptive and inferential statistics were used to process and analyze the data. Descriptive statistics included the calculation of the arithmetic mean (Mean) and standard deviation (SD) to describe the central tendency and variability of the examined variables.

To identify potential differences in somatotype components among young football players across different age groups, a one-way analysis of variance (ANOVA) was performed. Post hoc comparisons were conducted using the least significant difference (LSD) test to determine which specific groups differed significantly. The Kolmogorov-Smirnov test was applied to verify the assumption of normal distribution.
All statistical analyses were conducted using SPSS for Windows, version 26.0, with the level of statistical significance set at $p < 0.05$.

Results

A total of 200 football players were included in the study, divided into five age groups (14–18 years) with 40 participants in each group. The analysis focused on the three primary somatotype components: endomorphism, mesomorphism, and ectomorphism.
The one-way ANOVA revealed no statistically significant differences in endomorphy among the age groups ($F = 1.22$, $p = 0.305$), indicating that body fat percentage remained relatively stable between ages 14 and 18. This stability may reflect consistent training, nutritional discipline, and lifestyle control characteristic of young athletes in elite programs.
For mesomorphy, significant differences were observed across age groups ($F = 2.99$, $p = 0.020$). Post hoc LSD analysis indicated that 16-year-old players had significantly higher mesomorphic values than 15-year-olds ($p = 0.001$) and 17-year-olds ($p = 0.017$). Fifteen-year-olds had lower mesomorphy compared to 18-year-olds, but this difference approached statistical significance ($p = 0.063$). These results suggest that muscle and skeletal development increases progressively with age, reflecting both biological maturation and training adaptations.
Significant differences were also observed in ectomorphy ($F = 5.33$, $p < 0.001$), indicating that body linearity and morphological proportions change substantially with increasing age.

Table 1. Differences in somatotype components (endomorphism, mesomorphism and ectomorphism) in football players by age.

Component	Years	Mean	SD	F	Sig
Endomorphic	14 Years	2.76	0.96	1.22	0. 05
	15 Years	2.54	0.78		
	16 Years	2.63	0.77		
	17 Years	2.51	0.78		
	18 Years	2.39	0.70		
Mesomorphic	14 Years	4.60	1.19	2.99	**0.020**
	15 Years	4.18	1.05		
	16 Years	5.04	1.16		
	17 Years	4.80	1.21		
	18 Years	4.66	1.21		
Ectomorphic	14 Years	3.48	1.18	5.33	**0.000**
	15 Years	3.59	1.02		
	16 Years	2.77	1.01		
	17 Years	2.85	0.80		
	18 Years	2.99	0.98		

Table 2. Post hoc LSD test between groups in somatotype components (endomorphism, mesomorphism and ectomorphism) in football players by age.

Component	Comparison	Mean Difference	p-value	Significant
Mesomorphic	14 vs 15 Years	-0.42	0.104	
	14 vs 16 Years	-0.44	0.090	
	14 vs 17 Years	-0.2	0.445	
	14 vs 18 Years	-0.06	0.813	
	15 vs 16 Years	-0.87	**0.001**	**
	15 vs 17 Years	-0.62	**0.017**	*
	15 vs 18 Years	-0.49	0.063	
	16 vs 17 Years	0.24	0.349	
	16 vs 18 Years	0.38	0.144	
	17 vs 18 Years	0.14	0.597	
Ectomorphic	14 vs 15 Years	-0.1	0.645	
	14 vs 16 Years	0.71	**0.002**	**
	14 vs 17 Years	0.63	**0.005**	**
	14 vs 18 Years	0.49	**0.030**	*
	15 vs 16 Years	0.81	**0.000**	**
	15 vs 17 Years	0.74	**0.001**	**
	15 vs 18 Years	0.6	**0.009**	**
	16 vs 17 Years	-0.07	0.739	
	16 vs 18 Years	-0.22	0.336	
	17 vs 18 Years	-0.14	0.529	

Post hoc LSD analysis revealed several statistically significant differences in the ectomorphic component among age groups. Football players aged 14 and 15 years showed significantly higher ectomorphy compared with older players (16–18 years). In particular, significant differences were observed between the 14- and 16-year-old groups ($p = 0.002$), between the 14- and 17-year-old groups ($p = 0.005$), and between the 14- and 18-year-old groups ($p = 0.030$). Similarly, significant differences were found between players aged 15 and those aged 16 ($p < 0.001$), 17 ($p = 0.001$), and 18 years ($p = 0.009$). These findings indicate that younger football players tend to display a more pronounced ectomorphic somatotype, characterized by a relatively linear body structure. With increasing age, this tendency gradually decreases, reflecting the influence of biological maturation and training adaptations that promote the development of a more mesomorphic profile, which is typically associated with the strength and power requirements of football.

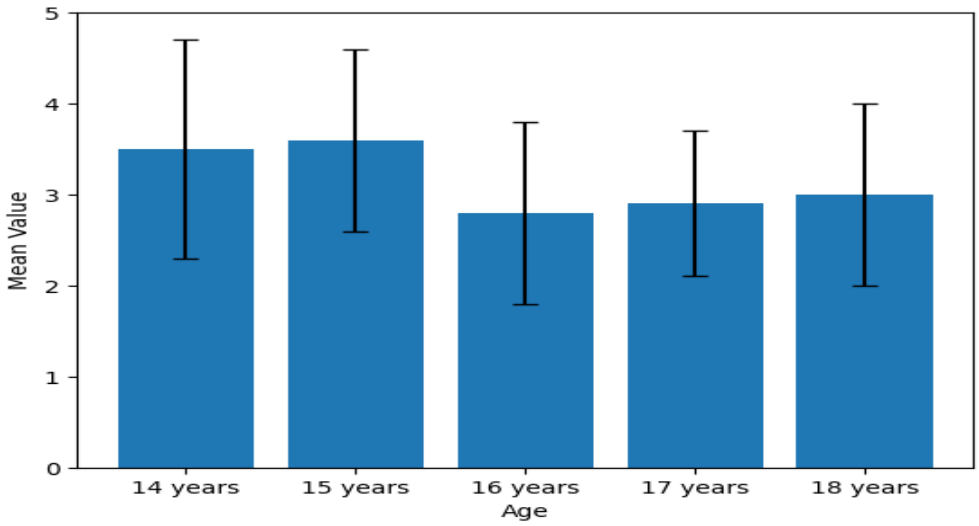


Chart 1. Overview of the arithmetic means of the mesomorphic component from 14 to 18 years of age in football players

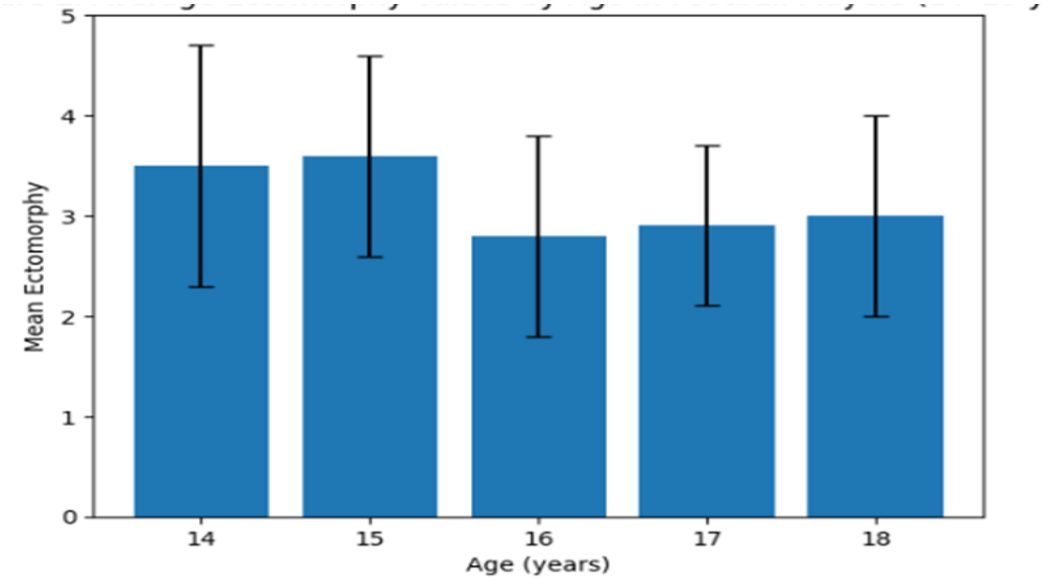


Chart 2. Overview of the arithmetic means of the ectomorphic component from 14 to 18 years of age in football players

Analysis of Figures 1 and 2. Age-Related Changes in Mesomorphic and Ectomorphic Components in Football Players (14–18 Years)

Figures 1 and 2 illustrate the age-related variation of the mesomorphic and ectomorphic components in football players aged 14 to 18 years, highlighting clear morphological adaptations during adolescence. Figure 1 demonstrates a progressive increase in the mesomorphic component with age, reaching its peak around 16 years. This trend reflects the combined influence of biological maturation and long-term football training, which promote muscular development, skeletal robustness, and functional strength. The elevated mesomorphic values observed in mid-adolescence correspond to the period of heightened anabolic hormonal activity and increased responsiveness to strength and power-oriented training stimuli. After the age of 16, mesomorphic values tend to stabilize, indicating a consolidation of muscle mass and structural characteristics typical of late adolescence. In contrast, Figure 2 presents a gradual decline in the ectomorphic component across the same age range. Higher ectomorphy values at

14 and 15 years suggest a more linear and slender body structure characteristic of early adolescence. A noticeable decrease occurs by the age of 16, reflecting a transitional phase marked by accelerated gains in muscle mass and bone density. From 16 to 18 years, ectomorphy values remain relatively stable, indicating morphological stabilization as players approach physical maturity. When interpreted together, Figures 1 and 2 reveal a clear inverse relationship between mesomorphy and ectomorphy during adolescent development in football players. As ectomorphic characteristics decrease with age, mesomorphic traits become more pronounced, demonstrating a morphofunctional shift toward body profiles better suited to the physical and technical demands of football. The variability observed within each age group, as indicated by the error bars, reflects individual differences in biological maturation, training exposure, and genetic predisposition. Overall, these findings emphasize that systematic football training combined with natural growth processes leads to distinct age-related morphological adaptations. Such information is valuable for talent identification, training periodization, and long-term athlete development, allowing coaches and practitioners to align training strategies with the biological and morphological characteristics of young football players. When interpreted together, Figures 1 and 2 indicate an inverse relationship between mesomorphy and ectomorphy during adolescent development in football players. As ectomorphic characteristics decrease with age, mesomorphic traits become more pronounced, reflecting a morphofunctional shift toward body profiles better adapted to the physical demands of football. The variability observed within each age group, represented by the error bars, may be explained by individual differences in biological maturation, training experience, and genetic factors. Overall, these findings suggest that the interaction between natural growth processes and systematic football training contributes to specific age-related morphological adaptations. Such information may be valuable for talent identification, training planning, and long-term athlete development in youth football.

Discussion

The morphological characteristics of young athletes result from a complex interaction between biological maturation, physical activity, and the specificity of the sport. The present study demonstrates that young football players aged 14 to 18 years exhibit pronounced somatotypic differences, reflecting adaptive mechanisms to both the demands of the training process and the specific requirements of football.

The endomorphic component remained relatively stable across the studied age range. This stability can be attributed to systematic training involving high energy expenditure, regular aerobic and anaerobic activity, and nutritional supervision, collectively contributing to a controlled body fat percentage (Malina et al., 2004). The lack of significant variation between age groups suggests that young football players are exposed from an early age to environments that limit adipose tissue accumulation, a characteristic of elite sports systems (Heyward & Wagner, 2004).

In contrast, the mesomorphic component peaked at age 16, reflecting the natural anabolic hormonal surge during mid-puberty (Rogol et al., 2000). Beyond physiological development, this finding likely results from the cumulative effects of years of training, leading to increased muscle mass and skeletal robustness—traits essential for football-specific tasks such as ball contests, physical stability in contact, and explosive actions. Previous research indicates that adolescent athletes, particularly those involved in power-speed sports, exhibit a more pronounced mesomorphic profile than their non-athletic peers (Carter & Heath, 1990; Gil et al., 2007).

A clear age-related decrease in ectomorphy was observed. Younger players (14–15 years) displayed greater body linearity, consistent with incomplete somatic maturation. Over time, this

ectomorphic dominance gradually transitions into a more mesomorphic profile, coinciding with the accelerated gains in muscle mass and bone density that occur in late adolescence (Beunen & Malina, 1995). The reduction in ectomorphy represents a morphofunctional adaptation to the demands of football, where efficiency, endurance, and stability outweigh linear elegance.
Similar findings regarding morphological variation according to positional roles have been reported. Midfielders and forwards exhibit distinct profiles in terms of Body Mass Index and aerobic capacity, reflecting the specific demands of their positions on the field (Heta, Bekolli, Ramadani, Ramabaja, & Rashiti, 2020). This emphasizes that not only age and maturation but also sport-specific role requirements influence somatotype development.
These results reflect not only biological maturation but also the long-term effects of systematic training, morphotype-based selection, and a sports culture that promotes morphological profiles suited to the sport. As Norton and Olds (2001) emphasize, "sports practices and training programs over time shape not only the abilities, but also the body of the athlete." From a practical perspective, knowledge of somatotype characteristics allows coaches to optimize player selection according to position and function and serves as a tool to monitor the impact of training and biological development over time. Moreover, understanding position-specific morphological differences can inform talent identification, training periodization, and individualized development strategies in youth football.

Conclusion

The results of this study indicate that age plays an important role in the morphological development of young football players aged 14–18 years. The endomorphic component remained relatively stable across all age groups, suggesting effective control of body fat levels, which may be associated with regular training and high levels of physical activity. In contrast, the mesomorphic component showed higher values around the age of 16 years, reflecting the combined influence of biological maturation and the cumulative effects of systematic football training. This increase in mesomorphy is consistent with the development of muscular strength and structural robustness required for football performance. At the same time, the ectomorphic component was more pronounced in younger players and gradually decreased with increasing age, indicating a transition from a more linear body structure toward a more muscular somatotype profile during adolescence. These findings highlight the importance of considering age-related morphological changes in the evaluation and development of young football players. From a practical perspective, understanding somatotype characteristics may contribute to more effective talent identification, training planning, and long-term athlete development in youth football.

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