DOI 10.26773/smj.250220

SportMont

ORIGINAL SCIENTIFIC PAPER

Exploring the Anthropometric Profiles of Youth Footballers: Differences Between Players from Top and Bottom Teams in the Montenegrin First Cadet League

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Abstract

Although recent studies support the importance of assessing the anthropometric status of football players, there is still a need for research that examines differences in anthropometric characteristics based on the quality of the team they represent. Therefore, this study aimed to identify the differences in anthropometric characteristics between cadet football players from top-ranked and lower-ranked teams in the league. This study included a total of 136 professional cadet football players from the Montenegrin First League, divided into two groups: players from top-ranked teams (n=61, 16.04±0.63 years, body height 177.43±6.74 cm, body weight 70.02±10.30 kg) and players from bottom-ranked teams (n=75, 16.00±0.76 years, body height 179.20±6.63 cm, body weight 68.13±10.01 kg). For the purposes of this study, a battery of seven anthropometric variables was used: arm span (AS), body height (BH), body mass (BM), body mass index (BMI), waist circumference (WC), hip circumference (HC), and waist-to-hip ratio (WHR). The Student's t-test determined that football players from top-ranked teams had higher values of body mass index (p=0.017), waist circumference (p=0.001), and waist-to-hip ratio (p=0.001), while players from bottom-ranked teams had higher values of hip circumference (p=0.005). There were no differences in other anthropometric parameters between football players from top-ranked and bottom-ranked teams. These findings showed that football players from top-ranked teams have higher values of weight-related parameters compared to those from bottom-ranked teams. Further research should include a broader range of anthropometric parameters, as well as body composition parameters. Additionally, young football players should be analyzed based on their positions within the team, which would lead to more comprehensive conclusions.

Keywords: *anthropometric characteristics, morphology, weight status, football, soccer players, youth*

Introduction

Football today places increasing demands on players. During a match, footballers run an average of about 10–12 km, performing between 1000 and 1200 movement changes, meaning that activity changes occur every 5–6 seconds with short pauses (Bangsbo, 1994; Helgerud, Engen, Wisløff & Hoff, 2001). Additionally, various movements are performed during matches, including walking (25%), jogging (37%), submaximal running (20%), sprinting (11%), and backward running (7%), with all these movements involving multidirectional motion (Di Salvo et al., 2007; Marković & Bradić, 2008). These data highlight the importance of physical preparation in foot-

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ball (Čaprić et al., 2022) alongside an optimal level of anthropometric characteristics (Cug, Stanković, Katanić, Djordjević & Masanović, 2024; Slimani & Nikolaidis, 2019).

The literature has well-documented that morphological characteristics are of great importance in athletes, as they are linked to sports success (Banjevic et al., 2022; Katanić, Bjelica, Rezić, Selimi & Osmani, 2022; López-Plaza, Alacid, Muyor & López-Miñarro, 2017; Slimani & Nikolaidis, 2019). It is now known that athletes should have an optimal level of anthropometric characteristics in relation to the demands of a specific sport (Cug et al., 2024; Katanic, Bjelica & Covic, 2022; Popovic, Akpinar, Jaksic, Matic & Bjelica, 2013; Slimani & Nikolaidis, 2019).

We are witnessing that previous studies have identified variations in the anthropometric status of football players (Dowson, Cronin & Presland, 1999; Reilly, Bangsbo & Franks, 2000). Additionally, studies examining the anthropometric characteristics of young football players have found certain differences based on team positions (Gjonbalaj, Georgiev & Bjelica, 2018) as well as across different age categories (Gontarev, Kalac, Zivkovic, Ameti & Redjepi, 2016). These studies support the importance of assessing the anthropometric status of football players; however, there remains a need for studies that examine differences in anthropometric status between players competing for teams of varying quality.

Some studies have investigated differences between top and bottom football teams but have focused on tactical aspects of the game (Araya & Larkin, 2013; Tenga & Sigmundstad, 2011), while no known studies have examined these differences in physical fitness and, specifically, the anthropometric status of football players. Furthermore, although certain studies have determined the anthropometric characteristics of young football players (Gjonbalaj et al., 2018; Gontarev et al., 2016), to the best of the authors' knowledge, no studies have investigated differences between players competing in stronger versus weaker teams.

Therefore, this study aimed to assess differences in anthropometric characteristics between football players from top-ranked and bottom-ranked teams in the Montenegrin First Cadet League. Consequently, this research will contribute to the existing literature on the anthropometric status of young football players while addressing the gap related to potential differences between football players from top-ranked and bottom-ranked teams.

Methods

Participants

This cross-sectional study included 136 professional cadet football players from first Montenegro league divided into two groups: players from top-ranked teams (n=61, 16.04±0.63 years) and players from bottom-ranked teams (n=75, 16.00±0.76 years). The inclusion criteria required participants to be football players from the Montenegrin First Cadet League, to be healthy, and to have had no injuries in the six months before the study. Participation in the study was voluntary, and written parental consent was obtained for all young players. The study adhered to the principles of the Helsinki Declaration (World Medical Association, 2011) and was approved by the Ethics Committee of the University of Montenegro.

Anthropometric characteristics

A standardized international biological program was employed to evaluate morphological traits (Eston & Reilly, 2009). A trained measurer conducted the measurement of anthropometric parameters. For the purposes of this study, a battery of seven anthropometric variables was used: arm span (AS), body height (BH), body mass (BM), body mass index (BMI), waist circumference (WC), hip circumference (HC), and waist-to-hip ratio (WHR). Morphological measurements were performed using anthropometers, and measuring tape (GPM, Zurich, Switzerland). All measurements were conducted at the diagnostic center of the Faculty of Sport and Physical Education.

Statistics

For the purposes of this study, descriptive statistics were first conducted by calculating the mean and standard deviation for each variable in both groups of football players. Subsequently, differences in anthropometric characteristics between the groups of youth football players were assessed using the Student's t-test for independent samples. Conclusions were drawn based on a significance level of $p<0.05$. All data obtained in the study were analyzed using SPSS 26.0 software (Statistical Package for the Social Sciences, v26.0, SPSS Inc., Chicago, IL, USA).

Results

Descriptive statistics (Table 1) show that cadet football players from the top-ranked teams, on average, have a body height of 177.43±6.74 cm, a body weight of 70.02±10.30 kg, and a BMI of 22.21±2.84. On the other hand, cadet football players from the bottom-ranked teams have an average height of 179.20±6.63 cm, a body weight of 68.13±10.01 kg, and a BMI of 21.13±2.19.

The Student's t-test for independent samples revealed that football players from the top teams have higher values of body mass index (p=0.017), waist circumference (p=0.001), and WHR (p=0.001), while players from the bottom teams had higher values of hip circumference (p=0.005).

Table 1. Differences in anthropometric characteristics and weight status between football players from top-ranked and bottom-ranked teams

	Top-team players	Bottom-team players	t	p
Arm span	178.10±7.87	179.59±8.49	-1.052	0.295
Body height	177.43±6.74	179.20±6.63	-1.538	0.126
Body weight	70.02±10.30	68.13±10.01	1.080	0.282
Body mass index	22.21±2.84	21.13±2.19	2.433	0.017*
Waist circumference	80.97±11.99	74.36±6.02	3.923	0.001**
Hip circumference	86.94±9.60	91.09±6.29	-2.906	0.005**
WHR	0.95±0.22	0.82±0.05	4.680	0.001**

Notes. The values are presented as arithmetic mean and standard deviation (mean ± SD); t – t-value; p – p-value; * - p<0.05; ** - p<0.01

Discussion

This study aimed to determine the differences in anthropometric characteristics between cadet football players from the teams of the top vs bottom of the league. The findings of this study showed significant differences in anthropometric characteristics between groups, with top players exhibiting a higher body mass index (p=0.017), waist circumference (p=0.001), and waist-to-hip ratio (p=0.001), while bottom players demonstrated a higher hip circumference (p=0.005).

This strategy proves crucial in identifying youth soccer players with the greatest potential for elite achievement (Buekers, Borry, & Rowe, 2015). The analysis of body height revealed no statistically significant differences between groups, with higher-ranked players averaging 177 cm and lower-ranked players averaging 179 cm. These findings are consistent with Gjonbalaj et al. (2018), who reported that the average height of U19 football players in Kosovo is similar to that of our sample. Similarly, Soós et al. (2022) found comparable values, with young Hungarian football players (mean age 16.64) averaging 177 cm. In addition, Gontarev et al. (2016) reported an average height of 176 cm among 16-year-old football players in Macedonia, further corroborating the uniformity of these anthropometric characteristics across different regions and levels of competition. These results imply that other factors beyond body height may play a more decisive role in determining the competitive performance of young football players.

The analysis of body weight revealed no significant differences between groups, with players in the top table averaging 70 kg and those in the bottom table averaging 68 kg. Our results are consistent with previous research conducted in Serbia, where Bjelica, Masanovic and Krivokapic (2020) reported an average body weight of 69 kg for players with a mean age of 16 years. Similarly, our findings support the study by Gjonbalaj et al. (2018), which reported a body weight of 68 kg. In contrast, one study on Hungarian footballers (mean age 16.64) observed slightly lower values, with an average weight of 66 kg. Interestingly, although all studies with a similar average age (Bjelica et al., 2020; Soós et al., 2022) reported an average height of 177 cm, only body weight differed, favoring Serbian players (66 vs. 69 kg). These differences may be explained by variations in training regimens, nutritional practices, and genetic factors that influence body composition (Martín-Rodríguez, Belinchón-deMiguel, Rubio-Zarapuz, Tornero-Aguilera, & Clemente-Suárez, 2024).

Body Mass Index is an important factor for assessing both physical conditioning and performance potential among young football players (Toselli et al., 2022). The analysis of body mass index (BMI) revealed a significant difference between groups (p<0.017), with top-table players averaging 22.21 and bottom-table players 21.13. These findings are consistent with those reported by Gjonbalaj et al. (2018), who found an average BMI of 21.77 among U19 players in Kosovo. Similarly, studies by Soós et al. (2022) and Gontarev et al. (2016) support our results, reporting mean BMI values of 21.10 and 21.85, respectively, for 16-year-old football players. However, the results of our study do not align with findings from studies on professional football players competing at the highest levels in this region, where BMI values ranged from 22 to 24 (Corluka et al., 2019; Joksimović et al., 2019; Masanovic, Popovic, & Bjelica, 2019; Popovic et al., 2013). These variations in BMI values may be attributed to differences in training intensity, muscle mass development, and nutritional strategies between youth and senior professional players. Higher BMI values in elite-level footballers likely reflect greater muscle mass, a result of advanced strength and conditioning programs tailored to the demands of professional competition (Nevill et al., 2019). Conversely, youth players may still be in developmental stages, with lower BMI values influenced by ongoing physical growth and adaptation to high-performance training (Ribeiro et al., 2024).

Waist circumference is a key anthropometric measure in football, as it reflects central adiposity and overall body composition, influencing agility, endurance, metabolic health, injury risk, and cardiovascular fitness, making it essential for performance monitoring and training optimization (Islam, 2018). The results of our study indicate a significant difference in waist circumference between top and bottom players (p<0.000), with top players exhibiting higher values (80.97 cm vs. 74.36 cm). The waist circumference of top players in our study aligns with the findings of Gardasevic and Bjelica (2020), who reported values ranging from 80 to 84 cm among footballers competing at the highest levels. Conversely, our results for both groups do not correspond with those reported by Corluka et al. (2019), where elite-level players in Bosnia and Herzegovina had waist circumference values ranging from 83.43 to 86.39 cm. These discrepancies may be attributed to differences in playing level, training methodologies, and body composition profiles across different competitive environments. Elite players often exhibit higher waist circumference due to greater muscle mass in the core region, which is crucial for stability, balance, and power generation during gameplay (Zhao et al., 2019). Additionally, variations in nutritional strategies and strength conditioning programs across leagues may influence fat distribution and overall anthropometric characteristics (Fitzgerald, 2020). Furthermore, genetic and regional differences in body morphology could contribute to these variations, as studies have shown that anthropometric traits can differ based on geographical and ethnic factors (Joksimović et al., 2019).

The analysis of hip circumference revealed significant differences between groups (p<0.005), with bottom players exhibiting higher values (91.09 cm) compared to top players (86.94 cm). The results of our study for both groups do not align with previous research, as Beba et al. (2023) reported a higher average hip circumference of 95.43 cm among football players in Iran. Similarly, waist-to-hip ratio (WHR) showed significant differences (p<0.000), with top players recording a higher value (0.95) compared to bottom players (0.82). However, our findings do not support the results of Beba et al. (2023), who reported a slightly lower WHR (0.78). These variations may be explained by differences in playing style, training intensity, and body composition requirements across different football environments. Higher hip circumference values in bottom players could indicate greater fat accumulation in the lower body, which may affect mobility and overall athletic performance (Beba et al., 2023). Conversely, lower hip circumference and higher WHR in top players suggest a more optimal body composition with reduced lower-body fat and a stronger core, contributing to better speed, agility, and explosive movements (Dolati, Ghazalian, & Abednatanzi, 2017).

The importance of this study lies in the fact that it is the first to examine differences in the anthropometric status of young professional football players based on their league

standings. Also, a key strength of this study is its focus on a comprehensive set of anthropometric parameters, providing valuable insights into physical differences between higher- and lower-ranked cadet football players. The inclusion of multiple measures such as BMI, waist circumference, and WHR allows for a more detailed assessment of body composition and its impact on performance. However, certain limitations must be acknowledged. First, the study is limited to a specific age group and regional sample, which may affect the generalizability of the findings to other populations. Additionally, the cross-sectional design does not allow for tracking developmental changes over time. Future research should aim to include differences in anthropometric profiles among youth football players based on their playing positions. Moreover, integrating physiological and biomechanical variables alongside anthropometric measures could provide a more holistic understanding of the physical attributes required for success in football. Finally, expanding research to different competitive levels and geographic regions would help clarify the influence of genetic, environmental, and training-related factors on body composition in young football players.

Conclusion

This study aimed to determine the differences in anthropometric characteristics between cadet football players competing in teams at the top and bottom of the league. The obtained results indicate significant differences between these groups. Players from top-ranked teams had a higher body mass index, greater waist circumference, and a higher waist-to-hip ratio, while players from bottom-ranked teams had a greater hip circumference, with no differences observed in other parameters between the groups. However, these findings suggest that certain body characteristics may play a role in differentiating players based on the quality and level of competition among young football players. Future research should explore differences among youth football players based on their positions within the team and incorporate a body composition variables to provide more comprehensive and meaningful conclusions.

Acknowledgments
There are no acknowledgments.

Conflict of interest
The authors declare that there is no conflict of interest.

Received: 22 November 2024 | **Accepted:** 19 January 2025 | **Published:** 01 February 2025

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