DOI 10.26773/smj.250212

SportMont

ORIGINAL SCIENTIFIC PAPER

Comparison of Anthropometric Characteristics and Body Composition between Professional Montenegrin Footballers and Karatekas

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Abstract

It has been established that athletes must maintain an optimal level of anthropometric characteristics in accordance with the demands of their specific sport. Recent studies have examined the anthropometric characteristics and body composition of footballers compared to athletes from other sports; however, no study has included karate athletes. Accordingly, the purpose of this study was to examine the differences in anthropometric characteristics and body composition between professional footballers and karatekas. This study included 34 professional male athletes from Montenegro, categorized into two groups: football players (n=19, 20.74±4.32 years) and karate athletes (n=15, 20.47±4.91 years). The anthropometric characteristics and body composition of football players were assessed by a battery of 11 variables: body height (BH), body mass (BM), triceps skinfold (TS), biceps skinfold (BS), subscapular skinfold (SS), abdominal skinfold (AS), front thigh skinfold (FS), medial calf skinfold (MS), body mass index (BMI), fat percentage (FP), and muscle mass (MM). Based on an independent t-test it was determined that there are no significant differences between football players and karate athletes in any anthropometric characteristics and body composition parameters. This finding suggests that, despite the differing demands of these sports, both are performed at a professional level, which requires an optimal balance of anthropometric traits—characterized by a lower body fat percentage and greater muscle mass—essential for both disciplines. Further research is needed, particularly through segmental body composition analysis, to provide more detailed insights into the physique of football players and karate athletes.

Keywords: *morphological characteristics, body fat, muscle mass, soccer players, karate athletes*

Introduction

It is widely established that the anthropometric characteristics and body composition of athletes are of crucial importance, as they are directly linked to athletic success (Banjević et al., 2022; Katanić, Bjelica, Rezić, Selimi, & Osmani, 2022; López-Plaza, Alacid, Muyor, & López-Miñarro, 2017; Slimani & Nikolaidis, 2019). It has been established that athletes must maintain an optimal level of anthropometric characteristics in accordance with the demands of their specific sport (Cug, Stankovic, Katanić, Djordjevic, & Masanovic, 2024; Katanić, Bjelica, & Cović, 2022; Popović, Akpinar, Jakšić, Matić, & Bjelica, 2013; Slimani & Nikolaidis, 2019).

Numerous studies have highlighted variations in the anthropometric characteristics of football players (Dowson, Cronin, & Presland, 1999; Reilly, Bangsbo, & Franks, 2000). Today, professional clubs regularly assess anthropometric characteristics and body composition throughout the season as part of their routine monitoring procedures (Stanković et al., 2023). Particular attention is given to football players' body composition, with a strong emphasis on body fat, as subcutaneous fat acts as unnecessary weight during movement (Katanic et al., 2023). The percentage of body fat in professional foot-

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ball players typically ranges from 7% to 12% (Shephard, 1999). Maintaining such a low level of body fat is crucial for players, as it, combined with a high proportion of lean mass, provides an optimal foundation for locomotor activities and the specialized technical skills required in football (Iga et al., 2014).

For achieving top-level results in karate, it is also essential to possess appropriate anthropometric characteristics and body composition, along with a high level of other performance-related attributes (Amusa & Onyewadume, 2001; Jukić, Katić, & Blažević, 2012; Lehmann & Jedliczka, 1998). Analyzing karatekas, it becomes evident that they are characterized by a well-balanced physique with a low percentage of body fat (Sterkowicz, 1992). Research has shown that skeletal longitudinal dimensions and a lower percentage of body fat have the greatest influence on success in karate sport (Abdel-Baser, 2010; Chaabène, Hachana, Franchini, Mkaouer, & Chamari, 2012). However, although the importance of anthropometry for success in karate has been well documented, research in this area remains relatively scarce (Chaabène et al., 2012; Gloc, Plewa, & Nowak, 2012).

Several recent studies have explored the anthropometric characteristics and body composition of footballers in comparison to athletes from other sports. For instance, research has examined differences between football and volleyball players (Masanovic, Bavcevic, & Bavcevic, 2019), football and basketball players (Bjelica, Masanovic, & Krivokapic, 2020), as well as across football, basketball, and volleyball players (Koç, Dongaz, Bayar, & Bayar, 2020). Similarly, studies have analyzed karate athletes in relation to competitors from other combat sports (Mala et al., 2019). Additionally, comparisons have been made between handball and volleyball players (Masanovic, Gardasevic, & Bjelica, 2021) and between basketball and volleyball players (Masanovic, 2018).

However, although these are not closely related sports, it is interesting to explore whether there are differences in anthropometric characteristics and body composition between football players and karatekas, especially given the lack of such studies. Accordingly, the purpose of this study was to examine the differences in anthropometric characteristics and body composition between professional football players and karate athletes. This study will contribute to the existing literature, which has identified differences in body composition among various athletes, by filling the gap in understanding the differences between these groups of athletes.

Methods

Participants

This study included 34 professional male athletes from Montenegro, categorized into two groups: footballers (n=19, 20.74±4.32 years) and karatekas (n=15, 20.47±4.91 years). The inclusion criteria required participants to be professional football or karate athletes, to be healthy, and to have had no injuries in the six months before the study. Participation in the study was voluntary, with all participants receiving detailed information about the research and providing written consent. 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 and body composition

A trained measurer conducted the measurement of anthropometric parameters, including body height and body weight, while skinfold thickness was measured using a caliper on marked body sites, following the guidelines of the International Biological Program (Eston & Reilly, 2009). Anthropometric characteristics and body composition were evaluated using a battery of 11 variables: body height (BH), body mass (BM), triceps skinfold (TS), biceps skinfold (BS), subscapular skinfold (SS), abdominal skinfold (AS), front thigh skinfold (FS), Medial calf skinfold (MS), body mass index (BMI), fat percentage (FP), and muscle mass (MM). Morphological measurements were performed using anthropometers, calipers, and measuring tape (GPM, Zurich, Switzerland). Body composition parameters, including fat percentage and muscle mass percentage, were assessed using a Tanita body fat scale (Tanita model BC-418MA, Tokyo, Japan). 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 athletes. Subsequently, differences in anthropometric characteristics and body composition between the groups of football players and karate athletes 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).

Table 1. Diferences in anthropometric characteristics and body composition between footballers and karate athletes

	Footballers	Karatekas	t	p
Body height	181.55±6.49	179.73±8.11	.725	.474
Body weight	74.22±7.22	73.04±9.49	.412	.683
Triceps skinfold	7.11±2.13	6.96±1.67	.217	.830
Biceps skinfold	4.62±0.97	5.37±1.90	-1.399	.177
Subscapular skinfold	9.27±1.99	9.57±2.54	-.387	.702
Abdominal skinfold	11.30±5.43	9.60±4.17	.997	.326
Medial calf skinfold	6.36±2.05	6.45±3.72	-.140	.889
Front thigh skinfold	12.30±4.02	11.37±1.58	.691	.495
Body mass index	22.50±1.46	22.55±2.14	-.095	.925
Fat percentage	9.75±2.96	9.35±4.13	.328	.745
Muscle mass	37.80±2.88	37.03±4.84	.571	.572

Notes. Mean - Arithmetic mean; SD - Standard deviation; t – t-value; p – p-value.

Results

Descriptive statistics (Table 1) show that professional football players, on average, have a body height of 181.55±6.49 cm, a body weight of 74.22±7.22 kg, and a BMI of 22.50±1.46, with an average body fat percentage of 9.75±2.96%. On the other hand, karate athletes show an average height of 179.73±8.11 cm, a body weight of 73.04±9.49 kg, and a BMI of 22.55±2.14. The average body fat percentage among karate athletes is similar to that of football players, at 9.35±4.13%.

The Student's t-test for independent samples revealed no significant differences in any anthropometric characteristics or body composition parameters between footballers and karatekas.

Discussion

Athletes' morphological status is crucial for their success in sports, as previously indicated (Katanic, Bjelica, & Covic, 2022). This research aimed to determine the differences in anthropometric characteristics and body composition between professional Montenegrin footballers and karatekas. Contrary to our expectations, the results of the conducted research indicated there is no differences in all considered anthropometric characteristics and body composition.

To achieve success, athletes must understand their performance capabilities and anthropometric characteristics (Gürsoy & Canli, 2021). The results of anthropometric measurements in the present study, specifically height and weight, did not show a significant difference between football players and karatekas. Regarding football players, our findings (181.55±6.49 cm) are consistent with previous research that reported body heights of 182 cm and 183 cm (Petri et al., 2024; Popovic et al., 2013; Soós et al., 2022). Similarly, for karatekas, Quinzi et al. (2022) reported a mean body weight of 71 kg, which aligns with our results. However, in contrast to our findings, Mulija et al. (2024) reported a mean height of 167 cm and a mean weight of 64.51 kg for karate. Furthermore, our analysis highlights differences in the morphological characteristics of football and karate athletes in comparison to their Serbian counterparts (174 cm and 69 kg; Slankamenac et al., 2021), Italy (171 cm; Quinzi et al., 2022), Brazil (170 cm and 67 kg; Spigolon et al., 2018), and Iran (175 cm and 68 kg; Arazi & Izadi, 2017). Previous studies has shown that athletes from different sports exhibit distinct anthropometric characteristics based on the specific demands of their discipline. For instance, endurance runners have lower body fat percentages, often around 6–8%, compared to football players and karatekas (Knechtle et al., 2011). Similarly, wrestlers and weightlifters typically exhibit higher muscle mass percentages, with values ranging from 42% to 47% (Yoon, 2002), exceeding those observed in both football players (40–42%) and karate athletes (38–41%; Chaabene et al., 2012). These differences highlight the sport-specific adaptations in body composition that arise from training and competition demands. In addition, the absence of significant differences in height and weight between football players and karatekas may be attributed to the similar physical demands of both sports, which require attributes such as speed, agility, and endurance. Additionally, both groups undergo rigorous training regimens that promote comparable body compositions (Martinez-de-Quel, Alegre, Castillo-García, & Ayán, 2021).

The body composition of football players and karate practitioners is shaped by the distinct physical demands of each sport, influencing factors such as muscle mass, fat distribution, and overall physical fitness (Anding, & Oliver, 2015). The results of our study indicated that there were no differences in skinfolds and body composition between football players and karate players in all observed variables. Our findings regarding BMI can be compared to the results of earlier studies that showed similar values, with football players exhibiting a BMI of 22.50 and karate practitioners exhibiting a BMI of 22.55. In relation to this, football players competing in Serie A in Italy have a BMI of 23.3 (Petri et al., 2024), while karate practitioners have a BMI of 23.1 (Mulija et al. 2024). Results obtained by Quinzi et al. (2022) are consistent with our findings, who reported a mean value of 22.7 for karatekas, while Shariat et al. (2017) reported slightly higher values for elite karatekas.

Our study found no significant difference in the percentage of body fat between football players (9.75%) and karatekas (9.35%). Regarding football players, our findings align with Popović et al. (2013) who reported a value of 9.64, but diverge from a study Soós et al. (2022) that reported a slightly higher value of 11.67 for football players aged 17.92 years. The body fat percentage range of top-level male karate athletes extends from approximately 7.5% for Japanese to 16.8% for Polish elite-level karatekas, with French international-level karatekas having a body fat percentage of 13.7% (Chaabene, Hachana, Franchini, Mkaouer, & Chamari, 2012). The lack of significant differences in body composition between football players and karatekas may be attributed to variations in methodologies employed in previous studies (Cavedon, Milanese, Sacristani, & Zancanaro, 2022). Additionally, similar dietary practices aimed at optimizing performance, including adequate protein intake and controlled caloric intake, could mask subtle differences in body composition (Burke, 2021). The relatively small sample size may account for the lack of significant differences between elite athletes. Given the high level of training and competition experienced by these athletes, their bodies have likely undergone similar adaptations, resulting in comparable body composition profiles, despite variations in specific sports skills.

This study provides valuable insights into the anthropometric characteristics and body composition of professional Montenegrin football players and karate athletes. The study utilizes a battery of 11 variables to assess body composition, including skinfolds, body mass index (BMI), fat percentage, and muscle mass. This provides a detailed picture of the athletes' morphological profiles. However, several limitations should be acknowledged. The relatively small sample size may have contributed to the lack of significant differences between groups, reducing the generalizability of the findings to a broader athletic population. Additionally, the study did not account for potential variations in training intensity, playing position, competition level, or specific skill requirements, all of which could influence body composition and anthropometric characteristics. Another limitation is the cross-sectional design, which does not allow for tracking changes in body composition over time or assessing the impact of long-term training adaptations. Furthermore, factors such as nutrition, hydration status, and recovery strategies were not examined, yet they play a crucial role in shaping an athlete's physique and performance (Burke, 2021). Future research should consider larger and more diverse samples, incorporate longitudinal designs to monitor changes across training cycles and analyze additional physiological and performance-related variables, in-

cluding muscle strength, endurance, and metabolic efficiency. Expanding the scope to include female athletes and different competitive levels could also provide a more comprehensive understanding of sport-specific morphological adaptations.

Conclusion

This study aimed to explore differences in anthropometric characteristics and body composition between groups of football players and karate athletes. However, the analysis revealed no significant differences between these groups. This finding suggests that, despite the differing demands of these sports, both are performed at a professional level, which requires an optimal balance of anthropometric traits—characterized by a lower body fat percentage and greater muscle mass—essential for both disciplines. Further research is needed, particularly through segmental body composition analysis, to provide more detailed insights into the physique of football players and karate athletes.

Acknowledgments
There are no acknowledgments.

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

Received: 08 November 2024 | **Accepted:** 11 January 2025 | **Published:** 01 February 2025

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