# Differences in the Morphological Characteristics and Body Composition between Elite Montenegrin Kata and Kumite Karatekas

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## Abstract

Elite karatekas should have specific morphological characteristics suitable for their specializations. This study aimed to determine the differences in morphological characteristics and body composition of elite Montenegrin karate athletes according to different specializations. This study consisted of a total of 16 male karate athletes divided according to specialization in kata (form or movement pattern) and kumite (fighting) disciplines. The subject sample included healthy, black belt karate senior athletes, with no prior injuries divided into kata (n-6, 19.83±4.71 years) and kumite (n-10, 20.4±5.21 years) athletes. Morphological characteristics and body composition were evaluated by a battery of 11 variables: body height (BH), body mass (BM), triceps skinfold (TS), biceps skinfold (BiS), back skinfold (BS), abdominal skinfold (AS), upper leg skinfold (UIS), lower leg skinfold (LIS), body mass index (BMI), fat percentage (FP), and muscle mass percentages (MP). The differences in morphological characteristics and the composition of the body between kata and kumite karatekas were determined by using a statistical procedure with a t-test for small independent samples. It was determined that the kumite had a higher body height, and body weight, as well as a higher percentage of muscle mass than kata karatekas. In other parameters concerning the distribution of subcutaneous adipose tissue, as well as the percentage of body fat, there was no difference between the groups. The results suggest that there is some difference in morphological characteristics between kata and kumite karatekas, but for more complete conclusions an analysis should be performed on a larger sample of high-level karate athletes.

*Keywords: karate, anthropometrics characteristics, body composition, elite karatekas, Montenegro*

## Introduction

The morphological status of athletes is very important and nowadays it is known that morphological characteristics are directly related to success in sports (López-Plaza, Alacid, Muyor, & López-Miñarro, 2017; Slimani & Nikolaidis, 2019, Banjevic et al., 2022). It was established that according to the requirements of a certain sport, athletes must possess an optimal level of morphological characteristics (Popovic, Akpinar, Jaksic, Matic, & Bjelica, 2013; Masanovic, 2019; Slimani & Nikolaidis, 2019; Banjevic et al., 2022). The morphological sta-

tus of top athletes is relatively homogeneous, depending on the sport, and can be defined as a pattern for athletes' achievements (Misigoj-Duraković, Matković, & Medved, 1995).

Karate is considered one of the most popular martial arts, which includes two competitive disciplines: forms (kata) and sports fighting (kumite) (Koropanovski et al., 2011; Tabben et al., 2013). To achieve top results in karate, in addition to other characteristics, the athlete must have suitable anthropometric characteristics (Lehmann & Jedliczka, 1998; Amusa & Onyewadume, 2001; Jukic, Katic, & Blazevic, 2012).

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Analyzing karate athletes, it is noticeable that they are characterized by a harmonious body constitution with a low percentage of fat tissue (Sterkowicz, 1992). In relation to the level of competition, there is no difference in body composition between intermediate and high-level competitors, although the percentage of fat tissue was lower in top competitors (Giampietro, Pujia, & Bertini, 2003). When considering some morphological characteristics, it was determined that the longitudinal dimensionality of the skeleton, with a smaller percentage of fat tissue, plays an important role in success in karate (Abdel-Baser, 2010; Chaabène, Hachana, Franchini, Mkaouer, & Chamari, 2012). However, the percentage of fat tissue in karate athletes varies in different studies with subjects of different nationalities (Chaabène et al., 2012).

One study that investigated the difference in body composition between kata and kumite karatekas showed that there was no significant difference in body composition between the given athletes (Koropanovski et al., 2011). Even though karate is a very popular and massive individual sport, as well as fact that knowledge about the morphological characteristics and body composition of karate competitors is necessary, research in the field of karatekas morphology is not so numerous (Chaabène et al., 2012; Gloc, Plewa, & Nowak, 2012). There is an obvious lack of data on the differences between kumite and kata competitors in morphological characteristics (Koropanovski et al., 2011). Accordingly, the study aimed to identify differences in the morphological characteristics and body composition between kata and kumite karatekas.

## Methods
### Sample of respondents
This cross-sectional study consisted of a total of 16 male karate athletes divided according to specialization in kata (form or movement pattern) and kumite (fighting) disciplines. The subject sample included healthy, black belt karate senior athletes, with no prior injuries divided into kata (n-6, 19.83±4.71 years) and kumite (n-10, 20.4±5.21 years)

athletes. Athletes voluntarily participated in the research process, also this research was carried out following the Helsinki Declaration.

### Measurements
The standard international biological procedure was used to determine morphological characteristics (Eston & Reilly, 2013). Morphological characteristics and body composition were evaluated by a battery of 11 variables: body height (BH), body mass (BM), triceps skinfold (TS), biceps skinfold (BiS), back skinfold (BS), abdominal skinfold (AS), upper leg skinfold (UlS), lower leg skinfold (LlS), body mass index (BMI), fat percentage (FP), and muscle mass percentages (MP). Anthropometer, caliper, and measuring tape were used for morphological measurements. To evaluate the body composition, Tanita body fat scale - model BC-418MA, was used.

### Statistics
Basic parameters of descriptive statistics were calculated: arithmetic mean, standard deviation, minimum, maximum, and range. To determine differences in morphological characteristics, and body composition among groups of karatekas, a T-test for small independent samples was used. For all statistical analyses, significance was accepted at $p<0.05$. Data processing was performed using the statistical program SPSS 26 (Statistical Package for Social Sciences, v26.0, SPSS Inc., Chicago, IL, USA).

## Results
Table 1 indicates descriptive values of morphological parameters. Kata karatekas have an average height of 174.22±6.35 cm and a body weight of 67.75±4.67 kg, respectively, which are slightly lower than kumite karatekas (183.47±6.8 cm, and 77.34±10.15 kg). Body mass index values are similar for kata (22.42±2) and kumite (22.87±2.33), as well as fat percentage values (10.03±4.75% for kata and 9.70±4.46 for kumite karatekas). It is noticeable that kata has lower values for muscle mass (33.73±2.49%) compared to Kumite karatekas (39.28±4.58%). While the skinfold values

**Table 1.** Descriptive data of morphological parameters between the groups

| Groups | | Mean | Std. Dev. | Minimum | Maximum | Range |
|--------|--------------------|--------|-----------|---------|---------|-------|
| Kata | Age | 19.83 | 4.71 | 16 | 28 | 12 |
| | Body height | 174.22 | 6.35 | 166.8 | 182.0 | 15.2 |
| | Body mass | 67.75 | 4.67 | 60.9 | 75.0 | 14.1 |
| | Triceps skinfold | 7.12 | 1.64 | 5.1 | 9.1 | 4.0 |
| | Biceps skinfold | 5.47 | 2 | 3.7 | 8.7 | 5.0 |
| | Back skinfold | 8.73 | 1.82 | 6.8 | 11.6 | 4.8 |
| | Abdominal skinfold | 9.42 | 2.92 | 6.0 | 13.2 | 7.2 |
| | Upper leg skinfold | 7.08 | 1.27 | 5.1 | 8.6 | 3.5 |
| | Lower leg skinfold | 12.33 | 1.87 | 9.6 | 14.0 | 4.4 |
| | Body mass index | 22.42 | 2 | 20.0 | 25.1 | 5.1 |
| | Fat percentage | 10.03 | 4.75 | 4.0 | 14.1 | 10.1 |
| | Muscle mass | 33.73 | 2.49 | 30.4 | 36.5 | 6.1 |
| Kumite | Age | 20.4 | 5.21 | 16 | 34 | 18 |
| | Body height | 183.47 | 6.8 | 166.6 | 192.0 | 25.4 |
| | Body mass | 77.34 | 10.15 | 63.6 | 96.3 | 32.7 |

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**Table 1.** Descriptive data of morphological parameters between the groups

| Groups | | Mean | Std. Dev. | Minimum | Maximum | Range |
|---|---|---|---|---|---|---|
| | Triceps skinfold | 7.23 | 2.05 | 4.0 | 10.6 | 6.6 |
| | Biceps skinfold | 5.47 | 1.9 | 3.2 | 8.0 | 4.8 |
| | Back skinfold | 9.92 | 2.8 | 7.5 | 15.0 | 7.5 |
| | Abdominal skinfold | 9.57 | 4.75 | 6.0 | 22.0 | 16.0 |
| | Upper leg skinfold | 6.03 | 1.59 | 3.6 | 9.4 | 5.8 |
| | Lower leg skinfold | 11.44 | 4.87 | 6.0 | 21.0 | 15.0 |
| | Body mass index | 22.87 | 2.33 | 19.6 | 27.8 | 8.2 |
| | Fat percentage | 9.70 | 4.46 | 3.9 | 16.9 | 13.0 |
| | Muscle mass | 39.28 | 4.58 | 31.1 | 46.2 | 15.1 |

are approximately similar.

Based on the T-test (Table 2), it was determined that a significant difference was achieved in the aforementioned variables, in body height (0.17), body weight (0.49) and muscle mass (0.17). In other parameters, there was no significant difference between kumite and kata karatekas.

**Table 2.** Descriptive data and t-test of 16 karate athletes enrolled in the study

| | Grupe | Mean | Std. Deviation | t | p |
|---|---|---|---|---|---|
| Age | Kata | 19.83 | 4.71 | -.22 | .831 |
| | Kumite | 20.40 | 5.21 | | |
| Body height | Kata | 174.22 | 6.35 | -2.70 | .017* |
| | Kumite | 183.47 | 6.80 | | |
| Body mass | Kata | 67.75 | 4.67 | -2.16 | .049* |
| | Kumite | 77.34 | 10.15 | | |
| Triceps skinfold | Kata | 7.12 | 1.64 | -.12 | .910 |
| | Kumite | 7.23 | 2.05 | | |
| Biceps skinfold | Kata | 5.47 | 2.00 | -.00 | .997 |
| | Kumite | 5.47 | 1.90 | | |
| Back skinfold | Kata | 8.73 | 1.82 | -.92 | .373 |
| | Kumite | 9.92 | 2.80 | | |
| Abdominal skinfold | Kata | 9.42 | 2,.92 | -.07 | .944 |
| | Kumite | 9.57 | 4.75 | | |
| Upper leg skinfold | Kata | 7.08 | 1.27 | 1.37 | .192 |
| | Kumite | 6.03 | .59 | | |
| Lower leg skinfold | Kata | 12.33 | 1.87 | .43 | .676 |
| | Kumite | 11.44 | 4.87 | | |
| Body mass index | Kata | 22.42 | 2.00 | -.40 | .698 |
| | Kumite | 22.87 | 2.33 | | |
| Fat percentage | Kata | 10.03 | 4.75 | .14 | .890 |
| | Kumite | 9.70 | 4.46 | | |
| Muscle mass | Kata | 33.73 | 2.49 | -2.71 | .017* |
| | Kumite | 39.28 | 4.58 | | |

## Discussion

This study showed that there are differences between some morphological parameters between kata and kumite karatekas. When compared to kata karatekas, kumite karatekas have higher values for body height, body mass, and muscle mass percentage.

The average height of kata karatekas in this study is about the same as the height of the karatekas from North America and Central America (Huertas, De-los-Santos, Bersain, & Cabrera, 2006). Additionally, they are slightly larger than the Colombian (167.4 cm; Sánchez-Puccini, Argothy-Bucheli, Meneses-Echávez, López-Albán, & Ramírez-Vélez, 2014), and the Philippines karatekas (169.6 cm; Pieter and Barcades, 2015). On the other hand, kumite karatekas have higher average values, which are about the same height as Polish and Italian karatekas (Giampietro et al. 2003; Sterkowics-Przybycien, 2010 ).

Kata karatekas in our study, also had a lower body mass, which corresponds to Colombian (Sánchez-Puccini et al., 2014), Italian (Giampietro et al., 2003), and North-American (Huertas et al. 2006) karatekas, while kumite karatekas achieved higher values than that. In addition, the average body mass of Polish karate athletes was higher (91.1 kg; Sterkowicz-Przybycien, 2010) than any other sample of karatekas.

The morphological parameters, above all body height and mass, are quite variable because karatekas in these studies are not classified into kata and kumite disciplines. In this study, a significant difference was determined precisely in body height and mass, which is on the side of kumite karatekas, who are more robustly built. This corresponds to the data of Koropanovski et al. (2011) who showed in a sample of male karatekas of the Serbian national team that there is no significant difference in body mass index (as in our case) between kata and kumite karate fighters, but it was noted that kumite fighters were more "robust" (larger body dimensions) compared to katas.

The percentage of adipose tissue was similar between kata and kumite groups, and is consistent with claims that elite karate fighters have a lower percentage of adipose tissue (Giampietro et al., 2003) and roughly corresponds to Polish karatekas (Sterkowicz, 1992), and it is slightly higher than Japanese karate fighters who have 7.5% fat tissue (Imamura, Yoshimura, Uchida, Nishimura, & Nakazawa, 1998). In contrast to these data, the study found that Polish karatekas have 16.8% fat tissue (Sterkowicz-Przybycień, 2010). Although due to the weight categories in sports fighters, karatekas should have as little fat tissue as possible as ballast, we still see that the percentage of fat tissue in karate fighters varies in different studies with respondents of different nationalities, and Chaabène et al. (2012) came to a similar conclusion in their review study.

It should be noted that there was no difference in skinfolds between the karate fighters, which corresponds to the fact that there was no difference in the percentage of fat mass.

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Since skinfolds are known to be the main indicators of body fat percentage, because over 60% of body fat is located precisely in the subcutaneous region (Wang, Thornton, Kolesnik, & Pierson, 2000).

A significant difference was realized between the groups in the percentage of muscle mass, where it was determined that Kumite fighters have more muscle mass than Katas athletes. Greater muscle mass in athletes is considered an important factor for athletes who encounter heavy physical struggles during training and competition (Shariat, Shaw, Kargarfard, Shaw, & Lam, 2017), so it is clear why kumite karatekas have more muscle mass than kata karatekas who are not subject to struggles.

### Limitations
Additionally, this study has some limitations, most of which are related to the small sample size. However, it was not easy to find elite karate seniors who have a black belt in the territory of Montenegro.

The proposal for further research on the body composition of elite karatekas should be carried out on a larger sample and with the assistance of more cutting-edge equipment that would determine the body status for the entire body as well as for individual body segments. This will allow for the collection of more comprehensive data and the determination of whether kumite and kata karatekas have distinct body types.

### Conclusion
This study's findings showed that kata and kumite karatekas have some distinct morphological characteristics. Practical implications would be reflected in a new approach to working with karate athletes. Therefore, according to their discipline, karate athletes should have a special approach when creating a training and nutrition plan in relation to the needs of their discipline. This study is important because it shows the direction in which subsequent studies examining the morphological status of karate athletes should go.

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