



## Anthropometric Profile of Elite Male and Female Cadet Taekwondo Competitors

Amel Mekić<sup>1,\*</sup>, Rasim Lakota<sup>1</sup>, Mladen Živković<sup>2</sup>, Muhammet Çelik<sup>3</sup>, Merima Merdan<sup>1</sup>

<sup>1</sup> University of Sarajevo, Faculty of Sport and Physical Education, Sarajevo, 71000, Bosnia and Herzegovina

<sup>2</sup> Faculty of Sport and Physical Education, University of Nis, 18000 Nis, Serbia

<sup>3</sup> Batman Üniversitesi, Spor Bilimleri Fakültesi, Batman, Türkiye

\* Corresponding author email: [amel.mekic@fasto.unsa.ba](mailto:amel.mekic@fasto.unsa.ba)

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### Resumen

**Introducción:** El Taekwondo se ha convertido en un deporte olímpico, lo que significa que es necesario un conocimiento profundo de las características de los principales atletas y competidores de Taekwondo. Este estudio investigó las medidas antropométricas fundamentales de los atletas de Taekwondo de alto nivel, con especial atención a las disparidades entre géneros. El objetivo de este estudio fue evaluar y contrastar los atributos físicos de los atletas de élite de Taekwondo, examinando específicamente las diferencias entre hombres y mujeres.

**Métodos:** En este estudio participó un grupo de 28 atletas de Taekwondo altamente calificados, compuesto por 14 cadetes femeninos y 14 masculinos. **Resultados:** Los resultados mostraron una diferencia significativa entre las variables antropométricas de los competidores masculinos y femeninos, más notablemente en el grosor de los pliegues cutáneos y la proporción de tejido graso ( $p \leq 0,01$ ). **Conclusión:** En consecuencia, estos datos pueden ayudar a los especialistas en taekwondo en las primeras etapas de selección, especialmente cuando los exámenes avanzados son imposibles. Estudios adicionales que perfilen a este grupo de respondedores deberían incluir más características para ayudar a los profesionales a reconocer talentos y crear objetivos en el programa de capacitación.

**Palabras Clave:** Deporte, Composición corporal, Deporte de combate, IMC

### Abstract

**Introduction:** Taekwondo has developed into an Olympic sport, which means that a thorough understanding of the main Taekwondo athletes and competitors' characteristics is necessary. This study investigated the fundamental anthropometric measurements of high-level Taekwondo athletes, with a particular focus on disparities between genders. The objective of this study was to assess and contrast the physical attributes of elite Taekwondo athletes, specifically examining the differences between males and females. **Methods:** A group of 28 highly skilled Taekwondo athletes, consisting of 14 female and 14 male cadets participated in this study. **Results:** The results showed a significant difference between male and female competitors' anthropometric variables, most notably in skinfold thickness and fat tissue proportion ( $p \leq 0.01$ ). **Conclusion:** Accordingly, these data can help taekwondo specialists in the early stages of selection, especially when advanced examinations are impossible. Further studies profiling this group of responders should include more characteristics to help practitioners recognize talents and create training program goals.

**Keywords:** Sport, Body composition, Combat sport, BMI

### Introduction

Taekwondo has undergone significant evolution, emerging as a contemporary Olympic combat sport. While various governing bodies oversee the sport element of taekwondo, the World Taekwondo Federation (WTF) holds official responsibility for enforcing rules and regulations in Olympic competitions and world championships (Bridge et al., 2014). Beyond the Olympic stage, WTF organizes events at regional, national, and international levels, tailoring competitions based on athletes' age, sex, skill level, and weight category. Standard matches follow a structure of three 2-minute rounds with a 1-minute interval between each round (Bridge et al., 2014).

In light of the sport's relatively recent inclusion in the Olympics in 2000 at Sydney, it is considered a young Olympic discipline. Prior research by Toskovic et al. (2004) suggests that success in taekwondo necessitates a high level of anthropological dimensions. Furthermore, Sadowski et al. (2012) and Gao (2001) emphasize the role of low adiposity levels in elite junior and senior taekwondo athletes for achieving optimal performance. further advocate for low subcutaneous fat tissue percentage in taekwondo athletes.

Physical characteristics are acknowledged contributors to performance across various sports (Carter & Heath, 1990), yet research on martial arts athletes is limited. Existing studies, predominantly on elite athletes in judo, karate (Claessens et al., 1986; Pieter & Bercades, 1999), and some in taekwondo (Taafe & Pieter, 1990), underscore the scarcity of information on recreational and professional martial arts athletes and, more specifically, taekwondo practitioners. Although articles like the extensive review on body composition by Bridge et al. (2014) lack categorization according to official weight categories, which poses like a challenge, differences between weight categories exist (Čular et al., 2021). However, scarcity persists in studies focusing on male-female contestant differences.

According to the author's knowledge, the only study comparing male and female taekwondo athletes was conducted by Čular et al. (2017), however, it included 258 national competitors who were considered sub-elite. Therefore, the aim of this study was to evaluate and compare elite Taekwondo competitor's body characteristics and compare them between sexes.

## Materials and Methods

### Experimental Approach to the Problem

All data were collected once during the European Cadet Championship held in Sarajevo. Since all participants are minors, the respective federations were informed, and 'written consent forms' were provided to them. Parents or legal guardians could complete these forms if they agreed to their child's participation in the study. All procedures were conducted in accordance with the Helsinki Declaration and after obtaining approval from the Ethics Committee of the Faculty of Sport and Physical Education. All testing was carried out by experts from the Faculty.

### Participants

In the study, a total of 28 young elite Taekwondo competitors participated, comprising 14 female cadets and 14 male cadets, all of whom were participants in a European competition, representing various European countries.

### Body Composition Measurements

Body height was determined using a stadiometer (BSM370, InBody, Korea) (Čaušević et al. 2023; Čović et al. 2023), while body mass, percentage and quantity of fat and muscle tissue were measured using a BIA scale (Inbody 370) as advised in previous studies Mašić et al. 2024; Kovačević et al. 2022. Skinfold thickness on the back, biceps, triceps, abdomen, thigh, and calf was measured using a caliper. All measurements were taken in the morning, before breakfast.

## Results

**Tabel 1.** Descriptive statistics and differences of body composition

	Male		Female		Mean difference	T value	Sig
	Mean	SD	Mean	SD			
Age (year)	13.55	0.68	13.18	0.87	0.36	1.59	0.11
Body height (cm)	168.65	10.95	162.02	9.62	6.62	2.36	0.02*
Body weight (kg)	52.53	12.83	46.59	9.49	5.93	1.97	0.05*
Skinfold triceps (mm)	6.45	1.84	9.08	2.59	-2.63	-4.00	0.00*
Skinfold Back (mm)	6.25	2.35	7.27	2.67	-1.02	-1.43	0.15

Skinfold biceps (mm)	4.50	1.31	6.16	2.33	-1.66	-2.92	0.00*
Skinfold abdomen (mm)	7.35	4.17	8.16	3.81	-0.81	-0.74	0.46
Skinfold calf (mm)	7.00	2.47	7.94	3.83	-0.94	-0.99	0.32
Skinfold thigh (mm)	9.50	2.69	12.83	4.89	-3.33	-2.82	0.01*
BMI (kg/m <sup>2</sup> )	18.18	2.76	17.41	2.37	0.76	1.10	0.27
%FAT (%)	10.28	3.82	15.31	4.86	-5.03	-4.00	0.01*
Muscle mass (kg)	26.01	6.94	21.02	4.17	4.98	3.39	0.01*

BMI – body mass index; %FAT – body fat percentage; \* -  $p < 0.05$

Table 1 presents gender differences and mean values by gender. Body weight, the proportion of fat and muscle mass, and the skinfold thickness of the upper arm, both biceps and triceps, showed statistically significant differences. Furthermore, while body height and muscle mass were statistically considerably higher in male competitors, all markers of fat tissue percentage were higher in female competitors. There were no statistically significant gender differences in other variables.

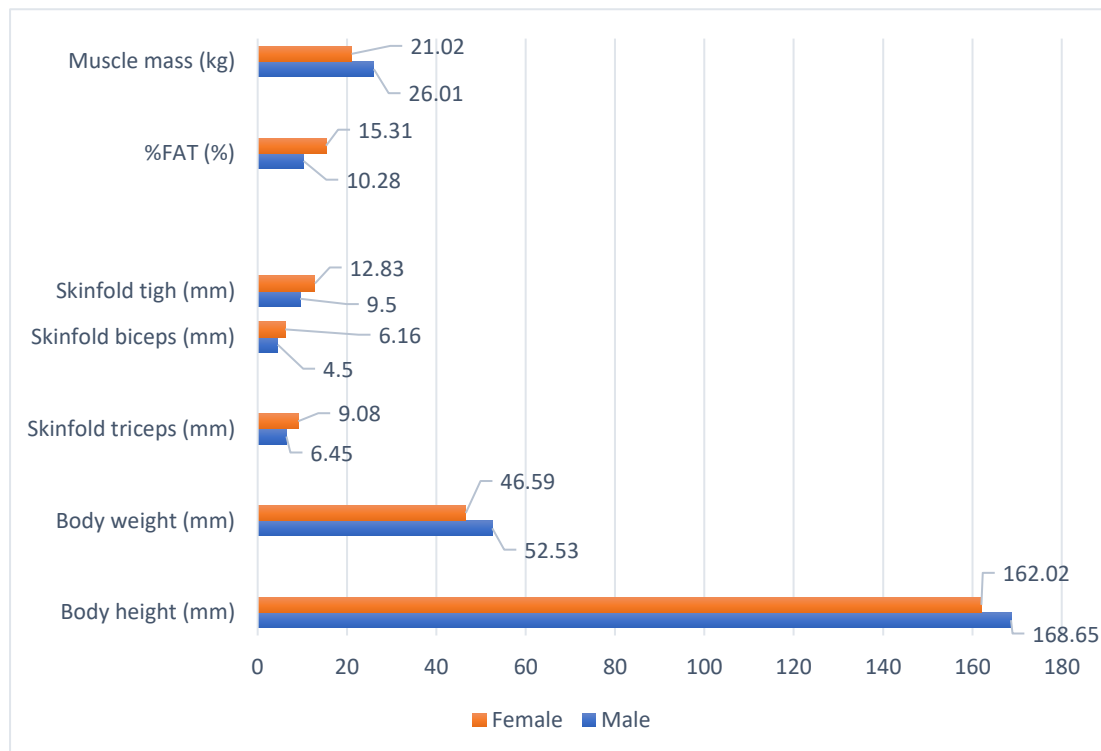


Figure 1. Descriptive parameters and differences between groups

## Discussion

This study aimed to evaluate and compare elite Taekwondo competitors' body characteristics and compare them between sexes.

The results indicate that there is a statistically significant difference between the anthropometric variables recorded in the male and female population. In addition to the fact that the results confirmed that male competitors are taller than female competitors and have greater muscle mass, which was previously recorded in all age categories, from juniors (Bešlija et al., 2021; Mathunjwa et al., 2015), cadets (Bešlija et al., 2021) to seniors (Čular et al., 2020) clear differences were observed in the proportion of fat in total body mass and the size (thickness) of skin folds. More specifically, in addition to the directly measured higher proportion of fat tissue in the total body mass,

out of a total of 6 "skinfold measures", indicators of the proportion of fat tissue in the total body mass, statistically significantly higher results were recorded in 4 of the female competitors compared to the male competitors.

Observing the rest of the variables used, and considering that they are all indicators of the body fat proportion, it can be noted that they are at the same low level in both sexes. Similar results were observed in earlier studies. Markovic et al. (2005) observed almost identical (15.3%) values of fat tissue percentage in the total body mass in "A category" athletes and defined them as "top-quality female taekwondo competitors", while in "B category", in female competitors who had not won medals until that moment, significantly higher values of the percentage of fat tissue were observed (17,6%). Similar results were observed by Agopyan et al. (2022) in males. They observed similar values of the proportion of fat tissue in the total body mass in competitors who won medals, while in competitors who did not, they noticed slightly higher values (11.43%). On the other hand, Sevinç Yılmaz et al. (2021) noticed a significantly higher percentage of adipose tissue in total body mass in a sample of slightly older (aged 14-16) elite Taekwondo male (10.28% to 17.36%) and female competitors (15.31% to 19.8%).

The results, viewed globally, are in accordance with the results of the review article (Bridge et al., 2014), based on the previous 42 studies, came to the unequivocal conclusion that one of the characteristics of elite and sub-elite taekwondo competitors of both sexes is low body fat percentage. Furthermore, these results can be useful to coaches because they show that by simply measuring skin folds it is possible to categorize taekwondo competitors and make a basic selection if they are not able to carry out more detailed diagnostic procedures.

## Conclusion

This research provided an insight into the basic anthropometric characteristics of elite taekwondo competitors. Furthermore, the findings indicated clear differences in the indicators of the proportion of fat tissue in the total body mass between these two groups. In accordance with the above, these results can help taekwondo experts in the initial stages of selection, especially in the case when the implementation of sophisticated tests is impossible. Further studies aimed at profiling this group of respondents should include a larger number of variables and thus help experts from practice in the process of identifying talents and setting the goals of training programs.

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Amel Mekić: Concept, implementation of test procedures, methodology, and writing; Rasim Lakota: methodology, and writing; Mladen Živković: Concept, implementation of test procedures, methodology, and writing; Muhammet Çelik: Concept, methodology, and writing; Merima Merdan: implementation of test procedures, methodology, and writing. All the authors read and approved the final version of the manuscript.

### **Conflicts of Interest**

The authors declare no conflict of interest

### **Data availability**

Full access to data on request.

### **Ethics Approval Statement**

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### **Informed Consent Statement**

Parents or legal guardians signed the study consent forms.

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