BODY COMPOSITION IN THE MIDDLE-AGED CROSSFIT PRACTITIONERS: MEN VERSUS WOMEN

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ABSTRACT

Introduction: Body composition has a significant impact on health status and sports performance. There is a close relationship between body composition and various factors, including age, sex, ethnicity, nutrition, and physical activity. The present study aims to investigate sex-related differences in body composition parameters among middle-aged CrossFit practitioners.

Material and Methods: A total of 93 CrossFit practitioners (54 men and 39 women) were included in the present study. Body height (BH) was determined by Martin's anthropometer (GPM, Switzerland). Bioelectrical impedance measurements (In-Body 170 analyzer) were applied to assess: body weight (BW), body mass index (BMI), muscle mass (MM), fat mass (FM), fat-free mass (FFM), and total body water (TBW). Descriptive statistics were made using SPSS 16 (IBM, USA), and the distribution of normality was checked. The independent samples t-test was used to assess the sexual differences in body composition components.

Results: The sexual differences of the assessed body composition parameters are well expressed, with higher values observed in males. According to the WHO cut-off values for BMI, the male athletes are overweight, but the women are of normal weight. CrossFit athletes of both sexes are characterized by high levels of MM, FFM, and TBW and normal levels of FM.

Conclusion: CrossFit training is associated with greater muscle mass accumulation and higher BMI values, which may be incorrectly associated with overweight and obesity. For this reason, body composition analysis is a more suitable measure than BMI for assessing the morphological status of CrossFit athletes.

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INTRODUCTION

Body composition (BC) is a significant factor that influences health status and sports performance (Liu et al., 2022; Hanna et al., 2022; Hilton & Lundberg, 2021). According to Lohman, body composition is a collection of different components of the human body (proteins, fats, water, and minerals, etc.) that are connected through biochemical and physiological relationships (Lohman et al., 1988). Over the years, various models of body composition have been developed and refined. According to the two-component model, established by Bencke, it consists of fat mass (FM) and fat-free mass (FFM) (Behnke, 1963).

Body composition is genetically determined but also shows environmental sensitivity and significance (Petrova, 2000; Milcheva & Orbetsova, 2004). A close relationship exists between body composition and various factors, including age, sex, genetics, nutrition, and physical activity. "Sex is an essential factor to consider when using DXA, BIA, or anthropometry to assess SMM and LBM development" (Baglietto et al., 2024).

Accurate estimation of fat mass and muscle mass has a crucial impact on improving sports performance (Lockie et al., 2021; Ferrari et al., 2022). Various studies have described the relationships between BC components and cardiorespiratory fitness (Komici et al., 2023), strength (Wang et al., 2018; Confortin et al., 2022), anaerobic performance (Ponce-García et al., 2025), and multi-joint movements (Gómez-Landero & Frías-Menacho, 2019) across various sports.

The present study aims to assess the sex-related differences in body composition parameters among middle-aged CrossFit practitioners.

METHODOLOGY

Participants

A total of 93 CrossFit practitioners (54 men and 39 women) were included in the present study.

The mean age of the men was 39 ± 6.3 years; the mean age of the women was 41 ± 7.06. All participants completed a questionnaire regarding their training experience (men have 3.67 ± 2.44 years; women have 3.80 ± 2.41).

Inclusion criteria:

- Participants with at least one year of training experience.

Exclusion criteria:

- No vigorous activity 24 hours before the testing.
- No caffeine intake 12 hours before testing.

Body composition

Body height (BH) was measured by Martin's anthropometer (GPM, Switzerland). Bioelectrical impedance measurements (InBody 170, InBody Co., Ltd., Korea) were applied to assess: body weight (BW), body mass index (BMI), muscle mass (MM), muscle mass percentage (MM%), fat mass (FM), fat mass percentage (FM%), fat-free mass (FFM), and total body water (TBW), total body water percentage (TBW%). Descriptive statistics were generated using SPSS 16 (IBM, USA), and the normality of the distributions was assessed. The independent-samples *t*-test was used to assess sexual differences in body composition components. In addition, we evaluate the differences in measured parameters between males and females as a percentage and as an effect size using Cohen's *d* (Cohen, 1988).

All athletes signed the informed consent form and voluntarily participated in the study. The study protocol was reviewed and approved by the Ethics Committee of the National Sports Academy (Protocol EC–NSA–2025-001). The study was conducted in agreement with the principles stated in the Declaration of Helsinki for human studies and research (WMA, 2008).

RESULTS

Relatively high levels of MM%, FFM, and TBW% and normal levels of FM% characterize CrossFit athletes of both sexes. The sexual differences of the assessed body composition parameters are well expressed, with higher values observed in males.

Table 1 presents all the body composition parameters studied and the percentage differences between men and women. The mean BH for men was 177.66 ± 6.79 cm, compared to 165.00 ± 5.54 cm for women ($p < .001$). The mean BW for men was 83.56 ± 10.02 kg vs 63.54 ± 8.45 kg for women ($p < .001$). The mean BMI for the men was 26.47 ± 2.80 kg/m², compared to 23.30 ± 2.24 kg/m² for the women ($p < .001$). The mean MM% in men was 45.91 ± 5.91% vs 43.53 ± 1.92% for women ($p < .017$). The mean MM in men was 38.89 ± 4.79 kg, compared to 27.62 ± 3.49 kg in women ($p < .040$). The mean MM% in men was 45.91 ± 5.91% compared to 43.53 ± 1.92% in women ($p < .017$). The mean FM in men was 16.10 ± 6.89 kg vs 13.82 ± 3.49 kg for the women ($p < .040$). The mean FM% in men was 18.18 ± 5.66% compared to 21.56 ± 3.60% in women ($p < .002$). The mean TBW in men was 50.28 ± 6.19 L vs 36.44 ± 4.27 L for women ($p < .001$). The mean TBW% in men was 60.37 ± 5.43% vs 57.53 ± 2.67% in women ($p < .003$). The mean FFM in the man was 68.21 ± 8.12 kg vs 49.69 ± 5.89 kg for the woman ($p < .001$). The sports experience was the same for both sexes. Cohen's *d* shows that the male sex effect sizes for BH, BW, BMI, MM, and TBW were large ($d \geq 0.8$), for FM% and TBW% were medium ($d \geq 0.5$), and for FM was small ($d \geq 0.2$) (Cohen, 1988).

Table 1. *Body composition parameters (Mean ± SD) and sex-related differences in CrossFit athletes*

Parameter	Men (n = 54)	Women (n = 39)	p - values	Difference (%)	d
Age (Years)	39 ± 6.3	41 ± 7.06	.000	5.13	
BH (cm)	177.66 ± 6.79	165.00 ± 5.54	.001	7.09	2.01
BW (kg)	83.56 ± 10.02	63.54 ± 8.45	.001	23.96	2.13
BMI (kg/m^2)	26.47 ± 2.80	23.30 ± 2.24	.001	11.98	1.23
MM (kg)	38.89 ± 4.79	27.62 ± 3.49	.001	28.98	2.62
MM% (%)	45.91 ± 5.91	43.53 ± 1.92	.017	5.18	0.51
FM (kg)	16.10 ± 6.89	13.82 ± 3.49	.040	14.16	0.40
FM (%)	18.18 ± 5.66	21.56 ± 3.60	.002	18.59	-0.69
TBW (L)	50.28 ± 6.19	36.44 ± 4.27	.001	27.53	2.53
TBW (%)	60.37 ± 5.43	57.53 ± 2.67	.003	2.84	0.63
FFM (kg)	68.21 ± 8.12	49.69 ± 5.89	.001	27.15	2.55
Sports experience (Years)	3.67 ± 2.44	3.80 ± 2.41	.555	none	

DISCUSSION

Recent CrossFit research has highlighted a clear advantage for athletes with greater training experience, as reflected in both body composition and physiological parameters (Magine et al., 2020). In our study, there was no statistically significant difference in the average sports experience between men and women (see Table 1). Therefore, the observed differences in anthropometric parameters can primarily be attributed to inherent sex-related differences.

A primary objective of the current study was to examine sex-related differences in body composition among middle-aged CrossFit practitioners.

Adipose tissue is the most variable tissue in the human body. The absolute and relative values of body fat differ at the different stages of human life. In the newborn period, the FM accounts for approximately 350 g of the total body mass (11-16% of body weight), and it reaches between 12% and 15% for young men and between 25% and 28% for young women (Widdowson et al, 1979; Lohman et al, 2013). Its values also vary depending on the type of sports activity (Jeukendrup & Gleeson, 2010).

The mean BW of the investigated Bulgarian CrossFit athletes was 83.56 ± 10.02 kg for men and 63.54 ± 8.45 kg for women. The mean BH was 177.66 ± 6.79 cm for the men vs 165.00 ± 5.54 cm for the women. In the literature, we found data on the height and weight of elite athletes practicing CrossFit, where the following values were announced for BW: 79.3 ± 8.3 kg for the men vs 60.9 ± 5.2 kg for the women, for height: 174.0 ± 4.5 cm for the men vs 163.5 ± 3.4 cm for the women (Menargues-Ramírez et al., 2022).

Body composition analysis provides extremely accurate descriptions of the components of the human body. Some of the BC parameters are closely related to a person's health and physical development. Such indicators are BMI, FM%, and MM%. The BMI for the men was 26.47 ± 2.80 kg/m^2 vs 23.30 ± 2.24 kg/m^2 for the women. The men's BMI was slightly above the normal range, according to the NHLBI (1998), but this is likely due to their well-developed muscle mass. According to Milanese (2025), BMI is not suitable for determining weight status in young male athletes (Milanese et al., 2025). FM on the men was 16.10 ± 6.89 kg, compared to 13.82 ± 3.4 kg for the women, indicating that men have more fat tissue than women. A recent publication showed similar results for FM in recreational CrossFit men (15.4 ± 7.0 kg) compared to women (13.8 ± 1.4 kg) (Mangine et al., 2020). This fact suggests that CrossFit activities can have a beneficial effect on body composition in women, helping to counteract the accumulation of excess fat cells.

Another study comparing somatic parameters in males with different sports experiences (2 years and 4-6 years) aimed to reveal the long-term effects of CrossFit training. The study reported that athletes with greater sports experience had lower FM% compared to the beginner group. The researchers suggest that improvements in sports experience, a decrease in FM%, and an enhancement in functional movement quality were observed (Sporek & Konieczny, 2024).

Of interest is the comparison of FM% between the two sexes. In our study, men had an FM% of 18.18 ± 5.66% compared to 21.56 ± 3.60% for women. Thus, according to the American Council of Exercise scale, men were assessed as having an "acceptable weight". In contrast, women had a "fitness weight" (Dorwart, L., 2025). We defined the gender differences in FM% observed by us as characteristic gender differences. In the literature, we found a similar study that reported middle-aged men practicing CrossFit had an FM% of 17.9 ± 3.09%, compared to 24.96 ± 3.86% for women (Oliveira et al., 2021).

We found statistically significant differences in the MM indicator between men and women practicing CrossFit. The man was MM 38.89 ± 4.79 (kg), vs women 27.62 ± 3.49 (kg); MM (kg) was 28.98% higher for men (see Table 1). The difference is in absolute values. In the literature, we found data on MM for CrossFitters of both sexes, where MM for men was 44.9 ± 1.3 kg vs 32.3 ± 1.1 kg for women, indicating a 28.1% higher difference for men (Hodžić et al., 2024). These data correspond to the differences found for MM, as in our study (Table 1). Another study presents a strong correlation between MM and total sports performance in CrossFit (Menargues-Ramírez et al., 2022).

Our study revealed that the FFM, measured by bioelectrical impedance, was 68.21 ± 8.12 kg for the men and 49.69 ± 5.89 kg for the women ($p \leq .05$). FFM is an accurate parameter for determining fat-free active body mass, as it excludes all fat depots, including visceral fats (Mcardle et al., 1996). The average difference between FFM for both sexes was 27.2% in favor of the male sex.

A very good TBW value was reported for the men at 50.28 ± 6.19 L and for the women at 36.44 ± 4.27 L, expressed as a percentage of body mass, which were 60.37 ± 5.43% vs 57.53 ± 2.67%, respectively (p < .003) (Table 1). The significant difference between the sexes of 2.85% is due to men having a higher percentage of muscle mass. According to Baglietto and coworkers, the degree of hydration does not affect the various methods used to determine body composition (Baglietto et al., 2024).

CONCLUSION

CrossFit training is associated with a greater muscle mass accumulation and high values of BMI, which may be incorrectly associated with being overweight and obesity. For this reason, body composition analysis is a more suitable measure than BMI for assessing the morphological status of CrossFit athletes. Regular CrossFit activities have beneficial effects on body composition in middle-aged men and women.

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