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EXAMINING THE LINK BETWEEN MOTOR FITNESS AND MORPHOLOGY IN 10-YEAR-OLD CHILDREN

PREUČEVANJE POVEZAVE MED GIBALNIMI SPOSOBNOSTMI IN MORFOLOGIJO PRI 10-LETNIH OTROCIH

ABSTRACT

The objective of this study was to investigate the relationship between motor fitness and morphological factors, including anthropometric measurements and body composition, in a cohort of 10-year-old children. The sample consisted of 32 boys (mean age 10.24 ± 0.22 years, body height: 147.12 ± 6.11 cm, body mass: 42.14 ± 11.02 kg, body mass index: 19.41 ± 4.16 kg/m^2) and 29 girls (mean age 10.12 ± 0.20 years, body height: 145.31 ± 7.68 cm, body mass: 40.10 ± 8.76 kg, body mass index: 18.91 ± 3.58 kg/m^2). Anthropometric and body composition variables encompassed body height (BH), body mass (BM), body mass index (BMI), body fat mass (BFM), and free-fat mass (FFM). The motor fitness tests, designed to evaluate strength, coordination, speed and aerobic fitness, included standing long jump (SLJ), medicine ball throw (MBT), sit-ups in 30 seconds test (SUT), hand tapping test (HTT), obstacle course backwards test (OCB), and shuttle run test (SRT). While there were no notable differences between boys and girls in terms of morphology, for MBT (p = 0.011) and HTT (p = 0.016) fitness tests significant sex-differences were observed. Except HTT, all motor variables showed small to moderate correlations with morphological variables. Through the utilization of regression analysis, it was determined that BMI (r = 0.201 - 0.389) and BFM (r = 0.166 - 0.418) were the most influential predictor variables for the majority of motor variables. These findings suggest that anthropometry and body composition have a moderate impact on performance in motor tests that assess strength, body coordination, and aerobic fitness.

Keywords: body composition, anthropometry, strength, body coordination, aerobic fitness

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IZVLEČEK

Cilj te študije je bil raziskati povezavo med gibalnimi (motoričnimi) sposobnostmi in morfološkimi dejavniki, vključno z antropometričnimi meritvami in telesno sestavo, v skupini 10-letnih otrok. Vzorec je sestavljalo 32 dečkov (povprečna starost 10.24 ± 0.22 leta, telesna višina: 147.12 ± 6.11 cm, telesna masa: 42.14 ± 11.02 kg, indeks telesne mase: 19.41 ± 4.16 kg/m^2) in 29 deklic (povprečna starost 10.12 ± 0.20 leta, telesna višina: 145.31 ± 7.68 cm, telesna masa: 40.10 ± 8.76 kg, indeks telesne mase: 18.91 ± 3.58 kg/m^2). Antropometrične spremenljivke in spremenljivke telesne sestave so vključevale telesno višino (BH), telesno maso (BM), indeks telesne mase (ITM), maso telesne maščobe (BFM) in maso proste maščobe (FFM). Testi motoričnih sposobnosti so bili namenjeni ocenjevanju moči, koordinacije, hitrosti in aerobne zmogljivosti. Vključevali so skok v daljino z mesta (SLJ), met medicinke (MBT), dvigovanje trupa (SUT), dotikanje plošč z roko (HTT), premagovanje ovir nazaj (OCB) in stopnjevalni tek (SRT). Medtem ko med fanti in dekleti ni bilo opaznih razlik glede morfologije, so bile pri testih telesne pripravljenosti MBT (p = 00.11) in HTT (p = 0.016) opažene pomembne razlike med spoloma. Razen HTT so vse motorične spremenljivke pokazale majhne do zmerne korelacije z morfološkimi spremenljivkami. Z uporabo regresijske analize je bilo ugotovljeno, da sta bila BMI (r = 0.201 – 0.389) in BFM (r = 0.166 – 0.418) najbolj vplivni napovedni spremenljivki za večino motoričnih spremenljivk. Te ugotovitve kažejo, da antropometrija in telesna sestava zmerno vplivata na uspešnost pri motoričnih testih, ki ocenjujejo moč, koordinacijo telesa in aerobno pripravljenost.

Ključne besede: telesna sestava, antropometrija, moč, koordinacija telesa, aerobna zmogljivost

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INTRODUCTION

Physical fitness is an essential aspect of overall health in children. It has been linked to numerous health benefits, including improved cardiovascular function, better mental health, and reduced risk of chronic diseases (Janssen & LeBlanc, 2010). Motor fitness, which encompasses various components of physical fitness, such as muscular strength, endurance, speed, agility, coordination, and flexibility, has also been linked to numerous health outcomes (Bala & Popović, 2007). Body composition is another critical indicator of physical fitness in children, reflecting the relative proportions of various elements within the body, including fat, muscle, bone, and water (Kyle, Earthman, Pichard, & Coss-Bu, 2015). High levels of body fat have been linked to numerous health problems, including cardiovascular disease, type 2 diabetes, and certain types of cancer (Daniels et al., 2005). Conversely, increased muscle mass was associated with lower levels of metabolic markers, such as insulin resistance and triglycerides (Banfi, Colombini, Lombardi, & Lubkowska, 2012). Hence, understanding the relationship between motor fitness and body composition in children is critical for promoting healthy lifestyles and reducing the risk of obesity-related health problems.

The impact of weight status on children's motor performance is widely recognized. Traditionally, body mass index (BMI) has been the primary method employed to investigate the association between weight status and motor development in children (Prentice & Jebb, 2001). Previous research has established a negative correlation between BMI and different components of motor fitness, such as agility, speed, strength, and aerobic fitness (Brunet, Chaput, & Tremblay, 2007; D'Hondt, Deforche, De Bourdeaudhuij, & Lenoir, 2009; Fiori et al., 2020). However, BMI has some significant limitations, as it cannot differentiate between fat mass and lean body mass. In some cases, excess fat mass may mask lean mass deficits, which are important for motor development (Prentice & Jebb, 2001). Therefore, body composition evaluation has been proposed to provide additional insights into morphological status (de Castro, de Lima, & Silva, 2018; Kyle et al., 2015). Unfortunately, while body composition assessment is commonly used in weight-related studies in adults, it is still an emerging field in children (Kyle et al., 2015).

Few studies utilized body composition assessment and investigated association with motor fitness in prepubertal children. Particularly, Webster et al. (2021) investigated the correlation between fundamental motor skills (locomotor and object control skills) and body composition (fat mass and percent, fat-free mass) in children aged 3-10 years. The results revealed that fat-free mass emerged as the primary determinant of locomotor skills, whereas overall body composition could account for approximately 23% of the observed variation. Lepes et al. (2014) found that "general motor fitness" expressed as the summed performance in motor coordination, strength, agility, and flexibility tests moderately correlated with the percent of body fat (r = 0.47 - 0.57). Interestingly, neither Webster et al. (2021), nor Lepes et al. (2014) investigated associations between body composition parameters and individual motor items. More recently, Henriksson et al. (2022) evaluated aerobic fitness, upper and lower-body strength in 9-years old children, and explored possible correlations with fat percentage and fat-free mass. They found that fat percentage was negatively correlated (r = 0.45 – 0.47) with aerobic fitness and lower-body strength, while fat-free mass showed positive association (r = 0.54) with upper-body strength.

Overall, prior research indicates that body composition, specifically the percentage and mass of fat, as well as fat-free mass, have a moderate impact on motor performance among prepubertal children. However, it is still uncertain which particular aspects of motor fitness are most strongly influenced by body composition status. In other words, there is a lack of empirical data that establishes a clear link between body composition and specific motor items such as body coordination, movement speed, or different types of strength in prepubertal children. Hence, the objective of the present study was to thoroughly examine the correlation between motor fitness, encompassing coordination, aerobic fitness, and different forms of strength, and morphology (including body height, body mass, BMI, and body composition) in a group of 10-year-old children.

METHODS

Experimental procedure

The experimental procedure comprised of two laboratory testing sessions. In the initial session, anthropometric measurements and body composition assessment were conducted, while the evaluation of motor fitness took place during the second session. Both sessions were conducted in the morning hours (8:00-11:00 AM) and maintained a consistent room temperature (20-25°C). Prior to data collection, all participants underwent two pre-visits to become familiar with the motor tests (Bala & Popović, 2007). Additionally, they were instructed to abstain from engaging in physical activity and consuming solid food within two hours preceding the testing.

Participants

The study sample comprised of 61 children, including 32 boys (aged 10.24 ± 0.22 years, BH: 147.12 ± 6.11, BM: 42.14 ± 11.02, BMI: 19.41 ± 4.16) and 29 girls (aged 10.12 ± 0.20 years, BH: 145.31 ± 7.68, BM: 40.10 ± 8.76, BMI: 18.91 ± 3.58). All participants had no history of musculoskeletal, neurological, or orthopedic disorders, and none of them had an athletic background involving less than 6 hours of physical activity per week. Before participating in the study, both the participants and their parents had been provided with detailed information about the experimental procedures and potential risks involved. They willingly provided written informed consent. The study received approval from the Institutional Ethics Committee and was conducted in adherence to the principles stated in the Declaration of Helsinki.

Anthropometric and body composition assessment

Anthropometric measures included body height (BH), body mass (BM), and body mass index (BMI). Body height was assessed using Martin's portable anthropometer from Siber-Hegner, Switzerland, with a precision of 0.1 cm (Norton et al., 2000). Body mass was measured using an electronic scale from Tanita, Arlington Heights, IL, USA. BMI was calculated using the standardized formula (WHO, 2020).

Body composition variables were determined using the Tanita MC-780 MA device (Tanita Corporation, Tokyo, Japan), utilizing the Direct Segmental Multi-frequency–Bioelectrical Impedance Analysis (DSM–BIA) method. The assessment encompassed four outcome measures, including body fat mass (BFM) and free-fat mass (FFM). The BIA device was manually input with height measurements, age, and sex information. Prior to the analysis, participants were instructed to refrain from eating in the morning, avoid any form of exercise 24 hours before the measurement, and attend to any physiological needs. Subjects were asked to stand for at least 5 minutes before the measurement to allow for the redistribution of body fluids. During the measurement, all participants wore lightweight sports clothing and removed any metal accessories.

Motor fitness assessment

The test battery consisted of a total of seven items and was conducted following the standardized protocols of Eurofit (Planinsec, 2002; Bala & Popovic, 2007); for assessing explosive strength - Standing long jump (SLJ) (cm); for assessing upper body strength - Overhead Medicine Ball Throw (MBT) (cm); for assessing trunk strength - Sit-ups in 30 seconds (SUT) (freq); for accessing frequency of movement – Hand taping (HTT) (freq); for assessing body coordination – Obstacle course backwards (OCB) (s); for accessing aerobic fitness – Shuttle run test (SRT) (s). All testing sessions were supervised by two experienced physical education teachers. Attention was paid to proper form throughout the testing. Above-mentioned tests are a part of euro-fit battery, and their procedures are explained elsewhere (Council of Europe).

Statistical analysis

The Shapiro-Wilk's test was employed to assess the normality of the distribution. Independent t-tests were utilized to investigate the sex-related differences in anthropometric and body composition variables (BH, BM, BMI, BFM, FFM), as well motor variables (SLJ, MBT, SUT, HTT, OCB, SRT). To examine the associations between morphological and motor fitness variables, Pearson's correlation coefficient (r) was employed. The strength of the Pearson correlation (r) was categorized according to Hopkins et al. (2009) as follows: trivial (0.01), small (0.1), moderate (0.3), large (0.5), very large (0.7), and extremely large (0.9). For discussion purposes, the correlation coefficients were compared directly with their 95% confidence intervals. Additionally, a backward multiple regression analysis was conducted to determine the most suitable model of morphological variables for each motor item independently. Also, in a case when none of the morphological variables were not significantly correlated with chosen motor item variable, backward multiple regression analysis was not performed. Prior to the regression analysis, multicollinearity was assessed using a variance inflation factor (VIF), and any variable with a VIF of 10 or higher was excluded from the model (Đurić et al., 2022). The statistical analysis was performed using IBM SPSS Statistics software package (version 20, SPSS Inc, Chicago, IL, USA). All data are presented as mean and standard deviation. A significance level of $p \leq 0.05$ was considered statistically significant.

RESULTS

Sex related differences in tested variables

No significant differences were found between sex-based groups when analyzing morphology using an independent t-test; i.e. variables BH, BM, BMI, BFM, FFM failed to reach significance (t = 0.396 – 1.109, p = 0.272 – 0.694). On the other hand, motor-related measures demonstrated significance for two variables, MBT and HTT (t = 2.632, p = 0.011; t = -2.468, p = 0.016, respectively), with MBT in favor of the boys, and HTT in favor of the girls. Other motor variables (SLJ, SUT, OCB, SRT) did not reach significance (t = 0.121 – 1.814, p = 0.075 – 0.904), while it is worth mentioning that for SLJ significance was near to its achieving (t = 1.814, p = 0.075), indicating a slight advantage for boys compared to girls (Table 1).

Table 1. Sex related differences in body composition and motor items variables.

Variables	Boys (n = 33)	Girls (n = 29)	t value	p
BH (cm)	147.12 ± 6.11	145.31 ± 7.68	1.003	0.306
BM (kg)	42.14 ± 11.01	40.10 ± 8.76	0.799	0.427
BMI (kg/m²)	19.41 ± 4.16	18.91 ± 3.58	0.499	0.620
BFM (kg)	9.51 ± 5.51	9.00 ± 4.47	0.396	0.694
FFM (kg)	32.62 ± 5.89	31.09 ± 4.83	1.109	0.272
SLJ (cm)	140.73 ± 23.82	130.38 ± 20.69	1.814	0.075
MBT (cm)	294.64 ± 46.37	262.03 ± 51.16	**2.632**	**0.011***
SUT (freq)	19.12 ± 4.23	19.24 ± 3.46	-0.121	0.904
HTT (freq)	29.24 ± 3.90	31.83 ± 4.35	**-2.468**	**0.016***
OCB (s)	21.03 ± 7.73	22.79 ± 6.23	-0.976	0.333
SRT (freq)	13.82 ± 7.41	11.69 ± 7.00	1.161	0.250

BH - body height; BM - body mass; BMI - body mass indes; BFM - body fat mass; FFM - free-fat mass; SLJ - standing long jump test; MBT - the medicine ball throw test; SUT - sit-ups in 30 seconds test; HTT - the hand tapping test; OCB - the obstacle course backwards test; SRT - shuttle run test; *$p \leq 0.05$

Relationship between motor items and body composition

Pearson correlation coefficient of all body composition variables was performed independently on each motor item variable, and its results have been shown in Table 2. In a case of relationship of morphological variables on SLJ, trivial-to-moderate correlations (r = 0.054 – 0.257) were observed. In the next case, morphological variables achieved moderate correlations (r = 0.265 – 0.485) with MBT. When it comes to relationship of the morphological variables with SUT, small-to-moderate correlations (r = 0.167 – 0.329) were observed. On the other hand, morphological variables made trivial-to-small impact on HTT (r = 0.089 – 0.211). In addition, morphological variables reached trivial-to-moderate correlations with OCB (r = 0.021 – 0.418). Further, SRT made trivial-to-moderate correlations with morphological variables (r = 0.040 – 0.396).

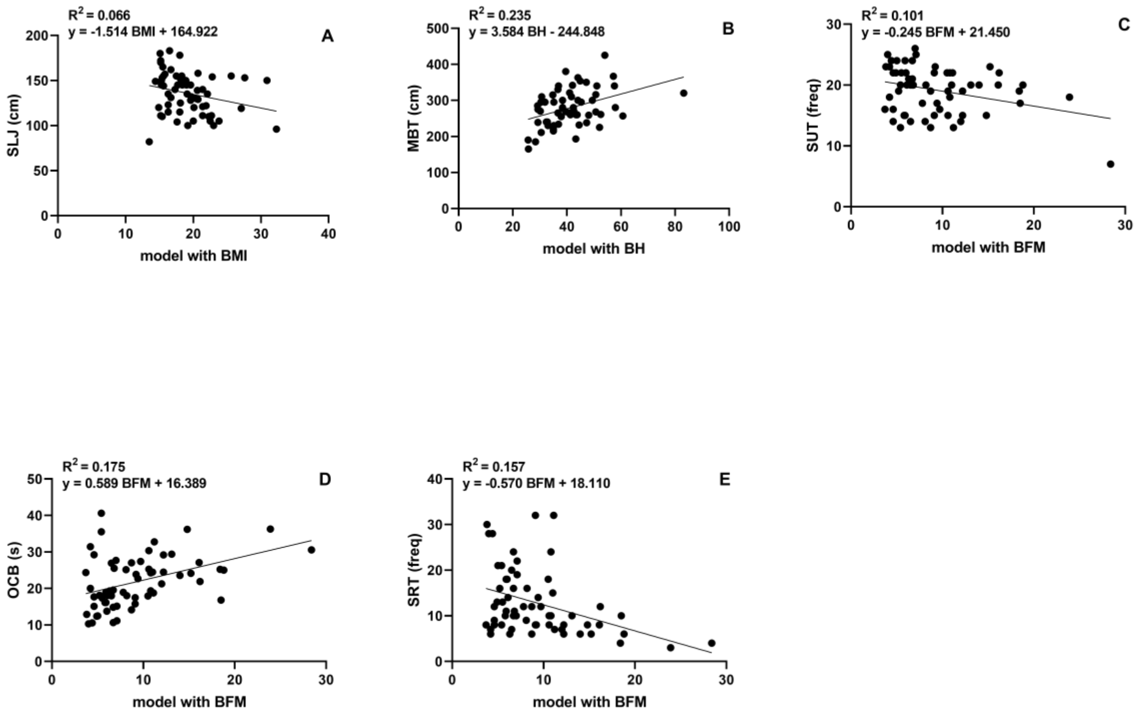
Table 2. Correlation of the motor items with body composition variables.

Variables		BH (cm)	BM (kg)	BMI (kg/m²)	BFM (kg)	FFM (kg)
SLJ (cm)	*r*	0.107	-0.140	**-0.257***	-0.220	-0.054
	p	0.409	0.278	**0.044**	0.085	0.676
MBT (cm)	*r*	**0.485****	**0.399****	**0.265***	**0.291***	**0.465****
	p	**0.000**	**0.001**	**0.037**	**0.022**	**0.000**
SUT (freq)	*r*	-0.167	**-0.329****	**-0.296***	**-0.318***	**-0.312***
	p	0.195	**0.009**	**0.020**	**0.012**	**0.013**
HTT (freq)	*r*	-0.089	-0.198	-0.201	-0.166	-0.211
	p	0.491	0.123	0.117	0.196	0.100
OCB (s)	*r*	-0.021	**0.306***	**0.366****	**0.418****	0.178
	p	0.868	0.015	**0.003**	**0.001**	0.167
SRT (freq)	*r*	-0.040	**-0.338****	**-0.389****	**-0.396***	**-0.256***
	p	0.755	**0.007**	**0.002**	**0.011**	**0.045**

BH - body height; BM - body mass; BMI - body mass index; BFM - body fat mass; FFM - free-fat mass; SLJ - standing long jump test; MBT - the medicine ball throw test; SUT - sit-ups in 30 seconds test; HTT - the hand tapping test; OCB - the obstacle course backwards test; SRT - shuttle run test; r - correlation coefficient; p - significance value
* $p < 0.05$, ** $p < 0.01$

Additional regression analysis (backward regression model), have revealed the best-fitting model with BMI, as independent variable, in describing SLJ as dependent variable. This model has explained about 7% of the named dependent test (BMI: $p = 0.044$), and equation and r^2 value are shown in on Figure 1A. When it comes to the best fitting model on MBT as dependent variable, backward regression analysis has singled out BH as the variable that has explained approximately 24% of the named variable (BH $p = 0.000$). The equation of this model and r^2 value have been shown on Figure 1B. In the case of the SUT, as dependent variable, in this model BFM variable fitted with describing around 10% of variance (BFM $p = 0.012$). This model equation and r^2 value are presented on Figure 1C. On the other hand, OCB variable was best described with model that consisted only with variable BFM, explaining about 18% of this dependent variable (BFM $p = 0.001$). The equation of this model and r^2 value have been shown in Figure 1D. Further, SRT variable best-fitting model was with BFM, with total variance approximately 16% (BFM $p = 0.001$). This model equation and r^2 value are showed on Figure 1E.

Figure 1. Best-fit regression models predicting: Standing Long Jump Test (SLJ), expressed in centimeters (cm) (panel A); The Medicine Ball Throw Test (MBT), expressed in cm (panel B); Sit-ups in 30 seconds Test (SUT), expressed in number of frequency (freq) (panel C); Best-fit regression models predicting: The Obstacle Course Backwards Test (OCB), expressed in seconds (s) (panel D); Shuttle run test (SRT), expressed in frequency (freq) (panel E).



Abbreviations: BH – body height; BMI – body mass index; BFM – body fat mass; BFM – body fat mass

DISCUSSION

The objective of this study was to examine the relationship between body morphology and motor fitness in a group of 10-year-old boys and girls. In general, present results revealed that influence of physical characteristics tends to vary according to the specific motor test among 10-years old children. Particularly, body composition status has a moderate impact on performance in motor tests assessing strength, body coordination, and aerobic fitness. However, when it comes to frequency of movement, morphology provides little explanation for performance.

The current findings suggest that there are no significant differences in body composition between boys and girls at the age of 10 years. Conversely, previous studies have reported variations in body composition between sexes in preschool (Kojić, Pelemiš, Jorgić, Olanescu, Suciu, & Peris, 2023) and adolescent populations (Mendoza-Muñoz, Adsuar, Pérez-Gómez, Muñoz-Bermejo, Garcia-Gordillo, & Carlos-Vivas, 2020). Their findings revealed that BH, BM and FFM was greater in boys than girls. Nevertheless, the disparities in these findings may be attributed to the specific age range of the sample in the present study. In other words, the age period of 10 years is characterized by distinct maturation patterns between boys and girls, with girls experiencing their peak growth spurt approximately 2 years earlier than boys (Thomas & French, 1985). Therefore, this difference in timing may account for the lack of significant sex differences observed in variables such as BH, BM, FFM, etc. Regarding motor fitness, the current results indicate that boys exhibit superior performance compared to girls in tests assessing upper body explosive strength, and in the case of frequency of movement, girls were superior. Additionally, boys generally outperformed girls in other motor tests, although these differences did not reach statistical significance. Based on this, it seems that physical characteristics provide limited explanation for the observed sex differences in motor performance, at least among 10-year-old children.

Among the six components of motor fitness analyzed, only HTT did not exhibit any notable correlation with measures of body composition. This finding is not entirely surprising, as the frequency of movement primarily relies on neural involvement rather than morphological characteristics (Volman, Laroy, & Jongmans, 2006). Our results align well with previous research in this area (Nikolić, Furjan–Mandić, & Kondrič, 2014; Volman, Laroy, & Jongmans, 2006). In contrast, motor tests aimed at assessing strength, aerobic fitness, and body coordination generally demonstrated a moderate association with morphological measures. Specifically, variables such as BMI and BFM were found to be significant factors impacting performance in most of the conducted motor tests, including SLJ, OCB, SUT, and SRT. This suggests that increased adiposity has a negative impact on overall motor fitness.

The most appropriate model for SLJ determined that the variable BMI emerged as the primary determinant, accounting for approximately 7% of the variability observed in motor test. These similar findings had already been confirmed in Macedonian children (Gontarev, Zivkovic, Velickovska,. & Naumovski, 2014). When analyzing MBT, BH has been singled out as the best explaining variable, with about 24% of the same variance. These findings are in accordance with previous study that analyzed athletes same age as in present study (Visnapuu & Jürimäe, 2008), as MBT in this study was highly dependent on the body height. Moreover, when SUT, OCB and SRT were examined, the model incorporating BFM explained 10%, 18% and 16% of the differences, respectively. These results suggest that, regarding repetitive strength, motor coordination and aerobic fitness in children, BFM may carry more significance than BMI. Current findings align with previous studies conducted by Henriksson et al. (2022) and Mendoza-Muñoz, Adsuar, Pérez-Gómez, Muñoz-Bermejo, Garcia-Gordillo, & Carlos-Vivas, 2020 (2020), which likewise demonstrated a negative association between BFM and motor tests measuring explosive strength and aerobic fitness, where BFM accounted for around 20-35% of the variance in those studies. The reason for this could be attributed to the requirement of propelling or lifting body mass in weight-bearing activities such as SLJ, SUT, OCB, and SRT. As a result, higher BFM levels impose an extra burden to be moved, leading to an adverse impact on performance in these motor tests (Mendoza-Muñoz, Adsuar, Pérez-Gómez, Muñoz-Bermejo, Garcia-Gordillo, & Carlos-Vivas, 2020).

Regarding OCB, it is important to acknowledge the limited available data in the literature concerning the association between body composition and motor coordination in prepubertal children, making it challenging to compare our findings with previous reports. Recently, Kojić et al. (2023) conducted a study to investigate the relationship between body composition parameters and OCB in 6-year-old boys and girls. Their study found no significant association between the variables they examined, leading them to conclude that morphological characteristics had minimal influence on motor coordination in children of that age. However, studies that focused on BMI have revealed that the connection between body coordination and morphology tends to vary depending on the specific age period. For example, Lopes et al. (2012) discovered a moderate correlation (r = 0.44–0.48) between BMI and coordination in 11-year-old boys and girls, but no significant correlation (r = 0.16–0.18) during the preschool period. Taking these findings into consideration, it is reasonable to assume that body composition variables, particularly the BFM, may play a more significant role in motor coordination as children grow older, as suggested by our results.

In addition to BFM, it was observed that FFM exhibited a significant correlation specifically with strength tests, namely MBT and SUT. It is widely recognized that greater FFM indicates higher muscle mass (Henriksson et al., 2022), which should provide an advantage in terms of strength performance (Lepes et al., 2014). Our current findings revealed that FFM displayed the strongest association with MBT, which was utilized to assess absolute strength. Similar results were also reported by (Mendoza-Muñoz et al., 2020) in a study involving adolescent children, where FFM exhibited a stronger association with handgrip strength (r = 0.64) compared to SLJ (r = 0.27). However, it is important to highlight that while FFM displayed a moderate correlation with MBT in the current study, the best-fit model emphasized that BH emerged as the most influential predictor of strength performance. This finding was not surprising, as previous research (Hogrel et al., 2012) had identified BH as a major explanatory morphological variable for absolute strength in children. The relationship between BH and absolute strength can be attributed to various factors. For example, taller individuals generally possess longer limbs, which can offer mechanical advantages during specific movements and exercises. Additionally, taller individuals often have larger bone structures and joint surfaces, which provide advantageous force transmission during weight-bearing tasks, ultimately contributing to higher levels of strength (Jaric, 2002; Hogrel et al., 2012).

There were certain constraints to consider in this study. Firstly, the present sample did not involve the calculation of biological age, which was the primary limitation. The second limitation pertains to the use of the SRT as a means of measuring aerobic performance, as it did not directly assess aerobic capacity (Armstrong, Tomkinson, & Ekelund, 2011). Thirdly, the assessment of motor coordination was conducted using only one test, which failed to capture the multidimensional nature of coordination and its various types such as rhythm coordination and speed performance in complex motor tasks (Kojić et al., 2023). Lastly, it is important to note that this research was conducted in a cross-sectional manner, thus preventing the establishment of direct causality between variables.

CONCLUSION

Limited research has focused on evaluating body composition in prepubertal children. The findings of this study reveal that there are no notable distinctions between 10-year-old boys and girls regarding anthropometric measurements and body composition. However, boys show better performance in motor assessments related to strength, while girls demonstrat superior performance in terms of movement frequency. The influence of physical attributes seem to vary depending on the specific motor test used. Notably, anthropometric measurements and body composition moderately correlate with performance in tests measuring strength, body coordination, and aerobic fitness. On the other hand, when evaluating movement frequency, body structure has limited explanatory power as it does not yield any significant findings.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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