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MOTOR SKILLS AND MORPHOLOGICAL CHARACTERISTICS OF 4TH GRADE PRIMARY SCHOOL STUDENTS - IDENTIFICATION OF DIFFERENCES IN RELATION TO GENDER

Abstract: *This study investigates the motor skills and morphological characteristics of fourth-grade primary school students, analyzing gender-related differences. The sample comprised 146 students (77 boys and 69 girls) aged 10 to 11 years (± 6 months) from three primary schools in Niš. Morphological characteristics measured included body height, body weight, chest circumference, waist circumference, upper arm circumference, and thigh circumference. Motor skills were assessed through tests such as the standing long jump (explosive leg strength), throwing a 2 kg medicine ball (explosive trunk and shoulder girdle strength), running 30 m from a standing start (speed), holding a pull-up for up to 120 seconds (static isometric strength), and performing a deep forward bend on a bench (flexibility). The instruments used included an altimeter, a scale, and a tape measure for morphological assessments, while motor skill tests were standardized and conducted under controlled conditions. Statistical analysis using descriptive parameters and T-tests revealed significant gender-based differences in motor skills but no substantial differences in morphological characteristics. The findings emphasize the importance of targeted interventions to address these disparities.*

Keywords: *physical fitness, body composition, growth, performance, elementary school.*

Introduction

Systematic and regular monitoring of children's growth and development is essential to understanding the relationship between motor skills and morphological characteristics (Vidaković, Korica, 2007).

Motor skills are a fundamental aspect of human psycho-physical abilities, encompassing innate and acquired capabilities that enable the successful execution of motor activities. They are described as latent motor structures responsible

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for numerous observable motor reactions, which can be measured and analyzed (Findak, 1999). These skills are shaped by physiological, biochemical, cognitive, and conative mechanisms, forming a consistent system of parameters that can be quantified with standardized measures (Zaciorski, 1975). Furthermore, motor skills relate to the development of latent dimensions that influence movement, regardless of whether these abilities are inherited or developed through practice (Kurelić et al., 1975). They represent a critical component of human motion and performance, forming the basis for physical activity and functional movement (Kragujević, 1991).

The term "biomotor dimension" is introduced as a more precise alternative. The term "psychophysical properties" includes "psycho," which refers to a broader area than what is typically covered in practice. Additionally, "motoric dimension" is less accurate because it encompasses motricity in general, while "biomotoric dimension" specifically refers to motor dimensions related to living beings (Opavski, 1975).

Morphological characteristics form the biological and physiological basis of anthropometric measures, such as body height and weight, trunk and limb circumferences, lengths and thicknesses of long bones, limb segments, corresponding joints, and skinfold thicknesses. They define children's growth and development, as well as their physical structure, by determining the structure of morphological characteristics (Bala, 2004). Morphological characteristics usually refer to a system of basic anthropometric latent characteristics represented by four factors: the factor of longitudinal dimensionality of the skeleton, the factor of transverse dimensionality of the skeleton, the factor of circular dimensionality and body mass, and the factor of subcutaneous fat tissue (Kurelić et al., 1975; Bala, 1981).

Motor skills and specific morphological characteristics play a vital role in the proper growth and development of children. Adequate development in these areas enhances overall physical fitness, supports participation in various physical activities, and promotes long-term health benefits. Furthermore, monitoring these characteristics enables early identification of potential developmental issues, paving the way for timely interventions (Burton & Miller, 1998; Wiart & Darrah, 2001). These factors collectively contribute to the establishment of a foundation for a healthy and active lifestyle during adulthood.

Previous research indicates significant gender-based differences in motor skills and morphological characteristics, often influenced by socio-cultural and biological factors. Recent studies suggest an increasing prevalence of sedentary behaviors among children, which negatively impacts their motor development and physical fitness (Pate et al., 2011; Malina, Bouchard, & Bar-Or, 2004). Trends also highlight disparities in physical activity levels between urban and rural children, necessitating targeted approaches to address these gaps (Trost et al., 2013).

Determining motor skills, morphological characteristics and identifying gender-based differences among primary school children is crucial for physical education. It aids in better planning and programming of activities tailored to

children's developmental needs. This study aims to assess the motor skills and morphological characteristics of fourth-grade primary school students and identify gender-related differences. Accordingly, the authors aimed to gather comprehensive information about these characteristics and highlight the necessity of regular and systematic monitoring of growth and development in primary school students and youth.

Methods

Participants

The research was conducted in three primary schools in Niš. The sample consisted of 146 fourth-grade primary school students aged 10 to 11 years (± 6 months), including 77 boys (52.7%) and 69 girls (47.3%). Schools were selected intentionally to include a diverse representation of students based on location and school size, while the sample was mixed in terms of gender and age.

Inclusion Criteria

- Students enrolled in the fourth grade during the academic year.
- Age between 10 and 11 years (± 6 months).
- Regular attendance in physical education classes.
- No medical conditions or injuries that could limit participation in motor skill assessments.

Exclusion Criteria

- Students with diagnosed physical or mental disabilities affecting motor skills.
- Absence from school during the data collection period.
- Parental refusal to consent to participation.

Table 1. Sample of Respondents by Gender and School

School	Gender	Frequency	Percentage
S1	Male	24	50.0%
S1	Female	24	50.0%
S2	Male	22	44.9%
S2	Female	27	55.1%
S3	Male	23	46.9%
S3	Female	26	53.1%
Total	**Male**	**77**	**52.7%**
Total	**Female**	**69**	**47.3%**
Overall Total	**-**	**146**	**100%**

Measurements

Morphological Characteristics

Variables: body height, body weight, chest circumference, waist circumference, upper arm circumference, and thigh circumference.

Instruments:

- Body height: Altimeter (calibrated before each use).
- Body weight: Scale (calibrated after every ten respondents).
- Circumferences: Tape measure.

Motor Skills

Variables:

- Explosive leg strength: Standing Long Jump.
- Explosive trunk and shoulder girdle strength: 2 kg Medicine Ball Throw
- Speed: 30 m running from a standing start.
- Static upper body muscular endurance: Bent-Arm Hang Test (up to 120 seconds).
- Flexibility: Stand-and-Reach test

Protocol for Tests:

- Standing long jump: Participants jumped forward from a standing position. Two attempts were allowed, with the best result recorded.
- Throwing a medicine ball: Participants threw a 2 kg ball from a standing position. Two trials were recorded, with the better attempt considered.
- Running 30 m: Conducted in the schoolyard with standard starting and finishing markers. Time was measured using a stopwatch.
- Bent-Arm Hang test: Participants hold their chin above the bar in a bent-arm position for as long as possible without moving, with a maximum limit of 120 seconds.
- Stand-and-Reach test: Participants bent forward on a bench, reaching forward as far as possible. The best of two attempts was noted.

Procedures

All measurements were carried out during regular physical education classes in the morning, under standardized testing conditions to ensure consistency. Indoor measurements were conducted in physical education halls, while the 30-meter run took place in schoolyards. The data collection spanned two days in each school. Respondents wore appropriate sports clothing, and all measuring instruments were thoroughly checked before each session to maintain accuracy and reliability.

Data Analysis

Descriptive statistics, including frequency, percentages, minimum and maximum values, arithmetic mean, and standard deviation, were calculated to summarize the dataset. An independent samples t-test was conducted to exam-

ine differences between boys and girls regarding motor skills and morphological characteristics. Additionally, Cohen's *d* effect size was computed to assess the magnitude of these differences. Effect sizes were interpreted based on established thresholds by Cohen (1988), where $d = 0.2$ indicates a small effect, $d = 0.5$ a medium effect, and $d = 0.8$ a large effect. The statistical software package SPSS v.27 (IBM Corp, Armonk, NY) was used for data processing.

Results

As shown in Table 1, the sample consisted of 146 fourth-grade primary school students from three schools in Niš. Gender representation was balanced, with 77 boys (52.7%) and 69 girls (47.3%). School 1 had an equal distribution (24 boys and 24 girls, 50.0% each). In Schools 2 and 3, girls slightly outnumbered boys, constituting 55.1% and 53.1% of respondents, respectively. This balanced distribution ensures a representative sample for analyzing gender-related differences in motor and morphological characteristics.

The results shown in Table 2 reveal notable gender differences across the assessed morphological and motor variables. Boys generally exhibited slightly higher averages in body dimensions, including body weight, chest circumference, waist circumference, and upper arm circumference compared to girls. However, the differences in body height and thigh circumference were minimal, suggesting relatively similar growth patterns in these dimensions at this developmental stage. In terms of motor skills, boys consistently outperformed girls in explosive power tasks such as the standing long jump and medicine ball throw, as well as in upper body endurance measured by the bent-arm hang. Boys were also faster in the 30 m sprint, although the difference was less pronounced. Boys demonstrated slightly better flexibility, as indicated by the stand-and-reach test results.

Table 2. Descriptive Statistics of Morphological and Motor Variables (Total, Boys, and Girls)

Variable	Min.	Max.	Mean (SD) Total	Mean (SD) Boys	Mean (SD) Girls
Body Height (cm)	115	156	142.61 (6.19)	143.06 (6.35)	142.10 (6.00)
Body Weight (kg)	21	90	37.08 (8.89)	37.69 (9.62)	36.41 (8.01)
Chest Circumference (cm)	48	92	60.47 (8.64)	61.57 (8.70)	59.25 (8.47)
Waist Circumference (cm)	45	87	56.45 (7.79)	57.42 (7.99)	55.38 (7.48)
Upper Arm Circumference (cm)	15	29	18.89 (2.61)	19.25 (2.81)	18.49 (2.32)
Thigh Circumference (cm)	28	50	34.95 (5.34)	35.62 (5.48)	34.19 (5.13)
Standing Long Jump (cm)	34	159	110.14 (16.51)	113.03 (19.21)	106.91 (12.20)
Medicine Ball Throw (m)	2	5	3.18 (0.58)	3.32 (0.58)	3.03 (0.55)
30m Sprint (s)	5	9	6.72 (0.89)	6.59 (0.87)	6.86 (0.90)
Bent-Arm Hang (s)	1	56	12.79 (9.05)	15.06 (10.81)	10.26 (5.62)
Stand-and-Reach (cm)	7	34	21.77 (6.01)	23.09 (6.09)	20.29 (5.61)

The results presented in Table 3 indicate that no statistically significant differences were observed between boys and girls in any of the measured morphological variables, as all p-values exceeded the conventional threshold of significance ($p > 0.05$). However, the effect sizes (Cohen's *d*) suggest small to moderate practical differences in some variables. For instance, upper arm circumference exhibited the largest effect size ($d = 0.30$), indicating a small to moderate difference favoring boys. Similarly, chest circumference ($d = 0.27$), thigh circumference ($d = 0.27$), and waist circumference ($d = 0.26$) showed small effect sizes, suggesting slightly larger measurements for boys compared to girls. Body height ($d = 0.15$) and body weight ($d = 0.14$) displayed negligible differences, aligning with the lack of statistical significance.

Table 3. Gender Comparison of Morphological Characteristics

Variables	Gender	N	Mean	SD	t	Sig.	ES
Body Height (cm)	Male	77	143.06	6.35	0.939	0.349	0.15
	Female	69	142.10	6.00			
Body Weight (kg)	Male	77	37.69	9.62	0.870	0.386	0.14
	Female	69	36.41	8.01			
Chest Circumference (cm)	Male	77	61.57	8.70	1.632	0.105	0.27
	Female	69	59.25	8.47			
Waist Circumference (cm)	Male	77	57.42	7.99	1.586	0.115	0.26
	Female	69	55.38	7.48			
Upper Arm Circumference (cm)	Male	77	19.25	2.81	1.773	0.078	0.30
	Female	69	18.49	2.32			
Thigh Circumference (cm)	Male	77	35.62	5.48	1.629	0.106	0.27
	Female	69	34.19	5.13			

Note. N: Sample size; SD: Standard deviation; t: t-test value; Sig.: Statistical significance (p-value); ES: Effect size (Cohen's *d*).

The results in Table 4 highlight notable gender differences in motor skills, with statistical significance and effect sizes providing insights into the magnitude of these differences. Boys outperformed girls in several motor tasks. In the standing long jump, boys achieved significantly greater distances ($p = 0.022$), with an effect size ($d = 0.38$) indicating a small to moderate practical difference. Similarly, in the medicine ball throw, boys demonstrated greater explosive strength ($p = 0.002$), with a moderate effect size ($d = 0.51$). The bent-arm hang test also favored boys significantly ($p = 0.001$), showing the highest effect size ($d = 0.53$) among all tests, reflecting their superior upper body endurance. The 30 m sprint results indicated no statistically significant difference ($p = 0.064$), but the effect size ($d = 0.31$) suggests a small practical advantage for boys in speed. For the

stand-and-reach flexibility test, boys again performed better (p = 0.004) with a moderate effect size (*d* = 0.47).

Table 4. Gender Comparison of Motor Skills

Variables	Gender	N	Mean	SD	t	Sig.	ES
Standing Long Jump (cm)	Male	77	113.03	19.21	2.319	0.022*	0.38
	Female	69	106.91	12.20			
Medicine Ball Throw (m)	Male	77	3.32	0.58	3.115	0.002*	0.51
	Female	69	3.03	0.55			
30m Sprint (s)	Male	77	6.59	0.87	-1.870	0.064	0.31
	Female	69	6.86	0.90			
Bent-Arm Hang (s)	Male	77	15.06	10.81	3.418	0.001*	0.53
	Female	69	10.26	5.62			
Stand-and-Reach (cm)	Male	77	23.09	6.09	2.893	0.004*	0.47
	Female	69	20.29	5.610			

Note. N: Sample size; SD: Standard deviation; t: t-test value; Sig.: Statistical significance (p-value); ES: Effect size (Cohen's *d*); *: Statistically significant at $p < 0.05$.

Discussion and conclusion

The results indicate statistically significant gender differences in motor skills, particularly in standing long jump (p = 0.022), throwing a 2 kg medicine ball (p = 0.002), bent-arm hang (p = 0.001), and stand-and-reach (p = 0.004) tests, with boys outperforming girls in all these tasks. However, there were no statistically significant differences between boys and girls in running 30 meters from a standing start. These findings align with previous research, which has consistently shown that boys tend to exhibit greater strength and explosive power during childhood due to biological and hormonal factors (Malina et al., 2004; Pate et al., 2011; Logan et al., 2012).

Conversely, the absence of statistically significant gender differences in morphological characteristics, such as body height, weight, and circumferences, is notable. This result suggests that at this developmental stage, boys and girls share similar anthropometric profiles, which may not yet reflect the divergence typically observed during puberty. This aligns with studies indicating that gender-based morphological differences become more pronounced during adolescence (Bala, 2004; Višnjić, 2006; Beunen & Malina, 2008).

The period of younger school age is characterized by rapid growth and development in both motor skills and morphological characteristics. This stage is crucial for establishing a foundation for physical abilities that can significantly

impact later performance and health outcomes (Zdanski & Galić, 2002; Horvat & Vuleta, 2002; Bavčević et al., 2006; Stodden et al., 2008). Regular and systematic monitoring during this period is essential for identifying potential developmental issues and addressing them effectively through tailored interventions (Burton & Miller, 1998; Wiart & Darrah, 2001).

The practical implications of these findings for physical education programs are significant. The identified gender disparities in motor skills suggest the need for tailored interventions that address specific areas of improvement for boys and girls. For instance, programs for girls could focus on enhancing explosive power and upper body strength through targeted exercises, while activities for boys could aim to maintain and further develop their motor proficiency. Such interventions could foster a more equitable development of motor skills across genders.

Furthermore, the study highlights the importance of early assessment of motor skills and morphological characteristics. By identifying strengths and weaknesses at an early age, educators and coaches can design customized physical education curricula that cater to the developmental needs of both genders, ultimately promoting lifelong physical activity and health.

These results align with findings from previous studies that underscore the role of gender in shaping motor performance during childhood. For example, Malina et al. (2004) and Wiart & Darrah (2001) emphasized the interplay between biological, environmental, and cultural factors in determining motor abilities. Additionally, the lack of significant morphological differences in our study mirrors observations from studies conducted in similar age groups, where the onset of puberty had not yet induced substantial anthropometric changes (Bala, 2004; Beunen & Malina, 2008).

An early assessment of children's motor skills and morphological characteristics provides important information not only about progress but also about the disadvantages, enabling the design of plans and programs to improve these traits. These findings should guide further research on motor abilities and morphological characteristics in younger school-age children, creating a baseline for monitoring and enhancing development (Višnjić, 2006; Logan et al., 2012).

While this study provides valuable insights into gender differences in motor skills, it has limitations. The intentional sampling method and the focus on schools within a single city may limit the generalizability of the findings to broader populations. Additionally, the cross-sectional design restricts the ability to infer causality or track developmental changes over time.

Nonetheless, the study's strengths include the use of standardized testing protocols and the inclusion of a balanced sample by gender and school, enhancing the results' reliability. Furthermore, the findings offer practical value by providing actionable data that can inform educational and developmental strategies.

This study underscores the significance of early assessments in identifying gender differences in motor skills among young children. The results highlight the need for targeted physical education interventions that address these

differences to ensure balanced development. Future research should explore longitudinal designs to track changes over time and investigate the effectiveness of tailored interventions in mitigating identified disparities. Additionally, expanding the study to include diverse populations could enhance its applicability and relevance.

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МОТОРИЧКЕ СПОСОБНОСТИ И МОРФОЛОШКЕ КАРАКТЕРИСТИКЕ УЧЕНИКА IV РАЗРЕДА ОСНОВНИХ ШКОЛА – УТВРЂИВАЊЕ РАЗЛИКА ПО ПОЛУ

Сажетак: *Аутори у раду истражују моторичке способности и морфолошке карактеристике ученика IV разреда основне школе, анализирајући разлике по полу. Узорак је обухватао 146 ученика (77 дечака и 69 девојчица) узраста 10 до 11 година (± 6 месеци) из три основне школе у Нишу. Процена морфолошких карактеристика обухватила је висину тела, тежину тела, обим груди, обим струка, обим надлакта и обим бутине. Моторичке способности су процењиване следећим тестовима: скок удаљ из места (експлозивна снага ногу), бацање медицинке од 2 кг (експлозивна снага трупа и раменог појаса), трчање на 30 м из високог старта (брзина), издржај у згибу до 120 секунди (статичка изометријска снага) и дубоки претклон на клупи (флексибилност). Мерни инструменти за морфолошке карактеристике укључују висинометар, вагу и мерну траку, док су тестови моторичких способности спроведени према стандардизованим протоколима и контролисаним условима. Статистичка анализа, која је укључивала дескриптивне параметре и Т-тестове, открила је значајне разлике по полу у моторичким способностима, док разлике у морфолошким карактеристикама нису биле статистички значајне. Резултати наглашавају потребу за циљаном подршком у унапређењу моторичких способности код оба пола.*

Кључне речи: *физички фитнес, телесна композиција, раст и развој, основна школа, пол.*

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