

Basic motor skills among 2nd–9th-grade elementary school students

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Abstract:

This study involved 3,644 elementary school students from grades 2–9. It aimed to evaluate students' basic motor skills across these grades, utilizing the Eurofit battery of tests. Analysis of results revealed that most students attained a score of 1 in the flamingo test, with the fewest achieving a score of 4. Similarly, in the hand-tapping test, most students achieved a score of 4, while the fewest scored a 2. Results from the gray test showed that the highest proportion of students received a grade of 1, whereas the smallest proportion received a grade of 4. In the standing long jump test, the greatest number of students received a grade of 5, while the smallest number received a grade of 2. Regarding the hand strength test, the largest proportion of students achieved a grade of 5, with the fewest scoring a 1. For the lying down test, the highest number of students scored 2, and the fewest scored 1. In the push-up test, most students scored 3, with the fewest scoring 1. In the 10×5 m running test, the largest number of students achieved a grade of 5, while the smallest attained a grade of 2. Of the respondents, 43% reported engagement in sports, while 57% did not. Given the larger proportion of non-sporting respondents, the basic motor skills results appear notably low. Descriptive statistics were employed alongside various statistical methods during analysis.

Keywords: motor skills, Eurofit, elementary school age, norms, grades, sports

Introduction

Motor skills play a pivotal role in a child's daily life, influencing both their physical and intellectual endeavors, fostering the development of psychological and social traits, and contributing to overall health and well-being. These skills are closely linked to morphological characteristics; thus, motor skill development, such as strength, impacts certain anthropometric characteristics like muscle mass and subcutaneous fat percentage. Some motor abilities have a genetic component. Therefore, it is crucial to systematically engage in various motor activities to preserve or enhance these skills and improve physical and health status. Initiating exercise early in life and respecting sensitive developmental periods is essential to influence motor abilities with a higher genetic predisposition. Teaching physical exercise in a planned, rational, and organized manner facilitates the development of motor skills, ensuring proper planning, programming, implementation, and monitoring. There is a concerning trend of declining motor and functional abilities in children and youth, largely owing to increasingly sedentary lifestyles. Thus, children must participate in extracurricular activities under professional supervision to counteract this decline effectively.

Changes in children's motor activities, regardless of gender, stem from alterations in muscular, skeletal, and other physiological systems, which can either facilitate or impede the execution of motor tasks. These changes occur within the context of current social and economic conditions, shaped by cultural, material, urban, and other environmental factors. Thus, the outcomes of these changes are not solely biological and physiological but can also be influenced by social and cultural conditions, knowledge, and circumstances specific to the given environment (Smajić et al., 2017). Motor skills play a crucial role in development. Age norms for assessing basic motor skills offer valuable benchmarks for typical development, but variations in cultural child-rearing practices can impact the age at which skills are acquired (Adolph & Hoch, 2020). Physical activity is instrumental in a child's physical development (C., Dapp. et al., 2021).

The World Health Organization, overseeing various health domains, advocates for 60 min of daily movement at a moderate to intense pace to mitigate the consequences of a sedentary lifestyle and promote the development of basic motor skills. However, despite these recommendations, approximately 67% of school-aged children aged 11–15 fail to meet these guidelines on daily physical activity (Kuzman et al., 2004). Physical education, integrated into the educational system with two lessons per week, falls short of achieving the optimal transformation of children's anthropological status (Nikšić et al., 2019a). To effectively leverage physical education's instructional content to influence students' anthropological status, foster proper growth, and develop their abilities, it is essential to assess their current anthropological status, establish transformation guidelines, and provide feedback on the progress achieved (Stanković, 2002). Participation in sports activities inevitably brings

about transformations in motoric and even morphological status. The critical aspect lies in tailoring sports activities to the appropriate age group to ensure their impact on students' transformation (Rašidagić et al., 2000). Certain motor abilities have a higher or lower degree of innate predisposition, determined by genetics. The extent to which these abilities can be influenced varies based on the inherent coefficient, gender, and age. While strength can be effectively developed throughout life, attributes like speed, coordination, and agility are predominantly shaped in early childhood. Strength, for instance, is 50% genetically determined, leaving the remaining 50% open to development. In contrast, speed is 80–95% innate, limiting the potential for development to 5–20% (Pistotnik, 2003).

Transformation denotes the process through which a student transitions from one state to another. The teaching process in physical and health education is conceptualized as a specific transformative journey, utilizing various methods to achieve systemic changes (Lakota, 2006). Children with superior coordination tend to be more active, while those facing motor difficulties participate less in regular physical activities (Aaltonen, et al., 2015). In a previous study (Đulić, 2021), data on the physical activities of elementary school students were collected and presented. The research, conducted through questionnaires, included inquiries about electronic device usage. Notably, approximately 32.5% of students use mobile phones and computers for over 2 h daily, while a similar percentage spend more than 2 h watching television. Success in any sport depends on anthropological characteristics, abilities, and their interconnection (Nikšić et al., 2019b). Physical exercise is a fundamental biological necessity for the organism's well-being and life. Its association with human health is unequivocal, serving as a primary determinant of changes in the body and the condition of its bones, muscles, cardiovascular, and nervous systems.

Physical activity induces specific transformations and improvements in functional abilities and individual organ systems (Nikšić et al., 2019c). A study focusing on 6th and 7th-grade students assessed their dietary habits, body composition, and nutritional status using a bioelectrical instrument (InBody 720). The findings reveal prevailing issues stemming from poor habits and sedentary lifestyles exacerbated by the COVID-19 pandemic. In current modern society, characterized by diminished physical activity and inadequate nutrition, a growing number of people are leading sedentary lifestyles. Proactive measures are imperative, including increased monitoring and analysis of growth and development and motivating youth to engage in sports actively or recreationally (Nikšić et al., 2020a). Morphology and anthropometry are important for all sports as the basis for athlete selection in particular disciplines. Success in any sport hinges on analyzing various interconnected anthropological dimensions (Nikšić et al., 2020b).

Materials and methods

Participants

This study encompassed a sample of $N = 3644$ students from the 2nd to 9th grades of elementary school. Among them were 1,891 (52%) male and 1,753 (48%) female respondents. Students were drawn from nine elementary schools, each representing a municipality in Sarajevo Canton, Bosnia and Herzegovina.

The sample of variables

The assessment of basic motor skills utilized variables obtained from the Eurofit battery of tests, specifically: flamingo (balance), tapping with the hand (speed of movement), reach in gray (flexibility), long jump from a standing position (explosive leg strength), hand strength (static strength), lying down (trunk strength), push-up endurance (functional strength), and running 10×5 m back and forth (running speed and agility).

Statistical Analysis

Descriptive statistics was employed among the statistical methods utilized. Data analysis for this research was conducted using SPSS Statistics 20.0 for the Windows 10 operating system. Specifically, the statistical program SPSS for Windows version 22 was utilized for data processing.

Results

Table 1 presents the descriptive parameters of the variables derived from the Eurofit battery of tests for students from the 2nd to 9th grades of elementary school. These parameters include N (number of students), range (range of variation), minimum (minimum value), mean value (arithmetic mean), maximum (maximum value), Std. Dev. (standard deviation), variance, skewness, kurtosis, and elongation coefficient. For a sample size of 3644 respondents (N), the average value for balance–flamingo was 00:11:45 (mean). The minimum value recorded was 00:00:00 (minimum), while the maximum value reached 06:00:00 (maximum). The difference between the maximum and minimum values is 06:00:00 (range). The Std. Dev. for balance–flamingo was 0.01, with a variance of 0.000186. A positive skewness value of 6.87 suggests a distribution of results skewed towards lower values relative to the arithmetic mean, indicating a prevalence of favorable outcomes. However, with a kurtosis value of 71.95 significantly exceeding 2.75, the distribution appears flattened and elongated, suggesting poor discriminative ability and compressed results (Beaukurtic distribution). For movement speed–hand tapping, the mean value was 00:15:52. The minimum and maximum values were 00:00:00 and 14:56:00, respectively, resulting in a range of 14:56:00. The standard deviation and variance were 0.01 and 0.000140, respectively. A positive skewness value of 40.51 indicates a distribution skewed towards lower values compared to the mean,

implying a prevalence of favorable outcomes. However, with a kurtosis value of 1994.92 significantly exceeding 2.75, the distribution appears flattened and elongated, suggesting poor discriminative ability and compressed results (kurtosis distribution). For flexibility–reach in gray, the mean value was 9.27. The minimum and maximum values were –44.00 and 178.00, respectively, resulting in a range of 222.00. For flexibility–reach in gray, the standard deviation was 10.50, with a variance of 110.32. A positive skewness value of 1.31 suggests a distribution skewed towards lower values relative to the mean, indicating a prevalence of favorable outcomes. However, with a kurtosis value of 18.03 significantly exceeding 2.75, the distribution appears flattened and elongated, suggesting poor discriminative ability and compressed results (kurtosis distribution). For explosive leg strength–standing long jump, the mean value was 140.59.

The minimum and maximum values were 0.00 and 261.00, respectively, resulting in a range of 261.00. The standard deviation and variance were 32.77 and 1073.66, respectively. A positive skewness value of 0.001 indicates a distribution skewed towards lower values compared to the mean, implying a prevalence of favorable outcomes. However, with a kurtosis value of 0.93 significantly less than 2.75, the distribution appears diffuse (platykurtic distribution). For statistical strength–hand strength, the mean value was 19.59. The minimum and maximum values were 0.88 and 356.00, respectively, resulting in a range of 355.12. The standard deviation and variance were 10.35 and 107.05, respectively. A positive skewness value of 10.22 suggests a distribution skewed towards lower values relative to the mean, indicating a prevalence of favorable outcomes. However, with a kurtosis value of 309.21 significantly exceeding 2.75, the distribution appears flattened and elongated, suggesting poor discriminative ability and compressed results (kurtosis distribution). For body strength–lying gray, the mean value was 19.16.

The minimum and maximum values were –15.00 and 67.00, respectively, resulting in a range of 82.00. The standard deviation was 5.53, with a variance of 30.61. A positive skewness value (0.14) suggests that the distribution of results is skewed towards lower values compared to the mean, indicating a prevalence of favorable outcomes. The kurtosis value (2.81) indicates that the distribution closely approximates the normal curve, reflecting mesokurtic distribution. In the case of functional strength–flexion endurance, the mean value was 00:21:57. The minimum and maximum values were 00:00:00 and 23:12:00, resulting in a range of 23:12:00. The standard deviation was calculated at 0.02, with a variance of 0.000535. A positive skewness value (21.16) indicates that the distribution is skewed towards lower values compared to the mean, suggesting a prevalence of favorable outcomes. However, with a kurtosis value of 801.71 significantly higher than 2.75, the distribution appears flattened and elongated, indicating a compression of results and a loss of discriminative ability (kurtosis distribution). For running speed and agility–running 10×5 m back and forth, the mean value was 00:28:38. The minimum value recorded was 00:00:00, while the maximum value reached 23:01:00, resulting in a range of 23:01:00. The standard deviation was calculated at 0.06, with a variance of 0.003406. A positive skewness value (14.34) suggests that the distribution of results leans towards lower values compared to the mean, indicating a prevalence of favorable outcomes. However, with a kurtosis value of 207.63 significantly higher than 2.75, the distribution appears flattened and elongated, indicating a compression of results and a diminished discriminative ability (kurtosis distribution).

Table 1. Descriptive statistics for variables in the Eurofit battery of tests

Label	Description	Balance flamingo	Movement speed–hand tapping	Flexibility–reach in gray	Explosive leg power–standing long jump	Static power–hand strength	Body strength–lying gray	Functional strength–push-up endurance	Running speed and agility–running 10×5 m back and forth
<i>N</i>	<i>Number of students</i>	3644	3644	3644	3644	3644	3644	3644	3644
<i>Range</i>	<i>Range of variation</i>	06:00:00	14:56:00	222.00	261.00	355.12	82.00	23:12:00	23:01:00
<i>Minimum</i>	<i>Minimalna vrijednost</i>	00:00:00	00:00:00	–44.00	0.00	0.88	–15.00	00:00:00	00:00:00
<i>Mean</i>	<i>Minimum value</i>	00:11:45	00:15:52	9.27	140.59	19.59	19.16	00:21:57	00:28:38
<i>Maximum</i>	<i>Maximum value</i>	06:00:00	14:56:00	178.00	261.00	356.00	67.00	23:12:00	23:01:00
<i>Std. Dev.</i>	<i>Standard variation</i>	0,01	0,01	10.50	32.77	10.35	5.53	0,02	0,06
<i>Variance</i>	<i>Variance</i>	0.000186	0.000140	110.32	1073.66	107.05	30.61	0,000535	0,003406
<i>Skewness</i>	<i>Skjunis</i>	6.87	40.51	1.31	0.001	10.22	0.14	21,16	14,34
<i>Kurtosis</i>	<i>Kurtozis</i>	71.95	1994.92	18.03	0.93	309.21	2.81	801,71	207,63

Tables 2 and 3 present the basic motor skills (Eurofit battery of tests) of the entire sample of respondents, regardless of gender, grade, and school, based on established norms for students in grades 2–9. Examining the results from these tables reveals that most students, irrespective of gender, grade, or school, scored 1.1031 (28%) in the flamingo test (balance), with the fewest scoring 4.323 (9%). There were 349 (10%) students at grade 5, 839 (23%) at grade 3, and 1102 (30%) at grade 2. In the hand tapping test (movement speed), the highest number

of students were at grade 4, 1028 (28%), while the fewest were at grade 2, 434 (12%). There were 784 (22%) students at grade 5, 889 (24%) at grade 3, and 509 (14%) at grade 1. Regarding the gray reaching test (flexibility), the largest proportion of students were a grade 1, 1475 (41%), while the fewest were at grade 4, 333 (9%). A total of 632 (17%) students attained grade 5, 574 (16%) achieved grade 3, and 630 (17%) obtained grade 2. For the standing long jump test (explosive leg strength), most students were at grade 5, 886 (24%), whereas the fewest were at grade 2, 533 (15%). A total of 805 (22%) students reached grade 4, 848 (23%) achieved grade 3, and 572 (16%) attained grade 1. In the hand strength test (static strength), the highest number of students were at grade 5, 1351 (37%), while the fewest were at grade 1, 341 (10%). A total of 666 (18%) students reached grade 4, 766 (21%) achieved grade 3, and 520 (14%) obtained grade 2. As for the lying down test (trunk strength), the largest group of students achieved grade 2, 943 (26%), with the fewest attaining grade 1, 662 (18%). A total of 672 (19%) students attained grade 5, 700 (19%) reached grade 4, and 667 (18%) achieved grade 3. In the push-up test (functional strength), most students reached grade 3, 1188 (33%), while the fewest reached grade 1, 225 (13%). A total of 308 (17%) students achieved grade 5, 234 (13%) reached grade 4, and 455 (12%) obtained grade 1. In the 10×5 m back and forth test (running speed and agility), the highest number of students achieved grade 5, 1179 (33%), while the fewest attained grade 2, 366 (10%). A total of 693 (19%) students attained grade 4, 664 (18%) reached grade 3, and 742 (20%) obtained grade 1.

Table 2. Basic motor skills of students from 2nd to 9th grades of elementary school

Grade	Balance–flamingo	Movement speed–hand tapping	Flexibility–reach in gray	Explosive leg power–standing long jump	Static power–hand strength	Body strength–lying gray	Functional strength–push-up endurance	Running speed and agility–running 10×5 m back and forth
1	1031	509	1475	572	341	662	455	742
2	1102	434	630	533	520	943	812	366
3	839	889	574	848	766	667	1188	664
4	323	1028	333	805	666	700	542	693
5	349	784	632	886	1351	672	647	1179
Total	3644	3644	3644	3644	3644	3644	3644	3644

Table 3. Basic motor skills of students from 2nd to 9th grades of elementary school represented in percentages

Grade	Balance–flamingo	Movement speed–hand tapping	Flexibility–reach in gray	Explosive leg power–standing long jump	Static power–hand strength	Body strength–lying gray	Functional strength–push-up endurance	Running speed and agility–running 10×5 m back and forth
1	28%	14%	41%	16%	10%	18%	12%	20%
2	30%	12%	17%	15%	14%	26%	22%	10%
3	23%	24%	16%	23%	21%	18%	33%	18%
4	9%	28%	9%	22%	18%	19%	15%	19%
5	10%	22%	17%	24%	37%	19%	18%	33%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Among the 3,644 respondents from 2nd to 9th grades of elementary school, 43% engaged in sports, whereas 57% did not, as shown in Figure 1. With a larger proportion of non-participants in sports, the results in basic motor skills notably lag behind.

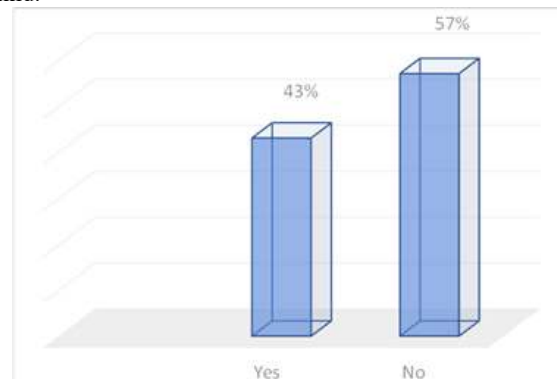


Figure 1. Do you play sports?

Discussion

Physical and health education classes require meticulous planning and organization to achieve their objectives effectively. Healthy lifestyle habits, proper growth, and development are instilled from a young age. Variations exist among children based on their capabilities, abilities, and gender. School-based physical and health education, along with additional physical activities, profoundly influence their growth and development, particularly in shaping their basic motor skills. Contrary to misconception, children in lower grades (2nd to 5th) engage in vigorous movement, often through games, and may not necessarily find physical exertion more challenging than their counterparts in higher grades (6th to 9th). The desire to compete and self-validate, where students set personal performance benchmarks, also drives their engagement. Social dynamics are pivotal in fostering a sense of belonging that motivates participation. It is crucial for all students, including those perceived as "weaker," to feel capable of success, fostering commitment and motivation. Teachers play a vital role in motivating, nurturing, and fostering individual progress. School physical education should prioritize areas of students' anthropological status where the most significant transformations are achievable. The vital role of physical education in schools and the growing demands in its planning and implementation underscore the need for teachers to engage in extensive research on methods and strategies to enhance students' overall anthropological status, particularly their basic motor skills (Badrić, 2011).

Utilizing the physical education curriculum to positively influence students' anthropological status and fostering their proper growth and skill development requires an initial assessment of their current anthropological status, establishing guidelines for transformation, and providing feedback on progress achieved (Stanković, 2002). Engaging in any form of additional sports activity brings about notable motor and morphological changes. Tailoring sports activities to the respective age groups is paramount, ensuring they effectively contribute to students' transformation (Rašidagić et al., 2000). Research findings on the motor abilities of younger elementary school students indicate a concerning decline in motor skills over time (Kraljević, Gadžić & Vučković, 2013). Therefore, prioritizing the development of motor skills during childhood is crucial, laying a foundation for continued growth and development into adolescence (Barnett et al., 2008). Irregular physical exercise reduces motor skill development in children (Badrić, 2011). Genetic inheritance plays a role in motor skill development, but environmental factors and kinesiology processes are also significant influencers. Participation in physical activities fulfills children's needs for movement, play, and socialization and fosters the development of competitive spirit. Physical activities should align with children's developmental stages to effectively develop motor skills.

Understanding the key elements of kinesiology activities is crucial for unlocking children's motor potential (Tešanović et al., 2018). In modern society, there is a notable decline in physical activity alongside poor dietary habits, leading to a rise in sedentary lifestyles. To address this, proactive measures such as regularly monitoring growth and development and encouraging youth to engage in sports, either actively or recreationally, are essential (Nikšić et al., 2020a). Daily monitoring, measurement, and analysis of students' anthropological status are necessary to promote basic motor skill development and combat obesity, a prevalent health issue. Evidently, relying solely on physical education classes is insufficient to tackle the challenges posed by modern sedentary lifestyles, exacerbated further by the COVID-19 pandemic and the shift to online learning (Nikšić et al., 2021).

Conclusions

This study aimed to assess the fundamental motor skills of students from 2nd to 9th grades in elementary school. The research was conducted on a sample of $N = 3644$ students, comprising 1891 (52%) male and 1753 (48%) female respondents. Basic motor skills were evaluated using the Eurofit battery of tests, including assessments such as flamingo (balance), hand tapping (speed of movement), reaching in the gray (flexibility), standing long jump (explosive leg strength), hand strength (static strength), lying down (trunk strength), push-up endurance (functional strength), and running 10×5 m back and forth (running speed and agility). Results indicated a higher proportion of non-athletic subjects, correlating with poorer motor skill performance compared to their more active counterparts.

The onset of the COVID-19 pandemic exacerbated the existing decline in physical activity among students, leading to a sedentary lifestyle and hampering normal growth and development. This underscores the critical role of sports in promoting children's health within the school environment. The pandemic-induced reduction in physical activity has significantly impacted children's overall development, particularly in motor skills, nutritional status, and body composition. Regular assessments of anthropological data are imperative to ensure optimal growth and development. These indicators are vital post-pandemic to inform parents, schools, and communities about the current status of students' development. Physical activity is a pivotal factor in enhancing anthropological status and restoring and enhancing students' capabilities. Encouraging participation in additional physical activities beyond physical education classes is necessary because traditional teaching alone may not substantially change children's physical well-being. Engagement in any form of sports activity facilitates the transformation of motor skills, emphasizing the importance of tailoring such activities to the appropriate age group to optimize developmental outcomes.

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Conflicts of interest

The authors declare no potential conflicts of interest related to the research, authorship, and publication of this article.

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