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ORIGINAL SCIENTIFIC PAPER

Motor Competencies among Athletic Population of 9- and 10- Year-Old Children

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Abstract

The aim of this study was to assess the basic motor competencies of primary school children in relation to their participation in sports. The research involved 86 children aged 9 and 10 (46 boys, 40 girls), comprising a group of 53 athletes (30 boys, 23 girls) and 33 non-athletes (16 boys, 17 girls). Using the MOBAK 3–4 test battery, the study compared motor competence data between these groups. Results indicated that sports-playing children demonstrated motor skills comparable to non-athletes in terms of object-movement (OM) abilities. Specifically, significant differences were observed in OM skills (mean =4.52), notably in the throwing test (mean =0.94) favoring the sporting population ($p<0.05$). While in other OM tests there was no difference between the groups. In the self-movement (SM) area, there was no difference between the athletic and non-athletic group. However, the overall score for SM (mean =3.43) demonstrated significance in favor of sports-playing children. The total score (mean =7.96) significantly favored the sports-playing group ($p<0.05$). The findings confirm that children engaged in regular sports activities exhibit higher levels of physical literacy, as reflected in their measurable motor competencies. This underscores the importance of incorporating motor competence diagnostics into school practices to enhance physical education initiatives.

Keywords: *primary school children, motor development, MOBAK test*

Introduction

Children's general motor predispositions, which shape their motor competencies, significantly influence their motor literacy (Mačura, Hubinák, & Krška 2021). Motor competencies and physical activity affect overall movement literacy (Mačura et al., 2021). Childhood, particularly during the primary school years, is a critical phase for motor skill development. However, there has been a considerable decline in children's motor competencies over recent decades (Masaryková, 2021; Ružbarská, 2018). Furthermore, for some children, physical education classes are the primary context for motor skill experiences. Masaryková (2021) states that innovative perspectives on motor competencies, differing from those in Slovakia, have long been conceptualized in the European context. These innovative approaches in motor skills assessment aim to redefine how children's achievements are evaluated. Traditionally, German-speaking countries and Slovakia have prioritized the evaluation of motor abilities, while English-speaking countries have focused predominantly on motor skills assessment (Masaryková, 2021). Recognizing these different assessment methodologies, experts were forced to think about creating a unified framework for assessing skills and abilities simultaneously, leading to the emergence of the concept of motor competence, which encompasses both components. Thus, motor competence can be understood as a set of motor abilities and motor skills (Masaryková, 2021).

Mačura et al. (2021) elaborate on the concept of motor competence, identifying it as an intermediary stage between motor abilities and skills. They characterize motor competencies as inherent capacities for motor performance developed through specific situational demands or functional expressions translated into movement. The authors emphasize that motor competencies, alongside relational

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dynamics and knowledge, significantly influence movement literacy. These competencies extend beyond sports, encompassing daily life activities and various environmental contexts, serving as preventive measures against lifestyle-related illnesses (Valková, 2010). Hermann and Seelig (2014) define basic motor competencies, highlighting their non-observable nature while enabling children to execute specific tasks and develop them over time. They assert that competencies are regulatory mechanisms for motor skills, such as determining a child's strength. From a theoretical perspective, motor competencies can be considered as the result of motor skills and abilities. As proposed by Whitehead (2019), the acquisition of motor competencies contributes to achieving movement literacy, spanning from infancy to the acquisition of specialized physical education skills in various activities.

The extent of basic motor competencies (BMC) among primary school students varies owing to internal and external factors. Several studies have investigated BMC levels (Herrmann, 2018; Herrmann, Heim, & Seelig, 2019; Quitério et al., 2018; Scheuer, Bund & Herrmann, 2019; Strotmeyer, Kehne & Herrmann, 2020; Tumynaitë, 2016). While these investigations reached differing conclusions favoring the sporting population, some also noted a satisfactory BMC level in the general population of children. For instance, in Finland, organized sports participation correlated with enhanced levels of SM and OM (Niemistö, Finni, Cantell, Korhonen & Sääkslahti, 2019). The aim of this study was to examine the basic motor competencies of primary school children relative to their sports participation.

Methods

Participants

The assessment was conducted in a group of primary school children engaged in sports activities (n=86, boys =46, girls =40). The study comprised an athletic group (n=53), with an average age of (x=9.03±0.73 years), actively participating in physical education classes, and a non-athletic group (n=33) with an average age of (x=8.90±0.67 years). Gender distribution is outlined in Table 1. Testing occurred during regular physical education sessions in the gymnasium, with each participant's parent providing voluntary written informed consent beforehand. The research adhered to the principles of the Declaration of Helsinki and was approved by the Ethical Commission at the University of Presov (ECUP 102023PO, 2023).

Table 1. Results of the number of participants relative to gender

	TOTAL		BOYS		GIRLS	
	N	%	N	%	N	%
Athletic population	53	61.63	30	56.60	23	43.40
Non-athletic population	33	38.37	16	48.48	17	51.52

Note: N- sample size %- Percentage

Procedure

A team of three trained test leaders administered the MOBAK 3–4 test (Herrmann, 2018). During the testing, participating school classes were divided into small groups of four to six children. Guided by one of the test leaders, these groups completed all MOBAK 3–4 test battery items at designated stations. Before each test item, the leader explained the motor task and provided a demonstration. Practice attempts were not allowed. Children completed all test items in accordance with the MOBAK 3–4 protocol. The purpose of the test battery is to convince children that they can perform natural movement activities (Machura et al., 2021).

Comprising two areas, the self-movement (SM) and object-movement (OM), the MOBAK 3–4 test battery is a suitable diagnostic tool for evaluating exercise competence in 9–10-year-olds. The SM section includes tasks such as balancing, rolling, jumping, and running, while the OM section assesses throw, catch, bounce, and dribble abilities. In the throwing and catching tests, each child had six attempts, with point scores allocated as follows: 0 to 2 hits =0 points, 3 to 4 hits =1 point, and 5 to 6 hits =2 points. For other test items, each child had two attempts, with scoring criteria as follows: both attempts failed =0 points, one attempt passed =1 point, and both attempts passed =2 points (Herrmann, 2018).

Statistical analyses

The observed data were analyzed using TIBCO Statistica™ 14.0.0. (Santa Clara, USA, 2020). Descriptive statistics such as mean, standard deviation, and percentage were used to characterize the data. Evaluation of the obtained data involved analysis, synthesis, and a factual assessment of the research results. The Shapiro–Wilk normality test was employed to assess the normality of data distribution. Differences between the observed groups were assessed using the non-parametric Mann–Whitney U-test. A statistical significance level of 0.05 was applied for all analyses.

Results

Table 2 presents the measured values of individual anthropometric indicators for the observed groups of primary school-aged children. Our sample from the athletic population indicates a relatively high participation rate (62%) in extracurricular physical activities among children.

Table 2. Descriptive indicators of anthropometric characteristics

	N	Age (x±SD)	Body height (cm±SD)	Body weight (kg±SD)	BMI (kg/m²)
Athletic population	53	9.03±0.73	138.93±5.79	34.40±6.94	17.79±2.81
Non-athletic population	33	8.90±0.67	139.06±7.97	34.73±10.00	17.59±3.42
Mann-Whitney U-test	86	0.45	0.72	0.64	0.51

Note: N-sample size, SD - standard deviation, BMI- Body mass index, statistical significance *p<0.05, x- average.

Table 3. Result of Mann-Whitney U test of motor competencies areas

Object-movement	Athletic population [x±SD]	Non-athletic population [x±SD]	U	Z	p-value
Throwing	0.94±0.71	0.30±0.55	451.00	-3.75	0.00*
Catching	0.77±0.72	0.54±0.66	724.50	-1.32	0.18
Bouncing	1.52±0.72	1.45±0.75	827.50	-0.41	0.67
Dribbling	1.28±0.76	1.42±0.75	783.50	0.80	0.42
Self-movement	**Athletic population [x±SD]**	**Non-athletic population [x±SD]**	**U**	**Z**	**p-value**
Balancing	0.43±0.63	0.30±0.58	776.00	-0.87	0.38
Rolling	1.22±0.93	0.87±0.89	696.50	-1.58	0.11
Jumping	0.52±0.79	0.24±0.61	712.00	-1.44	0.15
Running	1.24±0.80	1.21±0.73	842.50	-0.28	0.77

Note: N-sample size, SD - standard deviation, U- value of Mann- Whitney U-test, Z- approximation, statistical significance *p<0.05.

Table 3 presents data on the basic motor skills of the observed groups across both tested areas. Notably, in the OM area, the throwing test exhibited the most significant differences, statistically favoring the sporting population of children at a significance level of p<0.05. Additionally, improved results were observed in the catching and bouncing test items among the sports population. However, it was surprising to find that children from the general population outperformed the sports population in the dribbling test, a result that was evaluated negatively.

In the SM area, significantly higher performance values were evident across all test items in favor of the sporting population. Although the largest discrepancy in measured values was noted in the SM tests, statistical confirmation was not achieved.

Table 4 presents the total score of basic motor competencies measured among groups of primary school children under observation. Analysis of Table 4 data led to the conclusion that while the monitored group achieved significant values in basic motor competencies, it was insufficient to indicate the effectiveness or significant positive impact of free-time and interest-based movement activities on the basic motor competencies of primary school-aged children.

Table 4. Result of Mann-Whitney U test of basic motor competencies – Total score

	Athletic population [x±SD]	Non-athletic population [x±SD]	U	Z	p-value
Object-movement	4.52±1.81	3.72±1.50	665.00	-1.85	0.06
Self-movement	3.43±1.89	2.64±1.67	651.00	-1.98	0.04*
Total score	7.96±2.99	6.36±2.61	628.50	-2.18	0.02*

Note: N- sample size, SD - standard deviation, U- value of Mann- Whitney U-test, Z- approximation, statistical significance *p<0.05.

Discussion

Whiting et al. (2021) conducted a Europe-wide analysis, revealing a 44.1% membership rate of children aged 6–9 in sports clubs. The difference in basic anthropometric indicators among the monitored groups is negligible.

Masaryková (2021) noted that it is possible to assess the relationship between basic anthropometric characteristics and motor tests, demonstrating negative correlations with children's body weight. Comparisons with Slovak studies such as Halmová and Šimonek (2020), Štetinová and Leütterová (2021), and Leütterová and Štetinová (2021) reveal similarities in measured values. In contrast, compared to the study by Mačura et al. (2021), the groups monitored in our study exhibited a significantly lower body mass index (BMI) indicator level, nearly 0.44 kg/m2 lower. Studies by Štetinová and Leütterová (2021), and Leütterová and Štetinová (2021) found BMI levels for the general population of 9–10-year-old boys to be 16–18 kg/m2 and for girls 16.69–17.72 kg/m2, corroborating the similarity of values obtained in our study. However, noteworthy differences emerge when comparing data with Masaryková (2021), who reports an average BMI value in Slovak children at 16.34 kg/m2. Our results align more closely with the BMI values observed in European countries, averaging 17.49 kg/m2.

Understanding the level of basic motor competencies is crucial for enhancing the efficiency of the educational process. Therefore, utilizing a tool for extension is imperative in pedagogical practice. The primary objective of this study was to contribute to understanding the current level of basic motor competencies among primary school children. From a diagnostic perspective, it was pertinent to analyze the percentage of children who did not reach the boundary value of 3 points in individual competence areas of the MOBAK test, indicating the need for educational motor support (Herrmann, 2018; Ružbarská, 2023).

Based on our results, 15% of athletic and non-athletic populations demonstrated motor deficits in the OM domain. At the same time, higher values were observed in SM, with 34% of athletic and 48% of non-athletic populations exhibiting motor deficits. These findings align with the study by Ružbarská and Boržíková (2023), where approximately 20% of girls and 11% of boys showed motor deficits in OM. Moreover, a cross-sectional international study by Wälti et al. (2023) reported that over 25% of children aged 8–10 required educational motor support in OM and over 20% in SM. Interestingly, our research revealed a degree of motor insufficiency even among the athletic population, particularly in the SM component. In terms of OM competencies, both athletic and non-athletic populations showed levels comparable to those found in similar studies. For instance, the non-athletic population in our study demonstrated levels similar to Chilean children (mean =3.71; Carcamo-Oyarzun & Herrmann, 2020). The athlet-

ic population outperformed German children (mean =4.03; Herrmann, Heim, & Seelig, 2019) but fell slightly behind Swiss children (mean =4.67; Herrmann, Gerlach, & Seelig, 2015) and Portuguese children (mean =4.90; Quitério et al., 2018). The athletic population's OM scores were comparable to those in the study by Šiška et al. (2024) (mean =4.46). In the SM component, both the non-athletic and athletic populations achieved slightly lower levels than Chilean children (mean =4.72; Carcamo-Oyarzun & Herrmann, 2020), German children (mean =4.48; Herrmann, Heim, & Seelig, 2019), Portuguese children (mean =4.70; Quitério et al., 2018), Swiss children (mean =5.48; Herrmann, Gerlach, & Seelig, 2015), and Slovak children (mean =5.07; Šiška et al., 2024). Higher values in the SM area were also observed in Slovak children by Ružbarská and Boržíková (2023) (mean =5.25) and Wälti et al. (2023; mean =5.57). A negative evaluation is evident upon comparing our results with the study conducted by Šiška et al. (2024). It was initially assumed that the sporting population under observation would demonstrate higher motor competence values compared to the average Slovak general population of primary education children. However, when comparing the total scores with the study conducted by Mačura et al. (2021), our monitored sports population exhibited significantly higher scores, surpassing by 0.53 points, which was evaluated positively. Conversely, in the case of the non-athletic population, the total scores differed by 0.27 points in favor of Mačura et al. (2021), who monitored motor skills in 3rd and 4th-grade primary education children within a sample of 481.

Wälti et al. (2023) examined the influence of exogenous factors on motor competence. They found that extracurricular physical activities were significant predictors in the SM field, with ball sports being significant positive determinants of physical competence. Children participating in extracurricular physical activity demonstrated a higher level of basic physical competence in at least one area. Our research also confirmed the significant influence of extracurricular physical activities on SM, with the athletic population showing a statistically significantly higher level. These findings align with those of Drenowatz and Greier (2019), Schembri, Quinto, Aiello, Pignato, and Sgrò (2019), and Niemistö et al. (2020). Additionally, Madrona, Martínez and Faraco (2021) found higher average ranges in laterality, postural tonic control, and spatial orientation among children engaged in extracurricular physical activities.

Conclusions

Based on the obtained results, several key findings emerge that could inform pedagogical practices. It would be particularly beneficial to elucidate the basic motor competencies of primary school-aged children in the athletic population because this area has attracted increasing attention in recent studies. Our research focused on analyzing the motor skills of primary school-aged children using the MOBAK 3–4 test battery. The findings reveal that children engaged in sports demonstrate motor skills comparable to those of non-athletic counterparts in the OM domain. Notably, a significant value was observed in the OM area (mean =4.52). Among the individual test items in the OM domain, the throwing test (mean =0.94) exhibited significance ($p<0.05$) in favor of the sporting population.

The SM area analysis and comparison of its test items revealed higher average values favoring the sporting population, although without statistical significance confirmation. However, in the overall score of the SM area (mean =3.43), statistical significance favoring the sporting population was confirmed when compared to the sets. Additionally, the total score (mean =7.96) in favor of the sporting population was statistically significant at $p<0.05$. These results confirm that children engaged in regular sports activities attain a statistically higher level of physical literacy, as evidenced by measurable motor competencies. Based on the obtained results, it is evident that this study has certain limitations. Generalizing the findings is challenging owing to the low prevalence of children in the observed athletic and non-athletic populations. Additionally, it would be beneficial to specify the type and extent of leisure activities performed by children, particularly in the context of monitoring those involved in sports. It is essential to determine whether these activities are purely recreational or aimed at enhancing mobility performance under the guidance of qualified trainers. Children in the athletic population engage in various leisure activities that may impact their overall performance in the target exercise areas. However, these effects were not consistently confirmed across all test item indicators. This inconsistency can be attributed to irregular attendance and scheduling conflicts in sporting activities.

A strength of this study is that the used instrument for the assessment is well established and economical.

This study addresses the growing demand in scientific research for expertise in educational practice aimed at stimulating basic motor competencies. Furthermore, it underscores the necessity of establishing diagnostics for these competencies within the school setting. Effective educational support in physical education is crucial to providing children with a solid foundation for healthy motor development and lifelong physical education.

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Conflict of Interest

The author declares that there is no conflict of interest.

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