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Difference in Motor Skills between Active and Inactive Children

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Abstract

This research aimed to determine the differences in motor skills between active and inactive children at the age of 9 using the tests of motor skills BOT-2 and the tests of gross motor skills TGMD-2. The total number of respondents 40 (20 active and 20 inactive) was made up of students from the 3rd grade of elementary school Mika Antić, Niš. The age of the respondents is 9±0.5 years for both sexes. Motor status was assessed by standard tests of motor skills. Motor skills were assessed with a battery of BOT-2 tests was used to assess motor skills, subtests of speed and agility, and upper limb coordination. A battery test of gross motor development (TGMD-2), subtests for the assessment of locomotor skills, manipulative skills, and the overall result on the test of gross motor skills. A statistically significant difference was found in favor of active children versus inactive in two variables total score on gross motor test-TGM (p=0.036) and level of physical activity-TOTPA (p=0.00) while the other variables were not statistically significant (p>0.05). The general conclusion is that there are no differences in motor skills between active and inactive children.

Keywords: *Motor Skills, Motor Abilities, Gross Motor Skills, School children, TGMD2, BOT-2*

Introduction

A motor skill is the possibility to provoke a predetermined outcome of movement with maximum certainty (Santrock, 2008). Motor learning is a relatively permanent change in the ability to perform a skill as a result of exercise or experience (Kozomara et al., 2019). The goal of motor skills is to optimize the ability to exercise with the speed of success, precision, and reduce the energy consumption required for performance. Continuous practice of a certain motor skill will result in significantly improved performance, but not all motor skill movements (Santrock, 2008).

Motor skills are usually classified into two groups: gross motor skills and fine motor skills. Gross motor skills include the skills needed to control large muscle groups for walking, running, sitting, crawling, and other activities. The muscles needed to perform gross motor skills are mainly found in the arms, legs, back, abdomen, and torso (Needleman, 2000). Fine motor skills include the skills needed to control smaller muscle groups for writing, playing an instrument, artistic expression, and craftwork. The muscles needed to perform fine motor skills are mainly found in the arms, legs, and head (Payne, & Larry, 1998). Researchers use many tests for diagnostic, the most common or the most effective tests for motor skills are the BOT-2 test of motor efficiency and the TGMD-2 test of gross motor skills (Zuvela, Males, & Miletic, 2011; Franjko, Zuvela, Kuna, & Kezic, 2013; Baranasic, 2019; Barnett, Salmon, & Hesketh, 2016; Akbari et al., 2009; Top & Kallkavan, 2014).

This research aimed to determine the differences in motor skills between active and inactive children at the age of 9 to assess the importance of exercise in children of this age.

Methods

Sample of respondents

The total number of respondents 40 (20 active and 20 inactive) was made up of students from the 3rd grade of the elementary school "Mika Antić", from Niš. The age of the respondents is 9±0.5 years for both sexes. Before the start of the study, the consent of the parents was obtained for the participation of their

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children in the research. Parents also filled out a questionnaire on children's physical activity and about those results, children were classified. The study was conducted in accordance with the Declaration of Helsinki, approved by the Ethics Committee of the Faculty of Sports and Physical Education in Niš.

The sample of variables

Motor skills such a running speed and agility and upper limb coordination were assessed with two subtests of BOT-2, Bruininks-Oseretcky test for motor efficiency (Bruininks, 2005). This test is used in children 4-21 years (Deitz, Kartin, & Kopp, 2007). These skills are represented by variables TULC - total scale score on the subtest of upper limb coordination and TSAT - total scale score on the subtest of agility and speed. TULC contains five items and TSAT subtest contains seven test items, and all items were given a scale score based on performance and all items scores were totaled for an overall subtest score.

The second test used is the gross motor skills test (TGMD-2) which consists of subtests for the assessment of locomotor skills, manipulative skills, and the overall result on the test of gross motor skills. This test is designed to assess the skills of large muscle groups for children between the ages of 3-10 (Simons et al., 2008). These skills are represented by variables LOC - locomotor skills, MAN - manipulative skills, and TGM - total result on the test of gross motor skills. LOC and MAN contain 6 items each and all items were given a numerical score based on performance and the sum of all items from each subscale makes up an overall subtest score. TGM represents the total test score.

Measuring the level of children's physical activity performed by the questionnaire, and that questionnaire was filled out by parents. The questionnaire for physical activity (PAQ) is designed for children aged 4-17 has 4 sections concerning: sports activities, leisure activities, school activities, and other activities (Corder et al., 2009). Physical activity is represented by a variable TOTPA and it refers to the total result of the physical activity questionnaire.

Study protocol

The transversal research was conducted in the elementary school "Mika Antic", in Niš. Testing of children was conducted in four terms (November 26, 2019, November 27, 2019, December 3, 2019 and December 13, 2019). Five doctoral students from the Faculty of Sport and Physical Education Nis administered the BOT-2 and TGMD-2 tests. Every day the testing started at 11:00 am and lasted 1 hour and 30 minutes in the duration of two school hours. The temperature of the hall was in the range of 22° to 26°. Each student had a repeated oral explanation of the test in order to better concentrate. The measuring instruments used in this research are a digital scale, meter, stopwatch, and tennis ball.

Statistical analysis

Data processing was performed using the statistical program SPSS 19. Descriptive analysis was used to distribute data on the number of respondents, mean, and standard deviation. After performing the Kolmogorov-Smirnov and the Shapiro-Wilk data normality tests, a significant deviation from the normal data distribution was found, indicating that a nonparametric technique should be implemented, in this case, the Mann-Whitney U test. This test was used to determine differences between active and inactive children in motor skills.

Results

Table 1 shows the descriptive statistics data. When looking at the descriptive statistics in Table 1, it is noticeable that the active group (group 2) has on average numerically higher values than the inactive group (group 1) in all variables. The average values of the active group in the BOT-2, upper limb coordination (TULC) subtest are 38.70 versus 35.05 as achieved by the inactive group, also in the speed and agility subtest (TSAT), the result is on the active side in relation to the inactive group (42.80 vs. 41.45). When it comes to TGMD-2 tests, the active group also achieved higher values than the inactive group in the test of locomotor skills (LOC) 40.05 versus 37.05, manipulative skills (MAN) 42.65 versus 40.55, and the total TGM score 82.70 versus 77.60. Also, the result of the variable TOTPA assessment of physical activities shows a higher average in the active group compared to the inactive group (3.57 vs. 2.62).

Table 1. Descriptive parameters of results on tests of motor abilities active and inactive children

		BOT-2		TGMD-2			PAQ
Group		TULC	TSAT	LOC	MAN	TGM	TOTPA
1	Mean	35.05	41.45	37.05	40.55	77.60	2.62
	SD	7.22	2.98	5.13	4.62	8.44	.53
	Min	18	35	28	31	59	1.20
	Max	45	46	46	46	92	3.50
2	Mean	38.70	42.80	40.05	42.65	82.70	3.57
	SD	4.14	2.14	3.50	3.08	5.41	.39
	Min	28	39	34	34	70	3.10
	Max	44	47	46	46	92	4.40

Note: BOT-2 - Bruininks-Oseretcky test, TGMD-2 - test of gross motor skills, PAQ - physical activity questionnaire, TULC - total score on the subtest of upper limb coordination, TSAT - total score on the subtest of agility and speed, LOC - locomotor skills, MAN - manipulative skills, TGM - total result on the test of gross motor skills, TOTPA - total result of the physical activity questionnaire.

Table 2 presents data of the normality on the distribution of results. The results of the Kolmogorov-Smirnov test showed a deviation from the normal distribution for the two variables TULC (p=0.37) and MAN (p=0.00), while the remaining four variables had the normal distribution (p>0.05). Similar results were achieved on the Shapiro-Wilk test. Based on the given tests on the normality of data distribution, it was decided to approach the Mann-Whitney U test.

Table 3 shows the differences between groups a calculated by Mann-Whitney U Test. Between active and inactive groups a significant difference was found in two of the six variables, namely TGM (p=0.036) and TOTPA (p=0.00) while in the other variables there were no significant differences. No significant difference was found

Table 2. Normality of the distribution of results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TULC	.144	40	.037	.884	40	.001
TSAT	.131	40	.080	.953	40	.096
LOC	.102	40	.200*	.962	40	.201
MAN	.240	40	.000	.867	40	.000
TGM	.092	40	.200*	.960	40	.172
TOTPA	.130	40	.087	.969	40	.341

Note: TULC-total score on the subtest of upper limb coordination, TSAT-total score on the subtest of agility and speed, LOC-locomotor skills, MAN-manipulative skills, TGM-total result on the test of gross motor skills, TOTPA-result of the physical activity questionnaire.

in the BOT-2 scales of upper extremity coordination (p=0.09), and speed and agility (p=0.236). Also, no significant difference was found in the TGMD-2 subtests of locomotor (p=0.08), and manipulative skills (p=0.2).

Table 3. Differences between active and inactive children

	BOT-2		TGMD-2			PAQ
	TULC	TSAT	LOC	MAN	TGM	TOTPA
Mann-Whitney U	137.500	159.000	135.500	153.000	122.500	10.000
Wilcoxon W	347.500	369.000	345.500	363.000	332.500	220.000
Z	-1.695	-1.120	-1.751	-1.283	-2.100	-5.150
Asymp. Sig. (2-tailed)	.090	.263	.080	.200	.036	.000

Note: BOT-2-Bruininks-Oseretcky test, TGMD-2-test of gross motor skills, PAQ-physical activity questionnaire, TULC-total score on the subtest of upper limb coordination, TSAT-total score on the subtest of agility and speed, LOC-locomotor skills, MAN-manipulative skills, TGM-total result on the test of gross motor skills, TOTPA-total result of the physical activity questionnaire, Asymp. Sig. (2-tailed)-two-tailed p-value.

Table 4 shows the effect size (r), and according to the Cohen, criterion sorted to small influence (0.1), medium influence (0.3), and large impact (0.5). The value of the variable TOTPA is 0.66 and represents a large impact, which means the difference between the active and inactive groups in the TOTPA test is large, while the value of the variable TGM is 0.11 and represents a small impact or small difference between the active and inactive group.

Table 4. Effect size

The magnitude of the impact r = Z/√N	
TGM	**0.11**
TOTPA	**0.66**

Note: r-effect size, Z-z value, N-observation number, TGM-total result on the test of gross motor skills, TOTPA-result of the physical activity questionnaire.

Discussion

Motor development has been identified as an extremely important area in the overall growth and development of school children (Cairney et al., 2005; Goodway, Ozmun, & Gallahue, 2019; Acar & Ozer, 2020). That is why many authors deal with children's motor skills (Akbari et al., 2009; Baranasic, 2019; Barnett, Salmon, & Hesketh, 2016; Goodway et al., 2019; Katanic et al., 2020; Veljkovic, Katanic, & Ilic, 2020).

The results of these studies show that the difference between active and inactive children was found in two variables, and its TGM total score of gross motor skills (p=0.036) and a level of physical activity (p=0.00). These results correspond to the other findings that the level of motor skills is positively related to the level of physical activity, so children with the best results on motor tests had the highest level of physical activity (Cairney et al., 2005; Goodway et al., 2019;). Also, the level of motor skills is inversely related to the sedentary lifestyle in children. So children who have poor results on motor skills tests feel insecure and avoid physical activities and have more sedentary activities (Cairney et al., 2005; Goodway et al., 2019).

On the other hand, no significant difference was found in the BOT-2 scales of upper extremity coordination (p=0.09), and speed and agility (p=0.236). Also, no significant difference was found in the TGMD-2 subtests of locomotor (p=0.08), and manipulative skills (p=0.2). However, it should be mentioned that more active children had on average higher values on all tests than inactive children, but this difference is not statistically significant. In order to obtain complete results, the research on large samples should be investigated, as well as the complete motor space should be covered with measuring instruments.

With this transversal study, we obtained data that indicate that there are no complete differences between active and inactive children in motor skills at the age of 9 years. Out of a total of 6 applied tests, two tests showed that there are differences between active and inactive children that the statistical significance is below 0.05. In the TOTPA test, the result of the level of physical activity was 0.66 and represents a large impact, which means the difference between the active and inactive groups in the TOTPA test is large. In the TGM total score on gross motor test, the effect size was 0.11 and implies a small impact or small differences between groups.

One of the possible shortcomings of this research may be the

small sample of respondents (40 children), accordingly opens the question of the real differences between the mentioned group, and also creating space for further research by future researchers. Also, this study has a local character, so it cannot be generalized to the whole of Serbia, and that we recommend that the next survey is on a larger sample and that all regions be covered to get a real picture.

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Conflict of Interest
The authors declare that there is no conflict of interest.

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