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DIFFERENCES IN BILATERAL COORDINATION BETWEEN BOYS AND GIRLS AT 7 YEARS OF AGE

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Abstract: The study was conducted to identify differences in bilateral coordination between boys and girls in the first grade of primary school. The sample consisted of 30 first grade students, at the age of 7 years ± 6 months. The children were divided into two groups consisting of boys (14) and girls (16). The level of the children's bilateral coordination was assessed using the Bilateral Coordination (7 variables) subtests that are part of the BOT-2 - the Bruininks-Oseretsky Motor Proficiency Test Battery. The tests are used as a standardized measure of the level of motor skills in children. The obtained data was processed in the SPSS 19 statistical programme, and the non-parametric Mann-Whitney U test was used to determine differences in bilateral coordination. After processing the data, it was noted that there are differences in bilateral coordination between boys and girls, but that they were not statistical-

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ly significant. For more reliable results and, therefore, more conclusive results and conclusions, it is necessary to perform tests on a larger sample of children.

Keywords: *coordination, bilateral coordination, BOT-2 test, children*

INTRODUCTION

A child's motor development has been identified as one of the important areas in their overall growth and development. The development of general motor skills involves the development of fine and gross motor skills. Fine motor skills involve manipulative coordination using smaller muscles, while, in contrast, gross motor skills involve large muscle groups making various movements (Cairney, et al., 2005; Goodway, Ozmun & Gallahue, 2019). When working with children, fine and gross motor skills should equally be developed throughout schools' sports and physical education classes. Motor coordination is considered to be one of the main elements of children's motor abilities, of their cognitive abilities and psychological traits, too (da Silva, Gabbard, Ries & Bobbio, 2016; Goodway, Ozmun & Gallahue, 2019). Poor motor coordination in children not only interferes with their performance of a particular motor task, but can also have a negative impact on their participation in physical activities, school success, and within-group social relationships (Asonitou, Koutsouki, Kourtessis & Charitou, 2012; Cairney, Hay, Veldhuizen, Missiuna & Faught, 2010; Vandorpe, et al., 2011). This is why it is very important to detect abnormalities in the development of children's general motor coordination early and correct them.

Bilateral coordination refers to the ability to simultaneously use both sides of the body in a controlled manner (Balakrishnan & Rao, 2007; Karambe, Dhote & Palekar, 2017; Rutkowska, et al., 2016; Uzunovic, et al., 2018). The development of bilateral coordination begins at an early age and forms the basis for further overall motor development. Good results of participants on bilateral coordination tests indicate that both sides of the brain act in synergy (Karambe, et al., 2017).

Studies examining the motor coordination of children include primary school children as participants. The largest number of studies includes younger primary school children (Cairney, et al., 2005; Cairney, et al., 2010; da Silva et al., 2016; Kaur, Srinivasan & Bhat, 2018; Vandorpe, et al., 2011), while several papers address older elementary school age (da Silva, et al., 2016; Lopes, Stodden, Bianchi, Maia & Rodrigues 2012; Rutkowska, et al., 2016; Kaur, et al., 2018). The level of motor skills is positively correlated with the level of physical activity and inversely related to sedentary activity in children. Children with the best performance in motor tests had the highest level of physical

activity (Cairney, et al., 2005; Cairney, et al., 2010; Goodway, Ozmun & Gallahue, 2019). Karambe et al. (2017) have shown that with age, the result in the Bruininks-Osterecki coordination test increases in both boys and girls, as expected (Karambe, et al., 2017). Lopes, Santos, Pereira & Lopes (2013), and da Silva et al. (2016) studied coordination and its relationship to school success. Generally, it has been found that there is a positive relationship between gross motor tests and school success. None of the studies addressed gender differences in children of this age, and this is why the aim of this study is to examine differences in bilateral coordination between boys and girls in primary school.

METHOD

Sample of participants

The sample of participants in this study consisted of young children of primary school age, more precisely, children attending the first grade of primary school. The study involved 30 subjects at the age of 7 (± 6 months) from elementary school "Miroslav Antić" from Nis. Groups were formed by gender, including boys (n-14) and girls (n-16).

Sample variables

For this purpose, 7 motor tasks, subtests were performed to evaluate bilateral coordination using the Bruininks-Oseretsky test:

1. *Touching nose with index fingers - eyes closed*
2. *Jumping jacks*
3. *Jumping in place - same sides synchronized*
4. *Jumping in place - opposite sides synchronized*
5. *Pivoting thumbs and index fingers*
6. *Tapping feet and fingers - same sides synchronized*
7. *Tapping feet and fingers - opposite sides synchronized* (Bruininks, 2005)

The Bruininks-Oseretsky test is used as a standardized measure of the level of motor skills of children, and in this case to examine bilateral coordination as a motor ability.

Data processing

Data processing was performed using the statistical program SPSS 19. The basic parameters of descriptive statistics were calculated: arithmetic mean, standard deviation, range, minimum and maximum value. After per-

forming the Shapiro-Wilk data normality test, 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 in bilateral coordination between groups of boys and girls in the first grade of primary school.

RESULTS

The results obtained from testing the bilateral coordination of children are initially converted according to standardized BOT-2 test scores, for each test individually. The given grades are entered in the table and this represents the test results which are later subject to processing in statistical programs. Table 1 shows the results of descriptive statistics for all 30 students surveyed.

Table 1. *Descriptive statistics*

	Range	Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
Age	2	6	8	6.87	.43
Height	18	117	135	126.67	4.60
Weight	18.5	21.3	39.8	27.12	4.48
BMI	7.80	14.70	22.50	17.02	2.19
Test 1	3	1	4	3.37	.85
Test 2	3	0	3	1.83	.91
Test 3	3	0	3	2.90	.55
Test 4	3	0	3	2.67	.84
Test 5	3	0	3	1.87	1.28
Test 6	1	3	4	3.93	.25
Test 7	4	0	4	2.73	1.26

Table 1 shows that the average height of first-grade children is 126.7 cm, the average body weight is 27.1 kg and the average BMI values are 17.0. Looking at the minimum and maximum values, it is noticeable that the height ranges from 117 cm to 135 cm, the body weight ranges from 21.3kg to 39.8, while BMI varies between 14.7 and 22.5. It should be noted that the first, sixth, and seventh tests were rated from 0 to 4 points, while the other tests were

rated from 0 to 3. The children achieved the best results in the 3rd and 6th test, winning 2.9 from 3 and 3.93 out of the possible 4 points. Namely, in the 6th test, the success rate was very high, 98.3%, and in the 3rd test 96.7%. The lowest scores were 1.83 and 1.87 out of the maximum 3 points in Tests 2 and 5, which translates into a success rate of 61% and 62.4%, respectively.

Table 2. *Average values individually for each group as well as for all tests*

average values	boys	girls	all participants
	n-16	n-14	n-30
Test 1	3.00	3.79	3.37
Test 2	1.56	2.14	1.83
Test 3	2.81	3.00	2.90
Test 4	2.63	2.71	2.67
Test 5	1.56	2.21	1.87
Test 6	3.88	4.00	3.93
Test 7	2.63	2.86	2.73

When looking at the average values of the groups on all seven tests (Table 2), it is noticeable that the group consisting of girls was more successful. What is more, in two tests, the 3rd and the 6th group of girls achieved maximum points. When comparing groups, the girls performed better than the boys in all seven tests.

To examine the differences between the groups of boys and girls, the Shapiro-Wilk test (small sample, n-30) of data distribution fidelity was used, and it indicated that the distribution was not normal and that a non-parametric Mann-Whitney U test should be performed (Table 3).

Table 3. *Mann-Whitney U test between boys and girls group, ranks*

	Ranks			
	gender	N	Mean Rank	Sum of Ranks
Test 1	boys	16	12,16	194,50
	girls	14	19,32	270,50
	Total	30		
Test 2	boys	16	13,09	209,50
	girls	14	18,25	255,50
	Total	30		

Test 3	boys	16	15,06	241,00
	girls	14	16,00	224,00
	Total	30		
Test 4	boys	16	15,19	243,00
	girls	14	15,86	222,00
	Total	30		
Test 5	boys	16	14,31	229,00
	girls	14	16,86	236,00
	Total	30		
Test 6	boys	16	14,63	234,00
	girls	14	16,50	231,00
	Total	30		
Test 7	boys	16	15,06	241,00
	girls	14	16,00	224,00
	Total	30		

Comparing the value of the median as the central value in the distribution of scores, it is noticeable that the average rank values are on the girls' side in all tests.

Table 4. *Mann-Whitney U test between boys' and girls' group*

	Test Statisticsb						
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Test 6**	**Test 7**
Mann-Whitney U	58,500	73,500	105,000	107,000	93,000	98,000	105,000
Z	-2,490	-1,682	-,935	-,320	-,846	-1,346	-,307
Asymp. Sig. (2-tailed)	,013	,093	,350	,749	,398	,178	,759

There are differences between groups of boys and girls and they are in favour of the girls. However, these values are not statistically significant, except in the first test (p=0.13), where it was necessary to touch the nose with the index finger, eyes closed (Table 4).

DISCUSSION

When it comes to the development of a child's general motor skills, it should be noted that motor coordination is one of the main elements of chil-

dren's motor skills, as well as their cognitive abilities and psychological characteristics (da Silva, et al., 2016; Goodway, et al., 2019). This indicates that proper development of motor coordination is an extremely important factor, as it can greatly affect a child's quality of life itself, that is, various bio-psycho-social aspects of their life. Therefore, it is extremely important to detect irregularities in motor coordination at an early age and to remedy them with expert supervision in a timely manner.

Bilateral coordination refers to the ability to use both sides of the body simultaneously and in individuals who exhibit a high level of this ability, this indicates that both sides of the brain act in synergy (Balakrishnan & Rao, 2007; Karambe, et al., 2017; Rutkowska, et al., 2016; Uzunovic, et al., 2018). In case of children at the age of 7, the authors did not classify children according to their gender status, but conducted examination based on their other characteristics. The main reason is that puberty starts only as soon as between the ages of 9 and 11 (Kuzman, 2009; Rudan, 2004), so it is only from that age that authors are interested in researching this topic.

When looking at the average values achieved by groups in all seven tests, it is noticeable that the group of girls was more successful. It should be noted that the girls in the 3rd and 6th test achieved maximum points. Regarding differences in bilateral coordination between boys and girls in this study, girls were more successful in all seven bilateral coordination tests, although this difference was not found to be statistically significant except in the first test, p-0.13, where they needed to touch the nose with the index finger, eyes closed. It should also be noted that in the second test, a difference in the level of significance below 0.1 was made, so there is a probability of 9.3% that the observed relationship between the variables was created by the case coincidence. For further research of the topic, a large sample should be provided, since it is assumed that a larger sample would produce results that would discriminate against girls from boys in this motor ability over a given period of time.

CONCLUSION

Based on this study that examined the relationship between boys and girls using the Bilateral Coordination (7 variables) subscale, which is part of the BOT-2 (the Bruininks-Oseretsky test of Motor Proficiency) test battery, only one of the seven tests indicated a difference of statistical significance. When it comes to differences between boys and girls, these results suggest that during this age, there is no significant difference, but that it occurs with the onset of puberty. However, a major drawback of this research is the small sample of respondents. Other recommendations for further research concern

the inclusion of children from multiple heterogeneous social groups, observation of other factors, such as school success, the role of socioeconomic status, cultural, biological, and physiological differences.

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