

**DEVELOPMENT OF LOWER BODY PARTS' GROSS MOTOR SKILLS IN CHILDREN WITH AUTISTIC SPECTRUM DISORDERS****Vedran Budetić<sup>1,2,3</sup>, Kristijan Copak<sup>4</sup>, Marko Torić<sup>5</sup>**<sup>1</sup>*III. gimnazija Osijek*<sup>2</sup>*Škola primijenjene umjetnosti i dizajna Osijek*<sup>3</sup>*Department of chemistry Osijek*<sup>4</sup>*Klinički bolnički centar Osijek*<sup>5</sup>*Osnovna škola Josipa Matoša Vukovar*

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**Abstract**

Desire to move and successful overcoming of obstacles in a physical environment are foundations for better functioning in the community and improvement in life quality in general. Keeping that in mind, research about the impact of structured gross motor exercises on gross motor skills has been conducted within the project "Sport workshop for children with autism spectrum disorders" by a local association "DAR" from Osijek. The workshops were organized in the period from 2015 till 2017 once per week with duration of 45 minutes under the guidance of a kinesiologist, education rehabilitator and occupational therapist. Research sample is comprised of 18 children, members of the association (M=14, F=4) aged from 3 to 22. Using quantitative, parametric, and longitudinal methods gross motor screening was used initially and as an evaluation. Gross motor screening test has 21 different tasks and an initial assessment was in October/November 2016, evaluation assessment was 3 months later and final assessment in April/May 2017. The research results indicate valid methods and progress in individual specific gross motor skills of children with autism spectrum disorders. Furthermore, the results can be used as a basis for future evidence based practice and ongoing research on a similar subject.

**Key words:** *children, autism, gross motor skills, sports workshops***Introduction**

The need for movement and play is biologically implemented in humans as in most mammals. If we look at the way wild cubs play in wilderness, we can see that, through their play, they are learning basic motor skills. The same set of skills is going to help them to survive the harsh environment - to get food or defend themselves from predators, for example. Although modern man does not live in wilderness and it has not need to develop specific motor skills such as hunting or surviving, most parents make a big mistake by neglecting the importance of play in complete development of their children. In many cases parents participate in sport activities but their children do not. Insufficient physical activity, inappropriate diet and other negative influences from the environment are threatening, not only people's health but also their capabilities and that affects children as well (Findak & Delija, 2001), which results in a poor development of their children's motor skills. Sad, but true, is the fact that parents rather leave their children at home, sitting behind a computer, than take them outside or to some sports club. If we take in consideration that in Croatia there is not many sport activities for our youngest it is easy to imagine that the problem is even bigger if it is observed in children with development disabilities. Autism is a set of brain

disorders that starts in childhood, mostly in first three years of a child's life and it affects all psychological functions and lasts for a lifetime (Bujas Petrović & Frey Škrinjar et.al 2010). Children with autistic spectrum disorders (ASD) bearing all of their personal difficulties are often neglected by the society. Inert and sluggish system reacts too slowly to families' appeals, while other kids in kindergartens and schools often marginalize children with ASD. In Osijek, Association of families with children with autism - "Dar" is trying to minimize this problem. A few years back they had help from "Prime" sport studio - sports association specialized in, among other, work with children with disabilities. As a result of their cooperation this article was made. To obtain a scientific approach, only articles based on motor skills tests were analysed. By using Test of motor impairment-Henderson Revision (Scott, Henderson & Moyes, 1986), Manjiviona & Prior (1995) found out that 67 % children with ASD have motor impairments also. Bhat, Landa & Galloway (2011); Ming, Brimacombe & Wagner (2007) (as cited in Bo, Lee, Colbert & Shen, 2016) based their research on Bruininks-Osersky Test of Motor Proficiency (Bruininks, 1978) and concluded that children with ASD also show significant developmental delays in accurate hands, wrists, fingers, toes, lips, and tongue movement.

Vanuvechelen, Roeyers & De Weerd (2007) went a bit further - by using the Peabody Developmental Motor Scales (PDMS: Folio & Fewell, 1983) with low-functioning group and the Movement Assessment Battery for Children (MABC:Henderson & Sugden, 1992) with high-functioning group found that imitation difficulties in autism are part of a broad motor problem. On the other side Jansiewicz found that difficulties in fundamental motor skills often persist well into childhood, affecting motor coordination on a wide range of tasks, such as drawing, typing, writing, speaking and playing (Bo et al. 2016). And finally Ghaziuddin & Butler (1998), Leary & Hill (1996), and Notraedame (2002) (as cited in Ming et al., 2007) discovered that children with autism and speech disorders had significantly more motor deficits, suggesting motor deficits are, indeed, concurrent with autism. It is important to accentuate that before the start of this research an informed consent was given by all participant's parents.

## 2. Problem and aim of research

Having in mind the purpose of this research - importance of including children with ASD in active engagement in physical activities, the aim of this article was created. Main problem of this research was to show the authorities and all others that it is equally important for overall development of children with disabilities, in this case children with ASD, to be included in organized physical activity as it is for healthy children, with only one difference and that is the need for educated staff that is going to conduct this specialized sport workshops. Because of the nature of their condition it is very difficult for children with ASD to function in groups with healthy children. Taking in consideration duration of sport workshops, once per week for 45 minutes, the progress in level of gross motor skills was expected, regardless of anything and that is the aim that should help minimize the problem

## 3. Methods

### 3.1. Participants sample

Participants sample was quite small because, luckily, the population of children with ASD is not large. Although couple of months after the beginning of this research some ten more children joined us in attending workshops, they are not involved in the research because initial and evaluation assessment were already conducted. The test sample consisted of 18 children diagnosed with ASD, members of the association (M=14, F=4) aged from 3 to 22.

### 3.2. Exercise programme

In order to organize sports workshops for children with ASD, performers, kinesiologist, education therapist and occupation therapist decided that the best way to run workshops would be in closed space 150 square meters maximum covered with mat. In this type of space, it's easier for children to keep their focus on exercise they need to perform and the possibility of getting injured is minimized. Children are divided in three age groups. Every group can contain maximum three children with

heavier form of ASD. In that way every performer can take one child by the hand and work with it on predefined motor tasks. Each exercise consisted of physiological and therapeutic, mainly socialization, component. For example, waiting in line to cross the obstacle teaches children how to be patient or how to perform motor tasks that can be done only by co-operation. Methodological organizational forms of work were in the greatest extent obstacle polygons, followed by frontal work and groupwork. All these forms were realized by using variety of features, such as tennis balls, standard size balls, stability balls, different obstacles for jumping, skipping, tunnels, jumping ropes, agility ladder and so on. We were not able to perform more complex forms of work because of the nature and the state of the participants and the lack of performers (only three) of the workshops.

### 3.3. Data collection

For the collection of relevant data for the study, a screening test of gross motor skills consisted of 21 motor tasks was used, made by modified model GMFM (Gross Motor Function Measure). Originally GMFM was made for gross motor skills assessment of children with cerebral paralysis. Although Ghwarska, Klin, & Volkmar, (2008) found that this tool may be applicable to other, similar populations demonstrating qualitative and quantitative deficits in gross motor skills, such as children with Down syndrome and other intellectual impairments. In the making of screening test, taking in consideration variety of children involved in research, the motor tasks were selected by performers of workshops. Conducting the assessment lasted less than 10 minutes depending on child's capabilities (concentration, focus, self-regulation, understanding, behaviour regulation). Equipment needed for evaluation includes stop watch, meter, adhesive tape, hoop 60 cm in diameter, a stick and a regular size ball.

Scoring of the participants is based on the observation of qualitative and quantitative performance of a single motor task and adding 0-3 points according to:

- 0 – doesn't start to move,
- 1 – starts to move,
- 2 – partially makes the movement,
- 3 – executes movement,
- NT – not tested

Considering scales of normal motor development, maximum score (63 points) should be achieved from four years on (Table 1). With children at the age of 3 partial execution of motor tasks standing and jumping on one leg (tasks 2., 3., 20., 21.) (Table 1) was tolerated. During evaluation of performing individual motor tasks best score out of three was written. Initial data collecting took place in October and November 2016. After initial assessment, children continued to attend sports workshops once per week in duration of 45 minutes. Evaluation assessment was conducted 3 months

after initial assessment (January, February 2017.) and the final three months after (April, May 2017.). Collected results are displayed in table 1 and interpreted after statistical data processing. Difficulties in data collecting occurred mostly because 2 children joined after initial assessment (P13, P17), and 3 children (P2, P12, P14) did not attend evaluation assessment.

These difficulties were reduced by premise that their initial scores could not be better than the ones in

initial evaluation assessment. In that way, statistically, no handicap or advantage in data interpretation was made. Child P1 could not be evaluated at the initial assessment because of the difficulties with self-regulation. On the other side during evaluation assessment it was successfully evaluated with score 48/60 so the same rule as in upper cases was applied and there was no sample dispersion.

Table 1 Evaluation of gross motor skills

Ordinal number	Initial position	Description	Score				
			0	1	2	3	NT
1.	Standing	Holds position, hands freely					
2.	Standing	Lifts L foot, 10 sec					
3.	Standing	Lifts R foot, 10 sec					
4.	Standing	Makes squat, hands freely					
5.	Standing	Walks sideway 5 steps to the right					
6.	Standing	Walks sideway 5 steps to the left					
7.	Standing	Walks 10 steps forward					
8.	Standing	Walks 10 steps forward, turns and walks back					
9.	Standing	Walks 10 steps backward					
10.	Standing	Walks 10 steps forward carries ball with both hands					
11.	Standing	Walks 10 steps forward between two parallel lines 20cm apart					
12.	Standing	Walks 10 steps forward on straight line 4,5 cm wide					
13.	Standing	Steps over the obstacle at knee level, right leg first					
14.	Standing	Steps over the obstacle at knee level, left leg first					
15.	Standing	Runs 5m					
16.	Standing	Kicks ball with right leg					
17.	Standing	Kicks ball with left leg					
18.	Standing	Jumps 30 cm high bilaterally					
19.	Standing	Jumps 30cm forward bilaterally					
20.	Standing	Jumps on right leg 10 times inside 60cm wide circle					
21.	Standing	Jumps on left leg 10 times inside 60cm wide circle					

3.4. Data processing

After every assessment in every single one of 21 particles, participants accomplished a certain number of points. To make statistic processing as simple as possible, the results were summed up for

each participant in every assessment (Chart 1). After that, total scores for each assessment were calculated and arithmetic means for initial, evaluation and final assessment were obtained.

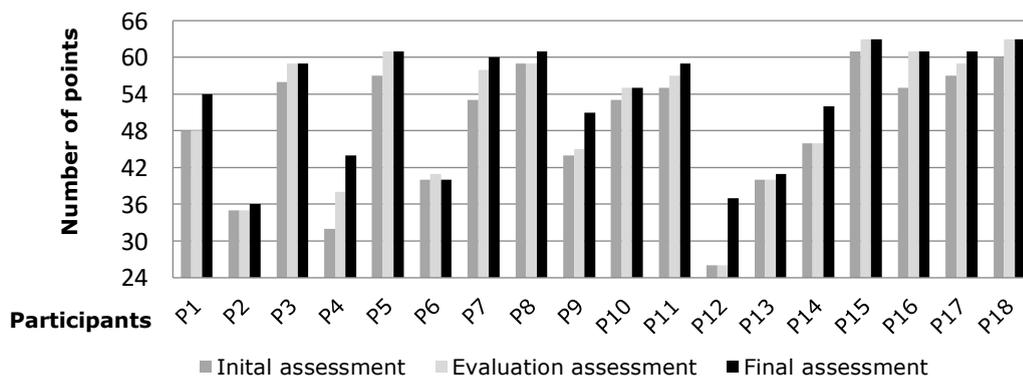


Chart 1 Point success of participants at initial, evaluation and final assessment.

By obtaining arithmetic means and in order to simplify data processing and results overview it was decided that paired samples t-test would be used.

**4. Results and discussion**

Results of each evaluation are ranks, in range from 0 to 3 points and as such they are not susceptible to parametric data processing. The goal was to modify that results into variables, so they can be used as parametric ones. That was enabled by calculating arithmetic means of initial, evaluation and final assessment (Table 3). Although, after grouping participants by age, it is visible that the biggest progress is done by youngest group age 3 - 4 (9.25 points in average). It would probably be even greater if the participants P1 and P2 have been tested properly at the initial assessment. Other three groups had results in range of 1.25 points (5.75 -7) but because of a small sample of participants (4-6 per group) these results have not been subdued to any data processing method and are here only for information purposes. Paired samples t-test was conducted by pairing means

from all three variables. First observed pair was initial and evaluation assessment, then evaluation and final and finally initial and final assessment. After analysis t-test showed statically significant differences of results between paired variables (Table 2).

Table 2 Paired samples t-test.

Paired variables	t	df	Sig
<b>Initial vs. Evaluation assessment</b>	-0.57	17	0.00
<b>Evaluation vs. Final assessment</b>	-3.64	17	0.00
<b>Initial vs. Final assessment</b>	-5.38	17	0.00

Legend: t – test; df – degrees of freedom; Sig – statistical significance

Table 3 Point success of participants at initial, evaluation and final assessment

Age	3-4				6-8				9-11						14-21					
Participants Assessment	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	M	Sd
	<b>Initial</b>	48	35	57	32	58	40	54	59	44	53	55	26	40	46	62	55	57	60	48.72
<b>Evaluation</b>	48	35	58	38	60	41	57	56	45	55	57	26	40	46	62	61	59	63	50.56	10.98
<b>Final</b>	56	38	61	46	64	43	63	64	53	57	61	38	43	54	66	64	64	66	53.22	9.47
<b>Final – initial</b>	8	3	4	14	6	3	9	5	9	4	6	12	3	8	4	9	7	6		
<b>M (Final – initial)</b>	9.25				5.75				7						6.5					

Legend: M – arithmetic mean, Sd – standard deviation

**5. Conclusion**

This research was mainly conducted to successfully determine if organized physical activity affects the development of gross motor skills in children with ASD. As time passed improvement was evident between all three assessments. If relatively short time that children spent practicing is added, once per week for 45 minutes, there is only one thing to conclude: Involving children with ASD in organized physical activity has a positive effect on development of gross motor skills and general motorics also.

To end with a recommendation: involving in systematic, organized physical or sport activity, at least twice per week, preferably more, is needed for a complete development of all children, especially those with difficulties. Unfortunately, in Osijek sports activities where children with disabilities can be involved are sorely missing. With more activities of this type, development of these children would be more complete. This article is expected to inspire authorities and all others who are capable of helping so that even more sessions of specialized sport workshops per week at "Prime" sport studio can be arranged.

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## RAZVOJ GRUBE MOTORIKE DONJIH EKSTRMITETA U DJECE S POREMEĆAJIMA IZ SPEKTRA AUTIZMA

### Sažetak

Potreba za kretanjem, kao i uspješno savladavanje prepreka u fizičkoj okolini, temelj su kvalitetnog života i funkcioniranja u zajednici. Sukladno tome, u okviru projekta "Sportske radionice djece s poremećajima iz spektra autizma" lokalne udruge "DAR" iz Osijeka provedeno je istraživanje o utjecaju osmišljenih strukturiranih vježbi na gruba motorička znanja djece s poremećajima iz spektra autizma. Radionice se provode od 2015.-2017.godine, u prosjeku jednom tjedno, u trajanju 45 minuta pod vodstvom kineziologa, edukacijskog rehabilitatora i radnog terapeuta. Uzorak se sastoji od 18 djece članova udruge (M=14, Ž=4) u dobi od 3 do 22 godine. Vodeći se kvantitativnim parametrijskim longitudinalnim metodama, korištene su inicijalne i evaluacijske procjene skrining testa grube motorike sastavljenog od 21 čestice. Inicijalna provjera provedena je u razdoblju listopad/studen 2016., tranzitivno provjeravanje siječanj/veljača 2017., finalno travanj/svibanj 2017. godine. Dobiveni rezultati istraživanja ukazuju na valjane metode rada i napredak u pojedinim specifičnim grubim motoričkim znanjima djece s poremećajima iz spektra autizma te služe kao podloga za daljnju praksu i istraživanja na navedenom području.

**Ključne riječi:** *djeca, autizam, gruba motorika, sportske radionice*

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