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Difficulties of the tactile sensory system sensory integration of children with autism

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Abstract. Sensory integration represents the organization of the senses for their use. It is a neuro-biological activity that allows the reception and processing of sensory information, which in arrive from the senses in huge quantities into the brain, at any time. The ability of the brain to successfully process tactile information allows the child to feel safe and develop a connection with those around it. An autistic child is not able to register many stimuli from their environment, so insufficient or poor sensory processing can contribute to the image of autism. Children with autism spectrum difficulties have specific difficulties in touch perception. The aim of the study was to examine the prevalence of sensory integration difficulties of the tactile sensory system of children with autism spectrum disorders, and to establish the statistical significance of differences in relation to children without developmental difficulties. The total sample of subjects (N=30) consisted of two subsamples. The first subsample of subjects (N=15) consisted of children with difficulties from the autism spectrum, and the second subsample of subjects (N=15) consisted of children without developmental difficulties. The measurement instrument was the „Questionnaire for testing tactile sensory sensitivity“ with 11 variables and the offered answers of possible sensory response was applied. The Mann-Whitney U test and the Wilcoxon W test at the level of statistical significance of $p < 0.05$ were used to examine the statistical significance of the differences between the subsamples of the subjects. The results of the study showed that 86.67 % of children with autism have difficulties in sensory integration of the tactile sensory system. The hypersensitive type of sensory response has 26.67 %, and the hyposensitive sensory response 20 % of children with autism. 40.00 % of children with autism have a mixed type of tactile sensory. There is a statistically significant difference between children with autism and children without developmental difficulties on 4 variables.

Keywords. sensory integration, tactile sensory system, autism, children with developmental difficulties, children without developmental difficulties

1. Introduction

Sensory integration is the organization of the senses for their use (Ayers, 2002). It is a neuro-biological activity that enables the reception and processing of sensory information, which arrive from the senses in large quantities to the brain, at any time (Biel and Peske, 2007).

Sensory disintegration is an abnormality or disorder in brain function that makes it difficult to integrate sensory input stimuli (Ayers, 2002). Difficulties of sensory integration occur when the brain and nervous system have difficulties in receiving and processing sensory information or if they are not exposed to appropriate sensory stimuli (Zglavnik, 2005).

The tactile system is the largest sensory system and develops first, still in intrauterine development. Tactile information is obtained through receptors (Kranowitz, 2018), located on the skin, but also in the throat, ear canals, digestive system... (Biel and Peske, 2007). The most tactile receptors are located in the mouth and on hands (Brack Clark, 2009). The first role of touch in a child's life is to establish a connection between the mother and the infant, and this connection is also important for the further development of the child's brain (Bošnjaković, 2017). The brain's ability to successfully process tactile information allows a child to feel safe and develop a connection with those around it (Chu, 2013).

Autism is a comprehensive developmental disorder that includes all mental functions, and occurs in the first three years of life and lasts a lifetime (Tešić, 2017). The prevalence of autistic disorder is 4:10,000 births (Blažević, Škrinjar, Cvetko, Ružić, 2006). Difficulties occur in the field of social, speech and communication development (Švraka, Avdić and Hasanbegović-Anić, 2012). Autism implies various changes in behavior such as anxiety, hypersensitivity, hyposensitivity, stereotypical and repetitive forms of behavior, limited interest, avoidance of contact, self-harm, aggressive behavior... (Tešić, 2017). Studies shows that most children with autism have sensory difficulties, but also hearing, sight, and touch are usually the most affected (Biel and Peske, 2007). An autistic child is not able to register many stimuli from their environment, insufficient or poor sensory processing can contribute to the image of autism (Mamić, Fulgosi Masnjak and Pintarić Mlinar, 2010). Children with difficulties from the autism spectrum have specific difficulties in the perception of touch, they do not like to be petted or carried (Novaković and Pejović-Milovančević, 2019). A child may be overly sensitive to the composition of clothing, objects and food (Marković, 2017).

The aim of the study is to examine the prevalence of sensory integration difficulties of the tactile sensory system of children with autism spectrum disorders, and to determine the statistical significance of differences in relation to children without developmental difficulties.

2. Study Methods

2.1. Subjects

The study was conducted on a sample of 30 subjects. The total sample of subjects was divided into two subsamples. The first subsample of subjects (N=15) consisted of children with autism spectrum disorders (students of the Vladimir Nazor Center and the Mjedenica Institute). The second subsample of subjects (N=15) consisted of children without developmental difficulties, students of the First Primary School in Ilidža.

2.2. Type of the study and measurement instrument

The study is prospective, analytical-descriptive and controlled. Data were collected using the „Tactile Sensory Sensitivity Test Questionnaire“ (Biel and Peske 2010). The measurement instrument consists of 11 questions, variables with offered answers of possible sensory response; neutral, avoids, seeks and mixed. Data was collected by observing students and interviewing rehabilitators, teachers, and parents of students.

2.3. Statistical data processing

Statistical analysis of the data was performed in the SPSS program version 24.0. The method of descriptive statistics was used. The ranks of the matrices and the sum of the ranks of the representation of the differences in the sensory integration difficulties of the tactile sensory system between children with autism spectrum disorders and children without developmental difficulties were made. The Mann-Whitney U test and the Wilcoxon W test at the level of statistical significance of $p < 0.05$ were used to test the statistical significance of the differences between the subsamples of the subjects.

3. Results and discussion

3.1. Analysis of frequencies and percentages of subsamples of subjects

Inspecting Table 1, and based on the analysis of frequencies and percentages of subjects for the variable „Touching some parts of the body, hugs and caresses“, it can be concluded that 13.33 % of children with autism have normal sensory integration. A large percentage of children with autism, 46.67 % of them have a mixed type of tactile sensory response, and a slightly smaller percentage, 40 % of them are hyposensitive. There are no subjects with hypersensitive sensory response. Children without developmental difficulties show hypersensitive sensory response in 26.67 % of cases, hyposensitive sensory response in 13.33 %, and a mixed type of tactile sensory response in 20 % of cases. 40% of children without developmental difficulties have a normal sensory response.

For the variable „Certain types of fabric, stitches, labels, belts, cuffs, etc.“, the largest percentage of children with autism have a mixed type of tactile sensory response, 40 %, and 20 % are hyposensitive, while 13.33 % have a hypersensitivity reaction. 26.67 % of children with autism have normal sensory integration. Children without developmental difficulties show in 33.33 % of cases a hypersensitive sensory response, in 6.67 % a hyposensitive, and in 13.33 % of cases a mixed type of tactile sensory response. 46.67 % of children without developmental difficulties have a normal sensory response.

From subsample total 46.67 % of children with autism have normal sensory integration for the variable „Clothing, footwear or embellishments that is very narrow or very loose“. The mixed type of tactile sensory response has 20 %, and the same number of children are hypersensitive, while 13.33 % of children with autism are hyposensitive. Children without developmental difficulties show in 20 % of cases a hypersensitive sensory response, in 6.67 % a hyposensitive, and in 6.67 % a mixed type of tactile sensory response. 66.67 % of children without developmental difficulties have a normal sensory response.

For the variable „Contamination of hands, face or other parts of the body with paint, glue, sand, food, lotion“, only 6.67 % of children with autism have a normal sensory reaction. Most children, 46.67 % of them have a mixed type of tactile sensory response, and 26.67 % are hypersensitive, while 20 % are hyposensitive. Children without developmental difficulties show hypersensitive and hyposensitive sensory response in 20 % of cases, and a mixed type of tactile sensory response in 6.67 %. 53.33 % of children without developmental difficulties have a normal sensory response.

Only 6.67 % of children with autism have a normal sensory reaction for the variable „Hygienic activities such as washing face and hair, combing, cutting nails, brushing teeth“. A large percentage of children with autism, 53.33 % of them have a mixed type of tactile sensory response. 26.67 % of children with autism are hypersensitive and 13.33 % are hypersensitive. Children without developmental difficulties show hypersensitive and hyposensitive sensory

response in 13.33 % of cases, and 26.67 % a mixed type of tactile sensory response. 46.67 % of children without developmental difficulties have a normal sensory response.

For the variable „Bathing, showering or swimming“, 20 % of children with autism have a normal sensory response. The largest percentage of children have a mixed type of tactile sensory response, 60 % of them, and 20 % have a hyposensitive reaction. Children without developmental difficulties show in 13.33 % of cases a hypersensitive reaction, in 6.67 % a hyposensitive, and in 20.00 % a mixed type. 60.00 % of children without developmental difficulties have a normal sensory response.

From the subsample total, 6.67 % of children with autism have a normal sensory reaction for the variable „Drying with a towel“. Most children with autism have a mixed type of tactile sensory response 40 %, 33.33 % are hypersensitive, while 20 % have a hyposensitive reaction. Children without developmental difficulties show a hypersensitive reaction in 13.33 % of cases, and a hyposensitive and mixed type of reaction in 6.67 % of cases each. 73.33 % of children without developmental difficulties have a normal sensory response.

There are no children with autism who have a normal sensory response for the „Trying new food“ variable. Hypersensitivity reaction have 66.67 % of children, 20 % a mixed type, and 13.33 % of children with autism are hyposensitive. Children without developmental difficulties in 13.33 % of cases show a hypersensitive reaction, and in 26.67 % of cases a mixed type of reaction. 60 % of children without developmental difficulties have a normal sensory response.

For the variable „Feeling of certain foods in the mouth (e.g., dry, crumbly, smooth, mushy, crunchy)“, 6.67 % of children with autism have a normal sensory response. A large percentage of children have a mixed type of tactile sensory response, 60 %, and 33.33 % are hypersensitive. There are no subjects who react hyposensitively to this type of tactile sensory input. Children without developmental difficulties in 6.67 % of cases show a hypersensitive reaction, and in 33.33 % of cases a mixed type of reaction. 60 % of children without developmental difficulties have a normal sensory response.

Normal sensory integration for the variable „Standing close to other people“ have 20 % of children with autism have. Most children with autism, 40 % of them react hyposensitively. 20 % of children with autism have a mixed type of tactile sensory response, and the same number are hypersensitive. Children without developmental difficulties in 13.33 % of cases show a hypersensitive reaction, and in 20.00 % of cases a mixed type of reaction. 66.67 % of children without developmental difficulties have a normal sensory response.

For the variable „Walking barefoot“, 13.33 % of children with autism have a normal sensory reaction. Most children with autism, 40 % of them react hypersensitively. 26.67 % of children have a hyposensitive reaction, while 20 % show a mixed type of tactile sensory response. Children without developmental difficulties in 20 % of cases show a hypersensitive reaction, and in 6.67 % of cases a mixed type of reaction. 73.33 % of children without developmental difficulties have a normal sensory response.

Based on the total frequencies and percentages of subjects' responses to all variables of the measurement instrument, it can be stated that children with autism and children without developmental difficulties have difficulties in sensory integration of the tactile sensory system. It can also be stated that children with autism have greater difficulties in sensory integration of the tactile sensory system compared to their peers, children without developmental difficulties. 13.33 % of children with autism and 60 % of children without developmental difficulties have normal sensory integration. 26.67 % of children with autism and 20 % of children without difficulties are hypersensitive. 20 % of children with autism and 6.67 % of children without

developmental difficulties have a hyposensitive type of sensory response. 40.00 % of children with autism and 13.33 % of children without difficulties have a mixed type of sensory response.

Table 1. Response frequencies and percentages

Variables	Children with autism				Children without developmental difficulties			
	Avoids N / %	Seeks N / %	Mixed N / %	Neutral N / %	Avoids N / %	Seeks N / %	Mixed N / %	Neutral N / %
Touching some parts of the body, hugs and caresses	0 0.00	6 40.00	7 46.67	2 13.33	4 26.67	2 13.33	3 20.00	6 40.00
Certain types of fabric, stitches, labels, belts, cuffs, etc.	2 13.33	3 20.00	6 40.00	4 26.67	5 33.33	1 6.67	2 13.33	7 46.67
Clothing, footwear or embellishments that are very narrow or very loose	3 20.00	2 13.33	3 20.00	7 46.67	3 20.00	1 6.67	1 6.67	10 66.67
Contamination of hands, face or other parts of the body with paint, glue, sand, food	4 26.67	3 20.00	7 46.67	1 6.67	3 20.00	3 20.00	1 6.67	8 53.33
Hygienic activities such as washing face and hair, combing, cutting nails, brushing teeth	4 26.67	2 13.33	8 53.33	1 6.67	2 13.33	2 13.33	4 26.67	7 46.67
Bathing, showering or swimming	0 0.00	3 20.00	9 60.00	3 20.00	2 13.33	1 6.67	3 20.00	9 60.00
Drying with a towel	5 33.33	3 20.00	6 40.00	1 6.67	2 13.33	1 6.67	1 6.67	11 73.33
Trying new foods	10 66.67	2 13.33	3 20.00	0 0.00	2 13.33	0 0.00	4 26.67	9 60.00
Sense of certain foods in the mouth (e.g., dry, crumbly, smooth, mushy, crunchy)	5 33.33	0 0.00	9 60.00	1 6.67	1 6.67	0 0.00	5 33.33	9 60.00
Standing close to other people	3 20.00	6 40.00	3 20.00	10 66.67	2 13.33	0 0.00	3 20.00	10 66.67
Walking barefoot	6 40.00	4 26.67	3 20.00	2 13.33	3 20.00	0 0.00	1 6.67	11 73.33
TOTAL	4 26.67	3 20.00	6 40.00	2 13.33	3 20.00	1 6.67	2 13.33	9 60.00

3.2. Differences in the prevalence of sensory integration difficulties of the tactile sensory system between children with autism spectrum disorders and children without disabilities

With an insight into the ranks of matrices and the sum of the ranks of the differences in the difficulties of sensory integration of the tactile sensory system between children with autism

and children without difficulties (Table 2), it can be concluded that there is a difference in sensory integration between subjects and that children with autism show lower results, that is, lower sensory integration of the tactile sensory system in relation to children without difficulties, on all variables of the measurement instrument.

Based on the analysis of frequencies and percentages of sensory integration difficulties of the tactile sensory system (Table 1) and differences in the prevalence of sensory integration difficulties of the tactile sensory system (Table 2) between children with autism and children without developmental difficulties, it can be concluded that there is a difference in sensory integration between children with autism and children without developmental difficulties.

In the further analysis, it was checked whether this difference was statistically significant at the level of statistical significance of $p < 0.05$.

Table 2. Differences in the representation of sensory integration difficulties of the tactile sensory system between children with autism and children without developmental difficulties

Variable	Children with developmental difficulties Children without developmental difficulties	N	Rank M	Sum of ranks
Touching some parts of the body, hugs and caresses	Autism	15	15.10	226.50
	Children without developmental difficulties	15	15.90	238.50
	Total	30		
Certain types of fabric, stitches, labels, belts, cuffs, etc.	Autism	15	15.30	229.50
	Children without developmental difficulties	15	15.70	235.50
	Total	30		
Clothing, footwear or embellishments that are very narrow or very loose	Autism	15	13.67	205.00
	Children without developmental difficulties	15	17.33	260.00
	Total	30		
Contamination of hands, face or other parts of the body with paint, glue, sand, food	Autism	15	13.07	196.00
	Children without developmental difficulties	15	17.93	269.00
	Total	30		
Hygienic activities such as washing face and hair, combing, cutting nails, brushing teeth	Autism	15	12.00	180.00
	Children without developmental difficulties	15	19.00	285.00
	Total	30		
Bathing, showering or swimming	Autism	15	13.30	199.50
	Children without developmental difficulties	15	17.70	265.50
	Total	30		
Drying with a towel	Autism	15	9.89	138.50
	Children without developmental difficulties	15	19.77	296.50
	Total	30		
Trying new foods	Autism	15	9.73	146.00

	Children without developmental difficulties	15	21.27	319.00
	Total	30		
Sense of certain foods in the mouth (e.g., dry, crumbly, smooth, mushy, crunchy)	Autism	15	10.97	164.50
	Children without developmental difficulties	15	20.03	300.50
	Total	30		
Standing close to other people	Autism	15	11.70	175.50
	Children without developmental difficulties	15	19.30	289.50
	Total	30		
Walking barefoot	Autism	15	11.37	170.50
	Children without developmental difficulties	15	19.63	294.50
	Total	30		

The results of the Mann-Whitney U test and Wilcoxon W (Table 3) show, that there is a statistically significant difference in the level of statistical significance of $p < 0.05$ between children with autism and children without developmental difficulties on 4 variables; „Hygienic activities such as washing face and hair, combing, cutting nails, brushing teeth“, „Feeling certain foods in the mouth (e.g., dry, crumbly, smooth, mushy, crunchy)“, „Standing close to other people“ and „Walking barefoot“. On other variables of the measurement instrument, no statistically significant difference was found between children with autism and children without developmental difficulties in the sensory integration of the tactile sensory system.

Table 3. Statistical significance of differences between children with autism and children without developmental difficulties

Variable	Mann-Whitney U	Wilcoxon W	Z	P
Touching some parts of the body, hugs and caresses	106.500	226.500	-.259	0.796
Certain types of fabric, stitches, labels, belts, cuffs, etc.	109.500	229.500	-.130	0.897
Clothing, footwear or embellishments that are very narrow or very loose	85.000	205.000	-1.294	0.196
Contamination of hands, face or other parts of the body with paint, glue, sand, food	76.000	196.000	-1.566	0.117
Hygienic activities such as washing face and hair, combing, cutting nails, brushing teeth	60.000	180.000	-2.294	0.022
Bathing, showering or swimming	79.500	199.500	-1.467	0.142
Drying with a towel	33.500	138.500	-3.261	0.001
Trying new foods	26.000	146.000	-3.788	0.000
Sense of certain foods in the mouth (e.g., dry, crumbly, smooth, mushy, crunchy)	44.500	164.500	-3.052	0.002

Standing close to other people	55.500	175.500	-2.494	0.013
Walking barefoot	50.500	170.500	-2.729	0.006

Similar studies

The prevalence of sensory integration difficulties is present in 80-90 % of children with autism spectrum disorder (Scaaf, Benevides, Kelly, Mailloux-Maggio 2012).

The aim of the Marković (2017) study was to determine the extent to which children with autism show deviations in stimuli from all seven senses. A modified version of the questionnaire from the book by Biel and Peska 2007 was used for the study. The results showed that 11 % of children with autism have a normal sensory reaction to tactile input. The largest number of children react hypersensitively 35 %, and mixed 31 %, and to a much lesser extent children react hyposensitively, 23 % of them.

The results of the study show that the majority of children with autism, 71.40 % of them have significant difficulties in the field of tactile perception, 14.30 % have possible differences, and the same number of children have a typical response to tactile input. Children without developmental difficulties, 77.10 % of them have adequate sensory response, 17.20 % have possible differences in tactile input, and 5.70 % have difficulties in the field of tactile perception (Demirović, Mujezinović, Bećarević et al. (2018).

Kientz and Dunn (1997) conducted study to determine whether there is a difference in the sensory profile between children with autism and children without difficulties. The study was conducted on a sample of 32 children with autism and 64 children without developmental difficulties. The age of the subjects ranged from 3 to 10 years. The results of the study showed that in 85 % of cases there is a difference between children with autism and children without developmental difficulties, and that this difference is statistically significant in 20 out of 21 applied variables, i.e. in 95 % of cases.

Tomchek and Dunn (2007) conducted a study of sensory processing of children with autism and children without developmental difficulties aged 3 to 6 years. The results of the study showed that 60.90 % of children with autism and 20.60 % of children without developmental difficulties have symptoms of tactile sensitivity.

Demirović, Mujezinović, Bećarević et al. (2018) examined the tactile and auditory sensitivity of children with autism, children with intellectual difficulties, and children without difficulties. The least difficulties of the tactile sensory system were shown by children without difficulties (SD = 3.350), followed by children with autism (SD = 5.506), while the greatest difficulties of the tactile sensory system were shown by children with intellectual difficulties (SD = 5.661).

4. Conclusion

Difficulties with sensory integration of the tactile sensory system have 86.67 % of children with autism and 40 % of children without developmental difficulties. Hypersensitive type of sensory response has 26.67 % of children with autism and 20 % of children without difficulties. Hyposensitive response has 20 % of children with autism and 6.67 % of children without developmental difficulties. Mixed type has 40.00 % of children with autism and 13.33 % of children without difficulties.

Children with autism have lower sensory integration of the tactile sensory system compared to children without difficulties. There is a statistically significant difference between children with autism and children without developmental difficulties on the variables „Hygienic activities such as washing face and hair, combing, cutting nails, brushing teeth“, „Feeling

certain foods in the mouth (e.g., dry, crumbly, smooth, mushy), crunchy)“, „ Standing close to other people“ and „Walking barefoot“. There are no statistically significant differences in the other variables of the measurement instrument.

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