

Psychosocial and Neuro-Sensory Effect of Complex Dolphin Assisted Therapy for Children with Psychiatric and Behavioral Disorders

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Abstract

The research aim is to assess the two-week program containing complex dolphin assisted therapy activities intended for psychosocial and neurosensory functions of children with psychiatric and behavioral disorders. The study involved 140 school-aged (7–17 years, $SD=3.36$) subjects: 26 girls and 114 boys. The subjects were diagnosed with mental, behavioral and neurodevelopmental disorder (ICD-10-CM) group codes: pervasive and specific developmental disorders (F80–F89), intellectual disabilities (F70–F79), and behavioral and emotional disorders with onset usually occurring in childhood and adolescence (F90–F98). By employing the convenient sampling, the data was collected from 70 children who participated in complex dolphin assisted therapy activities that lasted two weeks and 70 children without changing regular conditions of their living. The following were applied for the children who took part in the complex research program: a) ten dolphin assisted therapy activity sessions daily lasting 30 min. each; b) reflex integration activities; c) sensory integration activities; d) social skills development activities. The surveyed were individually assessed on the same day before the start of the first activity session and on the next day after the last activity session, the change in the psychosocial functions was measured at the beginning and end of the dolphin assisted therapy. The participants of the control group participated in regular training sessions without changing the rhythm of their daily routine. After the first assessment, additionally, the control group was assessed two weeks later. All of the subjects were assessed according to: 1) Chandler's (2005) Psychosocial Session Form – at the beginning and end of the dolphin assisted therapy activities; 2) neuro-sensory testing; 3) experiment, both applied before and after the investigation. Conclusions. Two weeks of the complex dolphin, assisted therapy program had a significant effect on psychosocial and neurosensory functions. The following aspects have statistically significantly changed in the investigated group children: social functions, such as engagement in team work, openness, flexibility, active listening, etc. When assessing the neurosensory functions, statistically significant changes were observed in expression of pathological reflexes, sensory modulation, and praxis. The statistically significant changes observed in the control group were minimal.

Keywords: Dolphin Assisted Therapy, Psychiatric and Behavioral Disorders, Psychosocial, Sensory issues.

1. Introduction

Children with psychiatric and behavioral disorders usually have sensory processing difficulties as well (Bundy & Murray, 2002). Sensory overload usually occurs due to the inability of the brain to sort out the abundance of information

reaching it through senses; therefore, one more trigger is accepted as unbearable (Kreiviniene & Vaitkienė, 2020).

Regularly, these neurological processes manifest through increased anxiety and arousal in children with psychiatric and behavioral disorders (Reynolds, Lane & Mullen, 2015). Some of the most frequent sensory dysfunction disorders are interceptions (Mahler, 2017) and psychomotor disorders (Sobin & Sackeim, 1997). Impairments of neuro-sensory functions usually have effect on

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social behavior, difficulties in expressing emotions and speech development delay (Kreivinienė & Vaitkienė, 2020; Reynolds, Lane & Mullen, 2015; Dell'Osso et al., 2017). Many scientific studies support that occurring vestibular disorders can affect people not only physically but also psychologically (Dix & Hallpike, 1952) as far as vestibular dysfunction quite often is related to experienced stress and anxiety (Saman, et al., 2012) or even panic symptomatology (Asmundson, Larsen, & Stein, 1998). It is related to an important role of the limbic system on the vestibular sensory system. The impairment is related with the part of the brain, which is responsible for child movements and sends the wrong signals to the muscles, causing the muscle tone to change (Ayres & Robbins, 2005).

A positive impact of the dolphin assisted therapy is being dealt with for many years investigating the long-term therapeutic effect (Rugevičius et al., 2016) as well as the short-term effect (Breitenbach et al., 2009; Salgueiro et al., 2012; Stumpf & Breitenbach, 2014; Kreivinienė & Mockevičienė, 2020) on children with with psychiatric and behavioral disorders. The research on the dolphin assisted therapy often involves parent surveys (Breitenbach et al., 2009; Dilts, Trompisch & Bergquist, 2011; Shaifudin, Md Yusof & Kok Hwee Chia, 2012; Kreivinienė & Perttula, 2012 et al.); therefore, the changes seen in parents' eyes may not always coincide with the changes in behavior and other parameters viewed by an independent observer (Dilts, Trompisch & Bergquist, 2011). Due to that reason, it is especially important to record objectivized data being collected by an independent observer (see e.g. Kreivinienė & Mockevičienė, 2020).

When reviewing the changes in the dolphin assisted therapy, the authors indicate that speech, communicative behavior, motor skills improve in children with disabilities after the applied dolphin assisted therapy (Kreivinienė & Perttula, 2012). Many research studies point out that, in the course the dolphin assisted therapy or after it, a child with the psychiatric and behavioral disorder becomes more courageous, more relaxed and self-confident, able to better focus and retain attention, one's speech expression, ability to retain the eye contact improve, a child is more keen on communicating with other children, more actively engages with performed activities and one's family life in general (Breitenbach et al., 2009; Stumpf & Breitenbach, 2014; Kreivinienė & Mockevičienė, 2020).

The condition of children with psychiatric and behavioral disorders is assessed as the most complex, which causes parents constantly search

for complementary assistance methods (Campbell, Vander Linden & Palisano, 2005; Kreivinienė et al., 2016). The therapy performed in the water with dolphins is unique for children with psychiatric and behavioral disorders because: a) children with this disorder actually enjoy water; b) the water is a neurosensory space where one may achieve better learning and psycho-emotional indicators (Kreivinienė & Vaitkienė, 2020). The dolphin assisted therapy in the water is performed with active movements in an ever-changing context. Such water-based activities can be fun and highly motivating. As Campion (1991, p. 12) notes, water interventions are a "widening experience – physically, developmentally, cognitively, and psychologically" (Schaaf & Mailloux, 2015). The psychomotor change is increased because of children's with psychiatric and behavioral disorders nervous system's capacity to change in response to experience or neuroplasticity (Smith Roley et al., 2007).

Due to these reasons, it is necessary to investigate as broad as possible the objectivized possibilities for assistance from the neurosensory level because many research findings demonstrate that communication with an animal during animal assisted therapy contributes to the development of children's psychosocial functions: positively influence their emotional development, autonomy growth, enhance motivation, teaches empathy, etc. (Shaifudin, Md Yusof & Kok Hwee Chia, 2012). However, there are evidences proving that dolphin assisted therapy makes a positive effect also at the neurological level: the emitted biosonar signal of the dolphin pulsed at low frequencies results in activation of piezoelectric collagen molecules within the body and generates a whole body entertainment of the receptive nervous system. Such a mechanism could result in entertainment of the brain to produce specific low frequency components in conjunction with the previous mechanisms, as well as changes which result from increased endorphin production (Birch, 1998). Moreover, when measuring objective neurosensorimotor changes in children's functions (see Kreivinienė & Mockevičienė, 2020), changes are recorded at the psychoemotional level, too.

The hypothesis. It is likely that the two-week complex dolphin assisted therapy makes a positive effect on psychosocial and neurosensory functions of children with psychiatric and behavioral disorders. It is supposed that the period of two weeks is sufficient to measure the first changes. Also, it is likely that when the neurosensory functions change, the changes in the psychosocial

functions are observed, too.

The aim: to investigate the effect of the complex dolphin assisted therapy on psychosocial and neurosensory functions of children with psychiatric and behavioral disorders.

We conducted our research in accordance with the Convention of the Human Rights and Dignity in Medicine approved on 19 November 1996 (The Convention of Human Rights and Biomedicine). The bioethics permission was issued by Klaipėda University Department of Holistic Medicine and Rehabilitation Committee on Biomedical Research Ethics (Lithuania) (No. SV-HMR-2, 03-10-2019). Relatives, parents and foster parents of children with disability who took part in the research were informed that they could terminate participation in the research any time, the process, methods of the research and likely inconveniences were explained to them. None of the participating families withdrew from the research.

2. Materials and Methods

2.1 Materials

The research of the dolphin assisted therapy was being implemented at the Lithuanian Sea Museum Dolphin Therapy Center, which applies the program approved by the Complementary and Alternative Health Care Law (Papildomosios ir alternatyviosios sveikatos priežiūros (PASP) įstatymas, No. XIII-2771) as complementary and alternative health care service and in compliance with the Hygiene Norm of the Republic of Lithuania (LR higienos norma HN133:2013). The following were applied to the children who took part in the complex treatment program: a) ten dolphin

assisted therapy activity sessions daily lasting 30 min. each; b) reflex integration activities; c) sensory integration activities; d) social skills development activities.

The results of the control group were collected in six special schools and education centers. The research was being conducted from January to December 2020 in Lithuania. In total, 140 surveyed (70 children with psychiatric and behavioral disorders in the research group and 70 children with psychiatric and behavioral disorders in the control group) took part in the investigation.

In the case of children in the control group, the research data was being collected on the first day and two weeks later; these children maintained a regular daily routine.

The criteria for selection of the participants:

- ✓ school age, from 7 to 17 years (see Table 1);
- ✓ all have the ICD-10-CM F (00–99) diagnosis;
- ✓ by applying the convenient sampling, the investigation involved the most easily accessible children who could independently participate in the research;
- ✓ parents/ foster parents registered their children for participation in the dolphin assisted therapy;
- ✓ the investigated group comprised and surveyed all children who took part in the dolphin assisted therapy in 2020 and were accessible as well as met the criteria.

The research involved 81.4 per cent (114) of male and 18.6 per cent (26) of female participants. The average age of the surveyed was 11 years (SD=3.36) (see Table 1).

Table 1. Socio-demographic characteristics of the participants.

		Number of surveyed	Per cent
Group	Control	70	50.0
	Investigated	70	50.0
Therapy	Before	70	50.0
	After	70	50.0
Sex	Female	26	18.6
	Male	114	81.4
Age	Under 10 years	68	48.6
	10–13 years	26	18.6
	Over 13 years	46	32.9
Living conditions	Lives with relatives	88	62.9
	Lives in institution of social care	52	37.1
Family status	Not married	92	65.7
	Other	48	34.3
Occupation	Other	70	100.0
	Primary	52	37.1
Education	Unfinished secondary (basic or vocational training school without the secondary school certificate)	40	28.6
	Secondary	2	1.4
	Other	46	32.9

The subjects were diagnosed with mental, behavioral, and neurodevelopmental disorder (ICD-10-CM) group codes: pervasive and specific developmental disorders (F80–F89), intellectual disabilities (F70–79), and behavioral and emotional disorders with onset usually occurring in childhood and adolescence (F90–F98). Group 1 (participants of the investigated group) comprised 70 children who regularly participated in dolphin assisted therapy sessions five times a week, two weeks in total with 2 days off and the following activities were arranged additionally: a) reflex integration activities; b) sensory integration activities; c) social skills development activities. Group 2 (participants of the control group) comprised 70 children who participated in the research without changing regular conditions of their living (see Fig. 1. Research Design).

2.2 Methods

Seeking to assess the psychosocial and neurosensory effect of the dolphin assisted therapy on the Children's functions, the following methods of assessment were employed: Psychosocial Session Form (the consent of the author Cynthia Chandler to use the form in the animal assisted therapy was received) (A), Neuro-sensory-motor testing (B), experiment (C).

For Group 1 (participants of the investigated group), the research data was collected by employing: (A) Chandler's Psychosocial Session Form was being filled out in accordance with Child's participation in the second and

ninth activity sessions. When assessing for the first time, the common society norm was referred to; when assessing for the second time, the first assessment of the child was considered. Seeking to avoid the effect of novelty and surprise, which is often criticized in research works on the dolphin assisted therapy (Marino & Lilienfeld, 2007a; 2007b), the assessment was being arranged during the second and ninth sessions of the dolphin assisted therapy activities.

(B) Neuro-sensory-motor testing was conducted using the diagnostic instrument NSM-I designed by the authors D. Mockevičienė and B. Kreiviniienė. The internal validity measured by this instrument to find out the correlations between functional and physiological parameters of children (reflexes, mobility, balance, etc.) and parameters of the modulation disorders – sensory over-responsive, sensory under-responsive, sensory seeking. It has been found that the instrument has high internal compatibility and can be used to collect the data in this particular investigation. For this purpose, Cronbach's alpha coefficients were calculated for each scale. Table 2 suggests that the internal compatibility of all scales with the data is acceptable because Cronbach's alpha is higher than or equal to 0.6, and this means that these scales can be used in the research and the elements of the scale blocks are quite strongly interconnected.

The measurement was carried out on the first day after the arrival in the dolphin assisted therapy activities and ten days after the dolphin assisted therapy activities.

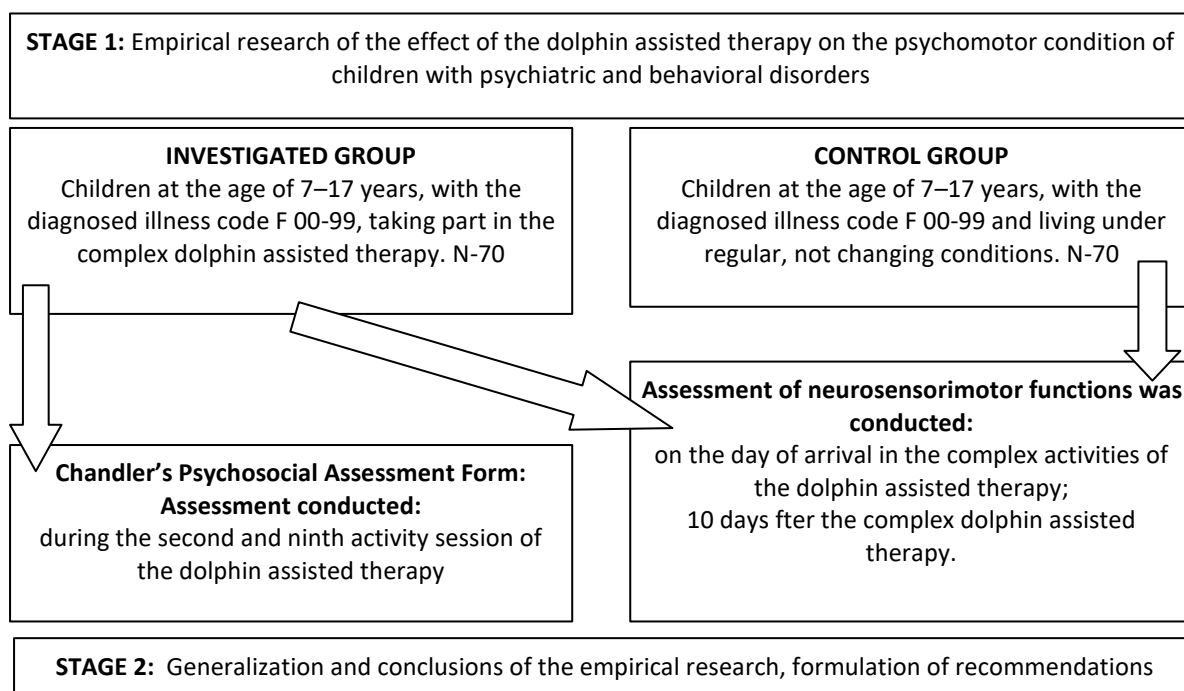


Figure 1. Research design

Table 2. Inner compatibility of the neurosensorimotor diagnostics instrument (NSM-I).

Scale	Cronbach's Alpha	Number of questions in the questionnaire
Reflexes	0.81	5
Functional mobility	0.60	3
Balance	0.97	11
Senses	0.94	9
Praxis	0.64	7
Perceptive-motor assessment	0.66	4
Assessment of sensory over-responsivity (SOR)	0.69	21
Assessment of under-responsivity (SUR)	0.82	21
Sensory-seeking (SS)	0.89	21

Additionally, the assessment of normality of the data in the scales designed by the diagnostic instrument was carried out. The testing of the scales data was performed to find out statistical methods (parametric or non-parametric) whether they are suitable for using in statistical analysis of scale values and what correlation coefficients are suitable for using in assessment of correlations among the investigated scales. Shapiro-Wilk

criterion was used to test the normality of the scales. The obtained results demonstrate that all scales do not satisfy the definition of normality because $p < 0.05$ (see Table 3). It follows that non-parameter statistical criteria will be used for the analysis of these scales: Mann-Whitney/Kruskal-Wallis for comparison of the means and Spearman correlation coefficient in correlation analysis.

Table 3. Results of the data normality in NSM-I.

Scale	Shapiro-Wilk test statistics	p-value
Reflexes	0.943	0.000
Functional mobility	0.426	0.000
Balance	0.955	0.000
Senses	0.960	0.000
Speech	0.897	0.000
Praxis	0.874	0.000
Perceptive-motor assessment	0.913	0.000
Assessment of sensory over-responsivity (SOR)	0.953	0.000
Assessment of sensory under-responsivity (SUR)	0.981	0.047
Sensory-seeking (SS)	0.910	0.000

(C) The experiment was conducted at the Dolphin Therapy Center where the two-week complex program was applied to the research participants. For two weeks, the research participants daily participated (10 days in total, including a break of two days) in: a) dolphin assisted therapy activity session lasting 30 min. each conducted by a specialist and assisted by 1–3 Black Sea bottlenose dolphins (*Tursiops truncatus ponticus*); b) reflex integration activities; c) sensory integration activities; d) social skills development activities.

The water pool where the dolphin assisted therapy interventions were held had capacity of 60 m³ and area of 55 m², depth from 0.40 m to 1.50 m, water temperature was from 19 to 25° C; all participants wore hydro-suits and hydro-shoes. The activities in the water were arranged in compliance

with the animal welfare principles and applying positive reinforcement for the animals. In the course of communication with the dolphins, the following measures were being applied: a) play elements; b) positioning exercises; c) initiation of activities.

3. Results

(A) When assessing the psychosocial change of functions of the children with psychiatric and behavioral disorders, Child's positive and negative behavior using the Psychosocial Session Form (Chandler) was being assessed during the second and ninth session activities of the dolphin assisted therapy. To measure the scale internal consistency for this assessment form, Cronbach's alpha coefficient which allows assessing whether all questions of the scale sufficiently reflect the

investigated value and enables detailed correction of the number of required questions in the scale was used (see Table 4). In this case, Cronbach's alpha coefficient is close to 1 and this means that separate questions correlate with each other.

Cronbach's alpha coefficient increases when increasing the number of questions making up the questionnaire. This means that questionnaires with a higher number of questions are more reliable.

Table 4. Results of the inner compatibility of the scales of the psychosocial form of the activity sessions with the data.

Scale	Cronbach's Alpha	Number of questions in the questionnaire
Positive behavior	0.884	25
Negative behavior	0.903	17

Further, we tested the changes in the means and standard deviations of the separate research groups after the dolphin assisted therapy employing the *T-test*. The paired sample *t-test*, sometimes called the dependent *t-test*, is a statistical procedure used to find whether the average difference between the two sets of

observations is equal to zero. When performing the paired sample *t-test*, each subject is measured twice; thus, the observation pairs are obtained. Usual cases of application of the paired sample "*t-test*" are case control investigations or projects on repeated measurements (Table 5).

Table 5. Changes of the means and standard deviations of psychosocial behavior of children with psychiatric and behavioral disorders after the dolphin assisted therapy.

Behavior	Measure-ment	N	Mean	Standard deviation
Scores of positive behavior	1	70	2.5673	.92466
	2	70	3.3908	.83514
Scores of negative behavior	1	70	1.83848	.80358
	2	70	1.2049	.50999
Common scores of behavior	1	70	.7288	1.4541
	2	70	2.1858	1.12076

Table 5 suggests that the means of the positive behavior and common scores of behavior are higher after the therapy (in red), and the means of the negative behavior scores are lower (in yellow). Therefore, it was decided to find out whether the means of the two groups significantly differ before and after the therapy by analyzing each point of the questionnaire separately (see Table 6). The *t-test* for independent samples was used. The *T-criterion* of two independent samples allows finding whether

differences of means of the same variable in the grouped data (i.e. among the groups) are statistically significant. The *T-test* (*T-test* for Equality of Means) of the two independent samples tests the hypothesis on the equality of the means; *t* is the criterion value calculated for the sample data. If $p < 0.05$, the hypothesis on the equality of the means is rejected, thus, the means are not equal. If $p > 0.05$, we cannot reject the hypothesis on the equality of the means.

Table 6. Changes of psychosocial behavior of children with psychiatric and behavioral disorders measured before and after the dolphin assisted therapy (only statistically significant criteria are presented).

PSYCHOSOCIAL BEHAVIOR	Dispersion	t-test for Equality of Means		
		DF	Sig. (2-tailed)	Difference of means
Participating, engaging with activities	Equal variances assumed	68	.000	-1.000
	Equal variances not assumed	65.230	.000	-1.000
Positively interacting, communicating with people around	Equal variances assumed	68	.001	-.914
	Equal variances not assumed	67.745	.001	-.914
Cooperating	Equal variances assumed	68	.001	-.800
	Equal variances not assumed	67.014	.001	-.800
Sufficiently obstinate	Equal variances assumed	68	.922	-.029
	Equal variances not assumed	65.188	.922	-.029
Focused, attentive to a task	Equal variances assumed	68	.001	-.886

	Equal variances not assumed	62.989	.001	-.886
Following instructions	Equal variances assumed	68	.001	-.714
	Equal variances not assumed	61.336	.001	-.714
Attentive to others	Equal variances assumed	68	.036	-.686
	Equal variances not assumed	67.597	.036	-.686
Team-member	Equal variances assumed	68	.000	-1.086
	Equal variances not assumed	67.967	.000	-1.086
Maintaining the eye contact	Equal variances assumed	68	.001	-.829
	Equal variances not assumed	67.119	.001	-.829
Actively listening	Equal variances assumed	68	.001	-.886
	Equal variances not assumed	63.633	.001	-.886
Flexible, open to novelties	Equal variances assumed	68	.000	-1.086
	Equal variances not assumed	67.582	.000	-1.086
Accepting remarks, suggestions	Equal variances assumed	68	.001	-.914
	Equal variances not assumed	67.423	.001	-.914
Feeling positively	Equal variances assumed	68	.001	-.800
	Equal variances not assumed	67.370	.001	-.800
Empathic	Equal variances assumed	68	.021	-.829
	Equal variances not assumed	67.929	.021	-.829
Sharing with others	Equal variances assumed	68	.040	-.600
	Equal variances not assumed	67.809	.040	-.600
Helpful	Equal variances assumed	68	.004	-1.057
	Equal variances not assumed	67.319	.004	-1.057
Solving problems	Equal variances assumed	68	.001	-1.114
	Equal variances not assumed	63.313	.001	-1.114
Self-confident	Equal variances assumed	68	.000	-1.229
	Equal variances not assumed	67.349	.000	-1.229
Having high self-value	Equal variances assumed	68	.004	-.971
	Equal variances not assumed	67.888	.004	-.971
Knowing, understanding himself/ herself	Equal variances assumed	68	.024	-.743
	Equal variances not assumed	67.739	.024	-.743
Understanding others	Equal variances assumed	68	.005	-.886
	Equal variances not assumed	67.973	.005	-.886
Able to express needs	Equal variances assumed	68	.011	-.714
	Equal variances not assumed	66.470	.011	-.714
Resisting	Equal variances assumed	68	.015	.686
	Equal variances not assumed	65.972	.015	.686
Defensive, cautious	Equal variances assumed	68	.000	1.057
	Equal variances not assumed	66.872	.000	1.057
Manipulating	Equal variances assumed	68	.040	.714
	Equal variances not assumed	65.079	.040	.714
Treacherous, insincere	Equal variances assumed	68	.486	.171
	Equal variances not assumed	63.625	.486	.171
Angry or aroused	Equal variances assumed	68	.021	.629
	Equal variances not assumed	65.295	.021	.629
Inflexible, rejecting arguments	Equal variances assumed	68	.011	.714
	Equal variances not assumed	66.470	.011	.714
Too shy	Equal variances assumed	68	.002	.914
	Equal variances not assumed	66.387	.002	.914
Anxious/ Hyperactive	Equal variances assumed	68	.007	.829
	Equal variances not assumed	61.896	.007	.829
Too passive	Equal variances assumed	68	.008	.714
	Equal variances not assumed	61.832	.008	.714
Too obedient	Equal variances assumed	68	.025	.543
	Equal variances not assumed	64.889	.025	.543

Introspective	Equal variances assumed	68	.013	.686
	Equal variances not assumed	52.100	.013	.686
Scores of positive behavior	Equal variances assumed	68	.000	-.823
	Equal variances not assumed	67.307	.000	-.823
Scores of negative behavior	Equal variances assumed	68	.000	.634
	Equal variances not assumed	57.566	.000	.634
General scores of behavior	Equal variances assumed	68	.000	-1.457
	Equal variances not assumed	63.859	.000	-1.457

Df means a number of independent sample scores to calculate statistics, deducting the assessed number of parameters from the sample scores.

Dispersion – statistical characteristics of the sample reflecting a most likely deviation of the routine measurement value from the arithmetical mean.

Sig. (2-tailed) - a two-tailed probability, two-value test. A two-tailed test is a method when a critical area of dispersion is two-tailed and tested whether the sample is higher or lower than a particular range of values. It is used when carrying out testing of null hypothesis and statistical significance tests. If an investigated sample occurs in any of the critical areas, an alternative hypothesis is accepted instead of the null hypothesis.

We see that significance of the t-test <0.05 is almost in all psychosocial parameters. It can be stated that the following indicators of psychosocial behavior of children with psychiatric and behavioral disorders improved statistically significantly after the dolphin assisted therapy: participation and Child engagement with activities, positive interaction, communication with people around, cooperation, obstinacy seeking one's goal, attentiveness to a task and others, active listening, openness, flexibility, positiveness, empathy, problem-solving skills, ability to express one's needs, etc. Whereas no statistically significant changes were observed in the following parameters of Children behavior: honest/ moral; leading, having ability to express oneself in words, unfriendly, expressing verbal aggression, expressing physical aggression.

The Psychosocial Activity Sessions Form (Chandler) was not being filled out for the control group because this is the form which is intended for measuring psychosocial changes of functions namely in the course of the animal assisted therapy.

(B) Neuro-sensory-motor testing was being implemented by using the diagnostic instrument NSM-I designed by the authors D. Mockevičienė and B. Kreiviniene. It facilitated the assessment of children belonging to both investigated and control

groups. It aimed to find which group of children demonstrated higher sensorimotor indicators and whether the recorded differences between the indicators were statistically significant. To achieve this goal, the scale means were calculated for each group and statistical significance was measured using the Mann-Whitney test.

Grounding on the scale values for the groups, it is obvious that assessment indicators for reflexes, functional mobility, balance, senses, perceptive motor assessment, and over-responsivity assessment differed statistically significantly because $p < 0.05$. It can be stated that reflexes (6.39 scores), functional mobility (2.83 scores), sensing (4.36 scores) and perceptive assessment (2.33 scores) of children in the investigated group were better than those in the control group (3.2 scores, 2.67 scores, 3.36 scores and 1.71 scores, respectively). Whereas the balance (3.93 scores) and over-responsivity assessment (15.5 scores) of children in the control group was statistically significantly better than those in the investigated group (3.27 scores and 13.5 scores, respectively) (Table 7).

Further, indicators of sensorimotor functions of children from both investigated and control groups before and after the dolphin assisted therapy were analyzed. For this purpose, the scale means were calculated for each group and statistical significance was assessed using Wilcoxon dependent samples test.

Grounding on the scale values before and after the therapy, it can be seen that indicators of balance, senses, speech and assessment of sensory over-responsivity differed statistically significantly because $p < 0.05$. It can be stated that balance (3.69 scores), senses (3.97 scores), speech (2.76 scores) and assessment of sensory over-responsivity (SOR) (14.76 scores) after the dolphin assisted therapy significantly improved in comparison to the indicator values before the therapy (3.51 scores, 3.74 scores, 2.53 scores and 14.24 scores, respectively) (see Table 8).

Table 7. Comparison of the means of sensorimotor functions between children of the control and investigated groups.

	Control		Research		MW statistics	p
	Mean	SD	Mean	SD		
Reflexes	3.20	1.58	6.39	1.34	-9.03	0.000
Functional mobility	2.67	0.49	2.83	1.01	-2.004	0.045
Balance	3.93	1.63	3.27	1.08	-2.673	0.008
Senses	3.36	0.91	4.36	1.06	-5.821	0.000
Speech	2.51	1.14	2.77	1.33	-0.987	0.324
Praxis	4.49	1.90	4.81	1.70	-0.675	0.499
Perceptive-motor assessment	1.71	1.07	2.33	1.26	-2.806	0.005
Assessment of sensory over-responsivity (SOR)	15.50	3.41	13.50	3.18	-3.84	0.000
Assessment of sensory under-responsivity (SUR)	9.34	4.48	10.01	4.98	-0.861	0.389
Sensory-seeking (SS)	6.54	5.44	6.10	5.06	-0.347	0.729

MW – Mann-Whitney statistics; p – statistical significance p-value

Table 8. Comparison of the means of indicators of the sensorimotor functions before and after the dolphin assisted therapy.

	Before		After		Wilcoxon statistics	p
	Mean	SD	Mean	SD		
Reflexes	4.79	1.26	4.8	2.81	-0.43	0.966
Functional mobility	2.74	0.79	2.75	0.80	0.00	1.000
Balance	3.51	1.42	3.69	1.41	-4.55	0.000
Senses	3.74	1.11	3.97	1.10	-3.76	0.000
Speech	2.53	1.22	2.76	1.26	-4.00	0.000
Praxis	4.61	1.86	4.69	1.76	-0.60	0.552
Perceptive-motor assessment	2.00	1.19	2.04	1.22	-0.65	0.518
Assessment of sensory over-responsivity (SOR)	14.24	3.52	14.76	3.36	-3.85	0.000
Assessment of sensory under-responsivity (SUR)	9.73	4.68	9.63	4.82	-1.02	0.309
Sensory-seeking (SS)	6.36	5.14	6.29	5.37	-1.03	0.303

p – statistical significance p-value

The investigation compares indicators of the sensorimotor functions of children from the investigated group before and after the dolphin assisted therapy. To achieve this, scale means were

calculated for each group and statistical significance was assessed using Wilcoxon dependent samples test.

Table 9. Comparison of the means of indicators of the sensorimotor functions for the investigated group measuring before and after the dolphin assisted therapy.

	Research group				Wilcoxon statistics	p
	Before		After			
	Mean	SD	Mean	SD		
Reflexes	5.38	1.18	7.4	0.43	-4.84	0.000
Functional mobility	2.82	1.01	2.83	1.02	0.00	1.000
Balance	3.09	1.03	3.45	1.10	-4.55	0.000
Senses	4.13	1.16	4.58	0.91	-3.76	0.000
Speech	2.54	1.31	3.00	1.33	-4.00	0.000
Praxis	4.74	1.82	4.89	1.59	-0.60	0.552
Perceptive-motor assessment	2.29	1.25	2.37	1.29	-0.65	0.518
Assessment of sensory over-responsivity (SOR)	12.97	3.15	14.03	3.18	-3.80	0.000
Assessment of sensory under-responsivity (SUR)	10.11	4.88	9.91	5.15	-1.02	0.309
Sensory-seeking (SS)	6.14	4.86	6.06	5.32	-0.66	0.512

p – statistical significance p-value

Grounding on the scale values before and after the therapy, we find out that indicators of reflexes, balance, senses, speech, and sensory over-responsivity differed statistically significantly because $p < 0.05$. It can be stated that reflexes (7.4 scores), balance (3.45 scores), senses (4.58 scores), speech (3 scores), and sensory over-responsivity (SOR) (14.03 scores) after the dolphin assisted therapy significantly improved in comparison to the indicator values before the therapy (5.38 scores, 3.09 scores, 4.13 scores, 2.54 scores and 12.97 scores, respectively) (see Table 9).

The indicators of sensorimotor functions of control group children participating in the research were measured initially and two weeks later, without changing their regular daily routine. Grounding on the scale values for the first and second measurements, it is obvious that all indicators, except for reflexes ($p = 0.001 < 0.05$), did not improve statistically significantly two weeks later because Wilcoxon criterion $p > 0.05$ for all scales. Whereas reflexes of children from the control group after the therapy significantly decreased, from 4.21 scores to 2.2 scores (see Table 10).

Table 10. Comparison of the means of indicators of the sensorimotor functions for the control group measuring for the first time and two weeks later.

measuring for the first time and two weeks later.							
		Control group				Wilcoxon statistics	p
		Before		After			
		Mean	SD	Mean	SD		
	Reflexes	4.21	1.07	2.20	1.37	-5.06	0.000
	Functional mobility	2.67	0.49	2.67	0.49	0.00	1.000
	Balance	3.93	1.64	3.93	1.64	0.00	1.000
	Senses	3.36	0.92	3.36	0.92	0.00	1.000
	Speech	2.51	1.15	2.51	1.15	0.00	1.000
	Praxis	4.49	1.92	4.49	1.92	0.00	1.000
	Perceptual-motor assessment	1.71	1.07	1.71	1.07	0.00	1.000
	Assessment of sensory over-responsivity (SOR)	15.51	3.45	15.49	3.42	-1.00	0.317
	Assessment of sensory under-responsivity (SUR)	9.34	4.51	9.34	4.51	0.00	1.000
	Sensory-seeking (SS)	6.57	5.47	6.51	5.48	-1.34	0.180

p – statistical significance p-value

This research also involved the analysis of whether there exists correlation between children of the control and investigated group children in terms of neurosensory functions and psychosocial functions. It was aimed to find out whether children's psychosocial condition was improving along with the improving neurosensory functions. For this purpose, the correlation between neurosensory functions and children's psychosocial functions was assessed.

First, indicators of the control group of children were analyzed. Grounding on Spearman correlation coefficients, we see that there exist statistically significant correlations between indicators of neurosensory functions and psychosocial condition. It was found out that the strongest correlation for children from the control group was between balance and assessment sensory over-responsivity ($r = 0.72^*$), senses (tactile skills) and speech ($r = 0.69^*$) as well as senses (tactile skills) and praxis ($r = 0.53^*$). Additionally, a reverse and statistically significant correlation was found between functional mobility and perceptive-motor assessment ($r = -0.34$) (Table 11). The research revealed that children having better balance

tolerate more sensory triggers. Moreover, it was found that there exists a correlation between senses (tactile skills) and better speaking skills and better praxis. Better functional mobility of Children is to be directly related to better proprioceptive functions.

Moreover, it was important to find the correlation among neurosensory functions of the children from the investigated group with their psychosocial condition. Grounding on Spearman correlation coefficients, it is also observed that the said parameters for children from the investigated group are statistically significantly correlating.

The research revealed that the analysis of the indicators of children from the investigated group demonstrated the strongest direct correlation only between senses (tactile skills) and speech ($r = 0.39^*$); whereas other indicators of their neurosensory and psychosocial condition were connected by statistically insignificant indicators of the condition ($p > 0.05$). This means that the children of the investigated group had significantly better developed senses (tactile system) and higher level of verbal development after the dolphin assisted therapy. The assessment of reverse

correlations for these children demonstrates that indicators of child balance in the investigated group correlated in reverse and statistically significant ways with indicators of the assessment of sensory under-responsivity (SUR) ($r = -0.64^*$) and sensory seeking (SS) assessment ($r = -0.41^*$) after the

dolphin assisted therapy (Table 12). This means that these participants of the investigation who had better indicators of balance had lower symptoms of sensory seeking and sensory under-responsivity dysfunction.

Table 11. Correlation between neurosensory and psychosocial functions of children from the control group.

	Functional mobility	Balance	Senses	Speech	Praxis	Perceptual-motor assessment	Assessment of sensory over-responsivity (SOR)	Assessment of sensory under-responsivity (SUR)	Sensory-seeking (SS)
Reflexes	-0.08	-0.08	0.19	0.24	0.15	0.16	-0.27	-0.17	0.08
Functional mobility		0.07	0.13	0.13	-0.18	-0.34*	0.21	-0.18	0.05
Balance			0.22	0.31	0.27	-0.11	0.72*	0.02	-0.04
Senses				0.69*	0.53*	-0.20	0.11	-0.30	0.09
Speech					0.43*	-0.09	0.20	-0.20	0.12
Praxis						0.30	-0.03	0.01	0.09
Perceptual-motor assessment							-0.28	0.07	0.19
Assessment of sensory over-responsivity (SOR)								-0.25	-0.36
Assessment of sensory under-responsivity (SUR)									0.54*

* correlation is statistically significant, when $\alpha = 0.05$

Table 12. Correlation between neurosensory and psychosocial functions of children from the investigated group.

	Functional mobility	Balance	Senses	Speech	Praxis	Perceptual-motor assessment	Assessment of sensory over-responsivity (SOR)	Assessment of sensory under-responsivity (SUR)	Sensory-seeking (SS)
Reflexes	0.23	-0.19	-0.03	0.01	0.08	0.00	-0.17	0.09	-0.08
Functional mobility		-0.03	-0.02	-0.14	0.15	0.16	-0.17	0.14	0.17
Balance			0.28	0.31	0.00	-0.25	0.33	-0.64*	-0.41*
Senses				0.39*	0.27	0.27	0.33	-0.07	-0.15
Speech					0.26	0.17	0.30	0.03	0.00
Praxis						0.51*	-0.01	0.34	0.31
Perceptual-motor assessment							0.09	0.40	0.19
Assessment of sensory over-responsivity (SOR)								-0.41	-0.33
Assessment of sensory under-responsivity (SUR)									0.58*

* correlation is statistically significant, when $\alpha = 0.05$

The investigation also assessed the effect of children's reflexes, balance, and functional mobility on children's speech, senses, and assessment of over-responsivity. This analysis was conducted between two scales: (1) assessing reflexes, balance, functional mobility and (2) skills of verbal speech,

tactile sensing, and sensory over-responsivity, having assessed the correlation between these two scales. The correlation between the said dimensions was assessed in both control and investigated groups.

Grounding on Fig. 2 and 3 for the control group,

it is obvious that the effect of functional elements on speech, sensing, and assessment of over-responsiveness is direct, i.e. when functional/

neurosensory and motor skills improve, psychosocial skills – speech, senses, responsivity to triggers, improve as well (see Fig. 2 and 3).

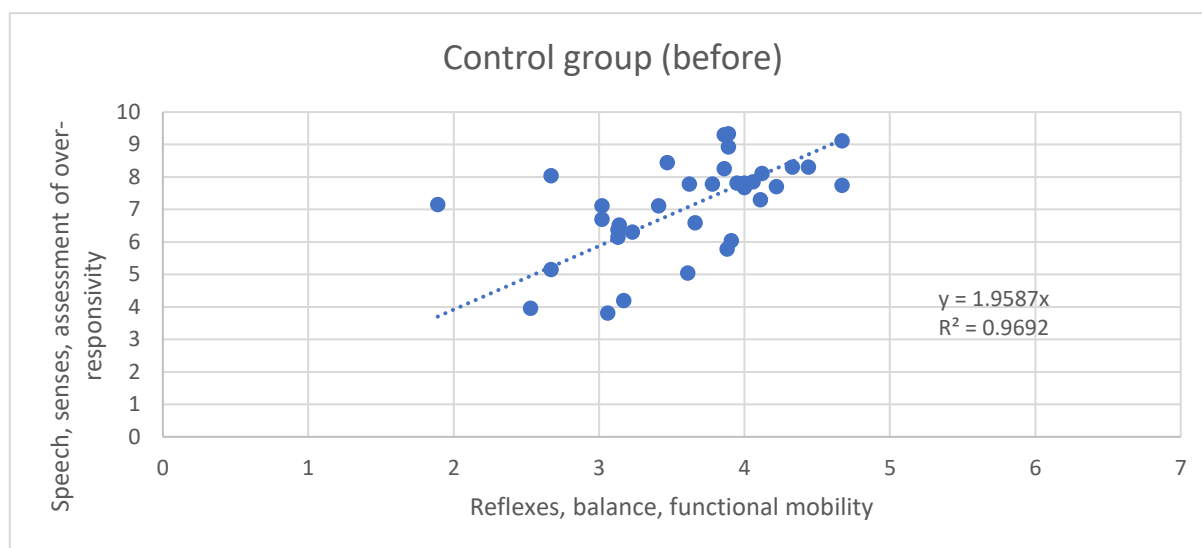


Figure 2. Effect of neurosensory (functional) parameters of the control group children on their psychosocial skills (speech, senses, and over-responsivity triggers), when measuring for the first time.

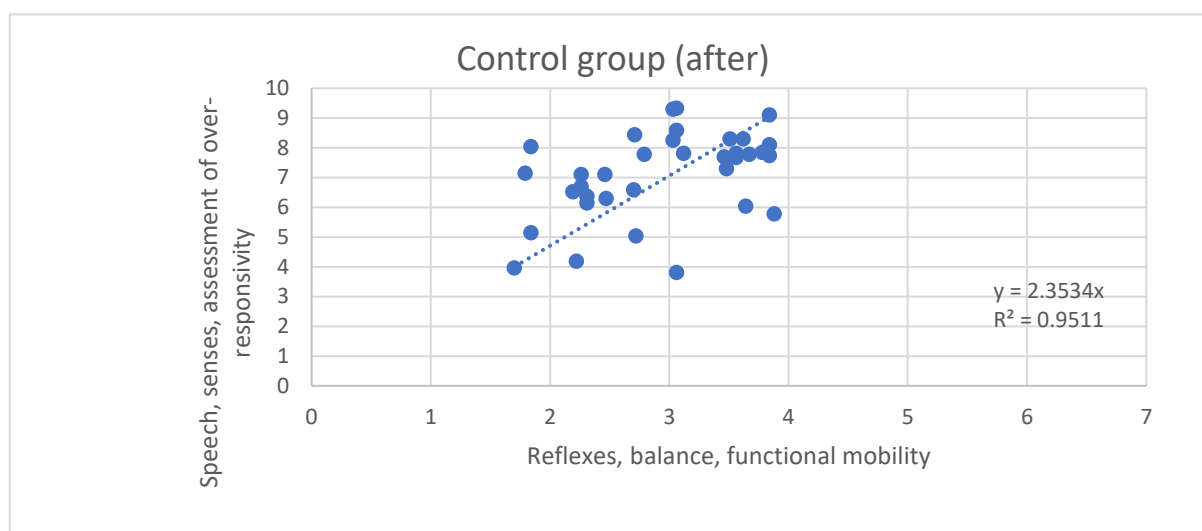


Figure 3. Effect of neurosensory (functional) parameters of the control group children on their psychosocial skills (speech, senses, and over-responsivity triggers), when measuring two weeks later.

Moreover, analogically, this dependence was observed in the investigated group of children, too. An analogous diagram is presented for the investigated group of children. Fig. 4 and 5 depict the direct effect of neurosensory (functional, motor) functions on children's psychosocial functions – speech, senses, and over-responsivity functions. Also, it was observed that in comparison to the neurosensory functions (reflexes, balance, and functional mobility) for the control group, motor skills of the investigated group are higher after the dolphin assisted therapy; whereas speech,

senses (tactile skills) and over-responsivity to sensory triggers increased less than in the control group (see Fig. 4 and 5). A conclusion is drawn that the dolphin assisted therapy had a significantly higher effect on the integration of pathological reflexes and reduction of active pathological reflexes, improved balance and functional mobility of the children. Also, comparing with the control group, tactile responsivity decreased and there was significantly less of sensory over-responsive behavior after the dolphin assisted therapy.

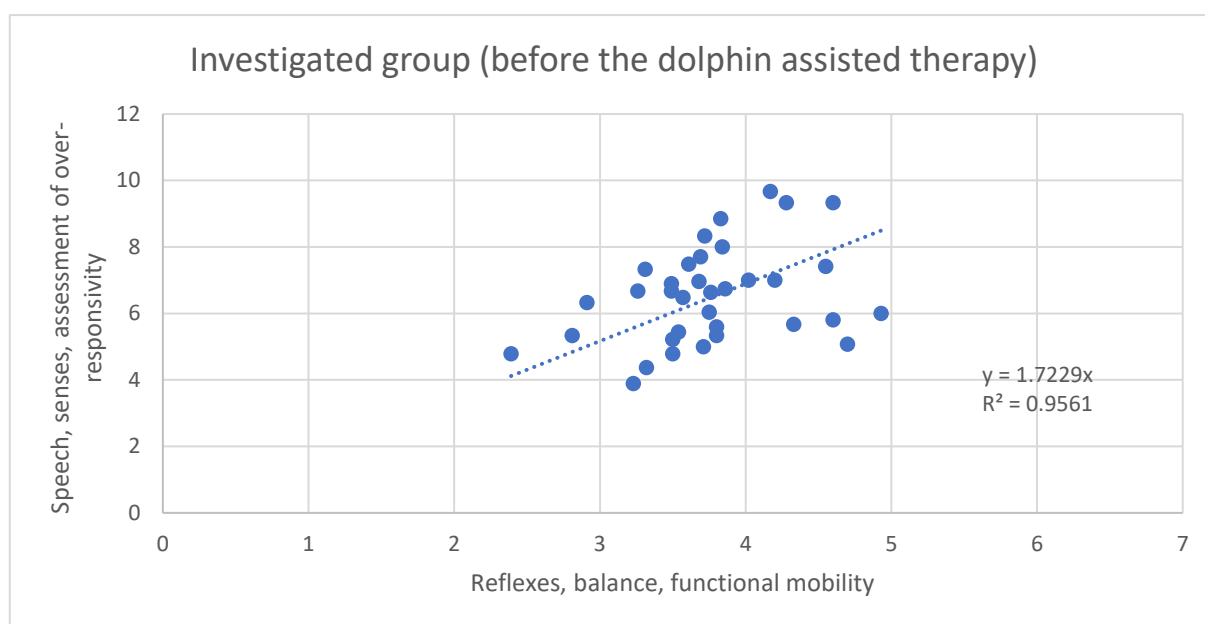


Figure 4: Effect of neurosensory (functional) parameters of the investigated group children on their psychosocial skills (speech, senses, and over-responsivity triggers), when measuring on the first day.

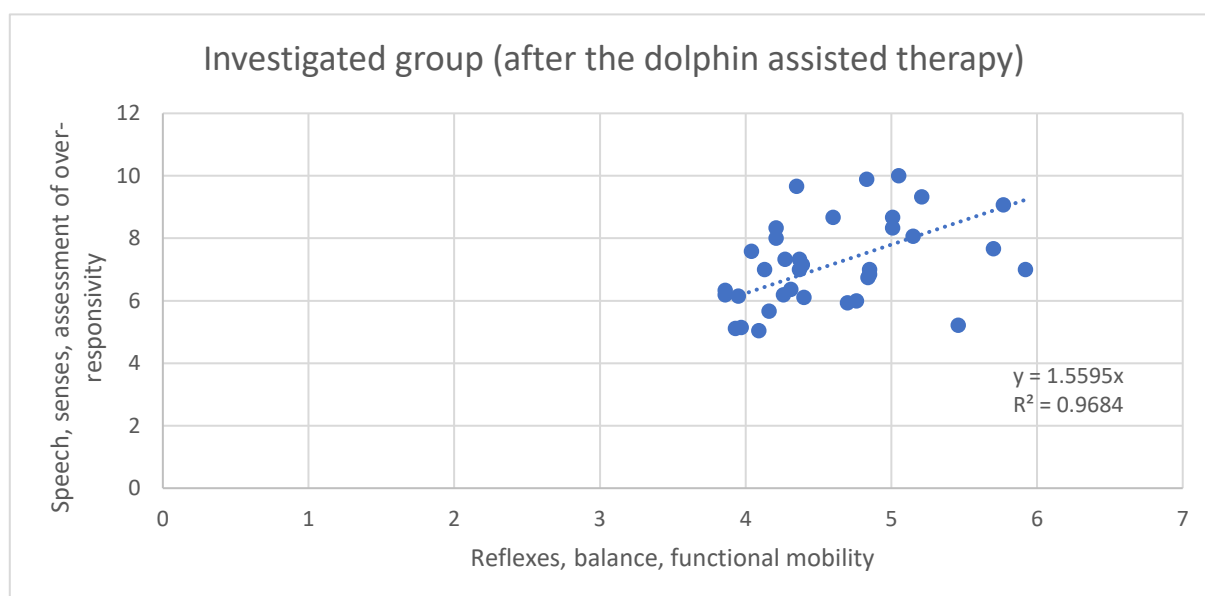


Figure 5. Effect of neurosensory (functional) parameters of the investigated group children on their psychosocial skills (speech, senses, and over-responsivity triggers), when measuring two weeks later after participation in the complex dolphin assisted therapy.

4. Discussion

Children's psychiatric and behavioral disorders are among the most complex ones, requiring a holistic approach. Experts suggest considering 12 per cent from the general population of children as the average ratio of children's psychiatric and behavioral disorders (Costello, Egger & Angold, 2005). Mental, behavioral, and emotional disorders are the most frequent reason of children's disabilities identified for the first time in Lithuania (Izokaitis et al., 2015).

The aim of this research was to investigate the effect of complex dolphin assisted therapy on psychosocial and neurosensory functions of children with psychiatric and behavioral disorders.

The research hypothesis stated that the two-week complex dolphin assisted therapy makes a positive effect on psychosocial and neurosensory functions of children with psychiatric and behavioral disorders. It is supposed that a period of two weeks is sufficient to measure the initial changes. Moreover, it is likely that the change is

observed in psychosocial functions along with the changing neurosensory functions.

140 children who took part in this research were diagnosed with mental, behavioral, and neurodevelopmental disorder (ICD-10-CM) group codes: pervasive and specific developmental disorders (F80–F89), intellectual disabilities (F70–79), and behavioral and emotional disorders with onset usually occurring in childhood and adolescence (F90–F98). Children with these disorders are among the most usual patients of the dolphin assisted therapy. Moreover, a large part of these children have sensory needs (Reynolds, Lane & Mullen, 2015) or sensory dysfunction (Mahler, 2017) and psychomotor disorders (Sobin & Sackeim, 1997). Due to these reasons, it is necessary to explore not only various possibilities to meet those needs while investigating the effect of the dolphin assisted therapy on neurosensorimotor and psychosocial functions of children, but also the correlations of these neurosensorimotor functions with the change of psychosocial functions. The condition of children with psychiatric and behavioral disorders usually requires a broad systemic approach bringing together neurosensory and psychological, social, psychoemotional functions (Zablotsky et al., 2014). In such a way, purposeful intervention resulting in best results will be provided to children.

The research results revealed that the two-week complex dolphin assisted therapy being applied jointly with: a) reflex integration activities; b) sensory intervention activities; c) social skills development activities, makes a positive effect on the changes of children's neurosensory functions, changes of psychosocial functions and the positive change of neurosensory functions and is directly correlate with better psychosocial functions.

The most frequent problems of the Children who took part in the research are problem behavior, communication disorder, hyperactivity, specific movement disorders (Kreivinienė & Vaitkienė, 2020; McGuire et al., 2016). The research data demonstrates that balance, senses (tactile skills), speech functions and social behavior resulting in decreased sensory over-reactive needs in Children with disabilities statistically improved after the complex dolphin assisted therapy. These important changes significantly improve not only the condition of these Children, but also make a broader effect – ease the situation of the entire family, which is usually discussed in insights of various authors, as the largest social problems are caused by Children's over-responsivity to sensory triggers (Edelson & Johnson, 2020), and the

unresolved sensory issues manifesting as “problem behavior” through ignoring or not properly solving them might become chronic, limit Children's independence or turn to aggression and self-aggression (Diržytė et al., 2016).

Activities in the water are important because of several aspects: first, the water can facilitate relaxation, reduces pain, stimulates sensory receptors in the skin, vestibular, vision, and hearing systems (Herold et al., 2016), skin and the tactile system react to the changing temperature of the water and sensations, a hydro-suit renders additional tactile experiences (Kreivinienė & Vaitkienė, 2020), the vestibular system reacts to the swinging water in the pool, vision is being stimulated because of the eye reaction to a changing surface of the water, the vestibular system receives much information on postural changes, stimulates the limbic system responsible for emotions (Kreivinienė & Vaitkienė, 2020; Gjessing, 2002).

Purposeful sensory interventions can improve person's behavior and well-being; however, activity sessions must include fun and playful motivation to engage and “just-right” challenges (Schaaf, Hunt & Benevides, 2012) for children. These statements are proven also by statistically significant changes in children of the investigated group who took part in the complex dolphin assisted therapy – the ability to work in team, flexibility, focusing of attention on a task, patience – an ability to wait for a toy brought by another social partner, the dolphin, have changed most positively.

Usually, such dysfunction of movement appears due to the inability to precisely perform a volitional movement and poor body position control caused by motor dysfunction, when the brain cannot coordinate the performance of ideation and motor planning tasks expressed in children with psychiatric and behavioral disorders. Therefore, among the most usually observed changes, are the following: disorders of daily motor functions, such as motor planning, inability to fit into the time limits, difficulties when planning tasks, slower learning in daily activities (e.g. tying shoelaces), writing difficulties, resistance against new tasks, impairment in fine and gross motor skills, balance, inability to organize tasks (Wilson, Enticott & Rinehart, 2018).

Thus, when analyzing positive changes in children with psychiatric and behavioral disorders after the dolphin assisted therapy, having recorded improvements in the reduction of pathological reflexes, balance, speech development and decrease in sensory over-responsivity, it can be

stated that these changes prove the benefit of the dolphin assisted therapy while working from the neurosensory level and developing social skills, expanding psychosocial functions. It has been proven that children of the diagnosed group under analysis are very diverse; they respond to triggers of the environment in different ways, adjust to the environment with difficulty. As children grow, behavioral problems often occur, which makes communication with a child, one's adjustment at home and education institution even more difficult (Navickienė et al., 2019).

A highly significant statistical dependence revealed in the research is seen among different parts of assessment in the diagnostic NSM-I scale – comparing with neurosensory functions of the control group (reflexes, balance, and functional mobility), motor skills of the investigated group that took part in the dolphin assisted therapy were significantly higher after the dolphin assisted therapy, whereas there was observed progress in speech development, lower tactile responsiveness, and decrease of over-responsive behavior for sensory modulation. The conclusion follows: the dolphin assisted therapy had a significantly stronger effect on integration of pathological reflexes and reduction of active pathological disorders, and also significantly improved children's balance influencing psychosocial functions. It was proven that when mental and central nervous system disorders exist and they influence movement control, the following characteristics are observed: speed of response decreases, a movement is performed slower, variability of movement performance increases, precision of a movement diminishes, movements are performed not plastically, but with interruptions or "cuts" (Skurvydas, 2011).

A movement is both a mental and physical phenomenon, and motor skills are the psychophysical ability which expresses senses and experiences through muscle performance (Kreivinienė & Vaitkienė, 2020). Motor skills are an interplay of continuous active movements of muscles which depends on the maturity and normal functioning of the nervous system. A movement together with other senses makes an integral chain which, due to various interactions of both external and internal world, continuously develops and perfects. A human owns a broad spectrum of movements: from the simplest reflexes, when a familiar trigger causes a stereotypical motor response, to the most complex learnt volitional movements (Hastie & Dawes, 2001).

This investigation of the dolphin assisted

therapy demonstrates that when children's neurosensory functions are changing the neuroplasticity may lead to achieving highly progressive results.

In the course of child development, movements of one's body, arms, speech and communication, cognitive processes, emotional social development are one interconnected whole. All areas of the development influence each other and are important to further child's health and development (Mikulėnaitė, 2007). This is proven by other investigations, too (see Zemblys & Lauritis, 2009), having it that the sensory and motor systems have been being investigated separately for a long time due to their different purpose and structure; however, in recent years, attention was focused on performance of coordinated movements, the sensory and motor systems operate integrally, i.e. together. It is not difficult to notice that the elements of the motor system – arms, legs, trunk, and fingers, also contain sensory information because we, even not seeing them, know what position they are in. In other words, the central nervous system, having received information from muscles on their tensions, draws the copy of the position of the body and its limbs in the space. This is also proven by investigations carried out by Rosenbaum, Carlson & Gilmore (2001) who put it that cognitive (intelligent) and motor skills have one feature in common – both are the result of learning. The cognitive (thinking, intelligent) skills are more abstract and more widely adaptable than the motor skills. Motor skills are more likely to be implemented under specific conditions than skills of thinking. Kreivinienė & Mockevičienė (2020) have also proven that the dolphin assisted therapy can result in favorable changes in the area of reflexes of Children with disabilities, make effect on the improvement of balance. Due to this reason, one can state that complex therapies which significantly correlate with psychosocial functions and not the development of single functions are highly beneficial to the improvement of neurosensory functions of Children with psychiatric and behavioral disorders.

5. Conclusions

The research showed that complex dolphin assisted therapy program of children who were diagnosed with mental, behavioral and neurodevelopmental disorders (ICD-10-CM) was significantly important to neurosensory and psychosocial functions.

The complex dolphin assisted therapy lasted for two weeks and comprised: a) reflex integration

activities; b) sensory integration activities; c) social skills development activities, and the dolphin assisted therapy in the pool meets children's sensory needs of children with psychiatric and behavioral disorders as well as helps developing tolerance to sensory triggers. The research results demonstrate that there exists a very close correlation between neurosensory and psychosocial functions; therefore, when working in a complex way, it is possible to achieve better results in terms of the changes of the child with disability. Both Psychosocial Session Form (Chandler) and diagnostic neurosensorimotor (NSM-I) instrument by the authors D. Mockevičienė and B. Kreiviniene recorded statistically significant changes in the children: social functions, such as engagement with team work, openness, flexibility, active listening, etc., and assessment of neurosensory functions revealed the statistically significant changes in: expression of pathological reflexes, sensory modulation, praxis. The changes recorded as statistically significant in the control group were minimal.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the submission of this manuscript.

Funding Statement

This article has been produced with the financial assistance partly of the authors of this manuscript and Lithuanian Sea Museum. Content of this article is the sole responsibility of the authors.

Acknowledgments

Kreiviniene, Mockevičienė, Alijošienė equally contributed to this work. All the authors have approved the manuscript that is enclosed.

References

- [1] Asmundson, G. J. G., Larsen, D. K., and Stein, M. B. (1998) Panic Disorder and Vestibular Disturbance: An Overview of Empirical Findings and Clinical Implications. *Journal of Psychosomatic Research*, 44 (1). 107-120
- [2] Ayres A.J., Robbins, J., "Sensory Integration and the Child". (2005). Understanding Hidden Sensory Challenges. 25th Anniversary Edition. Los Angeles CA: Western Psychological Services.
- [3] Birch S. (1998). "Dolphin Sonar Pulse Intervals and Human Resonance Characteristics", 2nd International Conference on Bioelectromagnetism, Australia, Melbourne: February.
- [4] Breitenbach E, Stumpf E, Fersen LV. and Ebert H. (2009). Dolphin-assisted therapy: changes in interaction and communication between children with severe disabilities and their caregivers. *Anthrozoös*, 22 (3): 277-289.
- [5] Bundy A.C and Murray E.A. (2002). "Sensory Integration: A. Jean Ayres' Theory Revisited". In: A. C. Bundy, J. Lane, & E. A. Murray, (Eds.), *Sensory Integration: Theory and Practice*. Philadelphia: FA Davis Company.
- [6] Campbell S. K., Vander Linden D. W. and Palisano R. J. (2005) "Physical Therapy for Children: 3rd edition", Saunders: ELSEVIER.
- [7] Costello J., Egger H. and Angold A. (2005) 10-Year Research Update Review: The Epidemiology of Child and Adolescent Psychiatric Disorders: I. Methods and Public Health Burden. *Journal of the American Academy of Child and Adolescent Psychiatry*, 44(10): 972.
- [8] Dell'Osso L., Gesi C., Massimetti E., Cremone I.M., Barbuti M., et al. (2017). "Adult Autism Subthreshold Spectrum (AdAS Spectrum): Validation of a Questionnaire Investigating Subthreshold Autism Spectrum". *Comprehensive Psychiatry*, vol. 73.
- [9] Dilts R., Trompisch N. and Bergquist TM. (2011) Dolphin-assisted therapy for children with special needs: a pilot study. *Journal of Creativity in Mental Health*, 6 (1): 56-68.
- [10] Diržytė, A., Mikulėnaitė, L. and Kalvaitis, A. (2016). Autizmo sutrikimų turinčių vaikų situacija ir įtraukties į švietimo sistemą galimybės analizė. Vilnius: Ugdymo plėtotės centras.
- [11] Dix, M. R., and Hallpike, C. S. (1952). The Pathology, Symptomatology and Diagnosis of Certain Common Disorders of the Vestibular System. *Proceedings of the Royal Society of Medicine*. 45 (341), 341-354.
- [12] Edelson S.M. and Johnson J.B. (2020). Understanding and Treating Anxiety in Autism: A Multi-disciplinary perspective.
- [13] Gjesing G. (2002) "Water-Based Intervention". In: A. C. Bundy, S. J. Lane, & E. A. Murray, (Eds.), *Sensory Integration: Theory and Practice*. Philadelphia: FA Davis Company.
- [14] Hastie, R. and Dawes R. M. (2001). *Rational choice in an uncertain world: The psychology of judgment and decision making*. Sage Publications, Inc.
- [15] Herold B., Stanley A., Oltrogge K., Alberto T., Shackelford P., Hunter E. et al. (2016) Post-Traumatic Stress Disorder, Sensory

- Integration, and Aquatic Therapy: A Scoping Review. *Journal Occupational Therapy in mental health*, Vol. 32 (4): 392–399. <https://www.tandfonline.com/doi/full/10.1080/0164212X.2016.1166355>
- [16] Izokaitis M., Liuima V., Stonienė L., Vitkūnienė O. (2015). Psichikos sveikatos priežiūros paslaugų prieinamumo vaikams, turinties psichikos, elgesio ir emocijų sutrikimų, Lietuvoje apžvalga. *Visuomenės sveikata*, vol. 3(70): 18–28.
- [17] Kreivinienė B. and Mockevičienė D. (2020) Dolphin Assisted Therapy: Evaluation of the Impact in Neuro-Sensory-Motor Functions of Children with Mental, Behavioural and Neurodevelopmental Disorders. *Revisita Argentina de Clinica Psicologica*. Vol. XXIX, Nr. 4, 292–307.
- [18] Kreivinienė B. and Perttula J. (2012) Delfinų terapija Lietuvoje: lūkesčiai šeimų, auginančių vaikus, turinčius kompleksinę negalę. *Specialusis ugdymas*, 27 (2): 142–152.
- [19] Kreivinienė B., Vaičiulienė J., Norkienė S., Skirutienė G. Papildomosios ir alternatyviosios medicinos reglamentavimas Lietuvoje: problemos ir perspektyvos. *Sveikatos mokslai*, 2016, Vilnius: „Sveikatos mokslai“; t. 26, Nr. 6, p. 242–248, ISSN 1392-6373.
- [20] Kreivinienė, B. and Vaitkienė, R. (2020). *Sensorinė judesio metodika pažeidžiamai suaugusių grupei*. Klaipėda: Švietimo, sveikatos ir socialinių inovacijų centras.
- [21] LR Sveikatos apsaugos ministerija. „Papildomosios ir alternatyviosios sveikatos priežiūros (PASP) įstatymas“ Nr. XIII-2771, 2020-01-14.
- [22] LR Sveikatos apsaugos ministro įsakymas. Lietuvos higienos normą HN 133:2013 „Delfinariumuose teikiamos psichoemocinio ir fizinio lavinimo paslaugos. Bendrieji sveikatos saugos reikalavimai“ 2013 m. balandžio 15 d. Nr. V-374.
- [23] Mahler K. *Interoception. The Eighth Sensory System*. USA: AAPC publishing.
- [24] Marino, L., Lilienfeld, S. O. (2007a). Dolphin-Assisted Therapy: More Flawed Data and More Flawed Conclusions. *Anthrozoös*, 20 (3), 239–249. 27. Marino, L., Lilienfeld, S. O. (2007b). Dolphin-Assisted Therapy for Autism and Other Developmental Disorders: A Dangerous Fad. *Psychology in Intellectual and Developmental Disabilities*, Vol. 33, No. 2.
- [25] McGuire, K., Fung, L. K., Hagopian, L., Vasa, R. A., Mahajan, R., Bernal, P., Silberman, A. E., Wolfe, A., Coury, D. L., Hardan, A. Y., Veenstra-VanderWeele, J. and Whitaker A. H. (2016) Irritability and Problem Behavior in Autism Spectrum Disorder: A Practice Pathway for Pediatric Primary Care. *Pediatrics*, 137(2), 136–148.
- [26] Mikulėnaitė L. (2007). Vaikų, turinčių raidos sutrikimų, gydymas ir abilitacija. Vilnius: Viltis.
- [27] Navickienė L., Piščalkienė V., Mikulėnaitė L., Grikainienė L., Tender J., Bukauskaitė M., Šulinskas U. And Šatė G. (2019). Pagalba tėvams, auginantiems vaikus, turinčius autizmo spektro sutrikimus. Lietuvos Respublikos švietimo, mokslo ir sporto ministerija: Ugdymo plėtotės centras, 163psl; ISBN 978-609-8246-04-9.
- [28] Reynolds S., Lane S. J and Mullen B. (2015). Effects of deep pressure stimulation on physiological arousal. *American Occupational Therapy Association Journal*, Vol. 69 (3): 1–5.
- [29] Rosenbaum D.A., Carlson R.A. and Gilmore R.O. (2001). Acquisition of Intellectual and Perceptual-Motor Skills. *Annu Rev Psychol*, 52, 453–70.
- [30] Rugevičius, M., Sąlyga, J., Kreivinienė, B., Bortkevičiūtė, L.B. (2016) Delfinų terapijos ilgalaikio efekto vertinimas. *Health Sciences in Eastern Europe*, 26 (6): 138–143. Salgueiro E., Nunes L., Barros A., Maroco J., Salgueiro A. and Santos M. E. (2012).
- [31] Effects of a dolphin interaction program on children with autism spectrum disorders – an exploratory research. *BMC Research Notes*; 5:199. <https://doi.org/10.1186/1756-0500-5-199>
- [32] Saman, Y., Bamiou, D. E., Gleeson, M., and Dutia, M. B. Interactions between Stress and Vestibular Compensation – A Review. *Frontiers in Neurology*, 3. 116.
- [33] Schaaf R. C. and Mailloux, Z. (2015). Clinician's Guide for Implementing Ayres Sensory Integration. Promoting Participation for Children with Autism. Aota Press, USA.
- [34] Schaaf R.C., Hunt J. and Benevides T. (2012) “Occupational Therapy Using Sensory Integration to Improve Participation of a Child with Autism: A Case Report”. *American Journal of Occupational Therapy*, vol. 66 (5): 547–555. <https://doi.org/10.5014/ajot.2012.004473>
- [35] Shaifudin M., Yusof B. Md. and Kok Hwee Chia N. (2012) “Dolphin Encounter for Special Children (DESC) Program: Effectiveness of Dolphin-Assisted Therapy for Children with Autism”, *International Journal of Special Education*, vol. 27 (3): 54–67.
- [36] Skurvydas A. (2011) Modernioji

- neuroreabilitacija: judesių valdymas ir proto treniruotė. *Vitae litera*, p.392.
- [37] Smith Roley, S., Mailloux, Z., Miller-Kuhaneck, H. & Glennon, T. Understanding Ayres' Sensory Integration. *OT Practice*, vol. 12 (7), 2007.
- [38] Sobin CH. and Sackeim H. A. (1997). "Psychomotor Symptoms of Depression". *American Journal of Psychiatry*, vol. 154 (1).
- [39] Stumpf E. and Breitenbach E. (2014) Dolphin-assisted therapy with parental involvement for children with severe disabilities: further evidence for a family-centered theory for effectiveness. *Anthrozoös*, 27 (1):95-109.
- [40] Wilson, R. B., Enticott, P. G. and Rinehart, N. J. (2018). Motor development and delay: advances in assessment of motor skills in autism spectrum disorders. *Current Opinion in Neurology*, 31 (2), 134–139.
- [41] Zablotzky B., Kalb GL., Freedman B., Vasa R. et al. (2014). Health care experiences and perceived financial impact among families of children with an autism spectrum disorder. *Psychiatr Serv*, 65(3):395–398.
- [42] Zemblys R. And Laurutis V. (2009) Ribinis taikinio sekimo greitis žmogaus žvilgsniu ir ranka. *Jaunųjų mokslininkų darbai*. Nr. 3 (24). ISSN 1648-877