



ISSN: 2230-9926

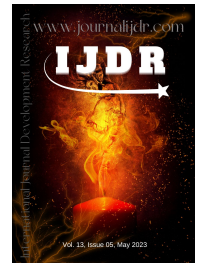
Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research

Vol. 13, Issue, 05, pp. 62630-62636, May, 2023

<https://doi.org/10.37118/ijdr.26700.05.2023>



RESEARCH ARTICLE

OPEN ACCESS

THE EFFECT OF PHYSICAL THERAPY TECHNIQUES ON MENTAL HEALTH IN CHILDREN WITH NEURODEVELOPMENTAL DISORDERS

Marianna Stavropoulou*¹, Maria Tsilingiri², Alexandra Hristara Papadopoulou³, Ioannis Xinias⁴ and Vaïos Dafoulis⁵

¹PhDc, MSc, NDT, PNF, Dip. Acupuncture, Physiotherapist, Academic Scholar of the Physiotherapy Department, Faculty of Health Sciences, at the International Hellenic University; ²PhD, Pediatrician, Professor of the Physical Therapy Department, Faculty of Health Sciences at the International Hellenic University; ³PhD, Physical Therapist, Professor of the Physical Therapy Department, Faculty of Health Sciences, at the International Hellenic University, Director of the Postgraduate Program in Pediatric Physical Therapy at the International Hellenic University; ⁴PhD, Pediatric Gastroenterologist, Associate Professor of Pediatric Gastroenterology, 3rd Pediatric Department at the Aristotle University of Thessaloniki, "Hippocraton" General Hospital, Thessaloniki; ⁵PhD, Child Psychiatrist, Director of the Child Psychiatry Department of "Hippocraton" General Hospital, Thessaloniki

ARTICLE INFO

Article History:

Received 28th March, 2023

Received in revised form

16th April, 2023

Accepted 22nd April, 2023

Published online 24th May, 2023

KeyWords:

Physical therapy, Autism syndrome, Attention Deficit Hyperactivity Disorder, Acupuncture, Diaphragmatic breathing, Neuromodulation, Pulmonary nerve Stimulation, Pressure therapy.

*Corresponding author:

Marianna Stavropoulou.

ABSTRACT

Introduction: Neurodevelopmental disorders like Autism and Attention Deficit Hyperactivity Disorder (ADHD) can severely impact children's social and communication abilities. These conditions often lead to anxiety and depression, further worsening the affected children's mental health. Physical therapy techniques such as acupuncture and relaxation exercises have emerged as promising approaches to managing these conditions. **Research Aim:** This paper aims to clarify the effect of physical therapy on the mental health of children with neurodevelopmental disorders, particularly in managing anxiety and improving mood and psycho-emotional state. **Research Methodology:** A quantitative survey was conducted using a 4-section questionnaire targeting parents of children diagnosed with autism and ADHD, as well as 18-year-olds diagnosed with either of the disorders themselves. Data was collected using an electronic questionnaire. **Results:** The study's results showed that physical therapy significantly decreased worry, stress, and depression in children with autism and ADHD. Anxiety levels were slightly above average but decreased significantly after the intervention. **Conclusions:** Physiotherapy, including breathing exercises, is crucial for children diagnosed with autism and ADHD due to the mental challenges they face. Various techniques, including diaphragmatic breathing, neuromodulation by the ear - auricular acupuncture, pulmonary nerve stimulation, pressure therapy and relaxation exercises, have shown promising results in reducing anxiety, achieving calmness, and improving social adaptability in children with neurodevelopmental disorders.

Copyright©2023, Marianna Stavropoulou et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Marianna Stavropoulou, Maria Tsilingiri, Alexandra Hristara Papadopoulou, Ioannis Xinias and Vaïos Dafoulis. 2023. "The effect of physical therapy techniques on mental health in children with neurodevelopmental disorders". *International Journal of Development Research*, 13, (05), 62630-62636.

INTRODUCTION

Mental health can affect daily stress management, personal and professional growth, and community contributions, indicating a state of well-being. Social support networks, interpersonal relationships, and emotional communication are specific components of mental health, as identified by the World Health Organization (2020). Practicing healthy habits, such as regular exercise, taking breaks, and maintaining a balanced diet, can contribute to good mental health. Mental health is a spectrum, with excellent mental health at one end and mental illness at the other end (Field, 2014). In particular, it is pointed out that according to the World Health Organization, it is defined as "the state of well-being where each person successfully

cope with the problems of life, can work productively, and participates actively in his social environment, and not simply the absence of a problem or a disorder. Two basic and essential conclusions emerge from this definition: in principle, mental health is not a clear measurable goal, which means that it can hardly be achieved and remains an ideal that each of us strives to achieve. Despite the extensive literature on interventions for autism focusing on alleviating its main symptoms, there is a lack of research exploring the potential impact of relaxation techniques through physical therapy, such as diaphragmatic breathing and acupuncture, on reducing anxiety and improving mental well-being in children. The potential impact of relaxation techniques in children with autism through physical therapy is an area that has not been extensively studied, despite the recognition of its effectiveness. Recent research in children with autism and ADHD have highlighted the potential

benefits of evaluating intervention outcomes, including heart rate variability. However, there is currently a significant lack of literature on the effect of physical therapy intervention on the mental health of children with neurodevelopmental disorders such as autism spectrum disorders and ADHD, both domestically and internationally.

The Concept of Mental Disorders and Neurodevelopmental Disorders: Mental disorders include a wide range of problems. They usually display a mixture of atypical thoughts, feelings, behaviors and interpersonal relationships. Examples are intellectual disability, schizophrenia, depression, and substance use problems. People suffering from mental illnesses such as depression, schizophrenia, and bipolar disorder often suffer from poor physical health and severe psychiatric, social, and cognitive impairments (Koren, 2018). Disorders known as neurodevelopmental disorders are generally related to the functioning of the brain and nervous system. ADHD, autism, learning disabilities, intellectual disabilities, behavioral disorders, cerebral palsy, and visual and hearing disorders are examples of neurodevelopmental disorders in children. Speech and language, motor skills, behavior, memory, learning, and other brain processes may be impaired in children with neurodevelopmental disorders. Although some neurodevelopmental disorders are permanent, their symptoms and behavior often change as the child grows. These disorders can be difficult to diagnose and treat. Treatment usually requires a combination of specialized therapies, medication, and physical approach at home and at school (Lai *et al.*, 2014). A variety of disorders whose symptoms begin in childhood are known as neurodevelopmental disorders (NDDs). ASDs include attention-deficit/hyperactivity disorder (ADHD), characterized by problems with short attention span, impulsivity, and/or hyperactivity, and autism spectrum disorder (ASD), characterized by social disturbances, including, but not limited to communication and learning disability (LD), which mainly manifests as a symptom of reduced literacy (American Psychiatric Association, 2013). Recent studies show that more children have a clinical diagnosis of NTD (Boyle *et al.* 2011), and many of these children also have co-occurring physical problems (Schieve *et al.* 2012). In addition to epilepsy, children with ADHD are more likely to suffer from gastrointestinal (GI) problems, eating disorders, headaches, and asthma. Studies have investigated a possible link between celiac disease and autism spectrum disorders but have not consistently found it (Lehrer *et al.*, 2021).

Some studies have shown that people with ADHD experience seizures (Cohen *et al.*, 2013), migraines (Fasmer *et al.*, 2011), and asthma (Fasmer *et al.*, 2011). Conversely, children with physical problems are more likely to have ADHD. For example, a child with asthma has a significantly higher risk of developing ADHD during school compared to a child without asthma (Chen *et al.* 2013). A recent Swedish study found that teenage girls with ADHD struggled to cope with type 1 diabetes, while a large epidemiological study found that children with nocturnal enuresis were nearly five times more likely to develop ADHD than children who did not. A cross-sectional study utilizing the Norwegian National Registry revealed a significant association between ADHD and psoriasis, particularly in women. While asthma is a well-documented physical comorbidity in adults with ADHD, there is currently a dearth of studies exploring the link between ADHD and epilepsy, migraines, gastrointestinal disturbances, and enuresis. One to three studies are conducted each year. Norwegian adults with ADHD have a high prevalence of migraine, and a good correlation between antimigraine medications and ADHD prescriptions has been shown. One clinical study showed that people with celiac disease had an excess of ADHD symptoms, while another study of ADHD patients found an excess of celiac disease, which was detected by the presence of antibodies unique to celiac disease. On the other hand, a large, controlled study could not support a link between childhood ADHD and celiac disease. In these children with NSD, studies show a moderate to a severe increase in the incidence of most of the medical disorders studied. Although phenotypic overlap is not considered a common etiology or cause, many medical or genetic disorders are known to cause physical problems similar to her NDD. Although studies have linked early

exposure to cranial radiation or chemotherapy with the later development of neurocognitive problems, the area of NDD in cancer patients remains largely unexplored. Children with tuberous sclerosis have a higher prevalence of ASD and learning disabilities. Despite the prevalence of NDD comorbidities, no studies have specifically examined the physical health of children with multiple overlapping NDDs, nor have these associations been fully summarized (Lu *et al.*, 2018).

The Concept of Autism: The term "Autism Spectrum Disorders" (ASD) was introduced to capture the diverse range of clinical features presented by individuals with autism. ASD encompasses three developmental disorders described in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders: Autistic Disorder (AD), Asperger Syndrome (AS), and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) (American Psychiatric Association, 2013). Despite strong evidence for a genetic basis, the precise etiology of ASD remains elusive. The disorder typically presents with distinct symptoms that can be detected before the age of three. Individuals with ASD, both children and adults, exhibit a number of shared characteristics (Lu *et al.*, 2018). These include persistent deficits in social communication and social interaction across various contexts. Such deficits are reflected in impairments in socioemotional reciprocity, nonverbal communication, and developing, maintaining, and understanding relationships (American Psychiatric Association, 2013). Individuals with ASD often display deficits in socioemotional reciprocity, nonverbal communication during social interactions, and in forming, maintaining, and understanding relationships (American Psychiatric Association, 2013). Another common feature is the presence of restricted and repetitive patterns of behavior, interests, or activities, such as stereotyped or repetitive movements, fixed or intense interests, and hypo- or hyper-reactivity to sensory input (American Psychiatric Association, 2013). These symptoms can cause significant impairment in social, occupational, or other important areas of functioning (American Psychiatric Association, 2013). ASD is considered a spectrum disorder, as individuals with ASD share many similar characteristics but differ in their severity of symptoms (Ehleringer, 2010). Autism can affect a child's ability to communicate, acquire social skills, and maintain typical brain function. While there is currently no cure for ASD, specialized education and therapy can help to reduce symptom severity. It is important to note that a person cannot be classified as having the least severe form of ASD if they previously met criteria for Asperger syndrome or pervasive developmental disorder (McIlwaine *et al.*, 2019).

Diagnosis of Autism: Autism spectrum disorders are usually diagnosed around 15–18 months. The speech delay is what usually prompts parents to look for the problem, although deficits in social skills usually appear at a young age. The prognosis depends on many factors and cannot be determined in early childhood, especially before the age of three (Moura *et al.*, 2018).



Figure 1. Incidence and ASD prevalence rates illustration by National Autism Spectrum Disorder Surveillance System (NASS) 2018 Report

Attention Deficit Hyperactivity Disorder: Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that typically manifests early in childhood, with a prevalence of approximately 5% among children aged 4–17 years. This disorder is characterized by classical symptoms of inattention, impulsivity, and hyperactivity. Many of the children diagnosed with ADHD continue

to experience problems in adolescence and adulthood related to their education, social functioning, and mental health (Moura *et al.*, 2014).

Diagnosis of ADHD: In order to establish the diagnosis of hyperactivity disorder, the simultaneous presence of symptoms in the areas of inattention, hyperactivity, and impulsivity is required, which are manifested in more than one environment (at home, at school, etc.) and lead to a reduction in learning, social, and work functions. The onset of symptoms must occur before the age of 12. ADHD patients show heterogeneity at the clinical, etiological, and pathophysiological levels and differ from each other in terms of core symptoms, deficits, and comorbidities (Rodrigues *et al.*, 2020).

METHODS

Acupuncture- neuromodulation: Acupuncture is a holistic medicine treatment that has been gaining more and more popularity in recent years. Beyond the field of complementary and holistic medicine, it is also widely used in sciences such as physical therapy and occupational therapy (Thapar, 2016). Although most treatments of this type are performed to treat pain, recent research reveals that they are quite promising in other cases as well, such as developmental and behavioral disorders (Field, 2014). Auricular acupuncture is a complementary treatment to classical acupuncture that involves the penetration of fine needles into specific points of the ear. In recent years, many parents of children on the autism spectrum have turned to complementary and alternative medicine treatments, as no single treatment has been found to alleviate the symptoms of autism. However, there are references in the literature that support the combined use of conventional and alternative methods. One such method involves stimulation of the vagus nerve, which has been shown to promote calmness and relaxation in individuals with autism, as demonstrated in a study by Dicarlo *et al.* (2013). The use of a special ear electrode to stimulate the vagus nerve is a complementary treatment to classical acupuncture, which involves the insertion of fine needles into specific points in the ear to provide permanent stimulation of the acupuncture points. This was the conclusion reached by TibinJoshoph *et al.* (2015) in their research. Auricular acupuncture dates back to the Han Dynasty in China, while its modern version was developed in the late 1950s to diagnose and treat physical and psychosomatic disorders by stimulating specific areas of the ear. The effects of this intervention have been explained through neurophysiology and reflexology. While ear acupuncture has been tested for chronic pain control, the results are still inconclusive due to heterogeneity (Moura *et al.*, 2019). Specifically, semi-permanent needles are placed in patients' ears for seven days before being removed two days after the next session to stimulate ear points and achieve therapeutic effects even after the end of the session, as shown by Padmavati *et al.* (2014).

Pressure therapy (pressure on specific points): Although most pressure treatments on specific points are performed to treat pain, recent research reveals that they are quite promising in other cases as well, such as developmental and behavioral disorders (Field, 2014). Such points are the point heart 5, heart 7, lung 9, pericardium 6, pericardium 7, spleen 6. In fact, it has been proven that when combined, three pressure points on the wrist can greatly help with anxiety and the feeling of low pressure. These are points Heart7, Pericardium 6 and Lung 9 (LU9) (Ghanem *et al.*, 2016). HT7 helps calm the mind as well as treat insomnia and depression. LU9 promotes lung function, particularly the ability to take a deep breath.

Respiratory physical therapy - Diaphragmatic breathing

Respiratory physical therapy (diaphragmatic breathing): Respiratory physical therapy (diaphragmatic breathing) is a form of physical therapy aimed at mobilizing and removing bronchial secretions from the patient's airways, as endorsed in the research of Fatemeh KimiyaeaeAsadi *et al.* (2016) and Georgiadis *et al.* (2019).

In addition, deep and slow breathing, diaphragmatic breathing in addition to contributing to brain oxygenation, stimulates the vagus nerve and PSNS, resulting in a decrease in heart rate, blood pressure, breathing rate, and even a decrease the production of stress hormones such as cortisol. In addition, activation of the PSNS stimulates the releases certain hormones and endorphins that have relaxing and even mood-enhancing effects due to their interaction with other body systems (Lipinski, 2021).

Progressive neuromuscular relaxation: Jacobson Exercise Plan: Progressive neuromuscular relaxation, also known as the Jacobson exercise, is one of the most well-known and widely used treatments for anxiety management. It was created and described by Edmund Jacobson in the early 20th century. This method involves learning techniques to relax muscles as a means of reducing stress and anxiety and their physiological and psychological consequences (Lehrer *et al.*, 2021). This approach leads the individual to systematically and alternately tense and relax various muscle groups throughout the body, resulting in relaxation of the mind and body (Tadakawa *et al.*, 2016; Buddhabyakan *et al.*, 2015). The goal of the method is to lower the threshold of perception of detected tension to the extent that the person can perceive even the slightest amount of tension and learn to consciously control and eliminate it.

Relaxation positions: The relaxation positions, based on the classical postures of yoga, aim to direct the student's energy to the elimination, reduction or management of symptoms that degrade his mental health. A child on the autism spectrum may require instructions in the form of pictures, while a child with attention deficit hyperactivity disorder may respond better to detailed wording of verbal instructions. Relaxation and rest positions include neck and back stretches as well as special positions based on squatting, corpse and mountain (Radhakrishna *et al.*, 2010).



Figure 2. Squatting position



Figure 3. Corpse position



Figure 4. Position of mountain

METHODOLOGY

Purpose of the Research: The present research investigates the effect of physical therapy on the mental health of children with neurodevelopmental disorders, and more specifically on autism and attention deficit hyperactivity disorder (ADHD) in children aged 6 to 18 years. In more detail, we studied whether physical therapy has an effect on the management of children's anxiety, stress, and depression, as well as on the reduction of the behaviors that appear and are related to each of the two disorders, which leads to the achievement of well-being and the improvement of their quality of life. According to the above, the research question can be formulated as follows:

Does the physical therapy of children with autism and ADHD affect the appearance of behaviors related to these disorders as well as the management of anxiety, stress, and depression?

Sample survey: The research sample consists of a total of 117 people, mainly parents of children with autism and ADHD but also 18-year-olds who themselves have one of the two disorders. In more detail, it appears that the children's mothers completed the survey more often, with 52 questionnaires referring to autism and 65 to ADHD. In addition, from the total of 117 subjects, 64 followed the intervention with physical therapy, while the remaining 53 were in the control group that did not follow physical therapy. The third section of the research tool includes the "Questionnaire for Parents of Children with ADHD", which was created by the psychometrics laboratory of the National Kapodistrian University of Athens. The questionnaire consists of a total of 18 statements, which investigate inattention through 9 questions, hyperactivity through 6 questions, and children's impulsivity through 3 questions. Parents are asked to indicate, from "Almost never" to "Very often," the frequency with which their children exhibit each behavior associated with the onset of ADHD. The 3 subscales are calculated by averaging the answers to the corresponding questions, so that a lower value can be 1 and a higher value 4, where a higher value is associated with an increased level of inattention, hyperactivity, and impulsivity. Through the Cronbach's Alpha index, it was seen that the experimental group presents reliability in the three scales of 0.775, 0.773, and 0.547 before the intervention and 0.793, 0.811, and 0.577 after the intervention, respectively. Relative to the control group, it presents reliability equal to 0.794, 0.706, and 0.572, respectively, for the 3 subscales as mentioned above. These values are considered acceptable, while the reliability of the impulsivity subscale, although low due to the small number of questions that make it up, was considered marginally adequate, so the subscale was used normally. The fourth and final section of the research tool investigates the levels of anxiety, stress, and depression in children using the "Dass-21" scale developed by Lovibond and Lovibond (1995). This scale has been translated into Greek and validated (Lyraeos, Arvaniti, Smyrnioti, & Kostopanagiotou, 2011), and has been used in various studies in Greece. The scale consists of 21 statements and assesses the subscales of stress, anxiety, and depression, each of which includes an average of 7 statements and receives values from 1 to 4, with higher values indicating greater levels of stress, anxiety, and depression. The reliability of the subscales was assessed using Cronbach's alpha index, with values of 0.838, 0.787, and 0.847 before the intervention and 0.809, 0.777, and 0.806 after the intervention for the experimental group. The reliabilities of the subscales for the control group were also found to be acceptable, with values of 0.748, 0.684, and 0.783, respectively, for the 3 subscales.

Treatment protocols that were followed: Regarding the therapeutic protocols followed:

Auricular acupuncture- Auricular neuromodulation: The method of electro-acupuncture by the ear was carried out with the help of a special electrode called the vagus nerve (Figure 5), which is applied to the ear and stimulates the vagus nerve for 15 minutes, helping to improve mood and reduce anxiety. In addition, electrical stimulation of points by the ear was also carried out with the help of a special

point select digital device. It is worth mentioning that points in the ear were detected with the help of tools such as "palpeur" detecting pressure sensitive points, as well as with the help of point select digital (Figure 6) which detected points by the ear of low electrical resistance. Once the ear points were found, patches with semi-permanent needles were placed (Figure 7). The acupuncture points are five and are as follows: (zero point, Shen Men, stress and anxiety zone, anti depression point, sadness and joy zone), while the length of the needle used varied according to the age and resistance of the child, bearing the following dimensions (Krames et al, 2018):

0.20 × 0.30
0.20 × 0.60
0.20 × 0.90

It is worth mentioning that the semi-permanent needles remained in the ear for about 7 days.



Figure 5. Kit nerf vague for Electrostimulation Tens Eco 2 SCHWA MEDICO manufacturer



Figure 6. Point toselect Digital DT, An exact acupuncture point detector, schwa-medico manufacturer



Figure 7. Uncoated acupuncture semi-permanent needles, Pyonex manufacturer

Acupressure: The process of acupressure, in the form of pressure on specific points with the aim of achieving relaxation, was applied to the point heart 5, heart 7, lungs 9, pericardium 6, pericardium 7, spleen 6 (Ghanem, 2016).

Respiratory physical therapy - Diaphragmatic breathing: The simplest method of relaxation as already mentioned is breath control. There are dozens (maybe hundreds) of relaxation techniques through breathing. Unlike the chest breathing that most people use, diaphragmatic breathing is done by contracting the diaphragm, a large dome-shaped muscle at the base of the lungs. During diaphragmatic breathing, air drawn into the lung inflated the abdomen. This is why diaphragmatic breathing is also called abdominal breathing.

Jacobson relaxation exercise: This method leads the child to alternately relax various muscles of the body and channel the pressure, with the aim of making even the slightest presence of pressure felt. As a method it has proven to be particularly helpful in the psychological treatment of many emotional and anxiety disorders. Finally, it is pointed out that Jacobson used muscle contractions as a means of perception and recognition of their sensation by the child in order to control them, and not as a means of achieving relaxation. (Lehrer *et al.*, 2021)

Data Collection: Data were collected using an electronic questionnaire from participants who expressed interest in participating in the study. Initially, the researcher informed the interested parties about the purpose and rationale for conducting the survey, the anonymous and voluntary nature of the survey, as well as the estimated time required to complete the tool.

questionnaire variables and the subscales of the instruments used. Accordingly, in order to investigate and answer the research question, the paired-sample T-test was used, as well as the t-test. All of the above is presented in tables and graphs created in the SPSS analysis program and the Microsoft Excel program.

RESULTS

First, the paired sample T-test is used to see if the results of the experimental group before the intervention differ from the results of the group after the physical therapy intervention. As can be seen from the control results in Table 1, there appeared to be a statistically significant difference between the results before and after the intervention, with the means of all variables being lower after the intervention. Therefore, this showed that physical therapy intervention was successful in reducing the occurrence of behaviors related to the autism spectrum and ADHD, as well as the level of anxiety, stress, and depression. In Table 2, the means of the pre- and post-intervention variables were again presented for easier comparison. As it can be seen regarding the appearance of behaviors on the autism spectrum, the difference reached 2.42 units, a small objective difference. Regarding the other variables, greater differences were shown in the levels of anxiety, stress, and depression, with differences in values from 0.67 to 0.51 that could be considered of moderate importance, while the differences regarding ADHD behaviors were small. In conclusion, we would conclude that the occurrence of autism and ADHD behaviors, although they presented a statistically significant difference, was small.

Table 1. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Level of occurrence of autism spectrum behaviors before intervention - Level of occurrence of post-intervention autism spectrum behaviors	1.56000	3.20260	.64052	.23803	2.88197	2.436	24	.023
Pair 2	Level of inattention before intervention - Level of inattention after intervention	.23489	.33186	.05691	.11909	.35068	4.127	33	.000
Pair 3	Pre-intervention hyperactivity level - Post-intervention hyperactivity level	.21078	.39846	.06834	.07176	.34981	3.085	33	.004
Pair 4	Pre-intervention impulsivity level - Post-intervention impulsivity level	.15686	.36914	.06331	.02806	.28566	2.478	33	.019
Pair 5	Pre-intervention stress level - Post-intervention stress level	.66518	.62980	.07872	.50786	.82250	8.449	63	.000
Pair 6	Pre-intervention stress level - Post-intervention stress level	.51339	.52147	.06518	.38313	.64365	7.876	63	.000
Pair 7	Pre-intervention depression level - Post-intervention depression level	.54464	.51531	.06441	.41592	.67336	8.455	63	.000

Table 2. Means of variables before and after intervention

	Average before intervention	Post-intervention average	Differences before and after intervention
Level of occurrence of behaviors on the autism spectrum	21.03	18.62	2.42
Level of inattention	2.96	2.72	0.23
Level of hyperactivity	2.59	2.38	0.21
Impulsivity level	2.44	2.28	0.16
Stress level	2.86	2.2	0.67
Stress level	2.08	1.56	0.51
Depression level	2.42	1.87	0.54

In addition, respondents were encouraged to answer all statements honestly and to contact the researcher via her e-mail address in case of any questions or problems. Furthermore, 64 participants, whose children were undergoing appropriate physical therapies, were requested to complete the same research tool for a second time.

Data Analysis: The SPSS v. 25 statistical program was selected and used for data analysis. Frequencies, percentages, means, and standard deviations were calculated for the descriptive presentation of the

However, there were some significant differences in children's stress, anxiety, and depression. Then, the T-test was used in order to see if the results of the control group and the results of the intervention group, after the physical therapies, presented a statistically significant difference. As can be seen, there were 3 statistically significant differences regarding the level of anxiety, stress, and depression (Table 3). In Table 4, it can be seen that the control group showed a higher level of stress, anxiety, and depression compared to the experimental group after the intervention.

Table 3. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Itself.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Level of occurrence of behaviors on the autism spectrum	Equal variances assumed	1.064	.308	-.243	44	.809	-.46538	1.91324	-4.32128	3.39051
	Equal variances not assumed			-.251	43.951	.803	-.46538	1.85533	-4.20468	3.27391
Level of inattention	Equal variances assumed	.195	.660	.175	62	.862	.02076	.11889	-.21691	.25843
	Equal variances not assumed			.174	60.550	.862	.02076	.11924	-.21771	.25923
Level of hyperactivity	Equal variances assumed	.045	.832	1.135	62	.261	.16895	.14889	-.12869	.46658
	Equal variances not assumed			1.136	61.976	.260	.16895	.14869	-.12827	.46617
Impulsivity level	Equal variances assumed	.130	.719	1.024	62	.310	.17823	.17408	-.16975	.52622
	Equal variances not assumed			1.027	61.958	.309	.17823	.17359	-.16877	.52524
Estress level	Equal variances assumed	.021	.886	5.736	114	.000	.55021	.09593	.36018	.74024
	Equal variances not assumed			5.732	110.348	.000	.55021	.09599	.35999	.74043
Stress level	Equal variances assumed	2.889	.092	7.473	114	.000	.63980	.08562	.47019	.80940
	Equal variances not assumed			7.378	103.440	.000	.63980	.08672	.46782	.81178
Depression level	Equal variances assumed	5.876	.017	6.149	114	.000	.62337	.10137	.42256	.82418
	Equal variances not assumed			6.021	97.469	.000	.62337	.10354	.41789	.82885

Table 4. Stress, anxiety, and depression averages of the control and the intervention group

	Control group	Intervention team
Stress level	2.75	2.20
Stress level	2.20	1.56
Depression level	2.49	1.87

These results confirm once again that the physical therapy intervention slightly affected the behaviors of autism and ADHD but had a strong effect on the level of anxiety, stress, and depression in the children.

DISCUSSION

The present study aimed to investigate the effect of physical therapy on the management of anxiety, stress, and depression, as well as on the occurrence of autism and ADHD behaviors in children aged 5 to 18 years. A total of 117 participants were recruited, including 64 in the intervention group and 53 in the control group. Before the intervention, the children in the experimental group exhibited a high level of autism spectrum behaviors and a high level of inattention, hyperactivity, and impulsivity. Moreover, they reported above-average levels of anxiety, stress, and depression. Following the physical therapy intervention, it appeared that the children still displayed behaviors related to autism, such as inattention and impulsivity, but to a lesser extent than before the intervention. This finding is consistent with the study by Dicarolo et al. (2013). Additionally, their stress level was slightly above average, while their levels of anxiety and depression were below average, which is similar to the results reported in the study by McIlwaine et al. (2019).

Upon investigation of the research question, it appears that the intervention was successful. Children in the intervention group exhibited a statistically significant reduction in autism and ADHD-related behaviors, although the difference was slight. Additionally, as noted in the research conducted by Rodrigues et al. in 2020, there was a statistically significant difference in the levels of anxiety, stress, and depression before and after the physical therapy intervention, particularly in a reduction of these symptoms after the intervention. It also appears that the level of stress, anxiety, and depression differed in a statistically significant way between the control group and the experimental group after the intervention, with the first group showing a higher level of all three variables. In conclusion, the physical therapy intervention produced a small level of improvement in the occurrence of behaviors related to the autism spectrum and ADHD, but the improvement it produced in the anxiety, stress, and depression experienced by the children is significant, as it was obvious in the Jin and Kong research in 2017. Respiratory physiotherapy, particularly diaphragmatic breathing, had a positive effect on both the respiratory system, which is greatly influenced by an individual's psychological state, and on a psychological level, as evidenced by the research of Rodrigues et al. Diaphragmatic breathing exercises, combined with active movements of the upper and lower limbs, as well as the trunk, resulted in the relaxation of contracted muscles and improved pulmonary ventilation. In mental disorders where there is a contraction of the respiratory muscles, pulmonary ventilation is unsatisfactory, as was demonstrated in the research of Al Mohameddali in 2016.

Acupressure on the dorsal surface of the chest, the front and ridges of the chest, and the cervical area can reduce painful muscle contractions that are often caused by changes in correct breathing patterns due to stress and pressure. This technique enhances relaxation, thus contributing to the reduction of stress, which is often responsible for the creation of secondary pain in various areas of the body, as confirmed by Koren and Kalichman in 2018. In a nutshell, it became clear that physical therapy had a positive effect and brought significant mental benefits to children with autism and ADHD, significantly contributing to the management of anxiety, improving mood, and overall psycho-emotional state, resulting in the promotion of quality of life.

CONCLUSIONS

The above research aimed to investigate the impact of physical therapy on the management of anxiety, stress, and depression, as well as the reduction of autism and ADHD-related behaviors in children aged 6 to 18 years. A total of 117 participants took part in the study, with 64 assigned to the intervention group and 53 to the control group. Regarding the intervention group, most of the questionnaires were completed by mothers who were married and high school graduates, with an average family income of 1285.93 euros. The average age of children in the experimental group was 13.14 years, and they were diagnosed with autism at an average age of 5.78 years. Prior to the intervention, the children exhibited a high level of autistic spectrum behaviors, as well as inattention, hyperactivity, and impulsivity. Additionally, the participants reported above-average levels of anxiety, stress, and depression. Following the intervention, the children continued to display autism-related behaviors, such as inattention and impulsivity, but to a lesser extent than before the intervention. Moreover, their stress level remained slightly above average, while their anxiety and depression levels were below average. Continuing with the control group, it appears that mothers completed questionnaires for their children more often. Furthermore, the average age of the children was 13.24 years, and they were diagnosed at an average age of 5.77 years. Regarding the people who completed the questionnaires for children with autism and ADHD, most are married, high school graduates, and reported an average monthly income of 1370.75 euros. The control group also exhibited a high level of ADHD behaviors, such as inattention, hyperactivity, and impulsivity, as well as above-average levels of anxiety, stress, and depression. Investigating the research question posed, it appears that the intervention was successful, as the children in the intervention group showed a slightly lower level of behaviors related to autism and ADHD, and these differences were statistically significant. Additionally, the levels of anxiety, stress, and depression showed a statistically significant difference before and after the intervention, with a particular reduction seen after the physical therapy intervention. Furthermore, it appears that the levels of stress, anxiety, and depression differed in a statistically significant way between the control group and the experimental group after the intervention, with the former group showing a higher level of all three variables. In conclusion, physical therapy intervention resulted in a small level of improvement in the occurrence of behaviors related to the autism spectrum and ADHD, but the improvement it produced in the anxiety, stress, and depression experienced by the children was significant.

REFERENCES

- Al Mohammedali Z, O'Dwyer TK, Broderick JM. The emerging role of respiratory physiotherapy: A profile of the attitudes of nurses and physicians in Saudi Arabia. *Annals of thoracic medicine*. 2016 Oct;11(4):243.
- Dicarlo, L., Libbus, I., Amurthur, B., Kenknight, B. H., and Anand, I. S. (2013). Autonomic regulation therapy for the improvement of left ventricular function and heart failure symptoms: the ANTHEM-HF study. *J. Card. Fail.* 19, 655–60. doi:10.1016/j.cardfail.2013.07.002.
- Dickson, K. S. (2021, July 1). Correction to: A Systematic Review of Mental Health Interventions for ASD: Characterizing Interventions, Intervention Adaptations, and Implementation Outcomes. SpringerLink.
- Field, T. (2014). Massage therapy research review. *Complementary Therapies in Clinical Practice*, 20(4), 224–229. <https://doi.org/10.1016/j.ctcp.2014.07.002>
- Georgiadis, P., HristaraPapadopoulou, A., Iakovidis, P., Trevlakis, M., Xalkia, A., & Tsakona, P. (2019). Respiratory intervention in children 7-14 years old with autism spectrum disorder, attention-deficit/hyperactivity disorder and down syndrome in special schools in Central Macedonia- Hellas. *Int. Res. J. Public Environ. Health*.
- Ghanem, T., and Early, S. V (2016). Vagal nerve stimulator implantation: an otolaryngologist's perspective. *Otolaryngol. Head. Neck Surg.* 135, 46–51. doi:10.1016/j.otohns.2006.02.037.
- Jin Y, Kong J. Transcutaneous Vagus Nerve Stimulation: A Promising Method for Treatment of Autism Spectrum Disorders. *Front Neurosci.* 2017 Jan 20;10:609. doi: 10.3389/fnins.2016.00609. PMID: 28163670; PMCID: PMC5247460.
- Koren, Y., & Kalichman, L. (2018). Deep tissue massage: What are we talking about? *Journal of Bodywork and Movement Therapies*, 22(2), 247–251. <https://doi.org/10.1016/j.jbmt.2017.05.006>
- Krames, Peckham, and Rezaei (eds) *Neuromodulation v.1-2*, (2009) (excerpted with permission of the author); 2nd edition (2018)
- Lai, M.-C., Lombardo, M. V., & Baron-Cohen, S. (2014). Autism. *The Lancet*, 383(9920), 896–910. [https://doi.org/10.1016/s0140-6736\(13\)61539-1](https://doi.org/10.1016/s0140-6736(13)61539-1)
- Lehrer, P. M., Woolfolk, R. L., & den, B. O. van. (2021). Principles and practice of stress management. The Guilford Press.
- Lipinski Boegl, S. K. (2021). A blind spot in mental healthcare? Psychotherapists lack education and expertise for the support of adults on the autism spectrum. *SAGE Journals*.
- Lu, W.-P., Tsai, W.-H., Lin, L.-Y., Hong, R.-B., & Hwang, Y.-S. (2018). The beneficial effects of massage on motor development and sensory processing in young children with developmental delay: A randomized control trial study. *Developmental Neurorehabilitation*, 22(7), 487–495. <https://doi.org/10.1080/17518423.2018.1537317>
- Matthews, M., Nigg, J. T., & Fair, D. A. (2014). Attention Deficit Hyperactivity Disorder. *Curr Topics BehavNeurosci*, 16, 235–266. https://doi.org/10.1007/7854_2013_249.
- McIlwaine, M., Button, B., & Nevitt, S. J. (2019). Positive expiratory pressure physiotherapy for airway clearance in people with cystic fibrosis. *Cochrane Database of Systematic Reviews*, 2019(11). <https://doi.org/10.1002/14651858.cd003147.pub5>
- Moura, C. de, Chaves, E. de, Cardoso, A. C., Nogueira, D. A., Azevedo, C., & Chianca, T. C. (2019). Acupuntura auricular Para DorCrônica NAS costasemAdultos: RevisãoSistemática E metanálise. *Revista Da Escola De Enfermagem Da USP*, 53. <https://doi.org/10.1590/s1980-220x2018021703461>
- Rodrigues, A., Muñoz Castro, G., Jácome, C., Langer, D., Parry, S. M., & Burtin, C. (2020). Current developments and future directions in respiratory physiotherapy. *European Respiratory Review*, 29(158), 200264. <https://doi.org/10.1183/16000617.0264-2020>
- Silva, MD, MPH, L., & Schalock, BSc, M. (2013). Treatment of tactile impairment in young children with autism: Results with Qigong Massage. *International Journal of Therapeutic Massage & Bodywork: Research, Education, & Practice*, 6(4). <https://doi.org/10.3822/ijtmb.v6i4.227>
- Sotoodeh, M. S., Arabameri, E., Panahibakhsh, M., Kheiroddin, F., Mirdoozandeh, H., & Ghanizadeh, A. (2017). Effectiveness of yoga training program on the severity of autism. *Complementary Therapies in Clinical Practice*, 28, 47–53. <https://doi.org/10.1016/j.ctcp.2017.05.001>
- Thapar, A., & Cooper, M. (2016). Attention deficit hyperactivity disorder. *The Lancet*, 387(10024), 1240–1250. [https://doi.org/10.1016/s0140-6736\(15\)00238-x](https://doi.org/10.1016/s0140-6736(15)00238-x)