REVIEW ARTICLE

FORMS OF REHABILITATION OF A CHILD WITH AUTISM DESCRIBED IN MODERN MEDICAL LITERATURE

FORMY REHABILITACJI DZIECKA Z AUTYZMEM OPISYWANE WE WSPÓŁCZESNYM PIŚMIENNICTWIE MEDYCZNYM

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ABSTRACT

Introduction
Autism is a complex neurodevelopmental disorder with unknown etiopathogenesis. The clinical picture of every child with autism is different. The spectrum of symptoms includes a number of characteristic features that the patient manifests. Patients often have the problem of coexisting disorders. Difficulties in communication often make it difficult to diagnose. Hence the strictly individualized rehabilitation program, which should be tailored to the needs and preferences of the patient. Effective therapy should be carried out, taking into account the patient’s motivation and pleasure.

Aim
A systematic review of publications for the most commonly used therapies in the rehabilitation of patients with autism and their effectiveness confirmed scientifically.

Material and methods
A review of the literature on the PubMed search engine has been made since 2000. Search terms used: ‘autism’, ‘ASD’, ‘therapy’, ‘physiotherapy’, ‘rehabilitation’.

Results
Among the articles found in the PubMed search after entering keywords, it can be stated that the majority of publications concerned alternative medicine, especially animal therapy. Others have also appeared, e.g. manual therapy, martial arts, acupuncture, choreotherapy or music therapy.

Conclusions
Children with autism spectrum disorders require constant rehabilitation. The form it takes depends individually on the patient’s current state. The chosen therapy may affect one deficit aspect of the child, but not improve another, for which the next treatment is required to improve. Analysis of the publication, however, indicates the positive impact of rehabilitation in children with autism.

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STRESZCZENIE

Wprowadzenie

Autyzm jest złożonym zaburzeniem neurorozwojowym o niepoznanej etiopatogenezie. Kliniczny obraz każdego dziecka z autyzmem jest inny. Spektrum objawów obejmuje szereg charakterystycznych cech, jakie przejawia pacjent. U chorych często obserwuje się problem występowania zaburzeń współistniejących. Trudność w komunikacji nieradko utrudnia ich zdiagnozowanie. Stąd ścisłe zindywidualizowany program rehabilitacji, który powinien być dostosowany do potrzeb, ale i również preferencji chorego. Terapia, która ma odnieść skutek powinna być przeprowadzona z uwzględnieniem motywacji oraz przyjemności dla pacjenta.

Cel

Systematyczny przegląd publikacji pod kątem najczęściej stosowanych terapii w rehabilitacji pacjenta z autyzmem oraz ich skuteczność potwierdzona naukowo.

Materiał i metody

Dokonano przeglądu piśmiennictwa w wyszukiwarce internetowej PubMed od roku 2000. Hasła użyte do wyszukiwania: ‘autism’, ‘ASD’, ‘therapy’, ‘physiotherapy’, ‘rehabilitation’.

Wyniki

Wśród artykułów znalezionych w wyszukiwarce PubMed po wpisaniu słów kluczowych można stwierdzić, że najwięcej publikacji dotyczyło medycyny alternatywnej, szczególnie terapii z wykorzystaniem zwierząt. Pojawiły się również inne, tj. np. terapia manualna, sztuki walki, akupunktura, choreoterapia czy muzykoterapia.

Wnioski

Dzieci z zaburzeniami ze spektrum autyzmu wymagają stałej rehabilitacji. Forma jaką ona przybierze zależy indywidualnie od aktualnego stanu chorego. Wybrana terapia może wpływać na jeden aspekt deficytowy u dziecka, ale nie poprawiać innego, do którego poprawy wymagane jest zastosowanie kolejnej terapii. Analiza publikacji wskazuje jednak na pozytywny wpływ rehabilitacji u dzieci z autyzmem.

Słowa kluczowe: Autyzm, ASD, terapia, fizjoterapia, rehabilitacja

Introduction

Autism (Autism Spectrum Disorder, ASD) is defined as a neurodevelopmental disorder that is characterized by deficits in the social area, communication problems, and the occurrence of stereotypical, repetitive behaviours (Shen et al. 2019).

Epidemiology

Statistics show that 1/54 children in the US have autism (Maenner et al. 2016). In Poland, these data are only estimated, reaching 200,000 people, which means 1/190 children. The United Nations (UN) reports that prevalence in Europe is estimated at 1/160 children (Qun Fang et al. 2019). Over the years, this number has been growing. The upward trend is a disturbing phenomenon, hence the growing interest in autism in the world of science.

Etiopathogenesis

The ethology and pathogenesis of autism are unknown. A review of the literature has
not provided conclusive information on the complexity of this disorder. Research on the causes and mechanisms of autism is being conducted around the world. The genetic and environmental background is indicated (Chaste, Leboyed 2012). Biological, immune and psychosocial factors also deserve attention. It is highly probable that all of them at the same time can affect the person developing an autism spectrum disorder (Bahmani et al. 2016). There is also a division of potential causes into prenatal (e.g. parental age, race, antenatal haemorrhage, a threat to pregnancy, gestational diabetes), perinatal (e.g. gestational age less than or equal to 36 weeks, caesarean section, induced delivery, adverse delivery child), as well as postpartum (including low birth weight, male sex, postpartum haemorrhage) (Wang et al. 2017).

**Diagnostics**

Diagnostics of neurodevelopmental disorders from the spectrum marked by ICD-10 with the F84.0 code for child autism is a complicated, tedious process. The problem is due to the variety of symptoms that can appear at different times and with varying intensity in each patient. Symptoms are manifested in a variety of ways. Only interdisciplinary teams of specialists can undertake such a difficult task. They are based on standardized diagnostic criteria in accordance with DSM-V. This is a classification of mental disorders proposed by the American Psychiatric Association. It includes social and communication deficits (verbal and non-verbal), stereotypical and schematic behaviour, a narrowed area of interest and sensory over responsive or under responsive (Rynkiewicz, Kulik 2013). The final diagnosis is the result of observations, measurements, tests and analyses (Winczura 2019). About 80% of parents notice disturbing symptoms when the child is two years old, 30–50% notice irregularities before the age of one. On average, 24 months pass from seeing the first symptoms to make the diagnosis (Rynkiewicz 2013). It has been estimated that parents usually report to a specialist’s office when the child reaches 19 months of age. Early diagnosis enables implementation at an early stage of therapy, which results in a better prognosis. The introduction of targeted therapy for work on deficit areas also improves the quality of life from the earliest months or years (Shreya et al. 2014).

**Clinical picture**

'Spectrum’ – this concept reflects the complexity and diversity of the described disorder. It covers all symptoms and clinical picture of the patient. The level of their intensity can be completely different (Paglia 2020). Autism in patients manifests itself in disorders in the social area, difficult for both verbal and non-verbal contact, as well as emerging stereotypical behaviours (Winczura 2019). The functioning of people with autism spectrum disorders is not natural. Patients face many difficulties. As many as 86.9% of children are at risk of mobility impairment. Unfortunately, the percentage of people using the help of a physiotherapist, for this reason, is much lower and amounts to 31.6% (Bhat 2020). Insomnia is another challenge for these people – 44–86% of children have sleeping problems. This is a considerable difficulty, because sleep is a time of recovery, and its lack may result in the intensification of abnormal behaviour during the day (Wintler et al. 2020). Over 80% of respondents struggle with gastrointestinal problems (Leader et al. 2020). Over 64% are overweight (Silva, Santos, Silva 2020). Sensory Integration (SI) disorders occur in about 90% of children, which suggests a massive demand for SI therapy (Balasco, Provenzano, Bizzi 2020). People with autism spectrum disorders sometimes suffer from a mental disorder, manifested as anxiety disorder or depression. This can affect their functioning in society (Joshi et al. 2013). In extreme cases, self-harming and even suicidal behaviour occurs (Oliphant, Smith, Grahame 2020). In almost 40%, the immunity is disturbed (Lai, Lombardo, Baron-Cohen 2014). Analyses have shown the possibility of premature death in children with autism compared to
neurotypical children (Hirvikoski, Mitterndorfer-Rutz, Boman 2016).

**Aim**
The aim of the work was a systematic review of publications in terms of the most commonly used therapies in the rehabilitation of patients with autism, and their effectiveness confirmed scientifically.

**Material and methods**
A review of the literature on the PubMed search engine has been made since 2000. Search terms used: ASD, autism, therapy, physiotherapy, rehabilitation.

**Forms of therapy**
In the rehabilitation process of disabled children, including children with autism, motivation and the form of classes, that will be accessible to the patient, are very important. Acceptance of the therapeutic form of rehabilitation of the child is necessary for effective cooperation. Patient involvement later translates into positive effects of rehabilitation (Eversole et al. 2016).

Almost half of the children with ASD, and more specifically, 45% of subjects with autism spectrum disorders use alternative medicine and report its effectiveness. Alternative medical systems such as acupuncture have been shown to be among the most commonly used forms, but ‘mind-body support agents’ such as yoga (Höfer et al. 2019) are also used.

The following are forms of therapy for a child with autism spectrum disorders.

**Results**
Motion therapies

**Physical activity**
A review of the literature provided information on the positive impact of broadly understood physical activity on the functioning of children with autism spectrum disorders. A physiotherapist plays a significant role in this process. Education about healthy movement, as well as consultation with a qualified person is beneficial in the process of proper movement treatment (Cynthia et al. 2019).

Targeted and planned kinesitherapy affects the well-being and health of patients. It improves motor skills but also takes into account the psychological aspect (Fessia et al. 2018). Physical exercises improve cognitive function in children with ASD. Research conducted on this topic indicates an overall improvement of 76% in this area, which helps in the perception of the external environment and communicating with it. This, in turn, translates into improved comfort of the child’s life. It should be noted, however, that these differences are not visible to everyone to a similar extent. It is conditioned by individual factors. (Tan, Pooley, Speelman 2016). Such exercises can also have a positive effect on eliminating stereotypical behaviour. However, it is essential to adapt them to the biomechanics of stereotypes. This means that they must be carefully tailored to each patient and also carried out in a very thoughtful and planned way (Tse, Pang, Lee 2018). Further research on physical activity is suggested in people diagnosed with autism.

**Sport**
Children with autism spectrum disorders often have problems with excessive weight. Research shows that 64.1% of children with ASD are overweight (Silva, Santon, Silva 2020). It is therefore essential that these children participate in sporting activities, e.g. these can be prefably team sports. This will allow regulating their body weight, which may increase as a result of the effects of psychotropic drugs given to the patient. This problem may also result from gastroenterological disorders. Gastrointestinal problems occur in almost 85% of patients. Noteworthy is the restriction of gluten in the diet (Marggraff, Constantino 2018).

**SPARK training**
SPARK training is successful in treating children with autism spectrum disorders in improving both static and dynamic balance. It improves motor coordination and
social interactions. Through exercises, it affects various spheres. SPARK training is a proven specialist in physical education. The assumptions are based on enhancing well-being and socialization, as well as the joy felt by participants. The part devoted to health exercises consists of elements of running, jumping and aerobic dance, while the fitness part contains, e.g. aspects of football and basketball. Team games force interaction with other people, which positively affects people with ASD who often have the problem of social withdrawal (Najafabadi et al. 2018).

**Exergaming**

Exergaming – modern technology also appears among forms of therapy. It is a digital game that requires physical activity from participants. It uses techniques that track the movement of the child. The level of difficulty can be adjusted depending on the needs as well as the child’s skills. The form of physical activity is also adapted to the user’s preferences. Improvement of cognitive functions thanks to vibrant graphics and physical activity are the main motives/advantages of using this method in improving children with ASD. Through play, the child is in constant motion. The position is diverse, encouraging physical activity, as well as a space for exercise in a place chosen by the guardians – a private one – which can provide comfort to the child. Motor skills and the emotional sphere are not improved when using this method (Fang et al. 2019).

**Martial arts**

Implementing children in martial arts, such as MMA (Mixed Martial Arts), can positively affect the cognitive functions of this group. However, the child’s age and individual preferences should be taken into account (Phung, Goldberg 2019). The impact of karate techniques on the functioning of children with autism was examined. Improvement after the implementation of this intervention appeared in the field of communication (Bahrami et al. 2016). In turn, Kata training reduces stereotypes. Over 42% of participants improve (Bahrami et al. 2012).

**Animal therapy**

**Hipppotherapy**

Most scientific reports, more than 20% of searches found in PubMed after entering keywords indicate therapies with the participation of animals. Horses are the most commonly used creatures to treat people with ASD. Hippotherapy, i.e. therapy with horses is primarily about communing with the animal, regular meetings with it. It is not necessarily horse riding. Care, stroking, or feeding is already part of the rehabilitation. Children recognize that there are other living beings in the world with whom you can integrate and that can be enjoyable. Children notice therapists, open up to parents. They begin to see the outside world (Chmiel et al., Kubińska, Derewiecki 2014). These exercises increase children’s motivation and involvement in activities or establishing relationships. They counteract social withdrawal (Llambias et al. 2016). Improvement occurs in the sphere of communication, socialization, motor behaviour and adaptation. Hyperactivity is reduced (Gabrieils et al. 2015). Hippotherapy has positive effects in 99% of children with autism spectrum disorders. There are suggestions that therapy with horses should be performed before stressful events for the child, such as medical treatments (Yap et al. 2017, Scheinberg, Williams 2017). Hippotherapy triggers empathy in children (Anderson, Meints Brief 2016). However, it should be noted that this is supportive therapy and does not improve the functioning of children in every aspect (Cerino et al. 2016). Hippotherapy affects the social sphere; in 70% of children, improvement is visible when attending classes regularly, in 63% this improvement is maintained. The number of therapeutic sessions is proportional to the level of development in the withdrawal of children (Holm et al. 2014). This can be assessed, among others, using the CARS scale. This is a gradual scale for assessing child autism. The questionnaire is
completed by the researcher. It is best when the re-examination is carried out by the same specialist, and then the result will be more reliable. The CARS score improves after the third month of practicing horse therapy (Kern et al. 2011).

Dogotherapy
Dogs' involvement in therapy (dogotherapy) is also widespread. Dogotherapy is a method supporting the rehabilitation process, especially in children requiring long-term rehabilitation, with chronic diseases (Bociarska et al. 2019). Dogs participating in it are trained and certified. The presence of a qualified specialist who knows the animal with whom he works is also required. Classes can take the form of playing with a dog (Animal Assisted Activity, AAA) and therapy with a four-legged animal (Animal Assisted Therapy). It also finds its application in supporting educational processes. Exercises proposed by the therapist should be adjusted to the child's age and problems. The first positive effects may appear after the first month of participation (minimum of four meetings) (Nawrocka-Rohnka 2010). Studies proving its effectiveness indicate a visible improvement in everyday functioning in the assessment of the family (Siewersten, French, Teramoto 2015). Improvement is also noticeable in the area of facial expressions and positive gestures, as well as communication (Michelotto et al. 2019). Studies show a close correlation between social and motor factors in patients with ASD (Bo et al. 2019). Dog therapy also helps to increase the child's physical fitness, and also affects social contacts. Participants show willingness to cooperate with a therapist, become more open and show more emotions. Greater trust and a sense of security can be seen in them.

Pet therapy
It is also possible to adopt and train a quadruped as a guide dog. The effectiveness of this solution is very individual, and this option should be considered for a particular child. However, overall effectiveness has been proven to improve both conflict resolution skills and enriching social contacts (Hall et al. 2016, Wright, Mills 2016). Parents of children with ASD report greater peace of mind for their safety, as well as relief and greater freedom from the restrictions associated with autism. It also translates into the possibility of increasing independence for children with ASD (Burgoyne et al. 2014).

Alternative therapies
Sensory integration therapy
Sensor processing includes receiving, organizing and interpreting information provided with the sensors – vision, hearing, touch, taste, smell, the vestibule (Radzimińska et al. 2015). Sensory integration came into existence in response to irregularities associated with it. It includes the assistance of motor reactions in response to stimuli that come from the external environment. The sensory integration therapy proposed by the creator – Ayres – is used in about 90% of children with ASD. Over- or under responsivity to sensory stimuli has been observed in children with ASD. SI content therapy has very high efficiency in this area. It helps in the perception of senses, as well as organizing sensory experiences, expanding the range of horizontal arousal, which can improve the quality of everyday life. For this purpose equipment, including swings or objects of various shapes and contents, is used. However, it should be remembered that every child may have disorders in a different sensor device, and the therapy is selected individually to meet the needs and deficits of the child. It is run by a certified, trained SI therapist (Kilroy et al. 2019, Aziz-Zadeh, Cermak 2019). Disorders of sensory integration can have a significant scope to contribute to learning difficulties (Wasilewski 2018). They affect 5 to 16% of school children and can result in inhibition of intellectual and social development (Owen et al. 2013). Sensory integration therapy can improve the quality of life of children with ASD. The effectiveness of this therapy in improving the sensation of
pain and tactile stimuli was studied (Riquelme et al. 2018, Hatem, Montoya 2018).

Craniosacral therapy
There have been reports of the effectiveness of craniosacral therapy. It is used to reduce the symptoms of autism and brings positive effects in the daily functioning of children. The goal is to mobilize connective tissues that have been reduced. The therapist gets acquainted with the rhythm of the patient’s body movements. The therapy serves to deepen inflation and deflation of the brain as well as the spinal cord. This rhythm characterizes the production, movement and resorption of cerebrospinal fluid. The quality of this movement helps the therapist to determine where the restrictions are localized. There are suggestions that neurobehavioural dysfunctions may be the result of impaired cerebrospinal fluid flow. Hence the suggestions for the introduction of this form of therapy in the process of children’s rehabilitation, which would help in a positive perception of the environment (Kratz et al. 2017, Kerr, Porter 2017).

Manual therapy
Recent research indicates the effective use of manual therapy to combat the symptoms of autism. This is one of the few forms of structural therapy (the majority is included in functional rehabilitation). It is based on manual physiotherapy or manipulation. The improvement is noticeable in all deficit areas, but up to a certain level. Soft tissue therapy, as well as myofascial release, are probably the first to have proven effectiveness in controlling all symptoms of autism, but without eliminating them. They affect skeletal muscle relaxation, stimulate muscle stretching, and affect blood and lymph circulation. Recreation involves finding a limit and then applying firm but mild pressure at a pathological site (Jungade 2020).

Yoga, choreotherapy, music therapy
Yoga, choreotherapy and music therapy based on a relaxation response are classified as alternative medicine and play an essential role in the process of improving children with ASD. Behavioral efficacy, as well as a change in the severity of some features of autism, confirm the correctness of using these methods as methods complementing therapy (Rosenblatt 2011). Yoga has a positive effect on the overall behaviour of children (Koenig et al. 2012, Buckley-Reen, Garg 2012). Choreotherapy affects the emotional sphere. It improves coping with emotions, as well as body control, synchronization, but also imitation and reciprocity, which is often a problem in this group of disabled children (Koehne et al. 2016).

Acupuncture
There are reports on the use of acupuncture in children with ASD. It turns out that this therapy can be tolerated by children and bring positive effects to the child-parent relationship. It is a non-pharmaceutical form of treatment that works well for children with autism (Warren, Rao, Paton 2017). Electro-acupuncture helps to improve self-service skills as well as language comprehension. (Wong, Chen 2010). The intellectual and sensory response and stereotype can also be improved (Chen et al. 2008, Wu, Wong 2008).

The assessment of the effectiveness of rehabilitation measures used in children with autism is a very complicated topic due to the characteristics of the disorder in question. Cognitive and communication deficits very often limit the possibility of objective assessment (Table 1). Nevertheless, due to the constant growth of these children, one should look for such forms of rehabilitation that will improve the prognosis and increase the likelihood of independence in adulthood.

Conclusions
Children with autism spectrum disorders require regular therapeutic interaction.

Rehabilitation has a positive effect on the functioning of children with autism and increases their quality of life.

The form of rehabilitation depends on the current state of health, pathological symptoms
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Table 1. Effectiveness of therapy including the area of impact.

| Form of rehabilitation | Impact area | Effectiveness | Source |
|------------------------|-------------|---------------|--------|
| Physical activity      | cognitive functions, stereotypical behaviour, motor skills | about 75% of children improve | Cynthia et al. 2019, Fessia et al. 2018, Tan et al. 2016, Tse et al. 218 |
| Sport                  | weight regulation | performance not confirmed (no explicit percentage data describing effectiveness) | Marggraff et al. 2018, Silva et al. 2020 |
| Hippotherapy           | social relations, communication, hyperactivity, socialization, adaptation, motor functions | about 70% of children function better when they attend hippotherapy regularly | Anderson et al. 2016, Cerino et al. 2016, Chmielewski et al. 2015, Gabriels et al. 2015, Holm et al. 2014, Kern et al. 2011, Lliambias et al. 2016, Yap et al. 2017 |
| Pet Therapy            | physical fitness, facial expressions, gestures, communication, trust, fear, emotions, motivation to acquire knowledge | physical fitness – about 56% communication – 54-70% | Bo et al. 2019, Bociarski et al. 2019, Michelotto et al. 2019, Nawrocka-Rohnska 2010, Siewertsen 2015 |
| Guide dog              | social relations, solving the conflict, calm of guardians | efficiency not confirmed | Burgoyne et al. 2014, Hall et al. 2016 |
| SPARK training         | static and dynamic balance, motor coordination, social interactions | coordination improved from 8.3 to 33.3% | Najafabadi et al. 2018 |
| Sensory integration therapy | reduction of pain reactions in response to touch | in 90% of children with ASD, SI therapy is used and produces positive results. | Kilroy et al. 2019, Owen et al. 2013, Radziminska et al. 2015, Riquelme et al. 2018, Wasilewski 2018 |
| Craniosacral therapy   | daily functioning | efficiency not confirmed | Kratz et al. 2017 |
| Exergaming             | cognitive functions | efficiency not confirmed | Fang et al. 2019 |
| Martial arts           | cognitive functions communication, stereotypical behaviour | over 40% of children practising martial arts perform better compared to children who did not participate in classes | Bahrami et al. 2016, Bahrami et al. 2012, Phung et al. 2019 |
| Manual therapy         | improvement in all deficit areas | efficiency not confirmed | Jungade 2020 |
| Yoga, choreotherapy, music therapy | behavioral range, emotional sphere, body control synchronization, imitation and reciprocity | efficiency not confirmed | Koehne et al. 2016, Koenig 2012, Rosenblatt 2011 |
| Acupuncture            | child-parent relationship, self-care, language comprehension intellect, sensory reactions stereotypes | efficiency not confirmed | Chen et al. 2008, Warren et al. 2017, Wong et al. 2010 |

presented by a person with ASD and the child’s preferences.

Each child with ASD presents different symptoms with varying severity, which is why therapy should be selected individually, targeted at deficit areas.

Therapy for every child with autism can affect to a different extend. In addition, it can affect one aspect without visible improvement in another area. Then additional rehabilitation measures are required.

REFERENCES
Anderson S, Meints K. (2016) 'Brief Report: The Effects of Equine-Assisted Activities on the Social Functioning in Children and Adolescents with Autism Spectrum Disorder', J Autism Dev Disord. 46(10) pp. 3344–3352.
Bahrami F, Movahedi A, Marandi SM, Sorensen C. (2016) ‘The Effect of Karate Techniques Training on Communication Deficit of Children with Autism Spectrum Disorders’, J. Autism Dev Disord. 46(3) pp. 978–986.

Bahrami F, Movahedi A, Marandi SM, Abedi A. (2012) ‘Kata techniques training consistently decreases stereotypy in children with autism spectrum disorder’, Res Dev Disabil. 33(4) pp. 1183–1193.

Balasch L, Provenzano G, Bozzi Y. (2020) ‘Sensory Abnormalities in Autism Spectrum Disorders: A Focus on the Tactile Domain, From Genetic Mouse Models to the Clinic’, Front Psychiatry, pp. 1000–1016.

Bhat AN. (2020) ‘Is Motor Impairment in Autism Spectrum Disorder (ASD) Distinct From Developmental Coordination Disorder (DCD)? A Report From the SPARK Study’, Phys Ther. 100 (4) pp. 633–644.

Bhat S., Acharya U. R., Adeli H., Bairy G. M., Malik S, Hartman L, McPherson AC, Gibson BE, Jachyra P. (2019) ‘Exploring the Role of Physiotherapists in the Care of Children with Autism Spectrum Disorder’, Phys Occup Ther Pediatr. 39(6) pp. 614–628.

Eversole M, Collins DM, Karmarkar A, Colton L, Quinn JP, Karsbaek R, Johnson JR, Callier NP, Hilton CL. (2016) ‘Leisure Activity Enjoyment of Children with Autism Spectrum Disorders’, J Autism Dev Disord. 46(1) pp. 10–20.

Fang Q, Aiken CA, Fang C, Pan Z. (2019) ‘Effects of Exergaming on Physical and Cognitive Functions in Individuals with Autism Spectrum Disorder: A Systematic Review’, Games Health J. (8) pp. 74–84.

Fessia G, Manni D, Contini L, Astorino F. (2018) ‘Strategies of planned physical activity in autism: systematic review’, Rev Salud Publica (Bogota). 20(3) pp. 390–395.

Gabriels RL, Pan Z, Dechant B, Agnew JA, Grim N, Mesibov G. (2015) ‘Randomized Controlled Trial of Therapeutic Horseback Riding in Children and Adolescents With Autism Spectrum Disorder’, J Am Acad Child Adolesc Psychiatry. 54(7) pp. 541–549.

Hall SS, Wright HF, Mills DS. (2016) ‘What Factors Are Associated with Positive Effects of Dog Ownership in Families with Children with Autism Spectrum Disorder? The Development of the Lincoln Autism Pet Dog Impact Scale’, PLoS One. 11(2) pp. 1–19.

Hirvikoski T, Mittendorfer-Rutz E, Boman M. (2016) ‘Premature mortality in autism spectrum disorder: a case report’, Riv Psichiatri. 51(6) pp. 270–274.

Chaste P, Leboyer M. (2012) ‘Autism risk factors: genes, environment, and gene-environment interactions’, Dialogues Clin Neurosci. 14(3) pp. 281–292.

Chen WX, Wu-Li L, Wong VC. (2008) ‘Electroacupuncture for children with autism spectrum disorder: pilot study of 2 cases’, J Altern Complement Med.14(8) pp. 1057–1065.

Chmiel K, Kubińska Z, Derewiecki T. (2014) ‘Terapia z udziałem zwierząt w rehabilitacji różnych form niepełnosprawności’, Probl Hig Epidemiol. 95(3) pp. 591–595.

Cynthia C, Duck M, McQuillan R, Brazill L, Malik S, Hartman L, McPherson AC, Gibson BE, Jachyra P. (2019) ‘Exploring the Role of Physiotherapists in the Care of Children with Autism Spectrum Disorder’, Phys Occup Ther Pediatr. 39(6) pp. 614–628.

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spectrum disorder’, Br J Psychiatry 208(3) pp. 232–238.
Holm MB, Baird JM, Kim YJ, Rajora KB, D’Silva D, Podolinsky L, Mazefsky C, Minshew N. (2014) Therapeutic horseback riding outcomes of parent-identified goals for children with autism spectrum disorder: an ABA’ multiple case design examining dosing and generalization to the home and community’, J Autism Dev Disord. 44(4) pp. 937–947.
Höfer J, Hoffmann F, Kamp-Becker I, Küpper C, Poustka L, Roepke S, Roessner V, Stroth S, Wolff N, Bachmann CJ. (2019) ‘Complementary and alternative medicine use in adults with autism spectrum disorder in Germany: results from a multi-center survey’, BMC Psychiatry. 1:19(1) pp. 1–8.
Joshi G., Wozniak J., Petty C., Martelon MK., Fried R., Bolfek A., Kotte A., Stevens J., Furtak SL., Bourgeois M., Caruso J., Caron A., Biederman J. (2013) ‘Psychiatric comorbidity and functioning in a clinically referred population of adults with autism spectrum disorders: a comparative study’, J Autism Dev Disord. 43(6) pp. 1314–1325.
Jungade S. (2020) ‘Manual physical therapy as a novel treatment modality for Autism spectrum disorder – A pilot study’, J Complement Integr Med. 31 p. 1.
Kern JK, Fletcher CL, Garver CR, Mehta JA, Grannemann BD, Knox KR, Richardson TA, Trivedi MH. (2011) ‘Prospective trial of equine-assisted activities in autism spectrum disorder’, Altern Ther Health Med. 17(3) pp. 14–20.
Kilroy E., Aziz-Zadeh L., Cermak S. (2019) ‘Ayres Theories of Autism and Sensory Integration Revisited: What Contemporary Neuroscience Has to Say’, Brain Sci. 9(3) pp. 68–69.
Koeheh S, Behrends A, Fairhurst MT, Dziobek I. (2016) ‘Fostering Social Cognition through an Imitation- and Synchronization-Based Dance/Movement Intervention in Adults with Autism Spectrum Disorder: A Controlled Proof-of-Concept Study’, Psychother Psychosom. 85(1) pp. 27–35.
Koenig KP, Buckley-Reen A, Garg S. (2012) ‘Efficacy of the Get Ready to Learn yoga program among children with autism spectrum disorders: a pretest-posttest control group design’, Am J Occup Ther. 2012 66(5) pp. 538–546.
Kratz SV, Kerr J, Porter L. (2017) ‘The use of CranioSacral therapy for Autism Spectrum Disorders: Benefits from the viewpoints of parents, clients, and therapists’, J Bodyw Mov Ther. 21(1) pp. 19–29.
Lai MC, Lombardo MV, Baron-Cohen S (2014) ‘Autism’ Lancet 8,383(9920) pp. 896–910.
Leader G, Tuohy E, Chen JL, Mannion A, Gilroy SP. (2020) ‘Feeding Problems, Gastrointestinal Symptoms, Challenging Behavior and Sensory Issues in Children and Adolescents with Autism Spectrum Disorder’, J Autism Dev Disord 50(4) pp. 1401–1410.
Llambias C, Magill-Evans J, Smith V, Warren S. (2016) ‘Equine-Assisted Occupational Therapy: Increasing Engagement for Children With Autism Spectrum Disorder’, Am J Occup Ther. 70(6) pp. 1–2.
Maenner M. J., A. Shaw K. A., Baio J, Washington A., Patrick M., DiRienzo M., Cristensen D. L., Wiggins L. D., Pettygrove S., Andrews J. G., Lopez M., Hudson A., Baroud T., Schwenk Y, White T, Rosenberg C. R., Lee L-C., Harrington R., Hewitt M. H. A., Esler A., Hall-Lande J., Poynter J. N., Hallas-Muchow L., Constantino J. N., Fitzgeral R. T., Zahorodny W., Shenouda J., Daniels J. L., Warren Z., Vehorn A., Salinas A., Durkin M. S., Dietz P.M. (2020) ‘Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years – Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States’, Surveillance Summaries 69(4) pp. 1–12.
Marggraff A, Constantino JN. (2018) ‘Physical and Psychosocial Impact of a University-Based, Volunteer Student-Led Running Program for Children With Autism Spectrum Disorder’, J Am Acad Child Adolesc Psychiatry. 57(12) pp. 97–977.
Michelotto ALL, Anater A, Guebert MCC, Borges TD, Michelotto PV Jr, Pimpão CT. (2019) ‘Animal-Assisted Activity for Children with Autism Spectrum Disorder: Parents’ and Therapists’ Perception’, J Altern Complement Med. 25(9) pp. 928–929.
Najafabadi MG, Sheikh M, Hemayattalab R, Memar AH, Aderyani MR, Hafizi S. (2018) ‘The effect of SPARK on social and motor skills of children with autism’, Pediatr Neonatol. 59(5) pp. 481–487.

Nawrocka-Rohnka J. (2010) ‘Dogoterapia jako metoda wspomagania rehabilitacji dziecka z zaburzeniami rozwoju’, Nowiny Lekarskie 79, 4, 304–310.

Oliphant RYK, Smith EM, Grahame V. (2020) ‘What is the Prevalence of Self-harming and Suicidal Behaviour in Under 18s with ASD, With or Without an Intellectual Disability?’, J Autism Dev Disord. 50 pp. 3510–3524.

Owen JP., Marco EJ., Desai S., Fourier E., Harris J., Hill SS., Arnett AB., Mukherjee P. (2013) ‘Abnormal white matter microstructure in children with sensory processing disorders’, NeuroImage: Clinical 2 pp. 844–853.

Paglia L. (2020) ‘Children diagnosed with ‘ASD’ are first of all... children’, Eur J Paediatr Dent. 1(1) pp. 8–9.

Phung JN, Goldberg WA. (2019) ‘Promoting Executive Functioning in Children with Autism Spectrum Disorder Through Mixed Martial Arts Training’, J Autism Dev Disord. 49(9) pp. 3669–3684.

Radzimińska A., Strojek K., Kaźmierczak U., Weber-Rajek M., Srokowski G., Bułatowicz I., Goch A., Zukow W. (2015) ‘Ocena zachowania dziecka z zaburzeniem integracji sensorycznej. Assessment of the behavior of a child with sensory integration disorder’, Journal of Education, Health and Sport. 5(11) pp. 685–697.

Riquelme I, Hatem SM, Montoya P. (2018) ‘Reduction of Pain Sensitivity after Somatosensory Therapy in Children with Autism Spectrum Disorders’, J Abnorm Child Psychol. 46(8) pp. 1731–1740.

Rosenblatt LE, Goranta S, Torres JA, Yarmush RS, Rao S, Park ER, Denninger JW, Benson H, Fricchione GL, Bernstein B, Levine JB. (2011) ‘Relaxation response-based yoga improves functioning in young children with autism: a pilot study’, J Altern Complement Med. 17(11) pp. 1029–1035.

Rynkiewicz A., Kulik M. (2013) ‘Wystandaryzowane, interaktywne narzędzia do diagnozy zaburzeń ze spektrum autyzmu a nowe kryteria diagnostyczne DSM-5’, Psychiatry 10, 2 s. 41–48.

Shen L, Liu X, Zhang H, Lin J, Feng C, Iqbal J. (2019) ‘Biomarkers in autism spectrum disorders: Current progress’, Clin Chim Acta. 502 pp. 41–54.

Siewertsen CM, French ED, Teramot M. (2015) ‘Autism spectrum disorder and pet therapy’, Adv Mind Body Med. 29(2) pp. 22–25.

Silva DVD, Santos PNM, Silva DAVD. (2020) ‘Excess weight and gastrointestinal symptoms in a group of autistic children’, Rev Paul Pediatr. 38 pp. 1–6.

Tan BW, Pooley JA, Speelman CP. (2016) ‘A Meta-Analytic Review of the Efficacy of Physical Exercise Interventions on Cognition in Individuals with Autism Spectrum Disorder and ADHD’, J Autism Dev Disord. 46(9) pp. 3126–3143.

Tse CYA, Pang CL, Lee PH. (2018) ‘Choosing an Appropriate Physical Exercise to Reduce Stereotypic Behavior in Children with Autism Spectrum Disorders: A Non-randomized Crossover Study’, J Autism Dev Disord. 48(5) pp. 1666–1672.

Wang C, Geng H, Liu W, Zhang G. (2017) ‘Prenatal, perinatal, and postnatal factors associated with autism: A meta-analysis’, Medicine (Baltimore) 96(18).

Warren LR, Rao PA, Paton DC. (2017) ‘A Pilot Observational Study of an Acupressure/ Acupuncture Intervention in Children with Autism Spectrum Disorder’, J Altern Complement Med. 23(11) pp. 844–851.

Wasilewski TP. (2018) ‘Integracja sensoryczna i jej znaczenie dla funkcjonowania i rozwoju mowy dziecka”, Pediatria i Medycyna Rodz. 14 (1) s. 20–32.

Winczura B. (2019) ‘Wczesne rozpoznawanie autyzmu u małych dzieci – sygnały ostrzegawcze dla diagnozy zaburzeń ze spektrum autyzmu”, Psychiatr Psychol Klin 19 (2) s. 216–225.

Wintler T, Schoch H, Frank MG, Peixoto L. (2020) ‘Sleep, brain development, and autism spectrum disorders: Insights from animal models’, J Neurosci Res.
Wong VC, Chen WX. (2010) ‘Randomized controlled trial of electro-acupuncture for autism spectrum disorder’, Altern Med Rev.15(2) pp. 136–146.

Yap E, Scheinberg A, Williams K. (2017) ‘Attitudes to and beliefs about animal assisted therapy for children with disabilities’, Complement Ther Clin Pract. 26 pp. 47–52.