

EFFECTS OF HIPPO THERAPY ON MOTOR ASPECTS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

Research notes

Diyana Georgieva¹ and Veselina Ivanova²

^{1,2} Trakia University, Faculty of Education, Stara Zagora, Bulgaria

Abstract

Alternative intervention strategies, such as hippotherapy, have become increasingly popular in autistic children with Autism spectrum disorders (ASD) in recent years. The article is dedicated to research aimed at examining the effects of hippotherapy on motor function in children aged between 7 and 15 with an ASD diagnosis. The study involved 19 children with autism Spectrum disorders. The two standardized tests (the Single-Leg Balance Test and The Posture Assessment Bertotti Scale), covering 3 stages of application (pre-therapy stage, intermediate stage, post-therapy stage) provided important information on the effects of horseback riding on equilibrium stability and body posture of these children. Data were

The final results indicated a significant improvement in balance and body posture in all 19 children. Hippotherapy intervention was determined to have aided in the development of the motor function.

Keywords: *hippotherapy, motor aspects, Autism spectrum disorders children*

INTRODUCTION

In today's sociocultural situation, the problem of integration and inclusion of children with special features in psycho-physical development is becoming more and more relevant. The provision of their physical, mental and social well-being is the subject of research by representatives of various scientific fields (Terzieva, 2019a, 2019b; Doncheva (Дончева), 2016). These value-meaning positions are among the most significant priorities of special education.

Specialized knowledge of atypical development distinguishes children who are grouped in autism spectrum disorders. The continuous increase in their number determines to a large extent the need to choose a special pedagogical technology for successful intervention.

Autism is classified as a generalized developmental disorder that affects multiple subsystems: social communication, behavioral, cognitive and sensory domains. The presence of stereotypical and repetitive behaviors and interests can be added to the major disorders (American Psychiatric Association, 2013). There are pervasive motor disorders in the clinical picture of autism. They manifest in muscle tone disorders in the form of hypertension or hypotension, underdeveloped synchrony of manual movements, causing poor differentiation of fine motor skills (Dziuk et al. 2007; Wiggins, Robins, Bakeman, & Adamson, 2009). Uncoordinated movements of the lower limbs in mobility are observed, forming a hesitant and incorrect gait - walking on the toes is a typical symptom. The movements are devoid of plasticity and flexibility. The absence of synchrony in the actions of the upper and lower extremities is manifested by the poor development of equilibrium stability.

In literature, equilibrium stability is defined as the ability of the body to maintain a vertical position at rest and various activities. Equilibrium is considered to be one of the dominant qualities affecting a child's motor activity. The definitive equilibrium definition includes the ability to maintain a steady-state of the body in a particular position under reduced reference plane conditions. Equilibrium is a constant and necessary component of motion. Postural control becomes an integrative response due to the improvement of the ability to choose appropriate postural strategies based on the prognostic consequences of movement (Assaiante, Mallau, Viel, Jover, & Schmitz, 2005). The deficit in equilibrium stability recalls a negative effect on the accuracy of movements, tempo and rhythm. Exercises in this direction promote the development of motor coordination and

qualities such as agility, courage, determination, confidence. The ability of the body to balance improves by redirecting the center of gravity (O'Brien & Williams, 2010). A crucial skill is to maintaining balance when performing different movements.

In children with autism spectrum disorders, early onset of complexes of stereotyped movements is noted. At the same time, there is a low movement activity, which is manifested in the establishment of a continuous unchanging posture of the body. Improper posture is one of the common manifestations of motor failure (Fournier et al. 2010).

Proper body posture is of particular importance for an individual's good health. Optimal posture has a beneficial effect on reducing stress, muscle tension, tendons, bones, internal organs and systems. The emotional tone and sense of confidence increase.

On the other hand, improper posture causes negative effects on the muscles, joints and spine, putting additional strain on them (Minshew, Sung, Jones, & Furman, 2004). Tension is created, which in turn causes a painful sensation in the lower back, neck, shoulders. It provokes headaches and migraines, as well as problems with the digestive system. The unusual posture of the body worsens sleep, increases fatigue, and creates preconditions for depression. In contrast, a harmonious posture can reduce or eliminate problems that arise. Physiological pain goes through. At the cellular level, afferent impulses are sent to the brain, resulting in the activation of endorphin, an important biochemical stimulator. Motor difficulties in children with ASD impose the use of multimodal interventions to effectively address the underlying and satellite symptoms in this population.

The leading therapeutic models for autism are based on the principles of the Picture Exchange Communication System (Bondy & Frost, 2003), Pivotal Response Therapy (Koegel & Koegel, 2006), ABA-based approaches, Early Start Denver Model (Rogers & Dawson, 2009), Developmental Individual- Difference, Relationship-based model (Kasari et al. 2008), etc. All of the approaches described are focused primarily on improving social communication, behaviour and academic skills of children with autism. Despite the existing evidence for optimizing these patterns, they are not able to meet the motor needs of these children.

Among the modern methods operating in this direction are those whose popularity is constantly increasing. Increasingly, preference is given to curative horseback riding as one of the alternative therapy

models. Hippotherapy is a relatively recent method of psychological, rehabilitation and adaptation support, although the idea of its application originated in ancient Greece in the treatment of neuroses. Over the last 30 years, hippotherapy has evolved as a science-based approach to rehabilitation and adaptation. In Bulgaria, the method has been practiced since the beginning of 1993. He obtained his first scientific substantiation based on studies by N. Gencheva (2002) on the impact of therapeutic riding on social integration and rehabilitation of children with childhood cerebral palsy. Its effectiveness has also been studied in children with musculoskeletal dysfunction (Gencheva, Ivanova & Stefanova, 2015).

Hippotherapy (from Dr. ἵππος - "horse", θεραπεία - treatment) is a type of animal therapy used as a basic means of communication with the animal and for therapeutic riding. The main characteristic of the method is manifested by the harmonious combination of cognitive and physiological mechanisms for special-pedagogical and psychological intervention. According to the neuropsychological theory of A. L. Luria (1976), the unique effect of hippo therapy on the sensorimotor level, taking into account the universal patterns of ontogenesis consists of activating the mechanisms for the development of higher psychic functions. The main differential feature of the method under consideration and other intervention models is the component of a complex influence on the physical and mental sphere of the child. The complex stimulation is conditioned by the favorable combination of two fundamental factors in therapeutic equestrian riding: biomechanical and psychogenic.

Given the subject of the experimental study, the emphasis is placed on the biomechanical factor. The latter has been studied to a greater extent and has been given a leading role in the mechanism of hippo therapy. The influence of the biological factor is due to specific characteristics.

First, it is the effect of oscillations occurring in the region of the back of a moving horse and propagating in three mutually perpendicular planes. Rhythmic variations and a temperature difference improve the circulation of muscles and joints. The result is the generation of alternating voltage and relative relaxation of the torso muscles of the rider, which determines the balance of the human body on the animal during its movement. The limbs of the horse serve as the limbs of the rider as they remain outside the anti-gravity system during the ride and the spine is in direct contact with the back of the animal. Therefore, the maximum load focuses on the muscles of the human body, mainly in the back area. Achieving synchronized movement between child and horse, i.e. the creation of a single biological system is the basis for the correction of a deformed spine.

The emergence of new reflexes, the development of equilibrium stability and the improvement of coordination of movements can be pointed out as other advantages. The development of equilibrium occurs in parallel with symmetrical training and strengthening the muscles of the musculoskeletal system: torso, limbs, joint and ligament apparatus. At the same time, mastering the balance of a horse rider at different speeds of movement determines the emergence and automation of new conditioned and unconditioned reflexes.

The characteristics described contribute to the formation of a new motor skill.

Today, hippo therapy is gaining increasing social significance through its application as a medical approach with a restorative and healing function. However, the Bulgarian literature still lacks sufficient theoretical and methodological developments related to the positives of the method in children with autism spectrum disorders.

The presented analysis of specialized literature sources justifies the choice of the research topic.

METHODS

The main goal of the study is to research the basic parameters of the motor function of children with autism Spectrum disorders and to assess the effects of horseback riding on their development.

The aims of the study were achieved through the following tasks: Development of a conceptual framework and terminology for the research; Analysis of the literature on the therapeutic effects of horse riding for the improvement of motor function in children with autism; Development of an appropriate methodology for the study; Selection of the participants in the experimental study; Comparison of the achievements of the children in the experimental group before and after the sessions of therapeutic horse riding; Analysis of the empirical data from the study and formulation of the conclusions.

The object of the study is the condition of motor function in children with autism. The subject of the experimental study is considered the process of improvement of important motor aspects by using the resources of therapeutic horse riding.

The experimental study involved 19 children with autism Spectrum disorders. Asperger syndrome was found in 76% of them. In 24% of the cases, there is childhood disintegrative disorder. The age range varies from 7 to 15 years.

The experiment covers 5 months. Thirty-five therapeutic sessions are held every week on a pre-established schedule for each specific child. The structure of each therapeutic session contained three parts of treatment: a preparatory part, the main part, and a final part of treatment, with a total duration of 15-20 minutes.

For the study a following battery of tests were used:

Equilibrium Stability Test – children maintain balance from an initial position standing on one leg up to 20 seconds with eyes open.

Bertotti test and posture rating scale during horse riding – the therapist observes the position or symmetry of 5 areas of the child's body: head and neck, shoulders and blades, torso, vertebral column and pelvis. The final rating is formulated by the summation of the rating of each observed part of the body during horse riding. Maximum rating – 15.

Standardized tests are applied in three stages: an initial stage, an intermediate stage, and a final stage. The results are noted in individual protocols.

For the detection of a statistically significant difference between the arithmetic mean of the three tests, a Student's one-sample t-test was used with a predetermined specific for the scientific study control number - "gold standard". The sample analyzed in the study is of moderate size ($15 < N < 30$) and there are no abnormal observations. In the interpretation for the extent of the effect the coefficient d is calculated using the following formula where „A“ is a constant or the "gold standard", „x“ is the arithmetic mean, and „s“ is the standard deviation of the sample.

$$\text{Formula 1: } d = (x - A) / s$$

RESULTS AND DISCUSSION

The following results are obtained for the parameter "equilibrium stability". Since the value obtained for confidence level p is less than 0.05 ($p = 0.01$), it can be concluded that there is a difference between the arithmetic mean $x = 3.42$ and the control number 0. H_0 is rejected and the alternative hypothesis H_1 is accepted, according to which the observed difference in the samples is statistically reliable and can be summarized for the generic sets. There is a statistically significant difference between "input" and the final measurement.

The magnitude of the effect ($d = 0.97$) is calculated according to Formula 1. Because $0.97 > |0.80|$ (Cohen, 1988) the magnitude of the effect is interpreted as much larger than the typical magnitude of

the effect of the model on the test parameter. The obtained data lead to the summary that the equilibrium resistance of the experimental subjects is improved tangibly. The findings of the favorable effect of horseback riding on the mentioned pattern correspond to other literature studies suggesting that the effects after the practice of hippo therapy included improvement in balance and increased range of motion (O'Brien & Williams, 2010). In terms of the structured therapeutic program, the results confirmed the importance of organizing and conducting therapeutic sessions for the development of balance stability. Equilibrium is one of the first habits used by the child in the process of mastering the control of one's own body.

The positive result is due to the rhythmic movements of the horse's back as well as by the habit of getting the correct riding position at the end of the healing course of therapeutic riding.

Higher values were also recorded in the Bertotti test for posture assessment during horseback riding.

The value obtained for the warranty probability p is less than 0.05 ($p = 0.01$). This gives a reason to conclude that there is a difference between the arithmetic mean $x = 3.74$ and control number 11. H_0 is rejected and the alternative H_1 is accepted, which is evidence of a statistically significant difference between the "input" and the last measurement. The magnitude of the effect ($d = 4.73 > |1.00|$) according to Cohen (1988) is interpreted as much greater than the typical magnitude of the effect of the applied system on the position of the examined children during riding. A study that evaluated the trunk alignment in the sitting position, using hippo therapy as a treatment, showed symmetry in the pelvis weight transfer, further dissociation of the pelvic girdle and cervical alignment (Leary & Hill, 1996). Another investigation reports that the sensorimotor stimuli applied to the individual sitting on the horse generate greater muscle activation of the extensor muscle groups of the spine and muscle tone normalization for triggering biomechanical adjustments, facilitating postural control (Debuse et al., 2005, Ajzenman et al. 2018). This data corroborates our findings, which demonstrated that the stimuli provided by hippo therapy contribute to a better alignment of biomechanical structures.

The comparative approach to the Bertotti test results shows the achievement of remarkable progress in posture development during riding. The children have improved the position of their head and straightened their torso – a positive consequence of the manual correction by the therapists and the conditions created for keeping them in an upright position on the back of the horse during riding. All muscle groups have been mobilized throughout the body. The smooth and rhythmic vibrations carried by the pelvis during the horse's drive have improved its stability and steadiness.

CONCLUSIONS

The study aimed to investigate the effects of hippo therapy as an alternative method for improving the motor function of children with autism Spectrum disorders. The obtained results show that hippo therapy is a complex therapeutic method that is suitable for improving the motor skills in children with autism. The following parameters were altered during the study: equilibrium resistance, correct body position, head position and torso straightening. According to the results of this study, horse therapy can be used as an alternative method for these children and may represent a form of rehabilitation in cases when other methods are less successful. The experimental

research is important for the future of children with autism Spectrum disorders and their parents and therapists who put forward extreme efforts to improve the motoring potential of children. Compiling an individual program and strictly controlling the quality of the sessions is necessary for the effects of hippo therapy. It can be a reliable alternative method to help all parties involved in this process.

REFERENCES

- Ajzenman, H.F., Standeven, J.W., Shurtleff, T.L. (2018). Effect of hippo therapy on motor control, adaptive behaviors, and participation in children with autism spectrum disorder: a pilot study, *American Journal of Occupational Therapy*, 67(6), 711-716. *American Journal of Occupational Therapy* (2013), 67(6): 653-663.
- Assaiante, C., Mallau, S., Viel, S., Jover, M., & Schmitz, C. (2005). Development of postural control in healthy children: A functional approach. *Neural Plasticity*, 12, 109-118.
- Bondy, A., & Frost, A. (2003). Communication Strategies for Visual Learners. In: Lovaas OI.(Ed). *Teaching Individuals with Developmental Delays: Basic Intervention Techniques*. Austin, TX: Pro-Ed; pp. 291-304.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Lawrence Erlbaum Associates.
- Debuse, D., Gibb, C., & Chandler, C. (2005). An exploration of German and British physiotherapists' views on the effects of hippo therapy and their measurement. *Physiother Theory Pract*. 21(4), 219-242.
- Дончева Ю. (2016). Рефлексивни характеристики на интерактивната образователна среда в началното училище [Reflective characteristics of the interactive educational environment in elementary school. In Bulgarian.] В Годишна университетска научна конференция на Национален военен университет "Васил Левски", Национален военен университет "Васил Левски", (94-101). София
- Dziuk, M.A., Gidley Larson, J.C., Apostu, A., Mahone, E.M., Denckla, M.B. & Mostofsky, S. H. (2007). Dyspraxia in autism: Association with motor, social, and communicative deficits. *Developmental Medicine and Child Neurology*, 49, 734-739.
- Fournier, K.A., Kimberg, C.I., Radonovich, K.J., Tillman, M.D., Chow, J.W., Lewis, M.H., & Hass, C.J. (2010). Decreased static and dynamic postural control in children with autism spectrum disorders. *Gait and Posture*, 32, 6-9.
- Gencheva, N. (2002). Study of the posture in CP children after Hippo therapy program. In Book of reports from 12th Balkan Sports Medicine Congress and 6th International Congress of Sports Medicine Association of Greece, March 22-24, Thessaloniki.
- Gencheva, N., Ivanova, I., & Stefanova, D. (2015). Evaluation of Hippo therapy in the course of multiple sclerosis treatment. *Activities in Physical Education and Sport*, 5(2), 183-187.
- Kasari, C., Paparella, T., Freeman, S., & Jahromi, L. B. (2008). Language Outcome in Autism: Randomized Comparison of Joint Attention and Play Interventions. *Journal of Consulting and Clinical Psychology*, 76(1), 125-137.
- Koegel, L.K., & Koegel, L.R. (1995). Motivating communication in children with autism. In: E. Schopler, G. B. Mesibov (Eds.), *Learning and cognition in autism*, 73-87, New York: Plenum Press.
- Leary, M. R., & Hill, D. A. (1996). Moving on: Autism and movement disturbance. *Mental Retardation*, 34, 39-53.
- Luria A.R. (1976). *Neuropsychology of memory*. M, Publ. Peter.
- Minshew, N. J., Sung, K., Jones, B. L. & Furman, J. M. (2004). Underdevelopment of the postural control system in autism. *Neurology*, 63, 2056-2061.
- O'Brien, J., & Williams, H. (2010). Application of motor control/motor learning to practice. In J. Case-Smith & J. C. O'Brien (Eds.), *Occupational therapy for children* (pp. 245-274). Maryland Heights, MO: Mosby.
- Rogers, S.J., & Dawson, G. (2009). *Early Start Denver Model for Young Children with Autism*. New York, NY: Guilford Press.
- Terzieva, G. (2019a). A concept for inclusive physical education training program for future pre-school and primary-school teachers. *Pedagogy*, 91(5), 696-701.
- Terzieva, G. (2019b). Формиране на професионална компетентност за адаптирано физическо възпитание. [Professional competence development for adapted physical education. In Bulgarian.] *Educational forum*, E-journal, 1, 40-50.
- Wiggins, L.D., Robins, D.L., Bakeman, R., & Adamson, L.B. (2009). Brief report: Sensory abnormalities as distinguishing symptoms of autism spectrum disorders in young children. *Journal of Autism and Developmental Disorders*, 39, 1087-1091.

Correspondence:

Assoc. prof. Diyana Georgieva, PhD
Trakia University, Faculty of Education, Stara Zagora
Address: 9, Armeyska Str.
E-mail: paskaldi1929@abv.bg