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Effects of exercise programs on the postural status of children with intellectual disabilities: a systematic review study

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Abstract. *Intellectual disability is a state of stopped or incomplete mental development, which is especially characterized by a disorder of those abilities that appear during the developmental period and which contribute to the general level of intelligence. Postural status is a disorder of the spine, chest, upper or lower extremities, and especially of the foot, with a tendency to progress. The research included six original scientific papers. All works satisfied the problem and could give an answer to the set goal. The aim of this study was to determine the effects of exercise programs on the postural status of children with intellectual disabilities. As a method, a selection of works from 2000 to 2016 was taken. We conclude that lack of movement impairs the neuro-motor regulation of body function, leads to a decrease in physical abilities and postural disorders in children with intellectual disabilities, which reduces the adaptive capabilities of the organism and physical abilities. Physical activities that affect postural status are: aerobic activities, swimming and horseback riding. The recommendations would refer to better organization and increase of physical activities of children, by engaging in specialized training sports facilities that will enable work on improving the postural status of children with intellectual disabilities.*

Key words: *postural disorders, children, intellectual disability, spinal deformities.*

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Introduction

Intellectual disability is a state of stopped or incomplete mental development, which is especially characterized by a disorder of those abilities that appear during the developmental period and that contribute to the general level of intelligence, such as speech, cognitive, motor and social abilities[4]. Retardation can occur with or without other mental or physical disorders. Within intellectual disability, there are a number of diseases: Down syndrome, Turner syndrome, Klinefelter syndrome, phenylketonuria, fragile X chromosome, Rett syndrome, autism, cerebral palsy and many others. Approximately 2% of children in the general population have a mental disability, while this percentage is up to 25% among children with cerebral palsy. Among children with epilepsy, mental disability occurs in about 9%. It is also stated that IQ is the result, just one measure of intelligence. Psychologists can measure a child's degree of adjustment or ability to lead daily activities such as feeding, dressing, and social interaction[19].
Recreation, leisure and sports for children with disabilities and people with disabilities contribute daily to improving the general condition of the body, self-affirmation and inclusion in society. Sports and recreational activities are of special importance[15].
The postural status of preschool and younger school children has been researched in our country by many authors, whose results differ somewhat, although they are mostly similar. The most important role in forming and maintaining proper posture is played by muscles as an active part of the locomotor system[22]. Weakness of certain muscle groups, their excessive and one-sided load, can cause the appearance of various disorders on the spine, chest, upper or lower extremities, and especially on the foot. Due to the plasticity and sensitivity of the child's organism, the formation of proper postural status is of special importance in the preschool period of development and in the first years of schooling[21].
Jovović[7] points out that one of the tasks of educational work is a positive impact on the development and health of the child, but the prevention of postural disorders is neglected. For a long time, it has been pointed out that postural disorders in children are constantly increasing. He concluded that the status of the locomotor system is endangered in a large number of children.
Physical activity is important for the health and quality of life of every person with or without a disability[3]. It is especially important for children with developmental disabilities who are disabled due to their condition, ie illness. Water therapies are special because staying in the water gives children a different sense of satisfaction, which is happiness, freedom of movement and greater self-confidence. Aerobic exercise in water confirmed the positive effects on the motor and functional status of children with intellectual disabilities[9,16].
Fraccaroli[8] believes that riding is a complete work of the legs, thighs and pelvis, united in the static preventive work of the torso holder. The positive effects of riding are such that riding is recommended for people with pronounced physiological curvature of the spine. Starting from the thesis that the task of medicine is not only to maintain life and prolong it, but also to improve

the quality of life, it gives us the right to include riding therapy in the treatment of neuromuscular diseases (spastic) despite the cost of therapy.
People with intellectual disabilities are included in a competition called the Special Olympics, and they can compete in three sports at the Paralympic Games. Novelties are sports adapted as Unified sport, where people with intellectual disabilities (athletes) participate in training and competition with people without disabilities[6].

Method of work

Research data found for the purposes of this review were collected through electronic search engines Google, Google scholar, PubMed, Proceedings of international public gatherings, journals in the field of sports sciences and relevant literature that could answer the task. The following key words were used in the research of databases: postural disorders, children, intellectual disability, spinal deformities. The descriptive method was applied in this paper.

The selection of papers is determined on the basis of titles and key words. Two selection criteria have been set. The first criterion refers to the issue of the postural status of children with intellectual disabilities.

The second criterion was the analysis of papers published in the period from 2000 to 2016. From the mentioned time period, six scientific papers were selected that were close to the subject of research and met the criteria for further consideration.

Research that met the set criteria was then analyzed and presented based on the following parameters: author and year of research publication, type of research, age, exercise program and exercise effect.

Results and discussion

The procedure for collecting, analyzing and eliminating found works is shown in Figure 1. Based on key words, 252 works were identified. The number of studies that were immediately excluded on the basis of titles, duplicate papers, as well as papers that were excluded on the basis of the period when they were published (older than 2000) is 211, while 41 papers were included in further analysis. Further analysis of 41 papers excluded 35 papers based on several criteria: abstract, because it was a systematic review of research, as well as the absence of a control group in research. The remaining six papers met the set criteria, namely: papers published in the period from 2000 to 2016. that persons with intellectual disabilities whose postural status was determined participate in the research.

Table 1 shows the papers that deal with different exercise programs and have an effect on the postural status of children with intellectual disabilities. It also shows the results of the application of a certain exercise program, as well as the methods used in working with these people. The analysis of the table shows that various exercise programs generally give positive results on the postural status of children with intellectual disabilities.

Figure 1. The process of collecting, analyzing and eliminating found works

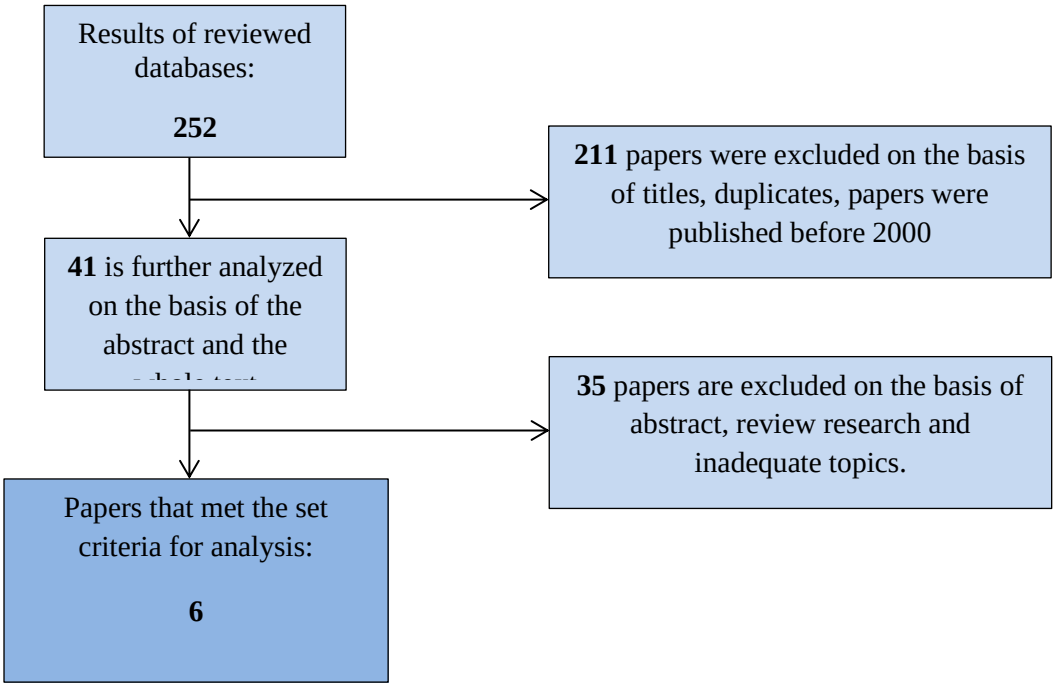

Table 1. Exercise effects of children with intellectual disabilities

Author	Type of research	Age	Exercise program	Exercise effect
[17]Rosegard et al., 2001.	Experimental	11-68	12 weeks, bowling program	Positive effect of exercise for the experimental group
[12]Kasum et al., 2012	Experimental	7-44	Futsal	Positive results in improving ability in tests.
[20]Tešanović et al., 2012	Experimental	15 ± 0.5	Individual corrective exercise	There is no positive impact on postural status during one school year.
[6]Baran et al., 2013	Experimental	12-15	8x90 min	Obtained a positive effect on the postural status of children.
[18]Saban & Kosinac, 2014	Clear	Children of different ages	Horseback riding	Increased mobility of the joints of the spine
[11]Chestnuts, 2015	Experimental	16 ± 0.5	12 weeks	Positive impact on postural status.

The first row of the table contains research data on a sample of athletes aged 11 to 68 (n = 40), who participated in a 12-week "Unified Bowling" program. Rosegard, Pegg & Compton[14]

examining the impact of a unique exercise program with Special Olympics participants, found that group exercise treatment has significantly less internalization and externalization of results. Manova showed that the results are significant for the multivariate interaction of the effects of group exercise. Univariate analysis has determined the importance of internal and external factors of maladaptive forms of behavior of individuals. A positive effect of exercise was found in the experimental group.

The second row of the table contains research data on a sample of people with mental retardation, aged 7 to 44 (n = 26). Kasum et al.[12] in their work confirm the fact that there are more barriers in the life of the respondents that hinder their development than is the case in the lives of most people.

The third row of the table contains research data on a sample of students aged 15 years (± 6 months), which were divided into experimental and control groups. The problem of the research was the effect of the applied contents of corrective exercise on the correction of postural disorders during the one - year schooling of students. Tešanović, Babić and Bošnjak[20] studying the impact of exercise on the development and health of the child, but also the prevention of postural disorders, which was neglected, the application of corrective exercise did not achieve positive effects in the experimental group during one school year.

The fourth row of the table contains data from the research of Baran et al.[6], who in their study examined the effects of eight weeks of aerobic exercise, lasting 90 minutes, on a sample of subjects with Down's syndrome (n = 23) and without Down's syndrome (n = 23), aged 12 up to 15 years. A positive effect on the postural status of children was obtained.

The fifth row of the table contains research data that include horseback riding as a method of choice in the rehabilitation of children with developmental difficulties and postural status problems. In their review paper, Šaban & Kosinas[18] confirm the conclusion that riding has positive effects on the postural status and psycho - physical characteristics of the children included in the research.

The sixth row of the table contains research data examining the impact of aerobic exercise on postural status, obesity, lipid profile and hemodynamic adaptations in people aged 16 ± 0.5 years (n = 46) with intellectual disabilities with or without Down syndrome. Kastanias et al.[11] in this study suggest that a twelve-week program of regular exercise will positively affect postural status, improve body composition, lipid profile, and chemo-dynamic response in people with intellectual disabilities with or without Down syndrome.

Jovović[10] points out kyphosis, lordosis and scoliosis as the most common deformities of the spine in childhood, and cites problems with early diagnosis. Postural disorders of children with intellectual disabilities have been poorly addressed in previous research. The biggest problem actually arises in gathering larger groups of respondents. He concluded that the status of the locomotor system was endangered among a large number of students. No more precise data have been found on the percentage of children with intellectual disabilities who have certain types of postural disorders[2].

Mostly postural disorders were treated as part of medical examinations of children, and anamnestic data obtained from such analyzes are included in general analyzes of physical characteristics and motor abilities, degree of obesity and functional characteristics of children with intellectual disabilities. This review paper singled out eight scientific papers that dealt with

the effects of exercise on children with intellectual disabilities. The lowest age of the respondents was seven years. The applied physical activities were: individual corrective exercise[20], horseback riding[18], aerobic exercise[6,11], indoor soccer[12] See Table 1.

Learning to swim according to the Halliwick concept is primarily intended for children with physical, sensory and combined difficulties, mild and severe developmental difficulties and children with motor developmental disabilities. The entire program is based on the scientific principles of hydrostatics, hydrodynamics and biomechanics, and is implemented through "Ten Points". The ten-point activities taught by the concept include water adaptation skills, breathing control, various forms of body rotation in water, body control in water, and basic swimming movements. Since the program is intended for people with special needs of all categories, it is designed so that each participant has his own helper until the time when complete independence is achieved. Through various games and activities adapted to age and abilities, children are introduced to the properties and behavior of water and how to control their own balance problems. Assessment of swimming abilities is an integral part of learning to swim according to the "Halliwick" concept. In this way, the swimmers' progress can be monitored and a further work program can be planned. Swimmers are tested for red, yellow, green and blue badges. Recently, tests for monitoring the progress of swimming abilities have been elaborated in detail, which is why there is more and more research in this area[1].

The Halliwick concept approach allows children and adults to enjoy water activities and learn to swim at the same time, but using the physical properties of water and their own body movements. This concept has been developed so that groups in which exercise is simultaneously motivated, encourage social interaction and optimize learning.

In 57% of the children who came to exercise according to the Halliwick method, an improvement in abilities and attention was noticed in group work, while in 43% of children it remained the same, which shows that activities and spending time in water really improve the mental abilities of children with cerebral palsy.

Furthermore, in 63% of children with autism, the first changes observed by parents occurred after four to five months, with, in the opinion of parents, the ability and attention to group work improved in 91% of children. Regarding the attitude towards other children, changes were observed in 63% of autistic children, while increased accessibility towards other children was observed in 91%. All parents confirmed that they have had better communication with their children since coming to the pool and exercising[2].

The effects of riding on the body of a child with intellectual disabilities are: psychomotor effects, development of balance and sense of symmetry, muscle strengthening, improving coordination, stretching stiff muscles, relieving cramps, increasing joint mobility, improving respiration and circulation, sensory integration, psychological effects, coordination between eye and hand[18].

Horseback riding is a particularly useful method in the treatment of scoliosis. People with scoliosis up to 25º Cobb can perform symmetrical exercises while riding.

The so-called "Total scoliosis" also includes shoulder girdle exercises. Depending on the character of the pelvic curvature, the emphasis will be on the left or right shoulder18. During riding, the arm, torso and pelvis should be raised ("heliotropism"). People with scoliosis who have completed the ossification process can also use riding in a plaster extensor or corset.

Horse riding requires stretching the muscles of the adductor (receiver) of the thigh. This is achieved by stretching before riding or starting riding on a narrow horse and gradually moving to wider horses. Gravity helps to stretch certain leg muscles when the rider is sitting on a horse without a stirrup. Riding with a stirrup at heel level or below helps stretch the Achilles tendon and leaf muscles. The abdominal and back muscles stretch if the rider is encouraged to maintain an upright position while riding despite the horse's movements. The muscles of the arms and hands are stretched during routine exercise on the horse and during holding and using the bridle. Dimoski, Stojković, Eminović and Grbović[7] found that participation in physical activities, in addition to its importance for physical health and functioning, contributes to the mental well-being of individuals: increasing self-esteem, social support, decreasing depression, etc.
It has been scientifically confirmed that participation and satisfaction in the daily activities of youth with mild mental retardation emphasizes the importance of participation in physical activities as a vital part of the development process in children and youth[13,14].

Conclusion

The effects of previous research on physical activities of children with intellectual disabilities who used aerobic activities (walking, running, football) showed a positive effect on physical and psycho-somatic characteristics, among which a positive relationship was observed, especially if the work was conducted in group activities. not by individual exercise (in a specialized institution - school or at home). The effects of previous research on the physical activity of children with intellectual disabilities have confirmed the positive impact of swimming as an exercise method, not only improving the postural status of children but also their communication with other children participating in the study. It can be concluded that physical activity and exercise of children had a positive effect on their socialization while improving their physical characteristics.
The effects of previous research on the physical activity of children with intellectual disabilities who have used equestrian rehabilitation are a relatively new type of exercise therapy, which is applied through hippotherapy and therapeutic riding. Hypotherapy (Greek "hippos", horse) is a form of medical treatment in which three-dimensional movements of the horse are used to achieve the therapeutic goal. Therapeutic riding must always be applied as one method combined with other methods of treatment, physical exercises, never alone and exclusively. Positive factors of riding therapy include: stimulation of balance and posture reaction, stimulation of normal head and torso posture, stimulation to equalize torso and limb muscle tone, stimulation of rhythmic contractions and flabby muscles, disappearance of fear and gain of self-confidence. Horseback riding as a useful therapeutic tool and method of rehabilitation and recreation is widely recognized and accepted in the world, with many positive effects on the body, psyche and socialization of people with disabilities. This method achieves excellent results in neuromuscular disorders and diseases, providing the only possible replacement for people who do not walk. Great importance is given to the possibilities of therapeutic riding with antiparamorphic function in the treatment of children with postural problems.

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