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BENEFITS OF PRACTICING SPORTS FOR CHILDREN WITH CEREBRAL PALSY. A LITERATURE REVIEW

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ABSTRACT. Physical therapy is one of the most important concerns in an infantile cerebral palsy diagnosis. Multiple studies debate in various directions about the necessity of rehabilitation and reintegration in society as functional persons. There are children who need to do physical therapy for all their life long, but there are also children who reach the main rehabilitation objectives. What should they all do more than physical therapy programs? Does the finished physical therapy sessions is enough for rehabilitated cerebral palsy symptoms? What we propose is physical activity which includes diversity from the point of view of stimulus, interests, social inclusion, and team involvement. All this means adapted sports practice along the physical therapy sessions. All the children involved are stimulated to change their routine and bring some competitiveness, creativity, fun, to participate with others in physical practice, as physical therapy is in general an activity done by him/herself. Bringing together sport and therapy, children's development is improved from physical abilities, fine and motor skills, psychical abilities and cognitive point of view. Introducing sports between physical therapy sessions or after the rehabilitation program, we actually manage to increase the progression pace and to maintain the gains over the deficiencies. As physical health is related to mental well-being, every child who's involved in sports is actually doing a type of treatment. This review explores the benefits of sports for a cerebral palsy diagnosed child.

Keywords: *physical therapy, sports, cerebral palsy, self-confidence, disabled children.*

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REZUMAT. ***Beneficiile practicării sportului pentru copiii diagnosticaţi cu paralizie cerebrală. Sinteză a literaturii ştiinţifice.*** Kinetoterapia este una dintre cele mai importante preocupări în diagnosticul de paralizie cerebrală infantilă. Studii multiple dezbat în diverse direcţii despre necesitatea reabilitării şi reintegrării în societate a acestor copii ca persoane funcţionale. Sunt copii care au nevoie să facă kinetoterapie toată viaţa, însă sunt şi copii care reuşesc să atingă principalele obiective de reabilitare. Ce ar trebui să facă mai mult decât includerea în programele de recuperare? Sunt suficiente programele terminate de kinetoterapie pentru simptomele de paralizie cerebrală reabilitată? Ceea ce propunem este o activitate fizică care include diversitatea din punct de vedere a stimulului, intereselor, incluziunii sociale şi a implicării în echipă. Toate acestea înseamnă practica sportivă adaptată de-a lungul sesiunilor de kinetoterapie. Toţi copiii implicaţi sunt stimulaţi să-şi schimbe rutina şi să aducă puţină competitivitate, creativitate, distracţie, să participe alături de ceilalţi la activitatea fizică, deoarece kinetoterapia este, în general, o activitate solitară. Adunând sportul şi terapia, dezvoltarea copiilor este îmbunătăţită din punct de vedere fizic, al motricităţii grosiere, al motricităţii fine, psihic şi cognitiv. Introducând sportul între şedinţele de kinetoterapie sau după programul de reabilitare, reuşim efectiv să creştem ritmul de progres şi să menţinem ameliorarea deficienţelor. Deoarece sănătatea fizică este legată de bunăstarea mentală, fiecare copil care este implicat în sport efectuează de fapt un tip de tratament. Această recenzie explorează beneficiile sportului pentru un copil diagnosticat cu paralizie cerebrală.

Cuvinte cheie: *kinetoterapie, sport, paralizie cerebrală, încredere în sine, copii cu dizabilităţi.*

THE IMPORTANCE OF CEREBRAL PALSY DIAGNOSE

Cerebral palsy, the most common type of a central motor neuron injury (Morgan et al., 2016), is characterized by symptoms like alteration of muscle control, muscle fatigue, alterations of the fine motor skills, clonus, synkinesis, dystonia, spasticity and accentuation of osteotendinous reflexes.

According to Pakula et al. (2009), the studies of C.D.C. (the U.S. Centers for Disease Control and Prevention) show that the cerebral palsy incidence is between 1.5 till 4 cases out of 1000 children, depending on the geographical area. On the Europe area, there are until 80 cases out of 1000 births of 28-31 gestation weeks and until 1.7 cases out of 1000 births of at least 37 gestation weeks.

A study by Kancherla et al. (2012) made over the population of U.S., analyzed the year 2005 medical costs of all children registered in the Medicaid medical platform (figure 1). The yearly costs for a child without mental retardation

or cerebral palsy were 1674 dollars, the yearly costs for a child with cerebral palsy was 16721 dollars (1000% out of 1674 dollars) and the yearly costs for a child with mental retardation after being diagnosed with cerebral palsy was 43338 dollars (2600% out of 1674 dollars).

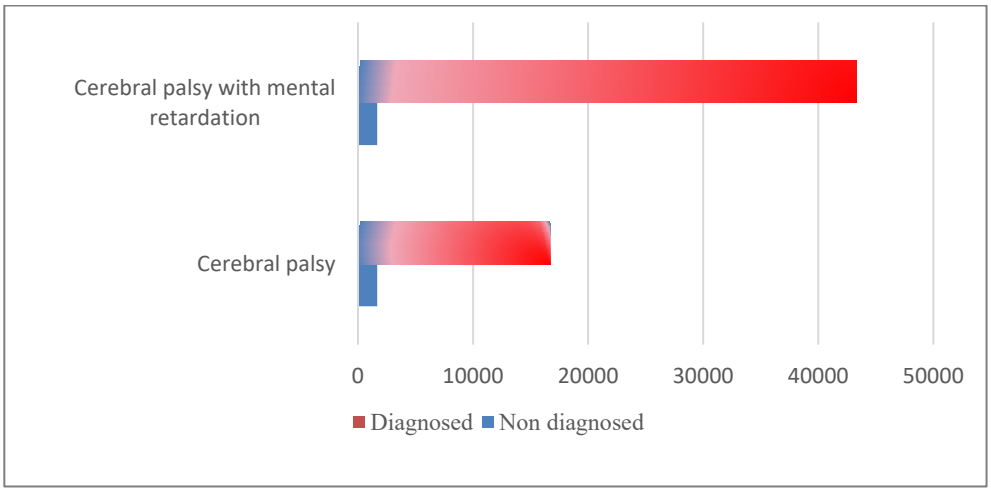

Figure 1. Medical Costs of a Cerebral Palsy Diagnosed Child

Cerebral palsy is usually associated with various other diagnoses and secondary medical conditions. In the study *Cerebral palsy in children: a clinical overview*, conducted by Patel et al. (2020), is described the necessity of a multidisciplinary team management. About half of the cerebral palsy diagnosed children were born at term, with a normal weight and without identifying a risk factor. 90% of all children who survive over 20 years old thanks to an early intervention and appropriate medical care. Through children diagnosed with cerebral palsy, there is a percentage of 75% of children who have quadriplegia and until 95% with diplegia who live at least 30 years; and 65% of children who have a severe cognitive deficiency and 95% with mild cognitive deficiency who can live until 38 years old. Having an appropriate intervention, 3 persons out of 4 can speak and 1 out of 2 doesn't have a cognitive deficiency.

THE CEREBRAL PALSY APPROACH - PHYSICAL THERAPY

A recent study published by Morgan et al. (2021) at the U.C. (University of California), consists in an international guide for specialists aimed to systematize the cerebral palsy into 9 affected parts: motor functionality, muscle tone,

musculoskeletal health, cognitive development, communication, the ability to eat and drink, sleep, visual acuity and the help of parent or guardian.

The specialists from almost all the studies included have the most important recommendations related to the motor functionality and development of cognitive area.

According to Novak, et al. (2017), cerebral palsy represents the most common physical disability and has a very important impact in the population, with an approximately incidence of 1 out of 500 live births. As a child can be diagnosed nowadays before 6 months motor age, comparing to past when he was diagnosed between 12-24 months motor age, the early intervention maximizes the potential functional and neuroplasticity outcomes. The conclusion of this systematic review is that all clinicians, pediatricians, neurologists, orthopedists and physical therapists, should understand the importance of early specific intervention for optimizing the infant cognitive and motor plasticity for preventing complications, secondary impairments and mental well-being.

Another study published in 2023 by Park et al., The effects of neurodevelopmental treatment-based trunk control exercises on gross motor function and trunk control in children with developmental disabilities, concluded that neurodevelopmental treatment-trunk control exercise (NDT-TCE) is an efficient approach measured with Gross Motor Function Measure (GMFM), especially in GMFM B dimension, but with no significance in reactive control. A good trunk control means improvement on developmental stages, from the trunk importance point of view in his role of head and extremities stability provider. NDT-TCE is a method that can be applied on children with disabilities diagnosed with cerebral palsy as a trunk-focused approach.

The study conducted by Das & Ganesh (2019), Evidence-based approach to physical therapy in cerebral palsy, demonstrates the limitations of physical therapy programs in cerebral palsy rehabilitation. Physical therapy is the gold standard in the cerebral palsy treatment and consists in various methods. Even if is recommended and used by all the clinicians involved, its inconsistency is opening for alternatives or add-ons searches. This review found moderate evidence related to the effectiveness of constraint-induced movement therapy for the upper limb recovery, functional training and gait training for improving the gait speed. There is conflicting evidence for the exercises' role on cardiorespiratory and strength training. Another important finding was the ineffective intervention of neurodevelopmental therapy. Reviewing the cerebral palsy approach, researchers found that functional goal-oriented training is the most effective.

THE CEREBRAL PALSY APPROACH – SPORTS AS THE NEXT STEP AFTER THE PHYSICAL THERAPY PROGRAM

According to Booth, et al. (2018), functional gait training has important benefits in cerebral palsy for walking and running motor stages after the physical therapy program. This type of physical activity approach is necessary to do after or at the same time with the other motor stages rehabilitation. The functional gait trainings have a better outcome on walking speed, compared to a standard physical therapy program in (effect size 0.79, p=0.04). Also, this study describes functional gait trainings as being an efficient intervention, safe and feasible that improves the walking and running abilities in both children, teenagers and young adults diagnosed with cerebral palsy. Another conclusion is that walking endurance and everything related to walking motor function benefits from a functional gait training.

A study published in 2022 by Storli, L., Aune, M., A. and Loras, H., *Aspects of developmental pathways toward world-class parasport*, demonstrates that early sport encounters, which is typically in an active or sports involved family environment, have been very important for the athletes with disabilities, shaping their interest in sports practice and focusing on what they can do, not what they can't. This is followed by rich childhood experiences of physical activities through being involved in different coach-led and organized sports. The sports background of a disabled person facilitates contact with the able-bodied peers, working as a substitute for peer-led unorganized physical activities specific to the able-bodied athletes. Furthermore, the intention of becoming an athlete on a high level emerges in the teenager period, where the parents, extended family, friends, coaches and athletes seem to play their role in motivating the improvements and the further progress.

The concept of reverse integration is described in the study of Ramsden, et al., (2023), Sport participation for people with disabilities: exploring the potential of reverse integration and inclusion through wheelchair basketball, where the researchers concluded that prolonged engagement in sports, specifically the wheelchair basketball, was facilitated by the health and social benefits, showing that reverse integration increased mutual understanding of the ability (abilities) and disability impact. The definition of reverse integration is the able-bodied people inclusion into disability sport. Both participants, able-bodied and people with a disability, reported a positive experience, supporting the inclusion of able-bodied as playing an important role in the local sports involvement for the persons with disabilities.

The study *Participant-reported benefits of involvement in an adaptative sports program: a qualitative study*, conducted by Lape et al. (2017), shows the benefits of practicing sports alongside or after the rehabilitation program for subjects with a motor or sensory impairment. The approached themes were physical/health well-being, social relationships, self-confidence and mobility. To gain all the benefits of sports practice, the participants have to confront significant barriers, as hard-to-find programs offer information, transportation or equipment costs.

CEREBRAL PALSY APPROACH – CONTRIBUTIONS OF SPORTS

Athletics is a multitude of disciplines related to one another, which their basics are representative for rehabilitation. It teaches and stimulates the gross motor skills like walking, jumping, running, throwing, or catching (Feitosa et al., 2017).

Basketball is one of the most popular sports for children with disabilities which is promoted in this community by his success on paralympic games and for the ease of playing altogether, disabled and non-disabled participants. It develops the grasping skills, shoulder mobility, eye-hand coordination, balance, strength, resistance and speed endurance.

On the other hand, basketball as a sport has some disadvantages for children diagnosed with cerebral palsy, the most important is the posture, as the body should be in semi-flexion during practice, and the chances of being injured. All these can be managed if there is an injury prevention perspective. A program that trains a proper landing on one and on two legs, core stability, muscular resistance, force and explosion is necessary.

The complexity of basketball is very useful when is used in the therapeutic program as a tool. Each one of its elements, as running, dribbling, throwing, catching, passing, attacking and defending, trains agility, speed, direction changes, core strength, grasping, hand and arm control, jumping, spatial orientation, communication, stress management in a dynamic situation, and much more (Pelemis et al., 2023; Cai et al., 2020; Moss et al., 2020).

Bocce is one of the oldest lawn games who develops motor skills, self-confidence and social contact. One of the biggest advantages is that it can be played almost everywhere and creates the opportunity for children with cerebral palsy to bond one to each other or with their family and friends. According to Huang et al. (2013), the torso and upper extremity coordination and spatial orientation are trained as different texture lightweight balls stimulate playing.

Even if *chess* is considered a sport of the mind, for children with disabilities is also a good alternative of training the fine motor skills, as coordination and grasping, the spatial orientation, strategy, psycho-emotional state, or attention (Mikhaylova et al., 2021). The used pieces are larger than usual and can be fixed on the chess table for easier handling.

Climbing, as the name says, is a sport where participants climb and fall while tracking a specific route already set on the walls. The climber ascends on the route using a rope attached to the top of the wall. It's a known activity for helping people with deficiencies in the rehabilitation and development processes. According to Liu et al. (2022), the climber uses closed-chain movement patterns which is beneficial for his musculoskeletal and neuromuscular system. There are different types of climbing, like deep water soloing, bouldering, or ice climbing, but the most used is top rope climbing. It has an important role for self-confidence, balance, coordination, focusing, agility, muscular force and resistance, planification/strategy and stress-relief.

Cycling is a great sport for children diagnosed with cerebral palsy, from various perspectives. First of all, it trains the endurance, the cardiorespiratory system, balance, strength, proprioception and strengthens the low limbs joints. Then, it increases the mobility of children. This means that one of the benefits is increasing motor capacity, self-confidence, cognitive stimulation, breathing-moving pace coordination, stress reliefs and facilitate accessibility. On the other hand, according to Toovey, et al. (2018), two-wheels bike is a goal for any children with disability, so can be a driver for them to increase their motor capacity in general, and particularly the balance and symmetry.

Football is the most popular sport worldwide (according to Milanovic et al., 2018). Being more than an entertainment and fun activity, football is an intense sport which trains the gross motor skills and social abilities. The trainings focus on high intensity effort, endurance, strength, teamwork and ball control skills. Its social involvement and interest make football one of the best physical activities where children with cerebral palsy can be involved in motor and social skills training (Abasov, et al., 2020).

A study from 2021, published by Sa et al., *Football for people with cerebral palsy: scope review*, reviewed the studies that address football for people with cerebral palsy. The conclusion is that almost all the research was focused on the performance and athletes' sports classes, but not many studied the incidence of injuries and sport classification.

Its physical, psychological and social benefits make gymnastics one of the most efficient and popular sports for children diagnosed with cerebral *Gymnastics* is, alongside athletics, an important part of the basic physical exercises of rehabilitation palsy. From the body alignment and corrected

posture, until balance, speed, resistance, strength, agility, flexibility and motor skills, gymnastics is a complex sport which can be adapted very easily to disabled children (Gitimoghaddam et al., 2019).

Riding, known also as hippotherapy, is considered a nontraditional therapy for children with cerebral palsy. According to Schwesig et al., 2009, it becomes more popular as his efficiency is visible from the point of view of posture and core strength. There weren't many studies about the effects on short-term and long-term practicing. In the last 10 years, was much more approached by researchers. The study *Short-term and long-term effects of riding for children with cerebral palsy gross motor functions*, published by Zaliene et al. (2018), concluded that there are no significant differences on the gross motor functions on a short-term practicing. The long-term has a significant improvement on the gross motor functions, but only for almost half of the subjects. The most important benefits of practicing riding are muscle coordination symmetry, core strength, balance, neuromuscular control, proprioception and joint stabilization.

Swimming is a sport where stereotyped cycle movements have a high energetic cost, but without a socio-educative value, compared to a team sport. As benefits, swimming improves tone, resistance and strength of the muscles, it's an all-over body workout, builds-up cardiovascular fitness, ameliorate coordination, balance and posture, improves flexibility and is a low-impact locomotion for low limbs and spine. The study *Disability and inclusion: swimming to overcome social barriers* published by Imparato et al. (2021) demonstrated the efficiency of swimming for both disabled and non-disabled subjects in a given 8-week training program. Both subjects had an extra physical activity during the program, physical therapy for disabled athletes and Pilates for all the athletes. The results are conclusive, as all the athletes improved their values, while the differences between disabled and non-disabled subjects are the same. The conclusion is that, even though the gap between the two can't be eliminated, the motor and physiological benefits of swimming are for both groups.

CONCLUSIONS

Even if the physical therapy programs are the gold standard in the children with cerebral palsy rehabilitation process, is not enough. By introducing exercises from regular sports basics into rehabilitation program or practicing regular/adapted sports represents a step forward to develop fine and motor skills, amelioration of cardiovascular system, adaptation, socialization, inclusion, teamwork, self-confidence, and much more.

The cerebral palsy diagnosed children are encouraged to go forward and to compete in local or national competitions. This opportunity is given by the facilities for disabled people, the associations or foundations who accept, organize and promote competitions for sports/adapted sports.

Adapted/regular sports are already adopted by many children, teenagers or adults diagnosed with cerebral palsy. The harmonious growth and amelioration of quality of life it should be a driver for all of them to practice sports as daily routine.

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