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Effectiveness of Physiotherapy Interventions in CP Child-Systematic Review

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Abstract: Background and Objective: Intensive physical therapy or exercise has been associated with favorable cerebral palsy (CP) outcomes, but few studies have investigated the effects of exercise intensity on the improvement in CP outcomes. In this review, we assessed the effects of intensive exercise-based therapy on improvement in gross motor function in children with CP. **Method:** This systematic review mainly includes randomized controlled trails and quasi experimental study. Searching done by Google Scholar, PubMed and PEDro from 2015 to 2019. We used terms like-Cerebral palsy, exercise, physiotherapy management. **Result**: Present outcomes shows that physiotherapy intervention is an effective technique for management of CP children. **Conclusion**: Intensive physical exercise improved CP outcomes in the intervention and standard therapy groups. The therapeutic interventions improved CP outcomes among the children who received the therapeutic intervention and standard therapy.
Keywords: Cerebral palsy, exercise, physiotherapy management, strengthening exercise.

Introduction

Cerebral palsy (CP) is a condition characterized by problems in movement and posture due to a lesions in immature brain[1]. Children with cerebral palsy present with faulty postures and problems in motor movements along with oral motor, speech and hearing problems[2]. Cerebral palsy is a major cause of disability in children[3]. Prevalence of cerebral palsy is 2.11 in 1000 live births in total population[4]. This is a non-progressive lesion in brain; however symptoms of cerebral palsy may be progressive with time, for example developing wrong patterns of movements and synergies[5].

Cerebral palsy can be categorized into spastic, athetoid, ataxic, low tone and mixed[4]. Children with spastic cerebral palsy have increased tone in muscles and there is spasticity in one group of muscles. In spastic cerebral palsy there is deficiency of gamma amino butyric acid (GABA), that has inhibitory effects on lower motor neurons[6]. Due to lesion in upper motor, there is deficiency of GABA that can lead to spasticity and increased tone in muscles[7]. In athetoid cerebral palsy, there are involuntary movements in hands and facial muscles and also there is fluctuating tone in muscles[5]. Immaturity and hypoxic brain injury is considered a leading cause in cerebral palsy, other causes may be traumatic brain injury, neonatal infections, pregnancy disorders and exposure to radiations[8].

Physical exercise can reduce many secondary conditions in patients with CP and can help improve posture, muscle tone, and balance[9]. Land-based exercises including muscle strengthening and stretching exercise programs increase the strength and improve gait performance, sit-to-stand capability, and functional performance in children with CP[10,11]. In a randomized controlled trial, a land-based exercise training program also improved the participation level and the quality of life in children with CP[12]. Aquatic exercises are also beneficial in several musculoskeletal conditions and have become more popular in the recent years. It can be applied to children with CP to improve

fitness and function, as the properties of water reduce excessive joint loading and enhance strengthening, providing assistance to children with decreased postural control and muscle weakness[13]. When the body is immersed in warm water (33 ^{0}C to 35 ^{0}C), the core temperature increases; thereby, leading to a reduction in gamma fiber activity which, in turn, reduces muscle spindle activity, facilitating muscle relaxation, and reducing spasticity. This results in an increased range of motion (ROM) in the joints and offers improved postural alignment[13,14].

Aquatic therapy provides many advantages to experience, learn, and enjoy new movement skills, which leads to increased functional skills and mobility, and builds self-confidence. However, there are few studies investigating the effectiveness of aquatic exercise in children with CP. These studies have shown that aquatic exercise may be beneficial in children with CP to improve fitness and function. However, none of these studies used randomization, and/or used blinding, and/or included controls[15-17]. Exercise programmes delivered in the home environment complement direct intervention and help children with CP to achieve the necessary intensity of practice to effect outcome. Home exercise programmes can account for 50%–80% of the total therapy received, with direct intervention with the therapist present making up the remainder[18]. As well as increased intensity of practice, other benefits of home programmes for children with CP include increased involvement of parents in goal setting and training and improved general education about the health condition[19].

Thus, this review was conceived to determine the effect of exercise in management of CP order to find out if exercise management approach is consistent with existing recommendations and guidelines for clinical practice.

Methods

This review study is performed in accordance to PRISMA-Preferred Reporting Items for Systematic Reviews and Meta-Analyses [20].

Search Strategy

The searching was done in PubMed, Goggle Scholar and PEDro. Key words like-Cerebral palsy, exercise, physiotherapy management. We included past 10 years articles (mainly RCTs-Randomized controlled trial) published in English language only from 2010-2019. The title and abstracts of all articles in the searches were screened in accordance with the inclusion and exclusion criteria to identify potentially eligible articles. Full texts of potential articles were read and assessed independently by the two reviewers.

Inclusion and exclusion criteria

The titles and abstracts of articles identified by the initial search strategy were assessed independently by 2 researcher for the following inclusion criteria: (1) population (adults or children with CP), (2) intervention (strength training or progressive resistance exercise program), and (3) outcome (measurement of change in strength, activity [function], or participation).

Studies were excluded if pharmacological therapy, surgery, injections of botulinum toxin-A, and hippotherapy or passive interventions, such as hydrotherapy, laser, reflexology, and orthoses; or did not clearly mention the duration and frequency of intervention in both arms.

Quality assessment

Methodological quality of selected articles was assessed using PEDro Scale[21] consisting of 11 questions in two aspects. Criteria 2-9 assess internal validity and criteria 10-11 assess statistical information required to make a study interpretable. Scoring of each question is done in accordance to its existence or nonexistence in the assessed study. The final scoring is done by the addition of all positive answers.

Studies considered of high quality scoring ≥5 (5/10) as stated by Moseley et al[22]. Therefore in our review all included studies scoring ≥5 were found to be of high in methodological quality. The studies were analyzed in PEDro scale by two independent investigators.

Data Analysis

The screening of included articles was done by two independent investigators. The selected articles were analyzed in an organized manner including parameters given: author-year, study design, subjects-age, interventions, study duration, outcome measures, and results. Differences between the investigators were solved by conversation to reach agreement and settled by using Cohen's kappa statistics.

Results

Studies identified

After implementing the inclusion and exclusion criteria, 50 articles were retrieved using the key words- Cerebral palsy, exercise, physiotherapy management. 35 articles were excluded as they were found in more than one database. For eligibility criteria 15 articles were screened. Further 10 articles excluded because either they were not available in full text, objective not available, they did not meet exclusion and inclusion criteria or no control group (Figure-1). Finally, 10 articles were selected by agreement for quality assessment phase.

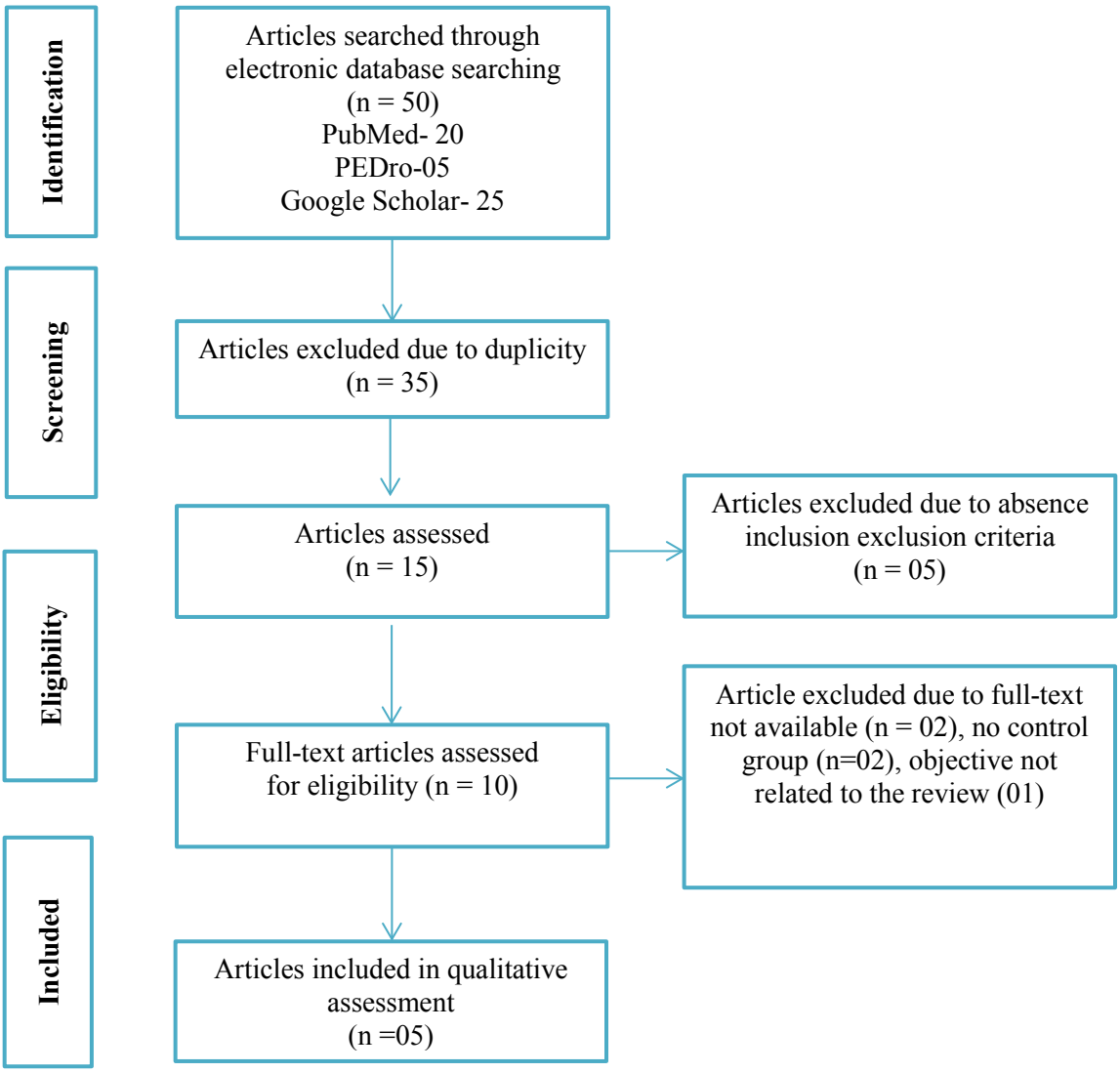

Figure 1. Flow diagram showing the screening and selection of articles

General data of the included studies

Selected articles in this review are summarized in Table 1 including given parameters: author-year, study design, subjects, interventions, study duration, outcome measures, and results. Out of the 05 studies included, three were RCTs[23,24,27] two were experimental design[25,26]. All studies were conducted between 2015 and 2019. Number of participants in the studies ranged from 07 to 45. All articles were experimental. Concerning the efficacy of results established in the most of the articles, both physiotherapy techniques and exercises were found to be significantly effective on pre-and post-intervention assessments.

Outcome Measures

The main outcome measures are Gross Motor Function Measure-88 (GMFM-88), GMFM-66, Timed Up and Go Test (TUG), modified Ashworth Scale (MAS), 01 minute walk test and 6 minutes' walk test, Physiological cost index (PCI), TCMS.

Table 1. Description of the included studies

Author	Study design	Subject	Intervention	Study Duration	Outcome measure	Result
Sevda Adar, Umit Dundar et al. 2017[23]	Randomized controlled trial	N=32	Group I: Aquatic exercise Group II: land-based exercise program	Five times per week for six weeks.	Gross Motor Function Measure-88 (GMFM-88),Timed Up and Go Test (TUG), modified Ashworth Scale (MAS)	Study results suggest that the aquatic exercises are as effective as land-based exercises for spasticity management and motor function improvement in children with CP. Aquatic exercise can result in a higher level of improvement in quality of life scores than the land based exercises. Ultra sonographic muscle compressibility ratio may be used to evaluate muscle elasticity in children with CP.
Mohammad H. Elgawish, Mohammad A. Zakaria 2015[24]	Randomized controlled trial	N=45	Group A: Intensive PT group Group B: Standard PT group	Five sessions weekly for 16 weeks group A. twice weekly for 16 weeks group B	GMFM-88,GMFM-66,	Intensive PT regimens were more beneficial than standard therapy in spastic CP, especially in children with a low functional level.
Farjad Afzal, Sidra Manzoor 2019[25]	Quasi experimental study	N=07	Group: Intervention group	Two days in a week for 12 months	Gross Motor Function Classification System, 01 minute walk test and 6 minutes' walk test.	Treadmill, Stationary cycling with adjustable seat and resistance, strengthening exercises with manual resistance, Functional training, quadriceps build up training, standing activity and walking training activity in combination have significant effects on gross motor function measure, trunk stability, standing time and walking distance in children with athetoid

						cerebral palsy.
Aishah Ahmad Fauzi, Masyitah Mohammad Khayat et al. 2019[26]	Quasi experimental study	N=11	Group: Intervention group.	8 weeks	Walking speed, GMFM-66 and physiological cost index (PCI), 6 minute walk test (6MWT)	Structured home-based exercise program (SHEP) can be a useful intervention tool, given as a written, structured, and practical exercise program undertaken at home to achieve short term goals for improving walking ability when added to standard care.
Priyabrata K Ojha, Monalisa Pattanaik et al. 2017[27]	Randomized controlled trial	N=30	Group-A: Experimental group Group-B: Control group	6 week study	GMFM-B, TCMS.	There were improvements in GMFM: B and TCMS score in both the groups from pre-treatment measurement to post treatment measurement for a period of 6 weeks. However more significant improvements were found in the experimental group (Group-A) after 6 weeks of intervention.

Discussions

Present systematic review was done to examine the effectiveness of physical therapy interventions in gross motor function in CP children.

In Farjad Afzal[25] study treatment sessions were provided only two days in a week. Efficacy of treatments can be increased if numbers of sessions are increased in a week. In his study the duration of single session was two hours, if same interventions are used with intensive protocols (a session of longer duration) then there will be more effectiveness of treatment. Study supports his results of previous studies in which the interventions like treadmill, stationary cycling with adjustable seat and resistance, strengthening exercises with manual resistance, functional training, quadriceps build up training, standing activity and walking training activity were used[28,29].

Declerck reported significant improvement in motor function following 10 weeks of aquatic training in 14 youths with CP, which was found to translate into functional independence and improved self-care[30].

These studies demonstrated that 10 weeks of aquatic exercise training program brought about significant improvement in gross motor function in the dimensions of lying and rolling, sitting, crawling, and kneeling, and standing as well as in the overall score. This may be attributed to the buoyancy effect of water, which provides antigravity positioning, weight reduction in water, and decreased compressive forces on joints, resulting in more fluid motor function for children who would not be able to do certain activities on land[31,32.]

The study by Chrysagis et al. found out that a 10-week aquatic training program improved the gross motor function in standing[33]. A randomized controlled study was conducted by Shamir et al. to assess sitting and gross motor progress in infants with CP who were treated with intermittent intensive PT as compared with a matched group treated with a standard PT regimen. Ten infants aged 12–22 months were studied; five were assigned to the intensive intermittent therapy group and

five to the control group. After 4 weeks of baseline intervention, the intervention program was administered to the experimental group for 8 weeks and the regularly scheduled weekly program to the comparison group, targeting sitting as the treatment goal. In baseline phase A, a 90-min treatment was administered to each infant once a week for 4 weeks, and in the intervention phase B group E received one therapy session for 4 consecutive days in 1 week followed by a 3-week rest period during which no intervention was administered.

The same schedule was repeated during the second 4-week period (B2). At the end of each month an assessment using GMFM 66 and 88 (dimension B) was made. During this period (B, B2), the comparison group C was treated for 8 weeks once a week (A1, A2) and evaluated with the same measurement tools applied in group E. The intermittent intensive regimen yielded a mean improvement of 7.8% as compared with 1.2% with the standard treatment. However, these results were attributed to infants with a low functional level only[34].

Another study conducted by Bower et al. aimed to determine whether motor function and performance is better enhanced by intensive physiotherapy in children with CP. Participants comprised a sample of 56 children with CP classified at level III or below on the GMFCS, aged between 3 and 12 years. To compare the effects of routine amounts of physiotherapy with intensive amounts following the 6-month treatment period there was a further 6-month period of observation. Changes in motor function and performance were assessed by using the GMFM and the GMPM at 3-month intervals. There was no statistically significant difference in the scores achieved between intensive and routine amounts of therapy[35].

Conclusion

Physiotherapy interventions along with strengthening exercises with manual resistance, Functional training, quadriceps build up training, standing activity and walking training activity in combination have significant effects on gross motor function measure, trunk stability, standing time and walking distance in children with cerebral palsy.

Conflicts of interest

There are no conflicts of interest.

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