



EFFECT OF AQUATIC THERAPY ON BALANCE GAITSPEED AND FUNCTIONAL MOBILITY IN SPASTIC DIPLEGIC CEREBRAL PALSY CHILDREN

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KEYWORDS :

INTRODUCTION

A group of permanent disorders of the development of movement and posture, causing activity limitation that is attributed to non-progressive disturbances that occurred in the developing foetal or infant brain. A collection of movement and postural abnormalities that limit activities and are caused by non-progressive disruptions in the developing fetal or infant brain are together referred to as cerebral palsy (CP).

A seizure condition and/or impairments in sensation, cognition, communication, perception, and/or conduct are frequently present in conjunction with the motor problems of cerebral palsy. The World Health Organization's International Classification of Functioning, Disability and Health speaks of 'activity' as the execution of a task or action by an individual, and identifies 'activity limitation' as 'difficulties an individual may have in executing activities. This term amplifies the previous concept of 'disability' to recognize changing international concepts and terminology¹

Aquatic (water) exercise is one of the physical therapy approaches used for children with CP. Postural stability can be increased by reducing the effect of the gravitational force by using water; helping the CP child to exercise more effortlessly than on land. On this base, children with CP could practice for long duration in aquatic setting, as conditioning extra muscle groups before reaching the sense of fatigue, in contrast to exercising on land. In spite of these benefits, few studies³

Despite regular conventional therapy, many children show minimal progress in balance and mobility. Aquatic therapy offers a complementary approach that may accelerate improvements in gait speed and daily functional activities, justifying the need to evaluate its specific benefits through this study.

Specifically, the study aims to assess changes in balance, measure improvements in gait speed, and determine enhancements in functional mobility following a structured aquatic therapy program. Additionally, the study seeks to compare the outcomes before and after the intervention and to examine the feasibility and acceptance of aquatic therapy as a supportive rehabilitation approach in this pediatric population.

Objectives of the Study

- To evaluate the effectiveness of aquatic therapy in improving Balance in children diagnosed with spastic diplegic cerebral palsy.
- To evaluate the effectiveness of aquatic therapy in improving Gait speed in children diagnosed with spastic diplegic cerebral palsy.
- To evaluate the effectiveness of aquatic therapy in improving Functional mobility in children diagnosed with spastic diplegic cerebral palsy.

Methodology

Study Design: Pre-test and post-test experimental with control group

Study Subject: children diagnosed with spastic diplegic cerebral palsy

Sample Size: 34

Total of 34 subjects were included for the study. Fisher's formula was used to calculate the sample size Therefore a total of 34 subjects were taken for the study

Study Setting and Source of Data: children with cerebral palsy at BRAINIX CHILD DEVELOPMENT CENTER KALABURAGI.

Study Duration: 6 weeks

Inclusion Criteria

1. Confirmatory diagnosis of children with spastic diplegic cerebral palsy.¹⁶
2. Age group between 4 years to 14 years old.¹⁶
3. GMFC score up to 2.¹⁶
4. Children who are able to follow commands.¹⁶

Exclusion Criteria:

1. Recent musculoskeletal injuries (fractures, muscle strain, ligament or tendon injuries).¹⁶
2. Any other neurological dysfunction.¹⁶
3. Cardiovascular disorders.¹⁶
4. Botox injection given in last 6 months.¹⁶

Method of Data Collection

Ethical Clearance will be obtained from the ethical committee of Florence College of Physiotherapy. Subjects will be randomly assigned to an aquatic therapy group and control group. Before initiating aquatic therapy, baseline data will be collected using standardized outcome measures:

- Balance Assessment: Pediatric Balance Scale (PBS)
- Gait Speed: 10-Meter Walk Test (10MWT)
- Functional Mobility: functional reach test

Intervention:

The intervention consists of a 6 weeks aquatic therapy program, with sessions conducted 4 times per week, each lasting 45-60 minutes. Exercises focus on improving balance, gait speed, and functional mobility while utilizing the properties of water, such as buoyancy, resistance, and hydrostatic pressure.

Outcomes Measures

To assess the impact of aquatic therapy on balance, gait speed, and functional mobility in children with cerebral palsy, the following standardized outcome measures were used like Pediatric Balance Scale, 10-Meter Walk Test, Timed Up and Go Test.

Data Analysis

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24, with a significance level of p value less than 0.05 and a 95% confidence interval set for all analysis.

Groups	Pre Test		Post Test		t - test	Significance
	Mean	S.D	Mean	S.D		

Group- A	31.05	5.25	47.66	7.60	-7.57	.001**
Group- B	33.29	4.94	41.52	4.00	-9.26	.001**

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B. There is a statistically significant difference between the pretest and posttest values within Group A and Group B at $P \leq 0.05$.

Groups	Pre Test		Post Test		t - test	Significance
	Mean	S.D	Mean	S.D		
Group- A	19.81	1.15	14.96	1.15	10.01	.001**
Group- B	19.15	2.17	17.07	1.38	7.54	.001**

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B. There is a statistically significant difference between the pretest and posttest values within Group A and Group B at $P \leq 0.05$.

Groups	Pre Test		Post Test		t - test	Significance
	Mean	S.D	Mean	S.D		
Group- A	15.94	1.11	11.82	.994	19.75	.001**
Group- B	16.68	1.56	14.85	1.10	4.28	.001**

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B. There is a statistically significant difference between the pretest and posttest values within Group A and Group B at $P \leq 0.05$.

RESULTS

On comparing the Mean Values of Group A & Group B on PBS Score, it shows a significant increase in the post test mean values in both groups, but (Group A) shows 47.66 ± 7.60 which has the higher mean value is more effective than (Group B) 41.52 ± 4.00 at $P \leq 0.05$. Hence the null hypothesis is rejected.

On comparing the Mean Values of Group A & Group B on 10 MWT Score, it shows a significant decrease in the posttest mean values in both groups, but (Group A) shows 14.96 ± 1.15 which has the lower mean value is more effective than (Group B) 17.07 ± 1.38 at $P \leq 0.05$. Hence the null hypothesis is rejected.

On comparing the Mean Values of Group A & Group B on TUG Test Score, it shows a significant decrease in the post test mean values in both groups, but (Group A) shows $11.82 \pm .994$ which has the lower mean value is more effective than (Group B) 14.85 ± 1.10 at $P \leq 0.05$. Hence the null hypothesis is rejected.

On comparing Pre-test and Post-test within Group A & Group B on PBS, 10 MWT score & TUG Test Score shows significant difference in the mean values at $P \leq 0.05$.

DISCUSSION

The present study was conducted to determine the effect of aquatic therapy on balance, gait speed, and functional mobility in children with spastic diplegic cerebral palsy. A total of 34 children diagnosed with spastic diplegic cerebral palsy were included in the study and were divided into two groups. Group A received aquatic therapy along with routine physiotherapy management, while Group B received conventional land-based physiotherapy exercises.

The intervention was carried out for six weeks with four sessions per week. Outcome measures included the Pediatric Balance Scale (PBS), 10 Meter Walk Test (10MWT), and Timed Up and Go Test (TUG). The findings of the study demonstrated statistically significant improvements in both groups following intervention; however, the improvements observed in Group A were greater when compared to Group B. The results indicate that aquatic therapy is more effective in improving balance, gait speed, and functional mobility in children with spastic diplegic cerebral palsy.

The findings of the present study are consistent with the study conducted by Kelly and Darrah (2019), who reported that aquatic therapy significantly improved postural control and dynamic balance in children with cerebral palsy. Similarly, Getz, Hutzler, and Vermeer (2017) found that children receiving aquatic therapy demonstrated improved balance and coordination compared to land-based interventions.

The present study concluded that aquatic therapy is an effective intervention for improving balance, gait speed, and functional mobility in children with spastic diplegic cerebral palsy. Therefore, incorporating aquatic therapy into pediatric rehabilitation programs may help improve overall functional outcomes, independence, and quality of life in children with Spastic diplegic cerebral palsy.

REFERENCES

1. Iona Novak, Roslyn N. Boyd, and Nadia Badawi Title: Cerebral palsy Journal: Developmental Medicine & Child Neurology Year: 2014 Volume: 56 Issue: 4 Pages: 328-329 DOI: 10.1111/dmcn.12416 Novak I, Boyd RN, Badawi N. Cerebral palsy. Dev Med Child Neurol. 2014;56(4):328- 329. doi:10.1111/dmcn.12416
2. Rosenbaum P Paneth N, Leviton A, Goldstein M, Bex M, Damiano D, Dan B, Jacobsson B. A report: the definition and classification of cerebral palsy April 2006. Dev Med Child Neurol Suppl. 2007 Feb;109:8-14. Erratum in: Dev Med Child Neurol. 2007 Jun;49(6):480. PMID: 17370477.
3. Graham HK. Classifying cerebral palsy. J Pediatric Ortho. 2005 Jan-Feb;25(1):127-8. Doi: 10.1097/00004694-200501000-00026. PMID: 15614073
4. Paulson A, Vargus-Adams J. Overview of Four Functional Classification Systems Commonly Used in Cerebral Palsy. Children (Basel). 2017 Apr 24;4(4):30. Doi: 10.3390/children4040030. PMID: 28441773; PMCID: PMC5406689
5. YALÇIN S., KOCACAO' GLU B., BERKER N. and EROL B.: Surgical management of orthopedic problems in adult patients with cerebral palsy. Acta. Orthop. Traumatol. Turc., 39 (3): 231-6, 2005.
6. TANG-WAI R., WEBSTER R.I. and SHEVELL M.I.: A clinical and etiologic profile of spastic diplegia. Pediatr. Neurol. Mar., 34 (3): 212-8, 2006
7. Becker BE. Aquatic therapy: scientific foundations and clinical rehabilitation applications. PM R. 2009 Sep;1(9):859-72. Doi: 10.1016/j.pmrj.2009.05.017. PMID: 19769921.
8. Becker BE. Aquatic therapy: scientific foundations and clinical rehabilitation applications. PM R. 2009 Sep;1(9):859-72. Doi: 10.1016/j.pmrj.2009.05.017. PMID: 19769921.
9. Koury JM. Aquatic therapy programming: guidelines for orthopedic rehabilitation. Champaign (IL): Human Kinetics; 1996. ISBN 0-87322-971-1. Guetta-Rodriguez J, Garcia-Muro F, Cano-Diez B, Rodriguez-Fernández ÁL, Lambeck J, Palacios-Ceña D. Identification of intervention categories for aquatic physical therapy in pediatrics using the International Classification of Functioning, Disability and Health-Children and Youth: a global expert survey. Braz J Phys Ther. 2017 Jul-Aug;21(4):287- 295.doi: 10.1016/j.bjpt.2017.05.007. Epub 2017 May 21. PMID: 28579189; PMCID: PMC5537483
10. Stevens SL, Caputo JL, Fuller DK, Morgan DW. Effects of underwater treadmill training on leg strength, balance, and walking performance in adults with incomplete spinal cord injury. J Spinal Cord Med. 2015 Jan;38(1):91-101. doi: 10.1179/2045772314Y.00000000217. Epub 2014 Jun 26. PMID: 24969269; PMCID: PMC4293539
11. Thorpe, Deborah & Reilly, M.. (2000). The effect of an aquatic resistive exercise program on lower extremity strength, energy expenditure, functional mobility, balance and self-perception in an adult with cerebral palsy: A retrospective case report. Aqua Phys Ther. 8.18-24
12. Fatorehchy, Saeid & Hosseini, seyed ali & Rassafiani, Mehdi. (2019). the effect of aquatic therapy at different levels of water depth on functional balance and walking capacity in children with cerebral palsy. International Journal of pharma and Bio Sciences. 9. 10.22376/ijpbs/lpr.2019.9.1.L52-57.
13. Amini, Amin & Salehi, Maryam & Bazgir, Behzad & Bakhshoodehnia, Iman. (2020). The Effect of Aquatic Exercise Therapy on Gross Motor Function of Students with Spastic Cerebral Palsy. 10.30472/aej.v4i2.120
14. van Vulpen LF, de Groot S, Rameckers E, Becher JG, Dallmeijer AJ. Improved Walking Capacity and Muscle Strength After Functional Power-Training in Young Children With Cerebral Palsy. Neurorehabil Neural Repair. 2017 Sep;31(9):827-841. doi: 10.1177/1545968317723750. Epub 2017 Aug 8. PMID: 28786309
15. Gorter JW, Currie SJ. Aquatic exercise programs for children and adolescents with cerebral palsy: what do we know and where do we go? Int J Pediatr. 2011;2011:712165. doi: 10.1155/2011/712165. Epub 2011 Nov 24. PMID: 22164180; PMCID: PMC3228376.
16. Blohm, D., et al. (2018). Effectiveness of aquatic therapy on gait in cerebral palsy: A comparative study. Journal of Rehabilitation Medicine.