

RESEARCH REPORT

IMPACT OF AQUATIC THERAPY ON SENSORY MODULATION OF AUTISTIC CHILDREN TO IMPROVE ACTIVITIES OF DAILY LIVING

ABSTRACT

OBJECTIVES

A Quasi experimental study was performed to evaluate the impact of aquatic therapy on sensory modulation in order to improve the ADL's in children with autistic spectrum disorder.

STUDY DESIGN

A Quasi Experimental study.

SAMPLING TECHNIQUE

Convenience sampling technique was used.

STUDY SETTINGS & PARTICIPANTS

This study was conducted in Liaquat National Hospital-Occupational Therapy Peads Unit. The participants were the children with autistic spectrum disorder having sensory modulation disorder.

INTERVENTIONS

56 autistic children were enrolled in this study. Each autistic child was first assessed on the basis of sensory profile for sensory deprivation and on WeeFIM pediatric functional independence measure for activities of daily living. The entire protocol was divided into six months of aquatic therapy with a frequency of 3 days a week.

RESULTS

A significant difference was observed in pre and post measurement of sensory profile and WeeFIM score measured by paired t-test. The p-value is found to be 0.03 on sensory profile and a p-value of 0.02 on FIM.

CONCLUSION

The findings indicated that the aquatic therapy has good impact on sensory modulation for activities of daily living.

KEYWORDS

Hydrotherapy, Sensation Disorder, Functional Independence Measure, Short Sensory Profile, Autistic Disorder.

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[Qureshi.S, Jarrar.T Impact of Aquatic Therapy on Sensory Modulation of Autistic children to improve Activities of daily living. Pak. j. rehabil. 2018;7(2):13-18]

INTRODUCTION

According to the National Health Statistics Reports, Autism spectrum disorder ASD affects 2.24% of children¹. ASD is a developmental disorder that is characterized by difficulties in communication and social interaction, along with behavioral rigidity and repetitiveness². Autism child requires a considerable number of services to improve behavior and developmental challenges³. ASD child often observed sensory processing difficulties in terms of discrimination, interpretation, and organization of sensory modulation.

Sensory modulation is the capability to maintain and grade responses to the environment so that sensory input will respond appropriately to the demands of daily life⁴. Children with Autistic spectrum disorder has altered sensory modulation. A study reported increased sensory responsiveness and low sensory integration behavior in autism as comparison with other developmental disorder⁵. Sensory modulation dysfunction has a significant influence on participation of daily living⁶.

A study shows that motor development is basic need of an autistic children, in this regard the rehabilitation centers should focus on children's physical movements games and sports to achieve better proficiency in motor development⁷. Autistic children with different sensory profile usually enjoy calming activities, deep pressures, tactile and vestibular activities to reduce their sensory problems, stereotype behavior and difficulties in daily living task⁸. Water and swimming activities are becoming progressively usual activities for children with Autism⁹. Families find swimming most common physical activity and overall favorite activity in children with disabilities¹⁰. Water activities help in energizing, relaxing and providing postural support to muscles thus allows variety of necessary motor skills to be performed that are dependent on an individual's skills level^{11,12}.

According to the study aquatic based exercises were found to be time effective approach in comparison to land based in improving balance and functional outcome¹³. Further, the concept Halliwick exercises of utilizing the body mechanics and hydrodynamics that comprises of 4 phases: adjust into the water, rotations, control of movement in water, and movement in water were too found to be effective in improving the motor and functional skills of Cerebral palsy children¹⁴. Frenzen and Tryniszewiskil in their 14-week of interventional strategy concluded that gait velocity, stride length and motor function were significantly improved among children given intervention on aquatic exercises program¹⁵. Similarly 12 weeks of hydrotherapy program was also found to be effective in improving motor activity among children with ASD¹⁶. A survey performed by occupational therapists

regarding the efficacy of hydrotherapy strategy revealed their perception that the strategy was not only effective in improving balance but indeed found to be effective in improving muscle strength, touch toleration, eyecoordination and social participation¹⁷.

Although the effectiveness of aquatic based exercises interventions are found to be proven in improving the balance and functional outcome among cerebral palsy children but the gaps in literature still exist regarding the effectiveness of strategy among autistic children. Hence our study is aimed to determine the impact of structural six weeks of aquatic based exercises program in improving the sensory modulation of autistic children.

METHODOLOGY

Study Design

It was quasi-experimental study

Study Settings

This study was conducted in Liaquat National Hospital

Study Duration

8 months

Sampling Method

Non probability convenient based sampling was used

Sample Size:

The Sample size of 56

Inclusion Criteria

- 5 to 8 years of diagnosed Autistic Children
- Able to follow simple commands¹⁹.

Exclusion Criteria

Children who has physical disability or decreased fitness or unable to walk independently and other medical symptoms which can be hinder in their performance¹⁵.

Data Collection Tool

- The data tool was sensory profile and Functional independence measure WeeFIM for pediatric clients.
- Short Sensory profile used for sensory modulation disorder and WeeFIM for activities of daily living.

Short Sensory Profile

A sensory profile is an assessment tool that helps to measure the children's sensory processing on regular performance. It is a standardized questionnaire comprise on 38 statements, all arise from the longer sensory profile. It is consist on >125 statements. A short sensory profile have 7 categories i.e. move-

ment sensitivity, tactile sensitivity, taste sensitivity, visual auditory sensitivity, auditory filtering, under responsive seeking, low energy²⁰. The occupational therapist rate the child response according to each statement on out of 5 points, i.e. (1=always, 2=frequently, 3=occasionally, 4=seldom, 5=never). The highest score suggest maximum number of behaviors that are in normal limits. This tool is used in research to measure the sensory modulation²¹. The reliability of short sensory profile is 0.70-0.90 whereas the construct validity of the SSP total and section scores ranges from (0.25-0.76)^{20, 21}.

Functional Independence Measure (WeeFIM)

The Functional Independence Measure for pediatric (WeeFIM) evaluates the functional class of a child on the basis of assistance level ,he or she requires. The scale consists of 18 items, with two parts in it–A motor and B cognition. Each statement is scored on out of 7 point ordinal scale. The highest the patient gain the score, the more patient is independence in daily activities of life. It measures several metrics of functional ability including selfcare(feed, groom, bath, dress, and complete toileting tasks including the management of bowel and bladder), mobility(transfer in/out of a chair or

wheelchair, on/off a toilet, or in/out of a tub or shower, walk, crawl, or use wheelchair; and go up and down stairs), and cognition(understands, expresses themselves, interacts with peers, solves daily problems, and recalls information). WeeFIM measures the improvement — or gain — in the areas from time to time during therapy.

Data Collection Procedure

The study was conducted on 56 autistic children both male and female (17 female, 39 male) aged between 5 to 8 years old, were selected among the children's currently receiving therapy sessions at an outpatient occupational therapy department. The participants were known case of autistic spectrum.

Disorder and having definite difference in sensory modulation. The consent was taken from the parents/guardians prior to the study. The participants of study were assessed on Sensory profile to assess their sensory modulation, deficits in the integration of sensations and WeeFIM to assess their Functional independence before and after the study. The autistic children were given 45 minutes of aquatic therapy thrice a week for six months.

Table 1. Shows Complete Intervention Protocol

Month	Activity	Time	Purpose
Week 1	Free body movement while immersed in water	45 min	To promote calmness through water pressure and enhance acquaintance with aquatic environment
Month 1 & 2	Drilling and flapping from upper and lower limb	15 min	Improve body awareness and interaction with the context
	Overhead reaching the cone and staking it on the cone in water	10 min	Improve Bilateral Coordination, eye to hand, reaching, grasp and spatial awareness
	collecting floating balls in the basket	10 min	Improve figure ground perception
	Passing through the floating swim rings	10 min	improves body orientation Facilitates AD L such as putting shirt over head
Month 3	Water gun activity	10 min	Improve eye hand coordination and targeting and proprioception
	Turning around	2 min with breaks	Bilateral integration of body
	Throwing and catching the ball	15 min	Improves bilateral integration
	Imitating therapist's movements /one-to-two instruction	20 min	Improves motor perception and motor execution skills. Improve perception of somatic Perception of arms positions and movements.

Month 4	Splashing water from feet	15 min	Engaging in play full movement
	One leg stance, alternating	10 min	Improves kinesthesia
	Following the water toys	10 min	Improves visuopraxis
	Following the squeezing of water duck toy	10 min	Improves auditory feedback
Month 5 Group activity	Passing the ball	15 min	Improves plays skills and interaction
	Simon says activity	20 min	Improves planning and executing bodily movements
	Popping the water bubbles	10 min	Improves motor planning
Month 6	Water Splash	20 min	Reduces repetitive movements

Intervention Protocol

In first week children in group of 6 were allowed to do free body movements in water pool bath tub swimming pool to reduce their anxiety and to make them familiar to it. In the following weeks, each time the session was started from 5 min free movements after which children were engaged in purposeful movements commanded by occupational therapists. The activities in water are designed according to purposeful movement. The following 2 months were intended to improve the body awareness, coordination and body orientation. The 3rd month works upon proprioception, bilateral integration and motor skills. The 4th month was designed to reduce repetitive movements, and improve kinesthesia, visuopraxis, and auditory feedback. The 5th month work on playing skills, interaction, and converting verbal commands into action, whereas the last 6th month improve motor planning that incorporated with daily activities, complete intervention protocol described in Table 1.

Data Analysis

Data was analyzed on SPSS version 20 Pre and Post analysis was determined by using paired t-test. Level of significance was calculated at 95% CI, p-value of < 0.05 was considered significant

Ethical Consideration

Consent form from parents was taken before the study to acknowledgment of all the risk during the study and to provide assurance of confidentiality. Data collection and intervention in the hospital was done after taking permission from Head of department.

RESULTS

A total of 56 participants within an age group of 5 to 8 years were recruited in the study. The baseline characteristics of the participants has revealed that at baseline the mean FIM score was 61.58 ± 9 and short sensory profile scoring was 51.48 ± 11.10 . The male and female proportion of the participants in the study was 69.6% and 30.3% respectively. (Table-2)

Table 2. Shows Demographic description of the participants

Items	N
Number of Participants	56
Male	39 (69.6)
Female	17 (30.3)
Age of the Participants	7.3 ± 2.5

After six months of intervention the mean score of the participants measured at FEM and Sensory profile scale had increase to 66.8 ± 7.8 and 54.98 ± 11 respectively (Table -3)

Table 3. Shows mean difference at baseline and post the intervention

Items	Baseline	Six Months	Mean Difference
FEM	61.58 ± 9	66.8 ± 7.8	5.22 ± 2.3
Sensory Profile	51.48 ± 11.1	54.98 ± 11.22	3.5 ± 1.02

Paired t test analysis of the data revealed that after six month of interventional strategies based on structured exercises protocol the participants has shown a significant mean difference from the baseline where the value on the FEM score has improved from 61.58 ± 9 to 66.8 ± 7.8 with a mean difference of 5.22 ± 2.3 at 95% of CI ($p=0.02$). The values on the short sensory profiles has also shown a significant mean difference from the baseline with a mean difference of 3.5 ± 1.02 at 95% of CI ($p=0.03$) where

the baseline values were 51.48 ± 9 and the values obtained at six months were 54.98 ± 11.22

DISCUSSION

The result of our study has revealed that aquatic therapy provides a positive effect in improving the Functional Independency and Sensory profile of children with Autistic spectrum disorder. The results were according to the study conducted by Alaniz ML in 2017 in which they had concluded that even a shorter duration of aquatic therapy had provided a significant results in improving the function independency of the children's, however their limitation was a small sample size²³. In another study conducted in 2010 it was observed that aquatic based structured exercises therapy had prolific results in improving the kinesthesia and social skills of the participants after 10 weeks session¹⁹. Yilmaz et al¹⁴ has evaluated the motor performance through water based exercises observed that 10 weeks of hydrotherapy sessions improves motor skills among autistic children where endurance, flexibility, speed, power balance and grip strength were improved Ennis et al¹⁸ in a research report concluded that 10 weeks hydrotherapy program with intention to increase strength and social skills has shown a significant improvement on WOTA (water orientation test) and paediatric quality of life Inventory (Peads-QL). Ballington et al reported in a Randomized Controlled trial performed on Cerebral palsy children reported a significant improvement on Gross motor functional scale among the participants whom were intervened on aquatic based exercises program in comparison to patient in the control group²⁴. A pilot on children with autistic spectrum disorder was performed in group aquatic exercise therapy and its effects were compared with control group who were asked to do their routine schedules activity and it was found that children who were given intervention on aquatic exercises showed a significant improvement in swimming skills, following a 14 week of programme²⁵.

The key strength of our study was that it was a first of its type in Pakistan that involved the aquatic based interventional strategy for the purpose of rehabilitation of autistic children that involved a sample size measured at 95% of CI with a 5% of bound of error. However the study have some weaknesses as well firstly the data was collected from single tertiary care hospital of Pakistan that may perhaps limits the generalizability of the methodology and second, the study include participants from the upper middle strata of society that may help in better understanding of the findings obtained among the children as the parents and the guardian were well aware with concepts of the intervention. The research however recommends that in future randomized controlled trials should be performed among in order to get further definite findings of the effects of aquatic therapy among the autistic

population of Pakistan.

CONCLUSION

The study concluded that six months of aquatic based intervention strategies showed significant results in improving FIM and Short Sensory profile of children diagnosed with autistic spectrum disorder.

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