

# The Role of Aquatic Training Program Among Special Need Children on Vestibular Processing of Sensory Stimulation

Anulekha Dey, Malika Sharma



**Abstract:** This study is pursued to find the role of Aquatic Training Program for children with special needs. Sensory profile questionnaire was used to assess the before and after performance of each students of each groups for Vestibular Processing, of 25 Children average of age nine years, randomly selected from Asha AWWA school at Delhi, India. Participants were divided into two groups Experimental (13) and Control groups (12). Result of Two Way ANOVA reflects positive accelerated change only in experimental group, showing moderate to considerable benefits with 27 session aquatic training program. In addition, individualized improvement was also studied, which resulted into minor to major enhancement of vestibular processing among all the experimental group participants. Hence a prolonged Structured Aquatic Training Program (intervention) is off paramount to get the best results. These findings also enhance the preceding research work based on aquatic intervention as vestibular senses develop first and controls other senses since the baby is in womb, so it is important to develop this sense so other sense can process better to acquire a better life.

**Keywords:** special need, aquatic training program, vestibular processing, standard of living, quality of life.

## I. INTRODUCTION

Special need population means anyone who has difficulties, physical disabilities or emotional and behavior difficulties (Oxford dictionary), mainly one that inhibits an individual from carrying on with a full, ordinary life and holding a profitable job. According to the Census 2011, it has been exposed that over 26.8 million people in India are suffering from disabilities, out of which sensory disability is around 43% of the total disable population in India. Children with sensory impairments have to face many problems apart from the sensory dis-functioning which are like - language delays, speech delays, delayed in fine engine abilities, delays in self-sustaining, lack of coordination, decreased muscle tone and trouble in tuning in a noisy domain, etc. and also suffer from mood disorders, eating disorders, anxiety disorders, attention-deficit etc. (Fink, Nov 6, 2017). In various researches have proved that by regular physical activity human being can develop all aspects of human body

(physical, mental, etc.), which can be land based or water based but both are beneficial with their own role & nature of significance. Aquatic activity is also a part of physical activity, which has a separate kind of benefits and on the other hand water activity, can be a gateway to reduce and give them a better life (Kim, 2018) In this study mainly has two types of developmental disabilities we are working on one is autism and cerebral palsy though the issues totally identical and influence every person in numerous ways, and side effects can run from gentle to serious. Autism is a formative issue that appears in the underlying 3 years of life and impacts the cerebrum's regular improvement of social and social capacities ASD's are a group of developmental inadequacies that can cause enormous social, correspondence, and direct challenges like social connection, correspondence, and take part in profoundly engaged practices or dreary exercises, debilitated social association. This group of formative inabilities is deliberated to fall along a scope of crippling conditions which makes it part of a range disorder. Numerous kids with an ASD participate in repetitive advancements, for instance, shaking, hand shuddering, and turning, or even in self-harsh direct, for instance, biting or head-hammering. Other regular side effects of the disorder incorporate irregular and in some cases uncontrolled responses to sensory data—for instance; noisy clamors, splendid lights, and certain surfaces of food may cause baseless responses (National Autism Association, 2011). If there should be an occurrence of Cerebral palsy (CP) is a perpetual development issue. They aspect both physical and mental issues appended with tactile issue also, the coordination is poor, solid and feeble muscles coming about into poor practical productivity and different troubles in sensation, thinking, and vision, reasoning and talking (NINDS, 2013). Since there is no known changeless solution for autism and cerebral palsy, a few treatments are intended to cure explicit side effects and found accommodating (Hall, 2013). The perfect treatment plan arranges treatments and mediations that meet the individual and explicit needs of the kids. In this way, it is imperative to address positive alternatives and propensities with these youngsters so they can keep on taking part every day in physical movement (Rosser-Sandt and Frey, 2005). It has been built up that physical movement can add to the physical/mental and demonstrate constructive outcome to their tactile strength of this gathering just as the all-inclusive community (Pan & Frey, 2006). Another type of physical activity is aquatic activity. In this study researcher conducted aquatic training program for these children considering the sensory need aspect.

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Water is considered as one of the great therapeutic measures since many years because of its physical standards of water, for example, thickness, hydrostatic weight, lightness, consistency, and thermodynamics it is utilized in restorative and recreational applications. Aquatic exercises have been accounted for to be one of the most prevalent physical exercises among youngsters paying little mind to condition (Mactavish, 2000). The advantages of aquatics, both physical and mental, are all around archived. Schilling (1993) placed that the advantages of aquatic exercise as well as movement are different and run from physical to mental in nature. Along these lines, Aquatic projects can be successful and helpful type of treatment for kids and young people with sensory disorders (Aleksandrovic, 2016) (Hall, 2013). It is helpful especially for those with noteworthy development restrictions, where land based physical movement are very troublesome for them also increase movement and flexibility (Lidija Dimitrijević, 2012) (Hall, 2013). In addition other author says swimming or any kind of aquatic activity is extremely beneficial to improve physical exercise that can improve the motor skills and physical abilities among the children reducing all kinds of disabilities and sensory impairments (Aleksandrovic, 2016) (Hall, 2013). With this understanding the creator arranged an organized oceanic preparing project to check its impact on Vestibular Processing.

## II. METHODOLOGY

### Participants

A sum of 26 kids from Asha AWWA School, Delhi Cant, India in summer 2018 with special needs and Developmental Disabilities were identified with the help of few criteria's of non-medical necessity and age from 7 to 11 years (mean age nine years). Contestants were separated into two groups, 13 students each in control group and experimental group, during training one student dropped out from Control Group. Hence, final data was collected on 12. Based on Sensory Profile Questionnaire's scores which are completed by their guardian/educators/parents, understudies were sorted and just the understudies decreasing in regular execution were chosen for this present examination. Be that as it may, for the smooth organization of the preparation, the understudies were separated into two portions in which 5 and 6 members were there, they received their training on alternative days this helps in better learning and concentration smaller group.

### Criterion measure

- Sensory Profile Questionnaire created by Winnie Duun, 1999, to be completed by guardians/instructors/parental figures was utilized to quantify the tactile performance.
- The synopsis score-sheet gives the scope of marks to accepting the students presentation at three measures for example
  - Typical Performance: demonstrating the performance of the child as great condition and needing no mediation,
  - Probable Difference: it demonstrates that the performance of the child will be enhance and
  - Definite Difference: it coordinates that the kid certainly needs mediation and has a ton of extension for development.

### Preparation of training program

The training program was structured with the chosen activities to advance Vestibular Processing. As per (O. VerschuAdaen, 2011) (Lidija Dimitrijevic, 2012) alliance of both high-impact and quality exercise are profoundly beneficial for youngsters with CP and Autism both to progress continuance, muscle quality and tone, which can directly affect Vestibular Processing the child become more efficient to control his/her own body. Also, own body weight along with number of exercises and continuous effort of controlling the body by child and try to perform the activity will lead to advance Vestibular Processing. Also the group activity may help social interaction and other psychological benefits. Program force was step by step expanded and varieties were presented after two weeks. Preparing program was finished after discourse and input, of the specialists and director. The concluded program comprises of three stages, to be specific, acquaintance with new condition, acclimatization with water and exercises and propelled exercises.

- ❖ The *first stage* incorporated land get ready for the main week - exercises like running and walking in various examples ashore and in water, and sprinkling in hands and legs in water.
- ❖ The *second stage* was built to build up member's water balance, certainty to execute movement, quality and perseverance to obstruction of water and dread evacuation drills. It comprised just water exercises like jumping and walking in water, squatting holding railing, bubbling, and floating.
- ❖ The *third stage* of the preparation comprises of cutting edge exercises which incorporated squat and walk, Prone/recumbent buoy, percolating, kicking holding pool side/rode/reeling, Catching and throwing, Squatting autonomously, Floating with wall push, Floating and kicking (with kick board) also included one fun and recreational activity every day. Every week, advanced and novel activities were introduced to the participants. Some fun activities targeting sensory development like putting the floating animals in bucket, putting rings in a pipe, collecting different coloured ball, Squatting with open eyes inside water as a number game, Balancing on the tube, etc. were also incorporated in every session. Inspite of all the water itself gives continuous effect through the skin to the receptors for sensory inputs.

### Administration of the Structured Aquatic Training Program

The recent Structured Aquatic Training Program was regulated for nine weeks three days in a week and every meeting went on for 40 minutes. It was arranged as substitute days preparing gives sufficient recuperation and increment flexibility for next preparing (Faigenbaum A. D., 2009) (Lidija Dimitrijevic, 2012). For the successful and smooth organization of the preparation, the understudies were separated into two fragments of 3 and 4 members for exchange days (Group 1: Mon, Wed, Fri; Group 2: Tues, Thurs, Sat) in every meeting there were two members and two mentors. On the off chance that, members were not ready to adhere to the given guidelines, the educator furnished vocal brief combined with a manual direction.

Manual direction was blurred when the member started to take part in the assignment autonomously (which normally took 2 to 3 periods for every movement or additionally relying on the seriousness of the members and action). In the event that the member didn't participate in the errand significantly after manual direction, it is viewed as that the member isn't eager to implement or is frightened of that specific movement. In this situation, the members were told to implement the following movement recorded in the program for each session. The period is possibly viewed as whole when the member completes all exercises referenced for one session. After consummation of every movement, vocal recognition was known to energize the members and once members finished the exercises for the period, they were supported by tapping on shoulder or shaking hands or high-five or various applauds.

**Safety precautions**

It was analyzed ahead of time through confirmation and physical visit that:

1. No members needed any medical help (low severity level).
2. Depth of the pool was 2.5 feet's at first for water acclimation, and slowly expanded till 3.5 all through the span to build the obstruction.
3. The pool had stairs just as two railings to maintain a strategic distance from any unexpected occurring.
4. Every member was helped by a senior individual outside the pool and even in changing rooms.
5. A proportion of one mentor to one member was kept up to get more consideration of the subjects.

**Collection of Data**

Pre information - before beginning the preparation program, the survey was circulated among the concerned guardians or educators. All inquiries were disclosed to them for accepting exact reactions. After pre information appraisal, subjects were recognized based on their tangible summarizing, having an essential of tactile intercession as far as Vestibular Processing and subsequently, chose for the examination.

Training program - All through nine weeks training program, after each period an account sheet was kept up to record the exhibition of members independently. It kept up the record of scores gain by the members for every one of the exercises made arrangements for the session, evaluated on the size of 0 - 5 according to the ideal degree of every movement.

Post information - After finish of the preparation program, the survey was again recorded by the instructors/Parents/guardian for assessment of post-execution of every single chosen member for assessment of perseverance and tone.

The present examination displays the statistical analysis and its elucidation of the impact of Structured Aquatic Training Program on Vestibular Processing a piece of Sensory Profile poll, based on pre and post-test directed Two Way ANOVA and Syntax counts of SPSS was utilized to test the impact of intercession on and among the groups. Additional, the Summery Section Score of Sensory poll helped the analyzer to comprehend the impact extravagantly.

Presents the result of Aquatic Training Program on Vestibular Skill, Findings are presented in table 1 to 5 and figure 1and 2.

**Table 1: Descriptive statistics of total Vestibular Processing Score of Sensory Profile**

Groups	Performance	Mean	SD	N
Experimental	Pre	26.43	8.56	13
	Post	41.76	5.91	12
Control	Pre	26.88	7.01	12
	Post	34.30	7.14	13
Total	Pre	32.68	7.71	25
	Post	37.72	7.39	25

Table explains the descriptive analysis of the Vestibular Processing score in pre and post training between control and experimental groups of designated sample. Mean of experimental group in pretest is 26.43 (SD 8.56) and post test is 41.76 (SD 5.91). Whereas the control group, pre and post scores as 26.88 (SD 7.01) and 34.30 (SD 7.14) correspondingly.

Two way analyses were calculated to check whether there is any statistically noteworthy difference between pre and post Vestibular Processing scores. Result is demonstrated below in table 2.

**Table 2: Analysis of Two Way ANOVA of Vestibular Processing within pre and post scores between Experimental and Control Groups.**

Source	Sum of Square	Df	Mean Square	F	Sig.
Groups	212.68	1	212.68	4.04	.05*
Performances	338.12	1	338.12	6.43	.01*
Groups*Performances	110.88	1	110.88	2.10	.15

\*P<0.05

Experimental and control groups were found altogether extraordinary with the scores as f (Df =1) 4.04, p<0.01. Both pre and post exhibitions were fundamentally extraordinary with f (Df =1) 6.43, p<0.01. The collaboration among gatherings and exhibitions were found to have no critical distinction with f (Df =1) 2.10, p<0.01.

To check the exact status, test of sample effect in Syntax of SPSS, was additionally calculated to test the interaction impact of pre and post scores with groups of training, as f value is significant. Discovered are given in table 3.

**Table 3: Pairwise Comparison of Pre and Post trials for the Experimental and Control groups Vestibular Processing Performance.**

Performance	(I) Groups	(J) Groups	Mean Difference (I - J)	Std. Error	Sig. <sup>a</sup>	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Pre	Experimental	Control	1.14	2.90	.69	-4.69	6.99
	Control	Experimental	-1.14	2.90	.69	-6.99	4.69
Post	Experimental	Control	7.10	2.90	.01*	1.26	12.95
	Control	Experimental	-7.10	2.90	.01*	-12.95	-1.26

\*P<0.05

The table uncovers that the pre execution of the experimental and control groups have no important contrast ( $p < 0.05$ ). Even the difference between the post-performance of the groups was found noteworthy with  $p < 0.05$  which indicates that the post-performance of groups are statistically higher ( $M = 41.41$ ) and the control group ( $M = 34.30$ ).

Findings represented in in table 4 are Post Hoc, to check the contrast among pre and post-execution of the trial and control groups independently.

Table 4: Pairwise Comparisons among experimental and control group for the pre and post performance of vestibular processing

Groups	(I) Performance	(J) Performance	Mean Difference (I - J)	Std. Error	Sig <sup>a</sup>	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Experimental	Pre	Post	-8.18	2.90	.00*	-14.02	-2.34
	Post	Pre	8.18	2.90	.00*	2.34	14.02
Control	Pre	Post	-2.22	2.90	.44	-8.06	3.61
	Post	Pre	2.22	2.90	.44	-3.61	8.06

\* $p < 0.05$

Important difference was found in the pre and post-performance of experimental group as  $p < 0.01$ . Whereas control group has no noteworthy contrast in Pre and Post performances also of Vestibular Processing.

The adjusted p-value for the comparisons of pre and post (each for experimental and control group) is  $0.05/2 = 0.03$ . By this criterion, the only difference which is significant is experimental groups. The graphical representation of result is presented in figure 1.

Table: 5 Vestibular Processing Scores before and after the Structured Aquatic Training Program of Nine Weeks.

Groups	Performances	Typical Performance	Probable Difference	Definite Difference
		Good Condition (55 – 48 Scores)	Moderate (47 – 45 Scores)	Poor Condition (44 - 11 Score)
Experimental	Pre	0	0	13
	Post	2	5	6
Control	Pre	0	0	12
	Post	0	0	12

The table indicates pre and post score of Vestibular Profiling of all the participants of the present study. It is clearly evident that experimental group has shown improvement with 13 subjects falling in Definite Difference in pre performance and after under training going program post-performance shows that 8 subjects remained in Definite Difference whereas, 3 participants shifted to Probable Difference and 2 participants improved to fall in Typical Performance. While, no changes found in control groups profiling in both pre and post-performance of 12 subjects were in Definite Difference. So we can conclude that there are some positive changes by the Structured Aquatic Training Program.

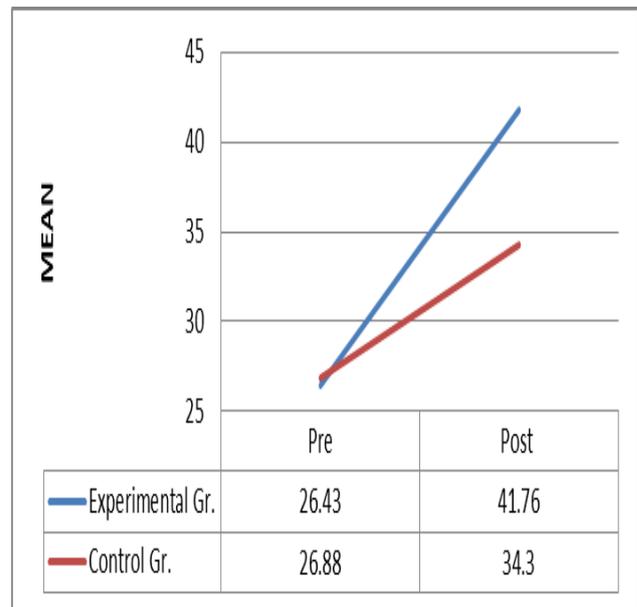


Figure 1: Graphical representation of Experimental and Control Pre and Post Vestibular Processing score Estimated Marginal Mean.

This graph represents the pre and post vestibular processing performance of experimental and control groups. It shows that there is improvement in post-performance of the groups.

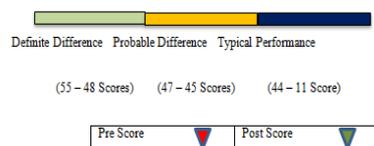
With above understanding a further step was taken to assess the status of the participants falling in three different categories of Sensory Profile, Questionnaire for Vestibular Processing. Results are as follows in table 5.

For additional understanding, the case astute enhancement is depicted distinctly for experiment group members. A positive speeding up from pre to post exhibitions of the test bunch members, on three sizes of tactile outlining (Definite Difference Probable Difference Typical Performance) is replicated in fig 2.



Participants	Vestibular	Section Raw Score Total	Categories of raw scores
A	Pre	21	
	Post	39	
B	Pre	33	
	Post	46	
C	Pre	36	
	Post	43	
D	Pre	18	
	Post	37	
E	Pre	21	
	Post	43	
F	Pre	11	
	Post	31	
G	Pre	15	
	Post	34	
H	Pre	11	
	Post	36	
I	Pre	34	
	Post	48	
J	Pre	43	
	Post	46	
K	Pre	31	
	Post	48	
L	Pre	34	
	Post	46	
M	Pre	36	
	Post	46	

CLASSIFICATION KEY



**Figure 2: Detailed description of improvement in Vestibular Processing for Experimental Group**

The above figure depicts that in exploratory gathering, complete 53% of members i.e.; 7 understudies have indicated huge development, among them 2 members i.e.; I and K have demonstrated a move from common execution to unequivocal contrast which is greatest enhancement among all. Other 5 members B, C, J, L and M have likewise demonstrated improved execution, by moving from ordinary execution to Probable distinction. Staying 39% of the members for example members A, D, E, F, G, and H have likewise improved in their scores, yet stayed in a similar size of Usual Performance in both pre and post preparing exhibitions.

The Typical Performance score extends from (11 - 44) which is most extreme in contrast with other two classifications, where Probable Difference runs from (45 - 47) and Definite Difference (48 - 55). As the scope of Typical Performance is high, the member may not bounce into the following predominant classification, however going inside this from a low score to high will have a positive indication of vestibular enhancement. Thus, it is apparent that A, D, E, F, G, and H have enhanced in their scores however stayed in Typical Performance which isn't unimportant.

### III. DISCUSSION OF FINDINGS

The current study measures the participant's responses to movement activities (Dunn W. , 1999). According to (Dino, 2005) study vestibular processing plays an essential role in the relationship between our body and the physical world. Another study states that the child will be able to start and stop movement and will have control over body with fully functioning vestibular processing and will secure and be able to organize their body to attend and respond to all other senses they need in daily activities (Braley, 2014). In addition, researcher also states that Vestibular processing organizes all the responses to sensory input and very close association to safety, attention and gravity, related sense (Greutman, 2014), with such understanding, the current work intended to comprehend the result of Aquatic Training Program on vestibular processing.

The positive effect of the water is also related to physical properties of water, which has been elaborated in introduction chapter, worked as strength in the effectiveness of Structuring the Aquatic Training Program and its effect. It is clear from the fact that when someone gets into water for the first time, it is observed that he/she finds it difficult to stand straight, walk or perform any activity in water; all this is because of water physical properties like bouncy, reduced gravitational pull which tend a person to feel like floating it is because the different medium and heavy density. Any activity in water creates wave, which makes the person unable to stand and difficulty in performing activities in water but within 9 weeks aquatic training program, participants have executed variety of activities like; walking, jumping, kicking, etc. in water which they have to lift their legs from pool floor which make them unstable but participating in the training program made them execute participants to learn to balance. Most children in the experimental group feel happy in the water during the training program which may have assisted them to overcome the barriers/fear of falling that they faced in every session.

In this line, current study reveals a significant positive change in vestibular processing of the participants in experimental group those who underwent the Aquatic Training Program. When the pre scores are compared for experimental and control group both found similar with 26.43 and 26.88 respectively, but when post scores were thought about among exploratory and control gatherings for vestibular performances both found similar with 41.76 and 34.30 respectively, so it is evident that post-performance for experimental group has more improvement than control group. Also the tables of pairwise comparison i.e. table 3 and 4 show that post-performance and experimental group has found significant difference. Hence, the aquatic training program was found positively effective for all participants of experimental group though degree may vary for each participant. Few studies also support the findings of the present study by stating that aquatic activity assist in improvement of balance and coordination through hydrokines-therapy (Luciela Vasile, 2013) also mentioned above. Further the Questionnaire Profiling was assisted with the help of summery score sheet to understand the level of improvement among the 13 participants in experimental group and 12 participants in control group.



In the initial profiling all were falling in definite difference which is considered as poor condition as described in the introduction of discussion part. After the completion of aquatic Training Program when pre and post performances were compared improvement was found in experimental group post-performance. Whereas, subjects in control group have shown no improvement and they remained in definite difference according to the questionnaire profile it is the poorest category. In total 53% i.e. 7 participants improved and shifted towards better condition among them participants I and K show best by shifting to definite difference results among all experimental group participants. Other 5 participants improved to moderate difference and shifted to good condition i.e. participants B, C, J, L and M. Remaining 5 participants has also improved but not shifted and instead stayed in a similar classification for example normal execution participants were A, D, E, F, G, and H.

Then again these members were orchestrated by their pace of progress in climbing request of H, E, F, D and G, A, K, I, B, L, M, C and J, where D and G have demonstrated equivalent paces of progress. Participant H score difference from pre and post is 25 scores and lowest is J which is 3. It is seen that even participant H, E and F are the participants from the group of no change but they have shown maximum improvement which is possible because among the three categories typical performance has the largest difference of 33 scores whereas Probable difference has 3 and definite difference has 8 which indicates that one has to be really good to cross the first category. Differences in progress are probably since pre-score positioning and, together with the literature, it is stated that this can happen because of numerous components such as individual differences, personality activity, regularity in frequency and live interest (Čoh M, 2004) like/dislike of choice / movement, considerate and implementing energy, existing muscle quality and power (Faigenbaum A. D., 2009), in harmony with the aquatic environment, also observed by the instructor.

Though both the groups have undergoing regular school schedule, but experimental group had undergone an additional program which showed quite an impact of Aquatic Training Program on these children performance enhancement. So it can be stated that the study has positive effect on vestibular processing. From this it can be derived that the ATP was effective for enhancing the Vestibular Processing, another study also states that specified training will give positive effect on Vestibular Processing (Ottenbacher, 1978).

## IV. CONCLUSION

This program is effective and simple to perform, so it is firmly prescribed in a special school for kids with sensitive needs, which can be granted by the teachers, therapists, and teacher assistants who feel comfortable in the water can guarantee a long period of training. The relationship should be between a trainer and a participant for safety and the best outcomes.

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