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OUTCOME OF STRUCTURED AQUATIC TRAINING PROGRAM ON MULTISENSORY PROCESSING AMONG CHILDREN WITH AUTISM

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ABSTRACT: To analyze Multisensory Processing of children having Autism Spectrum Disorder (ASD), this Structured Aquatic Training Program was prepared. For this, 8 children of 10 &11 years of age with sensory needs where purposely chosen. They were further divided into Experimental group and Control group. The Two Way ANOVA was employed to analyze the data collected from a special school at Delhi, India. To find out whether Structure Aquatic Training Program helps in improving the efficiency of Multisensory Processing which in turn process the standard of life of ASD children. The scores obtained from questionnaire in multisensory processing indicate huge changes within the stipulated duration of 9 weeks training program. Further, individualized scale of improvement was studied, which resulted minor to major development of Multisensory Processing among all the experimental group participants. With the findings of this study, it can be assumed that prolonged period of intervention will give enhanced and permanent results.

KEYWORDS: Special Need population, Multisensory Integration (MSI), Autism Spectrum Disorder (ASD), Sensory Processing, Structured Aquatic Training Program.

I. INTRODUCTION

Autism is a disorder which develops during initial 3 years of life and influences the cerebrum's natural development with respect to social and relational building abilities like communication, interaction, behavioral challenges and repetitive actions (Kimberly, 2020). ASDs are a set of developmental disabilities which comprises wide range of spectrum disorder namely mild moderate and severe. ASD children engage themselves in repetitive movements such as rocking, hand flapping and twirling, or in self-abusive behaviors like biting or head-banging. These adversely affect the quality of life. Other usual signs include uncommon and uncontrolled reactions when multiple inputs are received at the same time because it becomes very difficult to process and act on for an individual with ASD. Again when a particular sensory input is received in a large amount such as; very loud noises, bright lights and certain textures of cloths or fabrics may cause unwarranted reactions (National Autism Association, 2011).Kids with sensory impairments confront numerous issues other than the sensor y dis-functioning such as delays in language, speech, fine motor skills, self-care and self-feeding. They also lack in coordination, muscle tone and listening in a noisy environment. As a result, they experience adverse mood swing, eating disorders, anxiety issues, attention-deficit etc (Rachel Fink, 2017). A deficit in multisensory integration leads to physical or emotional imbalance and behavioral challenges which keeps an individual away from living a normal life (Happe, I 996)(Rinehart, 2000). Moreover, an incapability to process multiple sensory inputs will affect attention control, including shifting and joint attention. (Schroeder, 2010).

According to Census 20 I I , 43°/c of 26.8 million individuals suffering from disabilities in India, i.e. I 1.5 2 million are suffering from sensor y disability. In different researches, it is upheld that by regular physical movement an individual can build up all aspects of human body (physical, mental, and spiritual). Both land and water activities are helpful. Additionally, Aquatic activity is a measure of physical activity, which has different advantages. Water movement can lessen the fatigue and give them a healthier and joyful life as well (Ki-Hyeon Kim, 2018). Because of the basic physical characteristics of water viz density, hydrostatic weight, buoyancy, viscosity, and dynamics etc, it is utilized in clinical and recreational applications. Aquatic programs can be powerful and a valuable type of treatment for youngsters and youths with sensory disorders and tactile clutters. It is also beneficial for those with critical movement limitations, where land based physical activities become hard to perform (Lidija D, 2012). Another author opines that swimming or any sort of aquatic activities are quite useful to improve physical fitness which in turn can increase the motor skills and physical capacities of kids and also diminishes disabilities and sensory impairments to a large extent. (Aleksandrovic, 201 6) (Hall, 2013).An experiment has provided solid proof that children who have autism spectrum disorders have

unique/different sensory information aspects for example sound, contact/touch and vision in comparison to stereotypically growing kids (Russo, 2010). This research also states that individuals with ASD have difficulty in coping with multiple sources of sensory information. Effectively receiving signals and executing numerous integrations at the same time is vital for social conduct and behavior. Another study showed that multisensory integration (MSI) can be regulated by specific attention. Theories and concepts of Autism Spectrum Disorders (ASDs) propose that MSI influences this group, though it is not apparent to what range this is associated with disabilities in attention capabilities (Maurice J. C. M, 2011).Another study refers that physical activities are effective for improving multisensory processing (Devid Alais, 2010, March) but not for all memory type (Ayla Barutchu , Jan 2019). It may affect better through practicing activities continuously. The researcher designed a structured aquatic training program to check its impact on multisensory integration.

II. RESEARCH QUESTION

To check the research question following objectives were carried out:

- To understand any change in multisensory integration through the structured aquatic training program.
- To comprehend weather the capabilities of children progress on to the same scale.

III. METHODOLOGY

Subject selection

This study was conducted on 8 students with autism from Asha AWWA School, Delhi Cant, India in the year 2018. Only the students with autism were purposely selected for this study and then assed with the criterion: a) the individuals with non-clinical precondition and b) age vary between 10 & 11 (10.5 years average age). Scores were given on the basis of teacher/guardians opinion and understanding of the individual child's behavior on the Sensory Profile Questionnaire. Students were selected on the basis of their scores, only those who fall in typical performance were chosen for this study. The chosen participants were randomly divided into two groups of 4 participants each in experimental group and control group.

Criterion measure

A validated questionnaire- Sensor y Profile, developed by Winnie Duun, 1999, this is the commonly used questionnaire for understanding the sensor y profile of children and is to be filed by parents/ teachers/ caregiver. The questionnaire consist of 10 sensory sub-topics among which Multisensory processing is one and it consist of 7 statements which are to be rated in a scale of 5 namely: always, frequently, occasionally, seldom, never. Following are the statements of Multisensory processing: Gets lost easily, Has difficulty paying attention, Looks away from tasks to notice all actions in the room, Seems oblivious within an active environment, Hangs on people, furniture, or objects even in acquainted conditions, Walks on toes, Leaves clothing twisted on body.
Moreover the Summary Score Sheet gives the variety of scores to know the participants' performance at three scales which are as follows

- Typical Performance: showing the youngster's performance in adequate condition without any need of interference,
- Probable Difference: it shows that the youngster's competence can be developed further and
- Definite Difference: this indicates that the youngster unquestionably needs intervention and has an area for development.

Construction of Training Program

These activities were constructed with specific exercises directly targeting multisensory processing. The multisensory processing affects the anticipatory and cognitive factors of children (Molinari, 2009).On the other hand (Russo, 2010) says children with autism need more number of stimulation to react and respond. As per (0. Verschu Adaen, 2011)(Lidija D, 2012) combination of aerobic and strength activities are essential and profitable for children with developmental disabilities. This training program was based on body weight and resistance offered by water which has inculcated all activities according to the age group and abilities of the participants for their benefit. Program strength was increased slowly and variations were introduced after every two weeks. Training program was finalized after discussion and assessment of the experts and supervisor. The final program contains three phases, namely, familiarization with new environment, acclimatization with water and water activities and advanced activities. Multisensory learning comprises two or more sensor y involvement within the same activity as in the case of structured aquatic program. In compare to typically developing kids, children with autism need more number of stimulation to react and response (Russo, 2010), so repetition of each activity was set as per the participants.

- *The first tram* includes land based warm up throughout the first week —it's for the familiarization of kids with the new environment i.e., new instructor/ the researcher, pat terns of exercise and water environment

these includes exercises like walking and running in different patterns (straight line, circular, around the pool, zig-zag) on land and in water, and splashing in water with hands and legs.

- *The second phase was* built to remove participant's water fear (drills) and increase confidence activity, strength and endurance, motor skill against resistance water. It comprised only water activities like Walking and Jumping in water, Squatting holding railing, Bubbling and Floating.
- *The third part* of the training contains of progressive exercise which included Walk and squat, Squatting independently, Prone/supine float, Kicking holding pool side/rode/reeling, Floating with wall push, Catching and throwing, Floating and kicking (with kick board). Every two week, adjacent in activities was presented to the participants.
- *Recreational* activities targeting sensory improvement 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 in partner, Balancing on the tube, etc. were also merged in each session.

Administration of the Structured Aquatic Training Program

The present Structured Aquatic Training Program was conducted for 9 weeks 3 days in a week and every session for 40 minutes. The training program was planned on every other day so that they get adequate recovery and increase adaptability for succeeding training (Faigenbaurn A. D., 2009)(Lidija, 2012).For effective administration of the training, the students were divided into two segments of 2 participants each and session were back to back for the instructor but next batch of students will continue the same session (Sessions on: Mon, Wed, Fri; Group I : A, B,; Group 2: C , D) in each session there were two participants and two coaches.

Participants were given vocal prompt paired with a manual guidance when they were unable to follow instructions. Manual guidance was withdrawn as soon as they started engaging themself independently (which usually took 2 to 3 sessions for each activity or more depending upon the severity of the participants and activity). If the participant did not engage in the task even after manual guidance it was assumed that the participant doesn't wish to do the activity nor has a fear of the activity. In such situations, they were guided to skip the activity and try the next activity enlisted. The session is only considered complete when the participant finishes all activities mentioned for one session. After completion of each activity, participants got vocal praise for encouragement. Encouragement through the means of shoulders tapping or shaking hands or high- five or different claps were also given after completion of a session for the day.

Statistical Analysis

The analysis is done using two way ANOVA to understand how multisensory processing affects in pre and post data of the questionnaire. Syntax of SPSS is used to examine the intervention effects batches (experimental and control). Also, they help of Sensory Profile questionnaire was taken to further understand the effect in details.

IV. RESULTS

This presents the findings on the effect of Structured Aquatic Training Program on multisensory Skill, on the basis of pre and post test conducted. Findings are presented in table no 1

Table 1: Descriptive statistics of total Multisensory Processing Score of Sensory Profile

Groups	Performance	Mean	Std. Deviation	N
Experimental	Pre	13.50	5.00	4
	Post	24.75	2.06	4
Control	Pre	11.50	2.64	4
	Post	16.00	4.54	4
Total	Pre	12.50	3.85	8
	Post	20.37	5.70	8

Table explains the descriptive analysis of the multisensory Processing

The descriptive analysis shows the mean results between experimental and control group of the selected participants. Mean score of pretext of experimental group was I 3.50 (SD 5.00) and posttest was 24.75 (SD 2.06). Among the control group, pre and post scores were 11.50 (SD 2.64) and I 6.00 (SD 4.54) respectively. Further, the two way analysis was computed to check whether there was any significant difference in performances, the results shown below in table 2:

Table 2: Analysis of Two Way ANOVA of **Multisensory Processing among pre and post performances between Experimental and Control Group**

Source	Sum of Square	Df	Mean Square	F	Sig.
Groups	115.56	1	115.56	8.12	.01*
Performance	248.06	1	248.06	17.43	.00*
Groups*Performances	45.56	1	45.56	3.20	.09

*p<0.05

Experimental and control groups were found significantly different with the scores as f (Df =1) 8.12, p<0.01. Both pre and post performances were significantly different with f (Df =1) 17.43, p<0.01. The interaction between groups and performances found no significant difference with f (Df =l) 8.05, p<0.01. Thus, training program has some effect over multisensory processing as the scores are showing significant difference. To check the exact effect of training on the experimental and control groups, of control and experimental groups, Syntax of SPSS was further computed. Findings are represented in table below.

Table 3: Pairwise Comparisons of Pre and Post of both the groups in Multisensory Performance

Performance	(I) Groups	(J) Groups	Mean Difference (I - J)	Std. Error	Sig*	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Pre	Experimental	Control	2.00	2.66	.47	-3.81	7.81
Post	Experimental	Control	-8.75	2.66	.00*	2.93	14.56
Groups	**Performance**	**Performance**					
Experimental	Post	Pre	-11.25	2.66	.00*	-17.06	-5.43
Control	Post	Pre	-4.50	2.66	.11	-10.31	1.31

*P< 0.01

The table reveals that pre performance of experimental and control groups have no significant difference p>0.01 (MD= 2.00, Sig= 0.47), it can also be understood by the mean scores of pre performances of experimental (13.50) and control group (11.50). While, when post training performances was compared within experimental and control group, significant difference was found as p<0.01 (MD=-8.75, Sig=0.00). When pre and post performances of experimental group was compared, it shows significant difference p<0.01 (MD = - 11.25, Sig = 0.00). However no significant difference was found in comparison of pre and post performances control group p>0.01 (MD= -4.50, Sig = 0.11). In post performance is experimental group statistically higher (M = 24.75) as compared to the control group (M = 16.00). Conclusively, the pre performances of experimental and control group was statistically significant and post training performances of experimental group has shown a significant improvement, which indicates a positive effect of training on multisensory processing of ASD children. To get a clear glance on the change in performances, the below table of Sensory Profiling of the subjects is reflected as per their performance on the, Questionnaire [summary score sheet].

Table 4: Multisensory Performance Scores before and after the Structured Aquatic Training Program of Nine Weeks.

Groups	Performances	Typical Performance Good Condition (35 – 27 Scores)	Probable Difference Moderate (26 – 24 Scores)	Definite Difference Poor Condition (23 – 7 Score)
Experimental Group	**Pre**	0	0	4
	Post	1	2	1
Control Group	**Pre**	0	0	4
	Post	0	0	4

The table indicates effect of nine weeks training on multisensory processing of the subjects.

It shows that, only the experimental group participants have moved toward progress by showing improvement in

scores and profiling. In addition experimental group pre performance all for participants were falling in definite difference. Where as in post performance only participant is still in definite difference, in the same way no participants were in probable difference and typical performance in pre performance of experimental group but in post performance 2 participants shifted to probable difference and 1 showing the most improvement shifted to typical performance. On the other hand all 4 subjects of control group remained in definite difference in pre and post trials showing no prominent difference.

For further understanding, the case wise improvement is described only for experimental group participants. A positive acceleration from pre to post performances of the experimental group participants, on three scales of sensory profiling (Definite Difference, Probable Difference, Typical Performance) is reflected in fig 1.

Participants	Multisensory performance	Section Raw Score Total	Categories of raw scores
A	Pre	19	
	Post	27	
B	Pre	13	
	Post	25	
C	Pre	7	
	Post	22	
D	Pre	15	
	Post	25	

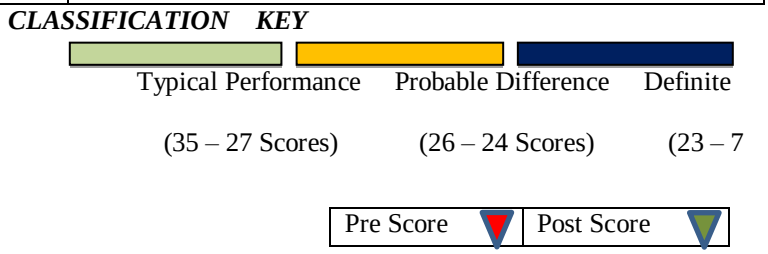

Figure 1: Detailed description of improvement in Experimental Group

This figure presents all (4) participants of experimental group have shown improvement. Among them total 25°/c of participants i.e.; participant A have shown incredible improvement and shifted from typical performance to definite difference which is considered as biggest progress among all. Other two participants B and D have also shown enhanced performance which is 50 % of the total participants, by shifting from typical performance to Probable difference. Only one has remained in same scale of Typical Performance after the training program, which is remaining 25% of total participants this indication that the designed training program has a great impact on these participants performance.

For further understanding of the scale the Typical Performance score range from (7-23=16) which is maximum in relation to other 2 categories, where Probable Deference range from (24- 26=2) and Definite Difference (27-35=8). As the range of Typical Performance is high, the participant may not jump into the higher category, but travelling within the Typical Performance from a low score to high will have a positive sign of multisensory processing. Hence, it is evident that A, B, C and D have improved but even if their scores would have remained in Typical Performance would not be ignorable.

V. DISCUSSION OF FINDINGS

According to (Dubois, 201 1) child improves in sensory processing as well as strengthening of muscles, which can help them in self-esteem, confidence, self-dependence. The main problems faced by this population are the social and behavioral aspects, various researches established link between motor skill deficits which results in disrupted schooling, socialization, and verbal communication (Leary, 1996). Therefore, mechanical preparation and execution through multisensory processing gets disrupted as a result motor dysfunction occurs which leads to social communication both directly and indirectly (gesture) (Gernsbacher, 2008). Performing routine activity efficiently has direct connection with mastering in motor skills. Hence improving motor skills will improve

routine activity performance (Gernsbacher, 2008). To improve motor skills we need to target the fitness related components, the researcher has structured the training program, understanding the requirements and deficits of the identified subjects, which shows great impact on improving performances of experimental group participant's in multisensory processing. The intensity level was uniformly increased through the whole program. Participants were not forced to push their performance beyond their limits. The training was imparted for nine weeks, three sessions per week. This facilitated sufficient recovery after each session and intensified multisensory integration (Lidija D., 2012)(Faigenbaum A. D., 2009). Other studies find that there is positive result to develop aspects like walking gait, gross motor, social aspect, etc. with aquatic intervention which have helped this population (Weaver, 2013) (Yilmaz, 2009) (Hall j. G., 2013)(Dubois, 20 I I). In addition to this water is considered as a more suitable environment than land for children to exercise freely (M. Kelly, 2005) due to properties of water.

Going into the details of this study, the choosing scheme ensured all shortlisted students were almost similar. The study suggests that experimental group (24.75) performance is higher than control group (16.00). Concert evidence was reflected by the pairwise comparison results that in post performance, control and experimental group have major difference. Further the Summery Score Sheet of the questionnaire Sensory Profile, found that only experimental group performance reflects improvement as they have shifted from Typical Performance to Probable Performance and Definite Difference, whereas only I participant was still in Typical Performance, this would have happened due to many reasons like individual difference, pre performance etc. It is said that the learning and cognitive process depends on the severity of the ASD children. It is proven that there condition can be improved in time and with accurate measures so the structured aquatic training program has proved that they can also improve with such activities.

Hence, post-performance of this training program for all the participants of experimental group showed an improvement in the scores of Multisensory Processing. These participants showed minor to major degree of improvement. On the basis of the three scales of Sensory Profiling, improvement can be understood better by presenting in two different perspectives improvement in score with no shift; and improvement in score with shift in higher profile. Participant A (25.00 %) exhibited maximum improvement of 8 scores (score difference) and shifted to superior category of sensory profiling, i.e. from typical performance to definite difference, this participant have shifted two categories during the training program. While another 50% of participants i.e. B and D have shown a moderate improvement of 11 and 10 respectively (score difference) and shifted one category upward, i.e. from typical performance to probable difference. Moreover, participant C showcased maximum improvement among all four experimental group children with a leap of 15 scores but post performances landing was still in typical performance. This participant might have shown a shift to superior category, had the training program been continued. On the contrary participant A had lowest improvement according to score difference but because his pre performance was good so he jumped to superior categories. It is assumed by class teacher that due to new environment participant A was unable to cope up with the school and training with his all potential (parents shifted to a new house, as a result new school for the kid might have been difficult). But it was clearly evident through the improvement in the scores of multisensory processing, that the participants in experimental group had achieved a better functional ability. It can be derived that the post scores is dominated by their pre performance scores, as the pre score was too low even after improving with good score difference as the case for participant A still remain in same categories. Hence, they have reached in the different profiles, even though having similar improvement in terms of scores difference.

They are arranged in ascending order according to their rate of improvement as C, B, D, and A. In case the arrangement is done according to the categories divided by the questionnaire, the participant's sequencing will be A, B, D and C. Variations among the improvements as the literature suggests; variation in grasping power (Marandi SM, 2013), concentration, individual differences, irregularity, activeness and interest (Ooh M, 2004), like/dislike for the activity, accepting and performing the activity, existing muscle strength and power (Faigenbaumn A. D., 2009), water acclarnatization along with these above reasons pre score positioning is also a big factor on participants landing category. This study might not help directly with some issues (speech, self-feeding), but Structured Aquatic Training Program has shown improvement in multisensory processing so coordination and strength will be built for the daily life.

In the same way mood swing, anxiety, attention deficit reduces with the physical properties of water, but combined with multisensory activities, triggers most senses in a smooth way so that the child gets most benefit. In nutshell it can effect positively in reducing behavioral challenges, which is the most challenging factor when we deal with ASD children. During the training program the participants were also brought together only for the recreational session so that t hey can have fun with the pear group and learn social bonding, adjustment , sharing, taking turn in the play, waiting for their turn, etc.

Few studies have described that the importance and effect of individualized aquatic program (M. Kelly J. D., 2005) is beneficiary for children with developmental disability (Bax M , 2005). The result of the present study also sheds light on the positive effect on the ASD children of their multisensory processing with different rates of improvement among participants through the structured aquatic training program which gave a chance of flexibility while imparting the training program considering the situation and individualized needs of the participants. Another good aspect of this training program is pliability of repetitions and rigidness in nature of activities. Hence, this type of aquatic training program may be suitable for a wide extent of ASD children to increase the quality of life and obtain better understanding and ability by mingling up with other kids (Anttila H, 2008)(M. Kelly J. D., 2005) and (Maria A., 2011). Autism causes lack in coordination, muscle tone which results in mood swing, eating disorders, anxiety issues, attention-deficit etc (Rachel Fink, 201 7), week grasping power and attention control, shifting and multiple focus (Schroeder, 2010). The y also face problems with age like abnormal gait and joint angles, reduced limbs movement (RMO) and abnormal posture (Rinehart N . I.-R., 2006) because delay in achieving motor milestones as a child (Espnsito, 2009). These problems were addressed with the structured aquatic training program and found improvement in multisensory processing.

To sum up, even the tiniest indirect shift also leads the participants towards betterment. Water-based skills can be retained for lifetime, though their efficiency may decreases with passing years if not regularly performed (Lidija Dimitrijevic, 2012). Hence the effect of training wanes with time after completing the short term program. So long-term continuous program to maintain and improve the skill is required to achieve long term benefits (0. Verschu Adaen, 2011) (Lidija Dimitrij evic, 2012). 1mproving MSI targetfully has definitely brought positive change among children with ASD as brain receives and regulates inputs of various sensory organs all together, information like proprioception, vision, auditor y, tactile, olfactory, interception, taste and vestibular into usable functional output that is multisensory processing (Devid Alais, 2010, March). Multisensory is the practice which systemizes sensation from body and surrounding, thus making the body effectively compatible within the environment was the main focus of this study.

VI. CONCLUSION

This program is beneficial and easy to execute so it is strongly recommended to special school for children with ASD, which can be imparted by teachers, therapist and assistant teachers who are comfortable in water, longer duration of training can ensure permanent change. The ratio should be one instructor to one participant for the purpose of safety and better results.

VII. REFERENCES

[1] Aleksandrovic, M. J. (2016). The effects of aquatic activities on physical fitness and aquatic skills in children with autism spectrum disorders: A systematic review. *Facta Universitatis, Series: Physical Education and* .

[2] Allen-Collinson, E. A. (2016). Women's embodied experiences of recreational aquatic activity with pre school children. In *'just a swimmer' to a 'swimming mother'* (pp. 35(2), 141-156). Leisure studies.

[3] Anttila H, A.-R. I. (2008). Effectiveness of physical therapy interventions for children with cerebral palsy: A systematic review. *BMC Pediatr*, 8:14 doi:10.1186/1471-2431-8-14.

[4] ARIANE M. DOWD1, N. J. (2010). Motor function in children with autism: Why is this relevant to psychologists? *Clinical Psychologist*, Vol. 14, No. 3, pp. 90–96.

[5] Ayla Barutchu, A. S. (Jan 2019). Multisensory Processing in Event Based Prospective Memory. *Elsevier*, 23-30.

[6] Bax M, G. M. (2005). Proposed definition and classification of cerebral palsy. *Dev Med Child Neurol*, 47(8): 571-576.

[7] Benda, D. H. (2015). *Acupuncture.* Retrieved from No medicine and no side effect: http://acupuncture.co.in/

[8] Braley, P. (2014, March 09). *Sensory Processing: The Vestibular System*. Retrieved from The Inspired Tree House: https://theinspiredtreehouse.com/vestibular/

[9] Chapan, C. (2019, May 06). *fitness professional online.* Retrieved from Vestibular Activities for the special needs children or teen: https://www.fitnessprofessionalonline.com/articles/special-populations/vestibular-activities-for-the-special-needs-child-or-teen/

[10] Čoh M, J.-G. D. (2004). Motor learning in sport. . *Facta Univ Phys Educ Sport*, 2(1).

[11] Collins English Dictionary. (2014).

[12] Darrah, M. K. (2005). Aquatic exercise for children with cerebral palsy. *Developmental Medicine and Child Neurology*, vol. 47, no. 12, pp. 838–842.

[13] Devid Alais, F. N. (2010, March). Multisensory Processing in review: from physiology to behaviour. *Research Gate*, 23(1): 3-38.
[14] dey, a. (2019). aquatics. *tyshdjas*, 2 - 5. dictionary, o. (n.d.).
[15] Dubois, M. (2011). Aquatic Theory for Children with an Autism Spectrum Disorder:. *Occupational Therapists perspectives*, 1 - 49.
[16] Dunn, W. (1999). sensory profile . *User Manual*. Green Vally, Bloomington, Missouri-Kansas, American : NSC Pearson.
[17] Esposito, G. V. (2009). An exploration of symmetry in early autism spectrum disorders:Analysis of lying. *Brain & Development*, 31, 131–138.
[18] Faigenbaum A. D., K. W. (2009). Youth resistance training: updated position statement paper from the national strength and conditioning association. *Journal of Strength and Conditioning Research*, vol. 23, no. 5, pp. S60–S79.
[19] Fink, R. (Nov 6,2017). *The warning signs of Mental illness in children.* Parentaing POD.
[20] Gernsbacher, M. A. (2008). Infant and toddler oral- and manual-motor skills predict later speech fluency in autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 49, 43–50.
[21] GorterJ.W., S. J. (2011). Aquatic Exercise Programs for Children and Adolescents with Cerebral Palsy: What Do We Know and Where Do We Go. *International Journal of Pediatrics*, 7.
[22] Haak Peterson, L. M. (2009). Cerebral palsy and aging. *Developmental Medicine & Child Neurology*, October.
[23] Hall, j. G. (2013). aquatic strategies and techniques and their benefit on children with autism. *election theses and dissertations*, 6.
[24] Happe, F. G. (1996). Studying weak central coherence at low. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 37, 873–877.
[25] Hillary A. Reinhold, M. P. (2014). Nervous system. In *Acute care Handbook for Physical Therapists* (p. Edition 4). https://www.sciencedirect.com/topics/medicine-and-dentistry/muscle-tone.
[26] Iliana. (2013, February 23). *The CP Dairy.* Retrieved from https://www.thecpdiary.com/health-and-wellbeing/sensory-problems-cp
[27] İlker Yılmaz, N. E. (2009). The Effects of Water Exercises and Swimming on Physical Fitness of Children with Mental Retardation.
[28] Ki-Hyeon Kim, B.-A. L.-J. (2018). effect of aquatic exercise on health-related physical fitness, blood fat, and immune functions of children with disabilities. *Journal of Exercise Rehabilitation*, 14(2): 289-293.
[29] Kimberly. (2020). *what is autism.* Holland: healthline.
[30] kumar, l. (2019). *wecapable*. Retrieved 2011, from Disable population in india: https://wecapable.com/disabled-population-india-data/
[31] Leary, M. R. (1996). Moving on: Autism and movement disturbance. *Mental Retardation*, 34, 39–53.
[32] Lidija D, M. A. (2012). the effect of Aquatic Intervention on gross motor function and aquatic skill in children with cerebral palsy. *journal of human kinetics*, 32: 167 - 174.
[33] M Peterson, P. Z. (2015). Greater adipose tissue distribution and diminished spinal musculoskeletal density in adults with cerebral palsy. *ArchPhys Med Rehabil.*, 96,1828–1833.
[34] M. Kelly, J. (2005). Aquatic exercise for children with cerebral palsy. *Developmental Medicine and Child Neurology*, vol. 47, no. 12, pp. 838–842.
[35] Maggie Dubois. (2011). Aquatic Theory for Children with an Autism Spectrum Disorder:. *Occupational Therapists perspectives*, 1 - 49.
[36] Marandi SM, N. V. (2013). A COMPARISION OF 12 WEEKS OF PILATES AND AQUATIC TRAINING ON THE DYNAMIC BALANCE OF WOMEN WITH MULTITPLE SCLEROSIS. *Int J Prev Medical*, 110-7.
[37] Maria A. Fragala Pinkham, S. M. (August 2011). Group swimming and aquatic exercise programme for children with Autism Spectrum Disorders: A pilot study. *Developmental Neurorehabilitation*, 14(4): 230-241.
[38] Maurice J. C. M, M. B. (2011). Multisensory Integration and Attention in Autism Spectrum Disorder: Evidence from Event-Related Potentials. *PLOS ONE*.
[39] MD Peterson, H. H. (2012). Predictors of cardiometabolic risk among adults with cerebral palsy. *Arch Phys Med Rehabil*, 93:816–821.
[40] MN Eek, R. T. (2011). Muscle strength and kinetic gait pattern in children with bilateral spastic CP. *Gait Posture*, 33:333–337.
[41] Molinari, M. R. (2009). State estimation, response prediction, and cerebellar sensory processing for behavioral control. *Cerebellum*, 8, 399–402.
[42] NIH. (2017). Cerebral Palsy: Overview. *National Institutes of Health*.
[43] NINDS. (2013, July). *Cerebral Palsy: Hope Through Research.* Retrieved from National Institute of

Neurological Disorders and Stroke and National Institutes of Health: https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Hope-Through-Research/Cerebral-Palsy-Hope-Through-Research

[44] O. VerschuAdaen, L. ,. (2011). , "Muscle strengthening in children and adolescents with spastic cerebral palsy: considerations for future resistance training protocols. *Physical Therapy*, vol. 91, no. 7, p 1130 - 1139.

[45] oxford dictionary. (n.d.).

[46] pan, c. y. (2019). Effects of water exercise swimming program on aquatic skills and social behaviors in children with autism spectrum disorders. *the national autisum socity*, Feb 2.

[47] Rachel Fink. (2017). *The warning signs of Mental illness in children.* Parentaing POD.

[48] Rinehart, N. J. (2000). Atypical interference of local detail on global processing in high-functioning autism and Asperger's disorder. *Journal of Child Psychology and Psychiatry*, 41, 769–778.

[49] Rinehart, N. J.-R. (2006). An examination of movement kinematics in young people with high highfunctioning autism and Asperger's disorder: Further evidencefor a motor planning deficit. *Journal of Autism and Develop Developmental*, 36, 757–767.

[50] Rosenbaum P., P. N. (2007). A report: the definition and classification of cerebral palsy April 2006. *Developmental Medicine and Child Neurology*, vol. 109, pp. 8–14.

[51] Russo, N. S. (2010). Multisensory processing in children with autism: high-density electrical mapping of auditory-somatosensory integration. *autism research*.

[52] Schroeder, J. H. (2010). The neurobiology of autism: Theoretical applica tions. *Research in Autism Spectrum Disorders*,, 4, 555–564.

[53] SLCarlon, N. T. (2013). Differences in habitual physical activity levels of young people with cerebral palsy and their typically developing peers: a systematic review. *Disabil Rehabil*, 35:647–655.

[54] Sultana, I. (2018, March 9). *Daily Sun.* Retrieved from Sensory Integration Difficulties in Children with Cerebral Palsy: https://www.daily-sun.com/arcprint/details/293956/Sensory-Integration-Difficulties-in-Children-with-Cerebral-Palsy/2018-03-09

[55] WB Strong, R. M. (2005). Evidence based physical activity for school-age youth. *J Pediatric*, 146:732–737.

[56] Weaver, J. A. (2013). Effect of a Cardio Kickboxing Program on Balance, Muscular sterength, Muscular endurance, Flexibility and Mood in Adultd with Developmental Disability. *Reasearch Gate*.

[57] Yılmaz, İ. F. (2009). The Effects of Water Exercises and Swimming on Physical Fitness of Children with Mental Retardation.