"Aquatic Games Effectiveness in Controlling Attention Deficit Hyperactivity Disorder (ADHD) in Children"

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Introduction and Problem

Pre-school is the pivotal stage in every human being's life where his personality is formed. Children are able to learn and absorb an insurmountable amount of information in that stage. Experts with focused interest on this stage claim that playing or movement in general is the most suitable learning method for children. "Aziza Khalil (2013), "Ibrahim Badr" (2004), "Laila Zahran", and others (2005) agree that playing is the first form of communication between children and the surrounding environment, as it helps exteriorize inner emotions and conflicts that may lead to stress. Scientists utilize playing in treating children, and the tools they use are the source of learning. Playing is essential to introduce a positive impact on social interaction for individuals in general, and disabled individuals in particular. It also allows the opportunity of adapting to one's disability. (9) (1) (10).

" Karin" and others (2011), "Neveen Al-Afifi, Hadir Said" (2010), "Noha Yehia"(2008) and "Adel Fawzy" (1997) say that sports play a role in the treatment of different diseases at different ages for both healthy and disabled individuals. Swimming is a sport that creates a fun and playful atmosphere away from the complicated routine and tiring work of everyday life through a physical activity that's loved by everyone; children in particular. Swimming is uniquely important amongst other sports for its physical, psychological and social benefits. Aquatic gmaes are important and favored methods of swimming teaching and performance enhancement; therefore, teachers must choose from these games what suits the learner's age, physical abilities and targeted skills. Aquatic games also increase the learner's motivation and enthusiasm to engage and maximize on development of basic skills and physical abilities. (26) (18) (19) (7)

"Brown" (2009) and "Kauffman" (2009) say that ADHD is a behavioral case and over the past few decades it has been referred to as Hyperactivity Syndrome, Minor Brain damage and many others. It isn't a slight increase in activity, but a very noticeable one. It's an inner conflict to stay active which is beyond a child's ability to stop or control unless it had a goal set by the child

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himself. If left untreated ADHD can lead to behavioral and social problems later on. (22) (27)

"Mahmoud El Deeb" (2015), "Mohammed Kamel" (2008) and "Sahar EL-Kharshumy" (2004) say that there are known symptoms for ADHD that show the observer a child's increase in movement and attention deficit such as hyperactivity, impulsivity, inattention, absentmindedness, forgetfulness, inability to stay in one place for several seconds or minutes, talkativeness, inability to abide by rules, wandering off from one activity to the next, constant fast movement, difficulty in sustaining attention to visual and audio information, interrupting, Answering inattentively, not sitting quietly, recklessness, moodiness, not following verbal orders regardless of punishment or threats, random and aimless performance in sports activities as the child is always ready for movement as if powered by an engine; however, with no aim, emotionality, wearing others out, wandering off tasks, noticeable increase in movement, etc. There are several causes for ADHD that can be categorized under: Genetic, physical, psychological or environmental elements. (5) (16) (36)

" Williams, Wilkins" (2006), "Barkley" and others (2002) agree that the mental capabilities for ADHD children are normal or close to being so. Their main problem, however, is the inability to fully benefit from learning and the difficulties they face with skills and sports activities due to their hyperactivity and attention deficit. They stress that ADHD children first need to control those behavioral issues in order to benefit from the learning process. "Safinaz Kamal" (2010) says that ADHD children don't intend to cause trouble for anyone, but their neurological system triggers inappropriate responses. They are aware of their problems, but it's beyond their control. (5) (21) (30)

Researchers, Physicians and psychological and educational experts have attempted various treatments for ADHD including medicinal treatments (Stimulant Drugs), psychological, behavioral and educational treatments; in addition to creating special-education programs and parent-training programs. ADHD treatment programs have been discussed by Funk (2011), "Ashraf Abdel-Ghany" (2008), "Tom" (2006) and "Ma'suma Ibrahim" (2003) in the form of behavior adjustment sessions either carried out through school programs, or by psychotherapists and speech therapists. These programs aim to develop the skills ADHD children had lost due to their disorder. On the other "hand Huss-M, all" (2010), "Joy", all (2010), "Ashraf Nabih" (2010), "Sinn N" (2008) adopt the point of view of nutritional treatment advocating the effects of nutrition on ADHD children like consuming supplements and eliminating sugar and food colorings. (23) (2) (29) (17) (24) (25) (3) (28)

Based the above, both researchers agree that ADHD treatment programs vary according to the causes of the disorder on the one hand, and the interests of specialists and scholars on the other. Therefore, we have concluded that solving this problem requires researching the appropriate motion programs.

Playing is a main part of motion education that is most attractive to children. Some educators and psychologists believe that it's quite appropriate for children with psychological disorders or conditions such as aggressiveness, nervousness, reclusiveness, etc.

Attention Deficit and Hyperactivity Disorder (ADHD) is undoubtedly a condition worth studying as it's relatively new compared to other categories of disabilities. ADHD research has included the definition, concept, causes, medicinal treatments and learning skills. We believe, however, it has left much to be studied in the field of playing in this area. We have found no research regarding aquatic games and teaching basic swimming skills through play. This has led us to establish a playing program in the water to increase focus and limit hyperactivity.

Aims of Research

This research aims to identify the effect of aquatic games on:

1. Level of hyperactivity and attention deficit on all aspects for ADHD children (Inattention, hyperactivity, impulsivity)
2. Learning the basic skills of swimming

Hypotheses of Research

The aquatic games program has a positive impact on:

1. Level of hyperactivity and attention deficit on all aspects for ADHD children (Inattention, Constant movement, impulsivity)
2. Learning the basic skills of swimming

Terminology:

Attention Deficit Hyperactivity Disorder:

The American society (2002) defines ADHD as a child's inability to sustain focus for a long time presenting a difficulty in following direction and seeing tasks through. It's accompanied by aimless hyperactivity that is inappropriate to the situation or given tasks causing annoyance to others (20)

Double Drawn:

Mohammed El-Nouby (2005) defines double drawn as a noticeable behavior that showcases a difficulty in quickly recalling attention, difficulty maintaining it and easily losing it to any outside stimulants; therefore they are unable to filter stimulants. It's indicated by high levels of attention deficit. (12:2)

Hyperactivity:

Increased and out of control movement accompanied by constant activity indoors or outdoors (27:564)

Impulsivity:

Behaving hastily with no regard to consequences exposing a child to danger or embarrassment; for example: chasing after a football in a heavy traffic street, or climbing to high spots (31)

Aquatic Games:

Games played by, in or under water with or without the use of tools. They are played individually, in pairs or in groups in an organized manner or freely aiming at learning, entertainment or competition. (Operative Definition)

Research Design

First: Method

Researchers have used the experimental method using one experimental group pretest and posttest design, as this suits the nature of this study.

Second: Participants

Participants have been chosen through purposive sampling from ADHD children studying at schools in Helwan and 15th of May cities. The sample consists of 40 children between the ages of 5 and 7.

Participants have been divided as follows:

- 20 children for pilot experiment
- 20 children for main experiment. 5 children have been eliminated due to irregularities in attendance; therefore, the main sample is 15 ADHD children.

Sampling Criteria:

- The child is in the second year of preschool. The teacher is the same from the previous year and is well acquainted with the child.
- The child is diagnosed with ADHD
- No physical or mental disabilities
- Parental consent to conduct the suggested program "Aquatic games increase attention and limit hyperactivity in ADHD children" upon explaining the aim and steps of the research in order to achieve optimum results and guarantee participants' commitment throughout the experiment.
- The child doesn't suffer from any chronic diseases

Researchers have measured the homogeneity of the following variables:

1. Height, weight, age
2. ADHD scale
3. Basic swimming skills assessment tests (chart 1)

Table (1)
Sample variables arithmetic mean, standard Deviation and Skewness Coefficient

N=15

s	Variables		Measurement	Mean	Std. deviation	Median	Skewness
1	**Age**		Year	5.93	0.43	6.00	0.15
2	**Weight**		Kg	19.67	0.86	20.00	-0.17
3	**Height**		Cm	1.04	0.42	1.04	0.27
4	**ADHD Scale**	Family attention deficit	**Degree**	41.00	1.41	41.00	0.18-
		Family hyperactivity points	**Degree**	63.02	1.29	64.00	1.35-
		Family impulsivity points	**Degree**	50.00	1.48	51.00	1.28-
		Teacher Attention deficit points	**Degree**	54.00	1.25	54.00	0.25-
		Teacher Hyperactivity points	**Degree**	49.87	1.36	50.00	0.77
		Teacher impulsivity points	**Degree**	44.06	.88	44.00	1.42-
		Family scale points	**Degree**	154.87	2.33	155.00	0.13
		Teacher Scale points	**Degree**	147.93	2.66	148.00	0.49
		Total scale points	**Degree**	302.80	4.26	302.81	0.28
5	**Adapting to the water and overcoming fear**	Test (1)	**Degree**	1.20	0.41	1.00	1.67
		Test (2)	**Degree**	1.27	0.46	1.00	1.18
6	**Breathing and opening the eyes**	Test (1)	**Degree**	1.33	0.49	1.01	1.67
		Test (2)	**Degree**	1.21	0.41	1.00	0.79
7	**Floating and sliding**	Test (1)	**Degree**	1.20	0.41	1.00	1.18
		Test (2)	**Degree**	1.13	0.35	1.00	1.67
8	**Moving in the water**	Test (1)	**Degree**	1.14	0.36	1.00	2.41
9	**Jumping and standing in the water**	Test (1)	**Degree**	1.20	0.41	1.00	2.41
		Test (2)	**Degree**	1.20	0.41	1.01	0.79

Table (1) shows that Skewness coefficient values vary from (-1.42 to 2.41), thus limited between -3 & +3 which indicated the homogeneity of this study's variables.

Data Assembling Tools:

First: Tools and instruments

- Swimming Pool. Space: 6 by 10 m, depth: 50~150 cm, water temperature: 35-37 ˚C
- Swimming Pool. Space: 12.5 by 25 m, depth: 70cm-3m for learning to jump and stand in the water.
- Restameter: for measuring height to the nearest 0.5cm

- Weighing Scale: for measuring weight to the nearest 0.5 kg
- Toys: balloons, ping-pong balls, small diving toys, big plastic hoops, long sticks, pool wide rope, floating boards, floating small toys, big colorful balls, Swedish exercise bench, adhesive tape, plastic cups, bucket, boats, fish, small hoops, floating stars, basket.

Second: Scales and tests:

- Attention Deficit and Hyperactivity Disorder Evaluation Scale Annex (4)

The scale was prepared by Dr. Magdy EL-Dosuky (2006) for both Family and teacher ratings over three supplementary scales for each rating: inattention, hyperactivity, impulsivity. High points indicate that a child has ADHD and vice versa.

- Swimming basic skills assessment sheet that included 7 variables; However, 80% of variables where approved by experts and chosen making the final number of variables 5. Annex (2)
- Individual data recording sheets for all participants designed by the researchers to include basic swimming skills: adapting to water and overcoming fear, breathing and opening the eyes, floating and sliding, moving in the water, jumping and standing in the water. Annex (3)

Third: Aquatic Games Programs:

1. Initial form for aquatic exercise Annex (5)

An initial proposal for the program and exercises was presented to a group of experts. Units were set at 5 units for basic swimming skills based on the results of the initial presentation annex (3). Lessons were set at 6 lessons for every unit; each lesson 40 minutes long for a total of 1200 minutes for the entire program. Experts suggested that it be adjusted to 50 minutes making the total of the program 1500 minutes. Methods and phrasings of some exercises were also adjusted.

2. Final state of the program Annex (6)

Based on theoretical and related studies and expert opinions, an aquatic games program for ADHD children was set. The proposed program aimed at the following:

Helping the sample of participating children acquire the skills chosen within the study; in order to achieve that the researcher took into consideration the following aspects:

- Games' appropriateness to achieving the targeted goal

- Appropriateness to the participants
- The graduation from easy to difficult
- Mastering a skill before moving to the next
- The games' entertainment value
- Appropriateness of the chosen tools to the participants
- Selecting exercises and games that require mental effort like matching exercises to encourage focus for a relatively short time.
- Selecting exercises and games that require mental effort like matching exercises to encourage focus for a relatively short time

2. Program Criteria

- Presenting various examples for carrying out games and taught skills
- Variety in general content and flexibility in units to suit individual, cognitive and motor differences among participants.
- Setting a form of communication with ADHD children with limited direct instruction during performance and unifying the used directions. For example, (up or down)
  - Using audio and visual stimulants taking into consideration preparing attention attracting methods such as variation of shapes, sizes and colors of used tools and models.

Program Timeframe:

The time frame for the study has been set based on expert advice and taking into consideration the nature of the participants. The 1500 minute program consists of (5) training units at 300 minutes each; every unit has 650 minute lessons that include exercises fitted to achieve the goal of the unit.

Program Duration: 10 weeks

Number of lessons: 30 lessons (3 per week)

Lesson Duration: 50 minutes divided as follows:

- Preparation and warming up (5 min.)
- Core lesson (40 min.)
- Conclusion (5 min.)

The program has been divided into 5 units:

1. Training Unit 1: (6) lessons

Target: Adapting to the water and eliminating fear

2. Training Unit 2: (6) lessons
Target: Exhaling and opening the eyes underwater
3. Training Unit 3: (6) lessons
Target: Floating and sliding
4. Training Unit 4: (6) lessons
Target: Moving in the water
5. Training Unit 5: (6) lessons
Target: Jumping into the water and standing in the water

Scientific Measures:

Both researchers re-standardized the ADHD evaluation scale despite the fact that there are scientific measures for said scale in order to guarantee accuracy with a sample similar to this study's participants.

First: Validity

Extreme Group Comparison Validity

Researchers applied the ADHD scale on Monday Oct.5th 2015 to calculate validity using extreme group comparison. This comparison was conducted on a group of 20 children from the participants, but not in the main sample. Points were ordered cumulatively, divided into quartiles and then comparing higher and lower quartiles to prove the validity of the questionnaire. A table was put together to measure that, and it's clarified in table (2)

Table (2)
Validity Coefficient for ADHD Scale

N=20

s	Variables		Measurement	Upper Quartile		Lower Quartile		"T" Value
				mean	Deviation	mean	Deviation	
1.	ADHD Scale	Family Inattention	Degree	42.40	0.55	38.8	0.54	7.77
2.		Family yperactivity	Degree	65.80	0.45	61.80	0.45	12.64
3.		Family Impulsivity	Degree	52.40	1.34	47.40	0.86	5.97
4.		Teacher inattention	Degree	55.60	0.57	52.40	0.57	16.00
5.		Teacher hyperactivity	Degree	51.60	0.55	47.60	1.51	7.30
6.		Teacher impulsivity	Degree	44.80	0.45	42.40	0.54	9.79
7.		Family scale	Degree	158.80	0.84	149.20	1.17	14.15
8.		Teacher scale	Degree	151.0	0.45	143.60	2.07	8.72
9.		Total scale	Degree	308.60	1.81	295.20	0.83	26.28

"T" Value at (0.05) level = (2.88)

The calculated "T" value is (26.28: 5.97) which is higher than the critical value (2.88) at a (0.05) level of significance; therefore, table 2 shows a statistically significant difference between the upper and lower quartiles in favor of the lower quartile group. This indicates the validity of the ADHD evaluation scale.

Second: Reliability

The reliability of the ADHD scale has been calculated through the Test-Retest method in the period Oct.5th 2015 – Oct.11th 2015 on a randomly selected sample of (20) children from the research sample the main study participants. Table (3) shows the Correlation coefficients between Test 1 and Test 2 of the scale.

Table (3)

ADHD Evaluation Scale Reliability Coefficient

s	Variables		Measurement	Test 1		Test 2		Reliability Coefficient (R)
				mean	Deviation	mean	Deviation	
1.	ADHD Scale	Family Inattention	Degree	40.40	1.63	40.55	1.73	*087
2.		Family hyperactivity	Degree	63.75	1.58	63.85	2.08	*0.59
3.		Family Impulsivity	Degree	50.00	1.81	49.80	1.85	*0.90
4.		Teacher inattention	Degree	54.00	1.29	53.95	1.27	*0.73
5.		Teacher hyperactivity	Degree	50.01	1.19	50.10	1.17	*0.96
6.		Teacher impulsivity	Degree	44.01	079	44.25	0.78	*0.89
7.		Family scale	Degree	148.02	2.19	148.30	2.20	*0.78
8.		Teacher scale	Degree	154.45	3.58	145.05	3.48	*0.97
9.		Total scale	Degree	302.65	4.30	302.15	4.78	*0.690

"R" value at 0.05 level = (0.44)

Table (3) shows a statistically significant correlation between the initial test and the retesting at significance level of 0.05 indicating high reliability to the test.

Research Operational Steps:

Pilot Study:

The pilot study was conducted on(20) children from the research sample the main study participants in the period between Oct.5th 2015 and Oct.11th 2015 with the following objectives:

- Measuring the time needed to conduct testing
- Identifying the obstacles and problems that may face both researchers and their assistance over the course of the study, and finding proper solutions for them
- Training and dispatching assistants (3 individuals)
- Clarifying whether the games are suitable for the participants

*Pretest:

The Pretest was conducted at the 15th of May Social and Sports Club pool as follows:

1- The Attention Deficit and Hyperactivity Disorder Evaluation Scale was conducted on Tuesday Oct.13th 2015.

2- A swimming level of skill evaluation on Nov.4th 2015. The evaluation was conducted by 3 teaching board members from the Department of Water Sports Faculty of Physical Education in Cairo. The researcher applied the evaluation sheet as of lesson (9) as the children had no background of swimming skills and hadn't undergone prior aquatic programs. Therefore, the researcher allowed them 9 lessons to adapt to the test before conducting the pretest.

Conducting Research Experiment:

The final program was conducted over 10 weeks in the period between October 15th 2015 and Dec.22nd 2015.

***Posttest:**

Having finalized the program, posttests were conducted as such:

1- ADHD Evaluation scale on Dec.23rd, 24th 2015

2- Basic skill evaluation tests on Thursday Dec.24th 2015.

Statistical Processing:

To realize the hypotheses and objectives of the study, we used the following statistical methods:

1. Arithmetic Mean
2. Median
3. Skewness Coefficient
4. T-test
5. Correlative Coefficient "R"
6. Rate of Change (Percentage)

Results and Discussion

First: Presenting Results

Table (4)

Variability of Pretest and Posttest of Inattention and Hyperactivity (ADHD) Evaluation Scale

N=15

	Variables		Measurement	Pre Measurement		Post Measurement		"T" Value	Improvement %
				mean	Deviation	mean	Deviation		
1.	ADHD Scale	Family Inattention	Degree	41.00	1.41	28.13	1.55	*22.66	31.39
2.		Family hyperactivity	Degree	63.02	1.29	47.73	2.43	*20.19	24.71
3.		Family Impulsivity	Degree	50.00	1.48	37.20	2.48	*19.73	26.29
4.		Teacher inattention	Degree	54.00	1.25	41.27	1.98	*22.55	23.57
5.		Teacher hyperactivity	Degree	49.87	1.36	36.67	2.58	*19.13	26.47
6.		Teacher impulsivity	Degree	44.06	.88	32.07	1.62	*13.72	27.56
7.		Family scale	Degree	154.87	2.33	113.07	4.03	*40.08	26.67
8.		Teacher scale	Degree	147.93	2.66	110.00	4.47	*27.66	25.64
9.		Total scale	Degree	302.7	4.13	223.07	7.47	*39.11	26.15

"T" Value at significance level(0.05) = (2.262)

Table (4) shows a statistically significant difference between the pre and posttests for the ADHD evaluation scale in favor of the posttest, and a (23.57-31.39%) rate of change increase in the posttest.

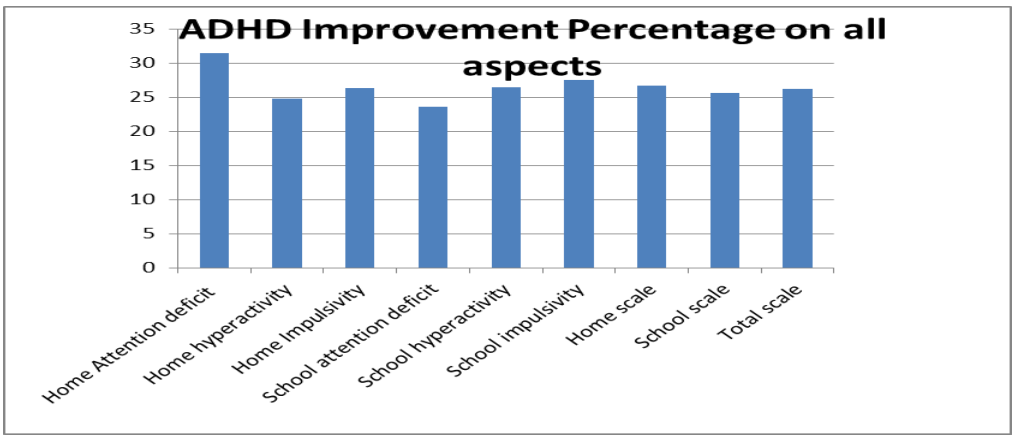

Chart (1)

Table (5)

Variability of Pretest and Posttest, and Rate of Change for Basic Swimming Skills Evaluation tests

N=15

	Variables		Measurement	Pre Measurement		Post Measurement		"T" Value	Improvement %
				mean	Deviation	mean	Deviation		
1.	**Adapting to the water and overcoming fear**	Test (1)	**Degree**	1.20	0.41	4.80	0.41	18.92*	300.00
		Test (2)	**Degree**	1.27	0.46	4.60	0.51	14.35*	262.20
2.	**Breathing and opening the eyes**	Test(1)	**Degree**	1.33	0.49	4.47	0.64	12.25*	236.09
		Test(2)	**Degree**	1.21	0.41	4.60	0.63	20.82*	280.17
3.	**Floating and sliding**	Test(1)	**Degree**	1.20	0.41	4.59	0.51	20.82*	282.5
		Test(2)	**Degree**	1.13	0.35	4.60	0.51	26.00*	307.08
4.	**Moving in the water**	Test(1)	**Degree**	1.14	0.36	4.67	0.48	21.38*	309.64
5.	**Jumping and standing in the water**	Test(1)	**Degree**	1.20	0.41	4.40	0.74	18.33*	266.67
		Test(2)	**Degree**	1.20	0.41	4.40	0.47	16.00*	266.67

"T" Value at significance level(0.05) =(2.262)

Table 5 shows a statistically significant difference between the pre and posttests for the basic skills evaluation in favor of the posttest, and a (236.09-309.64%)rate of change increase in the posttest.

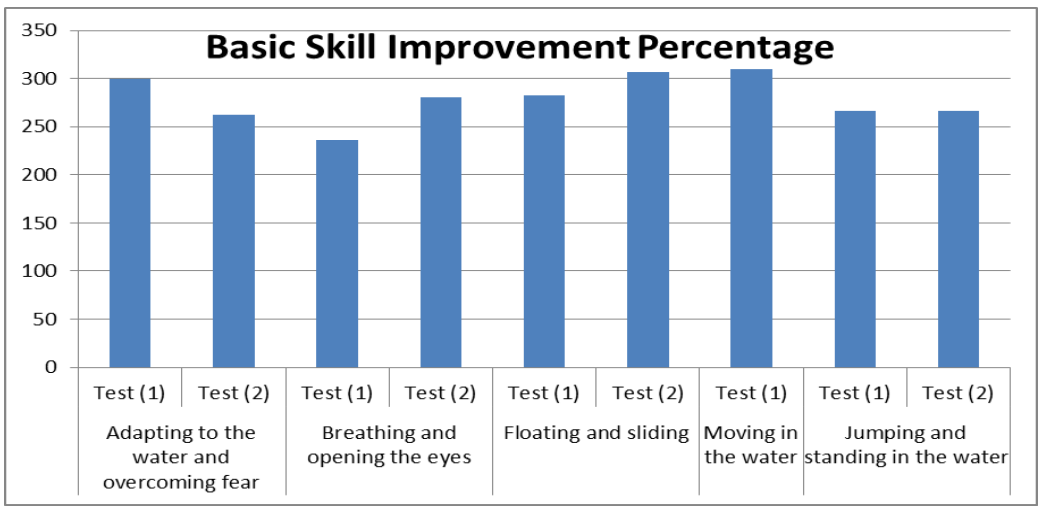

Chart (2)

Second: Discussing Results:

Table 4 shows a statistically significant difference in favor of the posttest for the ADHD scale in all its aspects as the percentage of improvement reached (31.39%) for Family Inattention, (23.57%) for Teacher Inattention, (24.71%) for Family Hyperactivity, (26.47%) for Teacher Hyperactivity, (26.29%) for Family Impulsivity and (27.56%) for Teacher Impulsivity. The total Family scale achieved a 26.67% improvement, and the teacher scale reached a (25.64%) improvement making the total scale improvement (26.15%.)We attribute these results to the principles upon which the program activities were based, the focus on achieving constant attention by utilizing various stimulants during training, attempting to benefit from the children's potential and finding the suitable ways to communicate with them and attract their lasting attention to the aquatic games and exercises to be introduced.

These results are in agreement with "Reda Khairy" (2012), "Ashraf Nabih" (2011), "Karin" and others (2011), "Neveen El-Afifi, Hadir Said" (2010), "Noha Yehia" 2008 and "mohammed Khetab" 2004.As they all agree that playing, in or out of the water, has a positive effect on hyperactivity, inattention and impulsivity. They also agree that laying can have a positive effect on many behavioral patterns, social roles, quality of life, and motor skills, and that it can limit unwanted behavior in ADHD children.

All the above proves the correctness of the first hypothesis that states: **Aquatic games have a positive effect on Attention Deficit and Hyperactivity (ADHD) children in all ADHD evaluation scale aspects (inattention, hyperactivity and impulsivity)**

Table 5 shows a statistically significant difference in favor of the posttest in basic skills through the elements of the program: adapting to the water and overcoming fear, breathing and opening the eyes, floating and sliding, moving in the water and jumping and standing in the water. The rates of change in basic skill evaluation tests reached a percentage of improvement of 236.09-309.64%. We attribute this improvement to utilizing tools in the games, graduating from simple to medium and varying between individual, pairs, and group games which, in turn, helped children increase social interaction with their peers, increase attention and limit symptoms of hyperactivity and impulsivity.

These results show the importance of various aquatic games and utilizing water in helping children gain psychological, mental and physical skills and learn basic swimming skills. Thereby these results are in agreement with

"Neveen Al-Afifi, Hadir El-Said" (2010), "Noha Yehia" (2008), "Mohammed Abdel-Salam" (2002) and "Azza Abdel-Monsef" (2001). This proves the correctness of the second hypothesis which states"

"The aquatic games program has a positive effect in teaching ADHD children basic swimming skills."

Conclusions:

From the data and information both researchers attained, the results discussed and explained, the nature of this study's objectives and participants and in the light of similar theoretic studies and research; both researchers were able to conclude the following:

1- The aquatic games program limits attention deficit in ADHD children.

2- The aquatic games program limits hyperactivity in ADHD children.

3- The aquatic games program limits impulsivity in ADHD children.

4- The aquatic games program allows ADHD children to gain some basic swimming skills.

Recommendations:

In light of the research results, researchers recommend the following:

1- Utilizing the suggested program and making it a main part of treatment programs for its positive impact on developing basic skills and limiting hyperactivity, inattention and impulsivity in ADHD children.

2- Conducting similar studies to different age groups of ADHD children and designing various treatment programs by experts in different fields.

3- Allowing ADHD children the chance to communicate and participate in recreational and dynamic activities and games that are designed on a scientific basis to help them limit inattention and hyperactivity symptoms.

4-Raising awareness about the importance of sports to ADHD children and guiding parents regarding the importance of exercise in improving children's physical, psychological and social conditions.

5- Training personnel to care for ADHD children inside schools and clubs and holding guidance courses for families on dealing with ADHD children.

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