The effect of an aquatic rehabilitation program to learn the backstroke and treatment hyperkyphosis for primary stage students

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The research aims to design an aquatic rehabilitation program to learn the backstroke and treatment hyperkyphosis for primary stage students. The two researchers used the semi-experimental method by using the pre and post measurement for one experimental group on a sample selected intentionally, it consisted of (20) students. The results of the research have shown that the positive effect of an aquatic rehabilitation program on the students with hyperkyphosis resulted in an improvement in the variables under consideration (increase in the total length of the body and the length of the spine, improvement in the performance skills of the Backstroke, improvement in the measurements of the angles of the thoracic spine region when performing various movements "upright, taking maximum inspiration, maximum output exhalation", improvement of the physiological measurements such as (inspiratory vital capacity, forced vital capacity, forced expiratory volume in 1 second , peak expiratory flow , blood pressure "systolic, diastolic ", pulse at rest) .

Keywords:

(Aquatic Rehabilitation – Backstroke – Hyperkyphosis)

Introduction

The primary stage characterized by various postural, physiological, anatomical and morphological changes and many other changes which clearly effect on the individual's posture, at this stage, students can control their movements to become more purposeful and economical in exerting effort, at the end of this stage, some physiological changes begin in body's organs. (Kherbotaly, 2011)

It should be noted that if students experienced postural problems, this will effect on the biological and internal body's organs. Hyperkyphosis is accompanied by occurrence of lungs pressure that decreases its functional efficiency, it results in several disorders to the biological organs exist in this area and decreases its efficiency in performance. (Rahim, 2011)

It also found that using kinetic rehabilitation using water therapy has remarkable results in qualifying spinal imbalances such as "hyperkyphosis, scoliosis, hyperlordosis, .. etc". (Mohammed, 2011)

It should be noted that there are some studies that recently studied the rehabilitation of hyperkyphosis. Whether that by using rehabilitation exercises used in water or outside for all groups " The health and those with special abilities, …etc." With both genders whether are adults or not from it one of them is the study of (Hamid, 2014; Ibrahim, 2013; Amin, 2013; Mubarak, 2012; Azizi, 2011).

The results of survey study conducted by the second researcher which entitled "**Postural imbalances of the spinal curves and its relation to the physiological status for primary stage students**" has proven that 9.3% of primary stage students at Qalubia governorate have "hyperkyphosis", through teaching swimming curriculums. The first researcher at college suggested to the second research to rehabilitate students with hyperkyphosis by using water therapy and teaching them the backstroke and that is what urged the two researchers to the following question:

What is the effect of an aquatic rehabilitation program to learn the backstroke and treatment hyperkyphosis for primary stage students?

The Aim of Research

The research aims at recognizing the effect of an aquatic rehabilitation program to learn the backstroke and treatment hyperkyphosis for primary stage students under research in each of the following:

1-The total length of body and spine from different situations (standing upright, taking peak inspiration & taking out the peak expiratory flow)

2-The level of skilled performance for the backstroke.

3-Angles measurements in the thoracic spine when performing various movements (standing upright, taking peak inspiration & outputting peak expiration).

4-Physiological measurements (inspiratory vital capacity, forced vital capacity, forced expiratory volume in 1 second , peak expiratory flow , blood pressure "systolic, diastolic " & pulse at rest)

Hypothesis of Research

1-There are statically significant differences between the pre and post measurement of the experimental group under research in favor of the post measurement in the total height of the body and length of the spine in the different situation (standing upright, taking the peak inspiration & taking out the peak expiratory flow).

2-There are statically significant differences between the pre and post measurement of the experimental group under research in favor of the post measurement in the level of performance skills of backstroke.

3-There are statically significant differences between the pre and post measurement of the experimental group under research in favor of the post measurement in the angles measurements of the thoracic spine when performing various movements (standing upright, taking the peak inspiration & taking out the peak expiratory flow).

4-There are statically significant differences between the pre and post measurement of the experimental group under research in favor of the post measurement in physiological measurements (inspiratory vital capacity, forced vital capacity, forced expiratory volume in 1 second, peak expiratory flow, blood pressure "systolic, diastolic" & the pulse at rest).

Methods and Material

The two researchers used a semi-experimental method by using the pre – post measurement design of one experimental group to appropriate the nature of this research.

Participants

The two researchers selected the research sample in an intentional method and it consisted of (20) students which percentage amounted to 14.3% of the research community (16) students who are the basic sample members and (4) students are the survey research sample of the same research community and outside the basic research sample.

Table (1) statistical description of the research sample in age, weight and height variables (N = 20)

Variables	Unit	Mean	Median	Standard Deviation	Skewness
Age	Year	10.9	11	1.1	-0.3
Weight	Kg	32.8	33.5	2.2	-1
Height	Cm	135.9	135.5	4.3	0.3

Table (1) indicates that the skewness coefficients for the variables of age, weight and height values confined between (-0.1 : 0.3) which means that the skewness coefficients limited between ± 3 which shows the moderation of the data.

Appendix (3) shows the moderation of the normal distribution of data using kolmogorov-smirnov test in the anthropometric, skillful, postural and physiological variables of the sample under research.

Measures

1- Ristameter to measure the height in cm.
2- Medical scale to estimate the body weight in kg.
3- Test of the skillful levels of backstroke
4- Spinal mouse. Appendix (4)
5- Spirostik. Appendix (5)

Procedures

A) <u>Steps of design of Aquatic rehabilitation program</u>

The two researchers reviewed the previous scientific studies and specialized references related to the research topic with the aim of designing an aquatic rehabilitation program and the following conducted:

1-Identify the goal of the Aquatic rehabilitation program

The aquatic rehabilitation program aims to achieve:

A-Improve the total height of the body and length of the spine in the various positions of the research sample.

B-Improve the skillful performance level of the backstroke of the research sample.

C-Improve the angles measurements of the thoracic spine at the performance of the various movements of the research sample.

D-Improve the physiological measurements of the research sample.

2-Identification of the bases of the Aquatic rehabilitation program

A-To achieve the rehabilitation program its content target, which was designed for it.

B-To appropriate the rehabilitation program for the research sample while taking into consideration the scientific and physiological basis.

C-The possibility of implementing the rehabilitation program and its acceptance of the practical application.

D-To suit the rehabilitation program content with the total time and the number of specified units.

E-Taking into account that there is a continuity and sequence in the parts of the rehabilitation program.

F-Proper rationing of the variables of the rehabilitation load.

G-Taking into account the security and safety factor in the selection of exercises.

3-Determine the general framework and the timetable of the distribution of an aquatic rehabilitation program

Table (2) General framework and the timetable of the distribution of an aquatic rehabilitation program

Content	Timetable
Duration of the program	Two months
The number of weeks	8 weeks
Stages of the rehabilitation program	3 stages
Number of weeks of each stage in the rehabilitation program	Two weeks for the first phase, two weeks for the second phase, four weeks for the third phase
Time of one rehabilitation unit	Starts with (65 s) and ends with (75 s)
The number of units of each program	24 rehabilitation units
Time of the application of each stage of the rehabilitation program	455 m for the first phase, 350 m second phase, 900 m for the third phase
Total time for the application of the rehabilitation program	1705 m (28.4 hours)
The implementation period of rehabilitation units	In the afternoon
Arrange parts of rehabilitation unit	**A**- Administrative works. **B**- Watching a video and photos of the backstroke. **C**- Moving from the computer room to the swimming pool. **D**- Warm-up. **E**- The main part which contains a "special rehabilitative exercises, learning activities for the backstroke." **F**- Cool -down.
Appropriate load in program	Average

Table (2) shows the general framework and distribution of the timetable of the rehabilitation program in the light of the scientific references and previous studies. The rehabilitation program period is 8 weeks, divided into 3 stages, the number of rehabilitation units in the rehabilitation program are (24) units with a time of (1705 m)

(28.4 hours) and the rehabilitation unit is conducted in the afternoon using the average load.

4-Determine the content of the rehabilitation program

The two researchers reviewed the references and previous studies that dealt with the design of rehabilitation programs in the field of posture and developed a set of rehabilitative exercises, which can be implemented within the water to the deviation of hyperkyphosis with defining the goal of these exercises and dividing them into progressive stages from easy to difficult. Noting that it has been added educational activity for the backstroke to the rehabilitation program under research. Appendix (1)

B) Steps of the application of an aquatic rehabilitation program

1-Pilot Study

The two researchers conducted an exploratory study during the period from 16/5/2015 to 21/5/2015 on a sample consisting of four students from the same research community and outside the basic sample is a sample in order to ensure the appropriateness of rehabilitation program for the sample under research.

2-The Study of basic research

In the light of the outcome of the pilot study, the two researchers applied the basic study of research as follows:

A-pre-measurements

The two researchers conducted the pre measurements of "anthropometric, skillful, postural & physiological variables" on the sample under research in the period between 23/5/2015 to 25/5/2015.

B-The application of basic research study

The two researchers applied the rehabilitation program on the sample under research in Benha sports stadium in the period from 30/5/2015 to 22/7/2015 by three rehabilitation units per week - days of (Saturday, Monday & Wednesday) for a period of two months.

Table (3) model of the rehabilitation unit for the hyperkyphosis in the third stage of the rehabilitation program

Aims of Rehabilitation	**Strengthen the back muscles and lengthen the chest muscles with improving the efficiency of the vital organs**	**Date**	**1/7/2015**
Aims of learning	**Learning arms movements of the backstroke**	**Time**	**75 min**

	Parts of the program		Content							Time	Equipments
	Administrative works		**Preparing the room, CDs and computers**							**2 min**	_____
	Watching videos and photos about what will have been learned of the backstroke in the unit by using computer									**10 min**	**- computers**
	Moving from computer room to the pool									**5 min**	_____
	Warm-up		Including running and stretching exercises and small games and some kinds of massage to prepare students physiologically, physically and psychologically as a preparation to the main part	**Variables of Load**						**7-10 min**	**- Hoops**
				Intensity	**Volume**		**Density**				
					Groups	**Frequency**	**Between Groups**	**Between Frequency**			
15	**The main part**	**Aquatic Rehabilitation Exercises**	This unit contains rehabilitation exercises specially numbers (4,12,16,17)	**(65% - 70%)**	**(3)**	**(12 – 15)**	**(60 – 90) s**	**(30) s**		**15 min**	**-Balls −Rubber - Stick**
		Learning Activities for the Backstroke	**1**-Revising the previous lesson exercise. **2**-Performing arms movements (the right arm then the left) using floating waistband with the help of the instructor. **3**-The same previous exercise without any help. **4**-Performing arms movements (the right arm then the left) and arms along aside the body without legs strikes and with the help of the instructor. **5**-The same previous exercise with legs strikes and the help of the instructor.							**30 min**	**- Floating waistband**
	Cool-down		The students make relaxation and calming training in water to be recovered then greeting and finally leaving							**2-3 min**	_____

Appendix (2) illustrates the rehabilitation program to the hyperkyphosis of the sample under research and after the completion of the application of the rehabilitation program, post measurements were conducted.

C-The Post measurements

The two researchers conducted the post measurements of "anthropometric, skillful, postural & physiological" variables on the sample under research in the period between 25/7/2015 to 27/7/2015.

Statistical Analysis

Data were processed by the following statistical methods:

- Arithmetic Mean
- Median
- Standard Deviation
- Skewness
- 1 Sample Kolmogrov- Smirnov
- Paired samples t-test
- The percentage of the absolute improvement %

Results

- First hypothesis results

Table (4) significant differences between pre and post measurement and the ratios of the improvement in the anthropometric variables for the experimental group under research (N = 16)

Anthropometric Variables	Unit	Pre measurement		Post measurement		Mean Difference	"t" value	Sig.	%
		Mean	SD	Mean	SD				
Height	Cm	135.9	4.3	138.2	3.2	-2.3	-3.6*	0.0	1.7
Spine length "Upright"	Cm	39	2.4	41.5	1.9	-2.5	-5.1*	0.0	6.4
Spine length "Inspiration"	Cm	40.1	2	43.3	1.7	-3.2	-4.7*	0.0	8
Spine length " Expiration"	Cm	37.2	3.4	40.8	1.4	-3.6	-3.8*	0.0	9.7

*Value of tabular "t" at significance level (0.05) and degree of freedom 15 = 2.131

Table (4) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the anthropometric variables. The calculated (t) values were limited between (-5.1: -3.6). The calculated values were greater than the tabular value at the significant level (0.05).The calculated probability values were less than its significant level, while the improvement rates were limited between the two measurements between (1.7%: 9.7%).

- Second hypothesis results

Table (5) significant differences between pre and post measurement and the ratios of the improvement in the skillful level of backstroke for the experimental group under research (N = 16)

Skillful Variables	Unit	Pre measurement		Post measurement		Mean Difference	"t" value	Sig.	%
		Mean	SD	Mean	SD				
Float on the Back	Degree	4.9	1	8.1	0.8	-3.2	-11.6*	0.0	65.3
Glide on the Water	Degree	4.4	0.8	7.6	0.5	-3.2	-15.2*	0.0	72.7
Leg Strikes	Degree	4.1	0.8	6.5	0.6	-2.4	-8.7*	0.0	58.5
Arms strikes	Degree	2.7	0.8	5.3	1.3	-2.6	-6.8*	0.0	96.3
Skill of backstroke	Degree	1.9	0.6	6.2	1	-4.3	-6.8*	0.0	226.3
Total	Degree	18	1.7	33.7	2.9	-15.7	-15.6*	0.0	78.2

*Value of tabular "t" at significance level (0.05) and degree of freedom 15 = 2.131

Table (5) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the variables of the skillful levels of backstroke. The calculated (t) values were limited between (-15.7: -6.8). The calculated values were greater than the tabular value at the significant level (0.05). The calculated probability values were less than its significant level, while the improvement rates were limited between the two measurements between (58.5%: 226.3%).

- Third hypothesis results

Table (6) significant differences between pre and post measurement and the ratios of the improvement in the postural variables of the spine when performing different movements (standing upright, taking peak inspiration & outputting peak expiration) for the experimental group under research (N = 16)

Postural Variables		Unit	Pre measurement		Post measurement		Mean Difference	"t" value	Sig.	%
			Mean	SD	Mean	SD				
Upright	Thoracic Spine 1/2	Degree	4.4	1.6	2.6	1.2	1.8	4.4*	0.0	40.9
	Thoracic Spine 2/3	Degree	5.4	1.4	3.9	1	1.5	5.4*	0.0	27.8
	Thoracic Spine 3/4	Degree	8.2	1.2	5.8	0.9	2.4	6.7*	0.0	29.3
	Thoracic Spine 4/5	Degree	9.6	1.7	6.6	0.9	3	9.1*	0.0	31.3
	Thoracic Spine 5/6	Degree	9.8	1.5	6.3	0.7	3.5	11.9*	0.0	35.7
	Thoracic Spine 6/7	Degree	8.5	2	6.1	0.7	2.4	4.5*	0.0	28.2
	Thoracic Spine 7/8	Degree	9.5	2.3	6.2	0.8	3.3	6.3*	0.0	34.7
	Thoracic Spine 8/9	Degree	7.6	1.1	5.8	0.7	1.8	8.5*	0.0	23.7
	Thoracic Spine 9/10	Degree	5.9	1.1	4	1	1.9	7.8*	0.0	32.2
	Thoracic Spine 10/11	Degree	4.2	1.2	2.7	0.8	1.5	6.7*	0.0	35.7
	Thoracic Spine 11/12	Degree	1.8	0.8	1	1.2	0.8	3.1*	0.0	44.4
	Total Thoracic Spine	Degree	74.9	4.4	51	2.8	23.9	20.6*	0.0	31.9
Inspiration	Thoracic Spine 1/2	Degree	4.4	1.5	2.4	1.2	2	4.4*	0.0	45.5
	Thoracic Spine 2/3	Degree	5.3	1.2	3.7	1.1	1.6	4.6*	0.0	30.2
	Thoracic Spine 3/4	Degree	7.4	1.1	5.5	0.8	1.9	5.3*	0.0	25.7
	Thoracic Spine 4/5	Degree	8.7	1.4	5.9	0.9	2.8	7.4*	0.0	32.2
	Thoracic Spine 5/6	Degree	8.9	1.1	5.9	0.9	3	10.9*	0.0	33.7
	Thoracic Spine 6/7	Degree	8.1	1.4	5.4	0.6	2.7	7.2*	0.0	33.3
	Thoracic Spine 7/8	Degree	8.8	1.8	5.6	1	3.2	6.9*	0.0	36.4
	Thoracic Spine 8/9	Degree	7.3	1.2	5.3	0.6	2	6.6*	0.0	27.4
	Thoracic Spine 9/10	Degree	5.5	1	3.8	0.9	1.7	5.9*	0.0	30.9
	Thoracic Spine 10/11	Degree	3.9	1.2	2.4	1	1.5	4.7*	0.0	38.5
	Thoracic Spine 11/12	Degree	1.8	0.8	0.9	1.2	0.9	3.2*	0.0	50
	Total Thoracic Spine	Degree	70.1	4.5	46.8	3.2	23.3	18*	0.0	33.2
Expiration	Thoracic Spine 1/2	Degree	4.4	1.6	2.7	1.2	1.7	4.3*	0.0	38.6
	Thoracic Spine 2/3	Degree	5.8	1.3	4.1	1	1.7	5*	0.0	29.3
	Thoracic Spine 3/4	Degree	8.4	1.3	5.9	1	2.5	7.8*	0.0	29.8
	Thoracic Spine 4/5	Degree	9.7	1.6	6.7	0.9	3	11.6*	0.0	30.9
	Thoracic Spine 5/6	Degree	10.3	1.5	6.5	0.8	3.8	10.1*	0.0	36.9
	Thoracic Spine 6/7	Degree	9.6	2	6.3	0.9	3.3	6.4*	0.0	34.4
	Thoracic Spine 7/8	Degree	9.5	1.8	6.3	0.9	3.2	6.7*	0.0	33.7
	Thoracic Spine 8/9	Degree	8.5	1.3	5.9	0.8	2.6	6.4*	0.0	30.6
	Thoracic Spine 9/10	Degree	6.1	1.1	4.5	1.2	1.6	4.8*	0.0	26.2
	Thoracic Spine 10/11	Degree	4.5	1.3	2.8	1	1.7	5.6*	0.0	37.8
	Thoracic Spine 11/12	Degree	2.3	0.9	1.3	1.1	1	2.2*	0.0	43.5
	Total Thoracic Spine	Degree	79.1	4.1	53	2.8	26.1	20.9*	0.0	33

*Value of tabular "t" at significance level (0.05) and degree of freedom 15 = 2.131

Table (6) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the postural variables of the spine when performing different movements. The calculated (t) values were limited between (3.1: 20.6) when standing upright and (3.2: 18) when the peak inspiration and (2.2: 20.9) when the peak expiration. The calculated values were greater than the tabular value at the significant level (0.05). The calculated probability values were less than its significant level, while the improvement rates were limited between the two measurements between

(23.7%: 44.4%) when standing upright and (25.7%:50%) when the peak inspiration and (26.2%: 43.5%) when the peak expiration.

- Fourth hypothesis results

Table (7) significant differences between pre and post measurement and the ratios of the improvement in the physiological variables for the experimental group under research (N = 16)

Physiological Variables		Unit	Pre measurement		Post measurement		Mean Difference	"t" value	%
			Mean	SD	Mean	SD			
Inspiratory vital capacity		liter	1.5	0.2	2.2	0.6	-0.7	-4.8*	46.7
Forced vital capacity		liter	0.8	0.7	1.6	0.4	-0.8	-3.8*	100
Forced Expiratory Volume in 1S		liter	0.7	0.5	1.2	0.4	-0.5	-2.8*	71.4
Peak Expiratory Flow		Liter / Second	1.4	0.7	2.7	0.6	-1.3	-5.9*	92.9
Blood Pressure	Systolic	mm hG.	127.9	9.2	119.6	7.2	8.3	3.6*	6.5
	Diastolic	mm hG.	81.4	5.8	77.2	3.2	4.2	2.5*	5.2
Pulse at rest		P / Min.	80.3	7.2	75.1	4.9	5.2	3.8*	6.5

*Value of tabular "t" at significance level (0.05) and degree of freedom 15 = 2.131

Table (7) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the physiological variables. The calculated (t) values were limited between (-5.9: 3.8). The calculated values were greater than the tabular value at the significant level (0.05). The calculated probability values were less than its significant level, while the improvement rates were limited between the two measurements between (5.2%: 100%).

Result discussion

- First hypothesis discussion

Table (4) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the anthropometric variables. The improvement rates were limited between the two measurements between (1.7%: 9.7%), the two researchers attributed this to:

1-The positive effect of the rehabilitation aquatic program, including its contents of purposeful standardized exercises using instruments and equipments as well as exercises to learn the skill of the backstroke suitable for students with hyperkyphosis working on the chiropractors even up to reach to its normal status by the following:

A- Improved the form and function of the thoracic spine, including that of "vertebrae, cartilage discs, joints & ligaments".

B- Improved the flexibility of the thoracic spine.

C-Improved the form and function of the muscles of the front and rear surface of the thoracic spine, where the aim of rehabilitation aquatic program is to prolong the chest muscles and strengthen and shorten the back muscles.

2-Natural growth period, which passes by it the students at this stage

These results agreed with the results of the study of each of (Mubarak, 2012; Ibrahim, 2013) provides that the rehabilitation exercise for students with hyperkyphosis working to increase the total height of the body and the length of the spine in the different situation.

- Second hypothesis discussion

Table (5) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the variables of the skillful levels of backstroke. The improvement rates were limited between the two measurements between (58.5%: 226.3%). The two researchers attributed this to:

1-Using the exercises of the learning activity for backstroke in the rehabilitation units from (1-5) improved the skill of float on the back.

2-Using the exercises of the learning activity for backstroke in the rehabilitation units from (6-7) improved the skill of glide on the water.

3-Using the exercises of the learning activity for backstroke in the rehabilitation units from (8-12) improved the skill of strikes the two legs.

4-Using the exercises of the learning activity for backstroke in the rehabilitation units from (13-24) improved the skill of arms strikes.

5-Using the exercises of the learning activity for backstroke in all rehabilitation units improved the skill of backstroke.

- Third hypothesis discussion

Table (6) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the postural variables of the spine in (standing upright, taking the peak inspiration & taking out the peak expiratory flow) .The improvement rates were limited between the two measurements between (23.7% : 44.4%) when standing upright and (25.7%:50%) when taking the peak inspiration and (26.2%: 43.5%) when taking out the peak expiration. The two researchers attributed this to:

1-Well planning of the contents of the aquatic rehabilitation program.

2-Follow the scientific basis when using the aquatic rehabilitation program.

3-The positive effect of the aquatic rehabilitation program, including the different exercises such as (warm-up, special rehabilitation, learning activities of backstroke & cool-down) using instruments and equipments, it became clear through the following:

A- The use of the special rehabilitative exercises numbers (1, 2, 4, 5, 6, 7, 8, 9, 10, 15&16) led to an improvement in the angles of the upper thoracic spine when performing various movements (standing upright, taking the peak inspiration& taking out the peak expiratory flow).

B- The use of the special rehabilitative exercises numbers (18, 19& 22) led to an improvement in the angles of the lower thoracic spine when performing various movements (standing upright, taking the peak inspiration & taking out the peak expiratory flow).

C- The use of the special rehabilitative exercises numbers (3, 11, 12, 13, 14, 17& 20) led to an improvement in the angles of the upper and lower thoracic spine when performing various movements (standing upright, taking the peak inspiration & taking out the peak expiratory flow)

D- The use of exercises of the learning activities of backstroke in the rehabilitation units (13-24) led to an improvement in the angles of the upper and lower thoracic spine when performing various movements (standing upright, taking the peak inspiration & taking out the peak expiratory flow).

These results agreed with the results of the study of each of (Azizi, 2011; Hamid, 2014) that the aquatic rehabilitation program for students with hyperkyphosis worked to improve the angles of the thoracic curves and the treatment of hyperkyphosis.

- Fourth hypothesis discussion

Table (7) illustrates that there are statistically significant differences between the pre and post measurement for the experimental group under research in favor of the post measurement in the physiological variables. The improvement rates were limited between (5. 2%: 100%). The two researchers attributed this to the positive effect of the aquatic rehabilitation program, including the contents of different exercises which have led to:

1- Improve the angels of the measurements of thoracic spine and treatment of the hyperkyphosis thus reducing the pressure on the lungs and heart rendering the respiratory system efficiency, especially " inspiratory vital capacity, forced vital capacity, forced expiratory volume in 1 second & peak expiratory flow " in addition to the improvement of efficiency the circulatory system and especially " blood pressure, pulse "

2- Improve the status of the airways and strengthen the muscles of breathing and especially "muscle of diaphragm, the intercostal muscles", which worked on the chest breadth and increase the volume of air breathing in addition to improving the pulmonary circulation and improve breathing mechanism.

These results agreed with the results of the study of each of (Mubarak, 2012; Amin, 2013) that aquatic rehabilitation program, including the contents of codified purposeful exercises works to improve the internal vital organs, particularly the efficiency of the two respiratory and circulation systems.

It should be noted that the rehabilitation exercises special for the hyperkyphosis worked to improve the efficiency of the various organs of the body, especially the respiratory system and covered of " inspiratory vital capacity, forced vital capacity,.... etc ". (Rahim, 2011)

Conclusions

Through the aim of the research and its hypothesis and within the nature of the sample and depending on the statistical analysis of the results and their explanations, the two researchers found that the positive effect of the aquatic rehabilitation program has led to improve the "anthropometric, skillful, postural & physiological" variables for the experimental group under research and represent it in the following:

1- Increased the total length of the body and the length of the spine of different situations (standing upright, taking the peak inspiration & taking out the peak expiratory flow).

2- Improved the skillful level of performance for backstroke.

3- Improved measurements of the angels of the thoracic spine when performing various movements (standing upright, taking the peak inspiration & taking out the peak expiratory flow)

4- Improved physiological measurements (inspiratory vital capacity, forced vital capacity, forced expiratory volume in 1 second, peak expiratory flow, blood pressure "systolic, diastolic" & the pulse at rest).

Recommendations

1- The need to apply the aquatic rehabilitation program under research on those primary stage students with hyperkyphosis.

2- Developing rehabilitation and preventative programs to reduce the postural imbalances before it becomes difficult to rehabilitate in advanced stages as well as the development of programs to improve the physiological fitness for school children.

3- The need for conducting scientific research aimed at developing special rehabilitation programs included the treatment of postural imbalances through learning. One of the sports that has proven rehabilitation in those with hyperkyphosis is the teaching of backstroke.

4- Hold educational sessions for physical education teachers to inform them of the latest measurements and rehabilitation programs in the field of posture.

5- Encourage the educational institutions (schools, college & universities) to organize lectures, seminars and conferences to discuss the postural problems and how to address them with the provision of specialists.

6- Establish units with a special character in schools and universities under the supervision of physical education colleges to follow up the implementation of rehabilitation programs designed by professionals.

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