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The Effect of Hatha Yoga on Functional Efficiency of Heart Muscle and Improving some Physical Variables for Female Students In Sports Science Faculty

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Abstract:

Hatha yoga is one of the best sports that achieves balance between the spirit, body and mind, this research aims to design a training program using hatha yoga exercises and determine its effect on the functional efficiency of heart muscle and improve some physical variables for female students. researcher used the experimental method with pre- and post-measurements for one experimental group, the number of whom was (17) female students from the second year, then pre- and post-measurements were conducted Before and after applying the program, To develop physiological efficiency and physical abilities for a period ranging from 30 to 40 minutes of (meditation and relaxation exercises) - (special Hatha yoga exercises), Starting from Thursday, corresponding to (9/5/2024 AD) until Friday, corresponding to (5/7/2024), for a period of (8) weeks, with (3) new weekly units (Sunday, Tuesday, and May) of each week in the college's practice sessions Then perform calm-down exercises to gradually return the body and its physiological systems to a normal state, including a group of relaxation and muscle lengthening exercises for 5minutes of total duration of program, showed a statistically significant improvement in physiological variables represented in blood pressure - heart rate, and improvement in physical variables such as muscular strength - muscular endurance - flexibility for experimental group under study for benefit of the post-measurement, percentages of improvement in all physiological measurements ranged between (2.222%: 28.229%), and the percentage of

improvement in the physical variables under study reached (25.140%: 64.286%) in favor of the post-measurement. The researcher recommends the importance of conducting other studies on different samples in terms of and studies in various sporting activities, because of their positive effects on public health and the efficiency of all vital systems.

Keywords:
Hatha yoga , cardiovascular system , cardiovascular fitness, blood pressure , heart rate.

المستخلص:

تُعد رياضة "الهاثا يوجا" من أفضل الرياضات التى تحقق التوازن بين الروح والجسد والعقل، لذا يهدف هذا البحث إلى تصميم برنامج تدريبي بإستخدام تمرينات الهاثا يوجا ومعرفة تأثيره على الكفاءة الوظيفية لعضلة القلب وتحسن بعض المتغيرات البدنية للطالبات، وقد إستخدمت الباحثة المنهج التجريبي ذو القياس القبلي والبعدى لمجموعة تجريبيه واحدة، بلغ عددهنَ (17) طالبة من طالبات الفرقة الثانية، ثم تم إجراء القياسات القبلية والبعدية قبل وبعد تطبيق البرنامج لتنمية الكفاءة الفسيولوجية والقدرات البدنية لفترة تراوحت 40:30 دقيقة من (تدريبات التأمل والإسترخاء) – (تدريبات خاصة بالهاثا يوجا) وذلك إعتباراً من يوم الخميس الموافق (2024/5/9م) إلى يوم الجمعة الموافق (2024/7/5م) لمدة (8) أسابيع بواقع (3) وحدات تدريبية أسبوعياً أيام (الأحد والثلاثاء والخميس) من كل أسبوع فى صالات التمرينات بالكلية، ثم عمل تدريبات تهدئة لعودة الجسم وأجهزته الفسيولوجية إلى الحالة الطبيعية بصورة تدريجية وتشمل مجموعة من تدريبات الإسترخاء وإطالة العضلات لمدة 5 دقائق من الزمن الكلى للبرنامج، أظهرالبرنامج التدريبى تحسناً ذات دلالة إحصائية فى المتغيرات الفسيولوجية متمثلة فى ضغط الدم – معدل القلب، وتحسن المتغيرات البدنية كالقوة العضلية – التحمل العضلى – المرونة للمجموعة التجريبية قيد البحث لصالح القياس البعدى، وقد تراوحت نسب التحسن فى جميع القياسات الفسيولوجية ما بين (2.222% : 28.229%)، كما بلغت نسبة التحسن فى المتغيرات البدنية قيد البحث (25.140% : 64.286 %) وذلك لصالح القياس البعدى.وتوصي الباحثة بأهمية إجراء دراسات أخرى على متغيرات وعينات مختلفة من حيث (السن والجنس) بالإضافة إلى دراسات فى مختلف الأنشطة الرياضية، لما لها من تأثيرات إيجابية على الصحة العامة وكفاءة جميع الأجهزة الحيوية.

الكلمات المفتاحية: (الهاثا يوجا – الجهاز القلب وعائى – اللياقة القلبية الوعائية – معدل نبض القلب).

The Effect of Hatha Yoga on Functional Efficiency of Heart Muscle and Improving some Physical Variables for Female Students In Sports Science Faculty

Introduction and research problem:

Sports training is an educational process that is subject to scientific foundations and principles and aims to prepare the individual to achieve the highest possible level in sports activities based on the laws and principles of various sciences such as anatomy, physiology, nutrition science, etc. Through physiology, we learn how the body's systems, tissues, and cells work and how their functions are integrated to regulate the body's internal environment. It is one of the most important basic and necessary sciences on which sports depend, The development in the level of physical performance comes as a result of the physiological effects of training through which the process of adapting the various body systems takes place.(3:23)

Practicing sports affects many vital systems in the body. The longer the period of practice, the higher the level of the body's adaptation to stimuli. It improves blood flow in the blood vessels and thus improves the level of blood pressure and increases the efficiency of the heart and pulse rate. Therefore, sports training scientists strive to try to reach the best methods and modern training methods that work to raise the level of performance as it is the focus and source of interest in the training process, Which reflects the success of training programs. Sports physiology is also concerned with identifying the various functional responses of the body's vital organs and systems and the various physiological and physical reactions to training. (12:54)

Ahmed Nasr El-Din (2003) pointed out that the cardiovascular system is one of the most important and active vital systems in the body at all, which helps trainees cope with that physical effort through the functional efficiency of this system, which is responsible for supplying active muscles with food and oxygen flowing to them through the blood, and the ability of the muscles to exploit energy materials in producing high energy, The heart is the vital, active muscular pump that works regularly throughout life. It is one of the most important organs in the body, because it works continuously as a pump that pumps blood loaded with food and oxygen to the various tissues of the body in sufficient quantity to maintain their activity and metabolic needs,cardiovascular system consists of the

heart, blood vessels, and blood, and the continuation of life depends on the continuity of that system, which is responsible for maintaining blood circulation in the body and thus on all of the body's organs and vital systems. (5:160)

Ahmed Nasr El-Din(2021) also states that cardiovascular fitness is ability of the heart, blood vessels, and blood to supply the muscles with energy materials, especially oxygen, and the ability of the muscles to benefit from energy materials and oxygen together in performing a physical effort characterized by continuous performance for the longest possible period of time.(7:215)

Hadeel Younis et al.(2020) indicated that the changes that occur to blood circulation during exercise lead to increased blood flow to the skeletal muscles as a result of increased pumping of blood leaving the heart, increased metabolism, and vasodilation during muscle stretching, in addition to increased blood supply to the heart during exercise.(14:12,23)

Abdel Rahman(2011) also explains that there are physiological changes that accompany sports training that have an impact on the functional efficiency of heart muscle, which is an increase in cross-sectional area of the heart, the size of heart, mass and weight of heart muscle, thickness of its walls, and fibers of cardiac muscle as a preparation for the necessary conditions for the blood returning and pumping it to all organs of body, These changes include all heart valves, widening of coronary arteries that feed heart muscle with oxygen, increased cardiac output, and pumping a larger amount of blood with fewer beats, which results in a lower resting heart rate as a result of organized and continuous training. (1:677)

Ahmed Nasr El-Din (2003) points out that development of level of physical efficiency is a reflection of physiological adaptation occurring in heart muscle, as the training condition can be evaluated and the load can be regulated through responses of circulatory system, due to the system's regulation of force of contraction of heart muscle, It controls stroke volume, so cardiac fitness means regulating heart rate, stroke volume, and widening of diameter of blood vessels, which has a positive effect on regulating rate of blood flow.The heart rate is inversely proportional to the average arterial blood pressure. (6:159,169)

The results of the study "Yahya Alaeddin (2005) (33)" demonstrated that heart rate is considered one of the most important indicators for regulating the magnitude of cardiac impulse,The higher the athlete's efficiency, the lower his pulse rate, This indicates cardiac functional efficiency, Bahaa El-Din Salama (2008) (8) added that the circulatory system is one of most important main pillars of various training programs for various sports activities, Sports training works to increase physical and physiological efficiency, through which athlete can perform effectively for long periods. The higher functional efficiency of body's systems, the higher physical efficiency of athlete and then he is able to perform in an optimal manner. (2:343)(7:291)

Exercises of all types and forms of performance constitute a basic foundation when aiming to develop performance levels of athletes physiologically and physically. Practicing Hatha yoga exercises is considered an ideal sport because it concerns the limbs, muscles and internal organs. Performing it does not require the presence of any type of devices or tools, and we can perform it in any place and time without noise or noise and for different age stages. (23:75)

Ellen Horovitz and Staffan Elgelid(2015) explained that Hatha yoga is considered mother of all types of yoga, as it is a group of exercises, It makes the body suitable for spirit and energies stored in it, and also works to develop fitness for all body systems. (11:18, 19) (32:168) (24:10)

This is consistent with the results of the study of "Howaida Al-Asra et al. (2008) (17)" Practicing Hatha yoga employs the use of various physical movements, including practicing various poses to get rid of stresses of life, and Hatha yoga can be performed to gain joint flexibility, strength, endurance, and muscle lengthening, as well as a sense of calm.

The studies of Krejci (2003) (21) and Jawinski (2012) (13) indicated the importance of practicing regular physical activity and using hatha yoga exercises as an essential component of training programs because of their positive effect in maintaining health of heart and lungs, stimulating blood circulation, and lowering blood pressure and heart rate.

Hatha yoga is considered one of the best exercises that achieve balance between spirit, body and mind. It aims to get rid of diseases, give health and physiological efficiency to all body systems, help maintain body

balance, improve heart muscle functions,and develop the practitioner to reach self-realization.(17:16)

The university stage is considered one of important stages in life, and role of university is based on helping students to excel and excel in their academic and practical lives, and this depends on their physical and physiological abilities and capabilities, as the faculties of sports sciences require intense physical effort during school day, and we conclude from this that female students need training programs that work to improve their abilities, Sports training is considered the basis and decisive factor in developing level of abilities, as it depends on various scientific theories that work to exploit maximum possible potential of capabilities and latent talents to reach the highest levels of performance and achieve achievements.

The problem of research arises in researcher's observation of decline in physiological fitness and physical abilities among female students and resulting rapid emergence of stress, feeling of fatigue, and loss of attention, which prompted the researcher to take this category of female students into consideration and benefit from hatha yoga exercises because of their positive effects on all parts of the body, to develop some important physiological and physical variables and try to identify their effect in improving level of performance among female students, Through practicing Hatha yoga exercises, the researcher noticed that it is a modern training method aimed at developing physical fitness and increasing physiological efficiency. It helps raise the level of female students and improve academic results, which leads to improving the educational process. From here, the idea of research was launched, which is to design a program using Hatha yoga exercises to improve functional efficiency of heart muscle and improve some physical variables for female students in Sports Science Faculty.

- Research objective:

Design a training program using Hatha yoga exercises and know their effect on:

1- Some physiological variables, including: (blood pressure - heart rate).

2- Some physical variables are: (muscular strength - muscular endurance - flexibility).

- Research hypotheses:

1- There are statistically significant differences between the pre- and post-measurements in physiological variables under investigation for experimental group in favor of the post-measurement.

2- There are statistically significant differences between the pre- and post-measurements in physical variables under investigation for experimental group in favor of the post-measurement.

- Terminology Used in the search:

-**Hatha yoga***:* Physical exercises by adopting fixed positions called (Asana) in which the range of motion of the joints is increased and the muscles and ligaments are lengthened, complemented by dynamic movements accompanied by deep breathing exercises called (Paranayama).(30)
Defined by "Ambrosini (2016)": Mental training in form of methods accompanied by training for young people only, until mental and organic relaxation and internal control of individual changes individual's ability to achieve balance between body and thought. (10:34)

- **Cardiovascular system:** "It regulates heart rate (HR), stroke volume (SV), and dilation of blood vessel diameter (BVD), which directly affects rate of blood flow through blood, heart, and blood vessels."(6)

- **Cardiovascular fitness:**"The ability of the heart, blood vessels and blood to supply the muscles with energy materials, and ability of muscles to benefit from energy materials and oxygen in performing a physical effort characterized by continuous performance for the longest possible period of time." (7:215)

- **Blood pressure:** Reem Mohsen and Maha Khalil (2014) defined it as "the pressure that occurs by the rush of blood against the walls of blood vessels" (28:50)
- **Muscular strength:** Medhat Qasim (2020) defines it as "the ability of muscles to overcome various resistances." (26:122)

- **Muscular endurance:** Mufti Ibrahim (2010) defines it as "the ability of muscles to contract during fatigue for a relatively long period" (27:39)

- **Flexibility:** "The ability to perform movements over a wide range." (9:35)

- Search procedures:

First: Research methodology:

The researcher used experimental method due to its suitability to nature of the research, using an experimental design with pre- and post-measurement for one experimental group.

Second: Research population and sample:

The research community represents the female students of the second year at the Faculty of Physical Education for Girls - Helwan University for the academic year (2023 - 2024 AD), They were chosen intentionally and randomly from among those taught by the researcher. Their number reached (17) female students whose ages ranged from 19 to 21 years. They were divided as follows:

Table (1)

Description of the research sample

number	Sample	M
8	Survey sample	1
9	Basic sample	2
17	Total research	3

Table (2)

Statistical description of the homogeneity of the basic research sample in the basic variables

(n=9)

Flatness coefficient	Torsion coefficient	Standard deviation	The mediator	Arithmetic average	The largest value	Less value	Statistical significance / Basic variables	
0.185	1.014	0.726	19.000	19.556	21.0	19.000	Year	Chronological age
-0.800	-0.537	5.590	165.000	163.333	170.0	155.000	Cm	height
-0.221	0.044	3.283	60.000	59.556	65.0	55.000	Kg	the weight

It is clear from Table (2) that the total data is moderate and characterized by a normal distribution for the sample, as the values of the skewness coefficient ranged between (- 0.537: 1.014). This value is close to zero and falls under the moderate curve between (± 3), which indicates the moderation and homogeneity of the sample in the basic variables before applying the basic study.

Table (3)
Statistical characterization of the homogeneity of the basic research sample in physiological variables

(n=9)

Flatness coefficient	Torsion coefficient	Standard deviation	The mediator	Arithmetic average	The largest value	Less value	Unit of measurement	Statistical significance / Physiological variables
-0.107	0.597	13.883	106.000	105.000	131.000	90.000	(mmHg)	Measuring systolic blood pressure
-0.573	0.745	8.016	67.000	68.000	81.000	60.000	(mmHg)	Measuring diastolic blood pressure
-0.094	-0.270	11.403	83.000	83.444	100.000	63.000	(Pulse/Min)	Pulse rate

It is clear from Table (3) that the total data is moderate and characterized by a normal distribution for the sample, as the value of the skewness coefficient in it reached between (- 0.270: 0.745). This value is close to zero and falls under the moderate curve between (± 3), which indicates the moderation and homogeneity of the sample in the level of performance.

Table (4)
Statistical description of the homogeneity of the basic research sample in physical variables

(n=9)

Flatness coefficient	Torsion coefficient	Standard deviation	The mediator	Arithmetic average	The largest value	Less value	Unit of measurement	Statistical significance / Physical variables
-1.343	0.363	4.387	10.00	9.333	16.00	4.00	(Sec)	Muscular endurance
-0.852	-0.496	7.849	10.00	10.888	19.00	-3.00	(CM)	Back/torso flexibility
4.316	1.780	3.391	20.00	21.000	29.00	17.00	(Kg)	Right grip strength
4.405	1.561	3.480	19.00	19.888	28.00	15.00	(Kg)	Left grip strength

It is clear from Table (4) that the total data is moderate, not dispersed, and characterized by a normal distribution for the sample, as the values of the skewness coefficient ranged between (-0.496: 1.780). This value is close to zero and falls under the moderate curve between (± 3), which indicates the moderation and homogeneity of the sample in the physical variables before applying the basic study.

- Third:Data collection methods:

1- Forms: Attachment (1,2,3)

• An expert opinion poll form on the plan of the proposed training program for Hatha Yoga in terms of (the time period for implementing the program monthly and weekly, the number of training units each week and the time of the training unit). The researcher sought the help of (13) experts from professors and expert trainers in the field.

2- Devices: Attachment (4)

- **Stop watch**
- **Medical balance**
- **Restameter**
- **Sphygmomanometer**
- **Pulse Oximeter**
- **Hand Grip Dynamometer**
- **Inclined prone test from standing (30 seconds)**
- **Trunk flexibility box**

- Fourth: Preparing the training program:

• Foundations for developing the program:

1- The training program is designed based on scientific foundations in designing training programs.

2- The training program must be consistent with the established objectives.

3- Flexibility and suitability of the training program for the sample under study.

4- Taking into account the principles of training physiology when developing the program.

5- Benefiting from previous studies in designing the training program.

6- Taking into account security and safety factors.

7- Selecting exercises that contribute to achieving the desired goal, which is the positive effect of hatha yoga exercises on the variables under research.

• Objective of the training program:

This program aims to improve some physiological variables represented in (blood pressure - pulse rate), and increase the efficiency of some physical variables represented in (muscular strength - muscular endurance - flexibility) among female students, through a variety of Hatha yoga exercises.

Table (5)
Time division of the training program

Unit time	Parts of the training	Training modules	weeks	The months
60 : 45	Introductory part	(24) units (3) units per week	(8)	(2)
	Main part			
	The concluding part			

• Content of the training unit:

- The introductory part lasts from (15:10) minutes:

This part aims to provide general preparation for all parts of the body, stimulate blood circulation, and physiological and physical preparation. The warm-up period included various comprehensive exercises for all parts of body, large muscle groups, joints, and ligaments to prepare them to reach present moment.

- The main part lasts from (40:30) minutes:

The basic training period is one of the most important periods of the program. It aims to develop physiological efficiency and physical abilities and is divided into: (relaxation and meditation exercises) - (special Hatha yoga training).

- The closing part lasts (5) minutes:

This period aims to gradually return the body and its physiological systems to a normal state and includes through a set of relaxation and muscle lengthening exercises.

- Fifth: Steps to implement the program:

First: The exploratory study:

The researcher conducted a survey study on a sample of (8) female students from the research community and from outside the basic research sample on Sunday and Monday, corresponding to (4/28 and 29/2024 AD), in order to ensure:

1- The suitability of the exercises for the research sample.

2- Ensure the validity of measuring devices and tools to avoid any obstacles.

3- Determine the locations of the experiment and its suitability for training.

4- The difficulties that the researcher may face when implementing the basic program and the possibility of avoiding them.
5- The extent of the students' response to the proposed program and the selected exercises in terms of their ability to perform them.
6- Knowing the appropriate time required to perform the training unit and determining rest periods.

Second: Basic study:

-Steps to implement the basic study:

1- Pre-measurements:

Tribal measurements were conducted from Wednesday, corresponding to 1/5/2024, until Wednesday, corresponding to 8/5/2024, at exactly ten o'clock in the morning, as follows:
- Measurement of weight and height on Wednesday (1/5/2024) at the Physical Fitness and Rehabilitation Unit in Kasr Al-Aini.
- Performing physiological tests (to measure blood pressure, measure pulse rate, and measure muscle strength of the hand grip) on Tuesday (5/7/2024) in the Sports Physiology Laboratory at the College of Sports Sciences on the island.
- Measurement of physical tests (flexibility test to measure torso flexibility, inclined prone test to measure muscular endurance) on Wednesday (5/8/2024) in the exercise halls of the College of Sports Sciences on the island.

- Program application:

The proposed program was implemented using HATHA YOGA exercises to improve physical fitness and develop the functional efficiency of the heart muscle by using various Hatha yoga poses and meditation exercises, thus improving their level of performance, focus and attention, starting from Thursday, corresponding to (5/9/2024) until Friday, corresponding to (7/5/2024) for a period of (8) weeks, with (3) training units per week on (Sundays). And Tuesdays and Thursdays each week in the exercise halls,The last week of the program was training on Mondays, Wednesdays, and Fridays, taking into account official occasions. The application took place at 3-4 pm at the College of Sports Sciences on the island, The researcher took care to begin with physical relaxation and meditation exercises, then various Hatha yoga exercises, graduated from easy to more

difficult and endurable until reaching stage of adaptation and correct technique for performance gradually.

3- Dimensional measurements:

The post-measurements were carried out in the same steps as the pre-measurements, during the period from Saturday, corresponding to (7/6/2024) until Tuesday, (7/9/2024) at exactly ten in the morning.

Sixth: Statistical treatments:

Statistical treatments were performed using the 25SPSS Version program at a significance level of 0.05, it is as follows:

- less value./ The largest value./ Arithmetic mean
- Median /standard deviation ./ Skewness
- Kurtosis ./ Kolmogorov-Smirnova
- Runs test / T-test for paired observations
- Person correlation ./ Improvement rate

- Presentation and discussion of results:

First: Display results:

Table (6)

The significance of the differences between the pre- and post-measurements in physiological variables - under investigation

(n=9)

Improvement rate (%)	value (T)	the difference Between the two mediums		Dimensional measurement		Pre-measurement		Unit of measurement	Semantics of statistical description / Physiological variables
		ع±	سَ	ع±	سَ	ع±	سَ		
2.222%	0.541	12.933	2.333	6.538	102.667	13.883	105.000	(mmHg)	Measuring systolic blood pressure
3.268%	1.006	6.629	2.222	6.741	70.222	8.016	68.000	(mmHg)	Measuring diastolic blood pressure
28.229%	5.252**	13.455	23.556	4.167	59.889	11.403	83.444	(Pulse/Min)	Pulse rate

*** The tabular (t) value is significant at the 0.05 level = (2.306) and at the 0.01 level = (3.355)**

It is clear from Table (6) that there are statistically significant differences between the pre- and post-measurements in some physiological variables in favor of the post-measurement. The improvement rates in all physiological measurements ranged between (2.222%: 28.229%) in favor of the post-measurement.

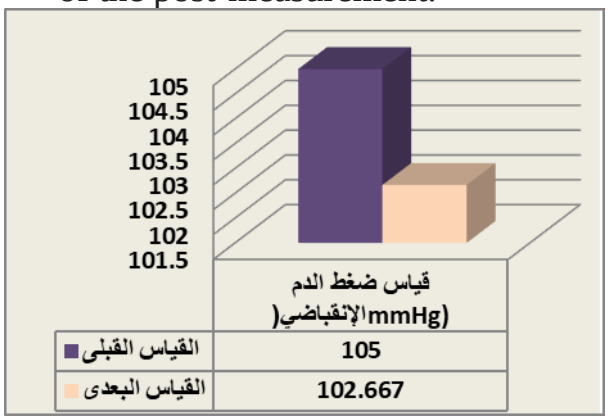
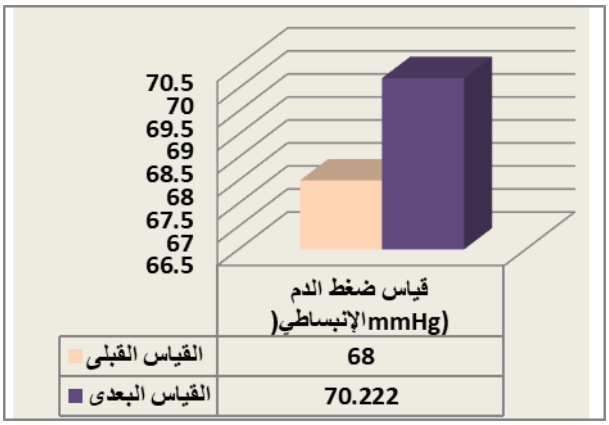


Figure (6/1)/Differences between the two measurements in the experimental group under study



Differences between the two /Figure (6/2) measurements in the experimental group under study

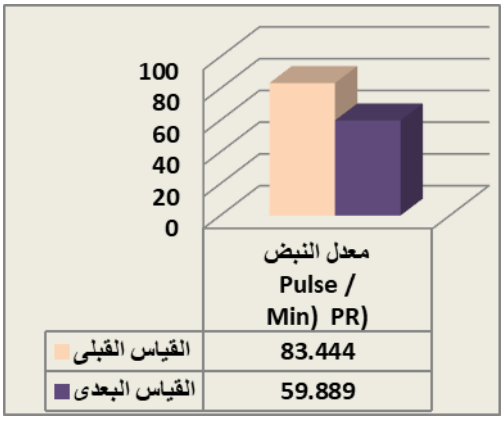


Figure (6/3)/Differences between the two measurements in the experimental group under study

Table (7)

The significance of the differences between the pre- and post-measurements in physical variables - under investigation

(n=9)

Improvement rate (%)	value (T)	the difference Between the two mediums		Dimensional measurement		Pre-measurement		Unit of measurement	Semantics of statistical description / Physical variables
		ع±	سَ	ع±	سَ	ع±	سَ		
61.905%	6.578**	2.635	5.778	3.333	15.111	4.387	9.333	(Sec)	Muscular endurance
64.286%	6.559**	3.202	7.000	7.507	17.889	7.849	10.889	(CM)	Back/torso flexibility
26.455%	5.882**	2.833	5.556	3.395	26.556	3.391	21.000	(Kg)	Right grip strength
25.140%	5.303**	2.828	5.000	3.790	24.889	3.480	19.889	(Kg)	Left grip strength

*** The tabular (t) value is significant at the 0.05 level = (2.306) and at the 0.01 level = (3.355)**

It is clear from Table (7) that there are statistically significant differences between the pre- and post-measurements in the physical variables under research in favor of the post-measurement, and the percentage of improvement in the physical variables under research reached (25.140%: 64.286%) in favor of the post-measurement

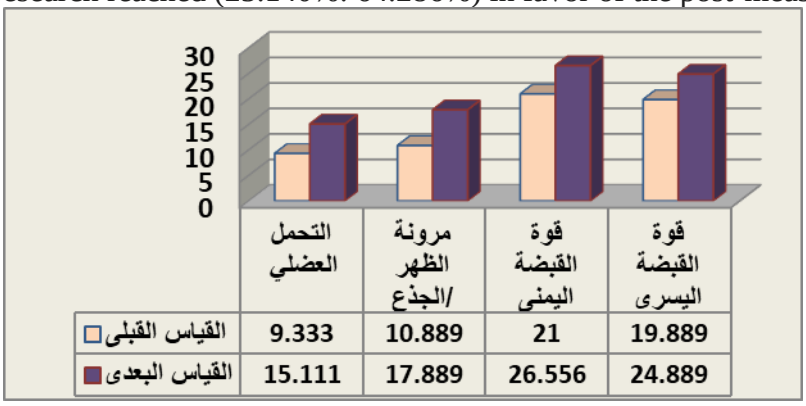


Figure (7/1) Differences between the pre- and post-measurements in the physical variables among the female students of the College of Sports Sciences under research

Second: Discussing the results:

In light of the results of statistical analysis, within the limits of measurements used, and through research objectives and hypotheses, following results were reached:

- Discussing the results related to the first hypothesis of the research:

Referring to Table (6), we find that the level of systolic blood pressure in the pre-measurement was (105), while the post-measurement was (102.7) for the experimental group, with an improvement rate of (2.22%) in favor of the post-measurement.

We find that the diastolic blood pressure level of the experimental group in the pre-measurement was (68), while the post-measurement was (70.2), with an improvement rate of (3.27%) in favor of the post-measurement.

The experimental group's pulse rate measurement in the pre-measurement was (83.44), while the post-measurement was (59.89), with an improvement rate of (28.23%) in favor of the post-measurement.

The researcher attributes the rates of change in the post-hoc measurements to the positive effect of Hatha yoga exercises, and the program included various and gradual exercises in performance with the accompaniment of calm music, which led to a feeling of relaxation and following the correct method while performing the exercises, as this was reflected in the students' increased desire to practice exercises regularly in accordance with the instructions and guidelines for performing each exercise to obtain the best results and their desire to improve their level of fitness, Hatha yoga exercises also helped raise the efficiency of the body's

vital systems. Continuous sports training leads to various physiological and physical changes that include all body systems. According to these changes, there is an increase in functional ability to achieve physiological adaptation of the body's systems to perform physical load with high efficiency and achieve the best level while saving time and effort. (16)

Abu Al-Ela (2003) indicated that exercise causes physiological changes For the body's systems, such as increasing the size, efficiency, strength, and thickness of heart muscle, and thus regular heartbeat, increasing the contractile force of heart muscle, and pumping a larger amount of blood with fewer beats, which led to a lower pulse rate as a result of the heart muscle adapting to physical effort and improving the efficiency of circulatory system. (3:38)

Rowell (2015) and Sharkey (2013) have indicated that a physiologically fit individual is characterized by a decrease in pulse rates compared to a non-athlete individual. The decrease in heart rate depends on the long period of focused training. It decreases to a greater extent when the level of physical fitness is higher, and pulse rate varies every minute according to circumstances and body positions. (29:419), (31:190,189)

The researcher attributes the low heart rate to the diverse Hatha yoga exercise program, which included stretching exercises, vibrational movements, and meditation exercises that work to achieve relaxation, which led to reducing stress, calming body and mind, quickly eliminating the stresses of the day, and returning the body's systems to their normal state,This is confirmed by Mara (2005) (25) and Catherine (2004) (20) that many yoga poses help improve blood circulation and help remove toxins and impurities from the body. It also helps lower the pulse rate, increases blood flow to the muscles and reduces fatigue.

The researcher explains that there are small rates of improvement in blood pressure measurements, due to the nature of the sample members and their level of physical and mental effort. Blood pressure is a dynamic state during the cardiac cycle that rises and falls depending on the level of activity of the individual. It is necessary to adhere to health guidelines, exercise, regulate time, meals, and adequate sleep to carry out physical effort efficiently and effectively, which leads to improving the level of performance.

This is consistent with what Ahmed Nasr El-Din (2003) pointed out, saying that the circulatory-respiratory system is one of the most important and most active vital systems in the body at all, which helps trainees cope with physical effort through functional efficiency of this system, which is responsible for supplying active muscles with food and oxygen flowing to them through blood, and ability of muscles to exploit energy materials in producing high energy.(5:160)

Krejci (2003) (21) and Jawinski (2012) (13) also recommended the importance of practicing regular physical activity and using Hatha yoga exercises as an essential component of training programs because of their positive effect in maintaining health of heart and lungs, stimulating blood circulation, lowering blood pressure and heart rate, and increasing self-awareness and self-confidence, Hussein Al-Ali and Amer Shaghati (2010) indicated that organized sports training is the main and basic means used in the process of influencing the physical and physiological capabilities of the athlete (18:88).

In this regard, the researcher explains these results to the effectiveness of the Hatha Yoga training program practiced regularly three days a week for two months, which aims to raise level of female students 'performance by providing modern training methods to improve physiological capabilities and raise functional efficiency of vital organs, while saving effort expended and achieving the desired goals.

Based on what was previously presented, first hypothesis was partially fulfilled, which states: "There are statistically significant differences between the pre- and post-measurements in physiological variables under investigation for experimental group in favor of the post-measurement."

- Discussing the results related to the second hypothesis of the research:

Referring to Table (7), we find that muscular endurance in the pre-measurement was (9.33), while the post-measurement was (15.11) for the experimental group with an improvement rate of (61.91%) in favor of the post-measurement.

It also showed that the level of flexibility of the back/torso for the experimental group in the pre-measurement was (10.89), while the post-

measurement was (17.89), with an improvement rate of (64.29%) in favor of the post-measurement.

The clearest measurement of right grip strength for the experimental group in the pre-measurement was (21), while the post-measurement was (26.56), with an improvement rate of (26.46%) in favor of the post-measurement.

Also, the left grip strength measurement for the experimental group in the pre-measurement was (19.89), while the post-measurement was (24.89), with an improvement rate of (25.14%) in favor of the post-measurement.

The researcher attributes this improvement in physical variables to the importance of the proposed training program using Hatha yoga exercises, and the various physical positions and exercises it contains that include (muscular strength - muscular endurance - flexibility) for all joints and muscles of the body, as well as regularity, continuity, and the students' commitment to training. Hatha yoga exercises have many benefits compared to other exercises in achieving balance between the spirit, body, and mind.

This is consistent with the results of the study of "Howaida Al-Asra et al. (2008) (17)" that the practice of Hatha yoga employs the use of various basic physical movements, starting from the limbs and muscles to the internal organs, to achieve a sense of health in both the body and mind. It is related to modern life in order to obtain balance, joint flexibility, and muscle strength and lengthening.

The researcher also concludes that elements of muscular strength, muscular endurance, and joint flexibility are among the most important elements of physical fitness that female students need, given that all their movements depend on how they move their body, and the muscles are ones that control this movement by contracting and relaxing from one position to another, and the stronger muscles are, the more effective these contractions will be for the longest period of time during physical effort.

Hatha yoga exercises have contributed to development of muscular strength, endurance and flexibility well by focusing on muscles targeted by the training by choosing the appropriate type of exercises, which include different parts of the body (legs - torso - arms). The program also took into

account the selection of exercises that helped to strengthen muscles of the legs and arms, In addition to improving muscular endurance, and also improving the range of motion of the body's joints, the diversity and progression of exercises helped achieve the desired goal of the modern sports training process to achieve the maximum and best athletic performance and reach the highest levels.

In this regard, the results of the study of "Joan M.B.Smith, et all (2003) (19), Hala Muhammad (2012) (15), Samah Battuta (2019) (30), Ahmed Tammam and at,all. (2020) (4)" indicate that practicing Hatha yoga exercises has a positive effect on improving some physical abilities such as flexibility, stretching, and strength, muscular endurance, balance, and motor coordination. Therefore, I recommend to each of them the necessity of using Hatha yoga programs because of their positive impact on health, physical fitness, mobility, and development of the level of performance, Hatha yoga, with its calm, sequential movement, increases muscular strength and endurance of the body's muscles, and relieves the body of tension that affects ligaments and joints, which may result in posture deformities. It also increases flexibility of the joints and is accompanied by correct, regular breathing exercises with performance of each exercise. Therefore, it develops the various body systems, protects the joints, improves muscle tone, and increases their efficiency, regardless of age.

The researcher attributes this improvement to the use of HATHA YOGA exercises under research, which help directly in improving level of performance physiologically and physically, and increase students' ability to endure performance for a relatively long period and speed up recovery as a result of hard effort in the faculties of sports sciences, as they require long hours of physical and mental effort.

Based on what was previously presented, the second hypothesis was fulfilled, which states: "There were statistically significant differences between the pre- and post-measurements in the physical variables under investigation for the experimental group in favor of the post-measurement."

-Conclusions and recommendations

First: Conclusions:

In light of the research objectives, hypotheses, and the nature of the sample, and within the framework of statistical treatments, interpretation and discussion of the results, the researcher was able to reach the following conclusions:

1- The selected HATHA YOGA exercises led to a clear and noticeable improvement in some of the physiological variables under study, namely (blood pressure - pulse rate).

2- HATHA YOGA training has a positive effect on some physical variables, including (muscular strength - muscular endurance - flexibility).

Second: Recommendations:

Based on the data and information provided in the context of this research, and based on what the conclusions drawn from the statistical analysis and discussion of the results indicate, the researcher makes the following recommendations:

1- Use the Hatha Yoga training program proposed in this study in various sports fields and activities, and circulate it to all sports bodies, due to its ease of implementation and its lack of need for specific equipment and its suitability for all age stages.

2- Work on conducting other studies on different variables and samples in terms of (age and gender), in addition to studies in various sports activities.

3-Using Hatha yoga programs accompanied by regular breathing exercises on patients with the circulatory system to improve cardiac functions to maintain health and physical safety.

4- Spreading cultural awareness of the importance of practicing Hatha yoga exercises in the field of injuries and rehabilitation in all centers, by paying attention to implementing them within a regulated sports program, because of its positive effects on public health and the efficiency of all vital systems.

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