The Effectiveness of a physical Rehabilitation program post open heart operations for patients with coronary artery

Prof. Dr., Iqbal Rasmi Muhammad
Faculty of physical Education- helwan university.
eqbalrasmy094@gmail.com

Prof. Dr., Reem Mohamed Mohsen
Faculty of physical Education- helwan university.
reemzoelfoqar@gmail.com

Prof. Dr., Omar Abdel Aziz Daoud
Department of Surgery- Faculty of Medicine- Cairo University.

Researcher / Rahma Abdel Tawab Sayed
rahmaaibrahim093@gmail.com

Abstract:

The current research aims to design a rehabilitation program for coronary artery disease patients and identify its effect on the physical variables under study. The researchers used the experimental method due to its suitability to the nature of the research using the experimental design for one group following the pre- and post-measurement. The research community included children with heart disease aged (45:60) years who visited the National Heart Institute in Imbaba and who underwent heart surgeries and did not suffer from any serious complications after the operation, amounting to (30) thirty women. The researchers selected a deliberate sample based on the opinions of the doctors following up on the cases of these women, amounting to (10) women, in order to include them in the program under study. The exploratory study sample was also selected from the same original research community and from outside the basic research sample, amounting to (10) women, in order to conduct the exploratory study of the tools used in the research. A number of (10) women were also excluded for not agreeing to participate. The most important results indicated that the proposed rehabilitation program contributed positively to improving the physical variables in coronary artery disease patients, the research sample. The researchers recommend the necessity of using the proposed rehabilitation program in institutes. Treating heart patients because it has a positive effect on improving the efficiency of the heart muscle.

تأثير برنامج تأهيلي على بعض المتغيرات الفسيولوجية لدى مرضى الشريان التاجي

الملخص:

يهدف البحث الحالي إلى تصميم برنامج تأهيلي لمرضى الشريان التاجي والتعرف على تأثيره على المتغيرات الفسيولوجية "ضغط الدم الانقباضي، ضغط الدم الانبساطي، كفاءة عضلة القلب" محل الدراسة. استخدم الباحثان المنهج التجريبي لملاءمته لطبيعة البحث باستخدام التصميم التجريبي لمجموعة واحدة بعد القياس القبلي والبعدي. وشمل مجتمع البحث الأطفال المصابين بأمراض القلب الذين تتراوح أعمارهم بين (45:60) سنة والذين راجعوا معهد القلب القومي بإمبابة والذين أجريت لهم جراحات في القلب ولم يعانوا من أية مضاعفات خطيرة بعد العملية، وبلغ عددهم (30) ثلاثين سيدة. وقد اختار الباحثان عينة عمديه بناء على آراء الأطباء المتابعين لحالات هؤلاء السيدات والبالغ عددهم (10) سيدات وذلك لإدراجهم في البرنامج محل الدراسة. كما تم اختيار عينة الدراسة الاستطلاعية من نفس مجتمع البحث الأصلي ومن خارج عينة البحث الأساسية وعددها (10) نساء وذلك لإجراء الدراسة الاستطلاعية للأدوات المستخدمة في البحث، كما تم استبعاد عدد (10) نساء لعدم موافقتهن على المشاركة في إجراءات البحث. وأشارت أهم النتائج إلى أن برنامج التأهيل المقترح ساهم بشكل إيجابي في تحسين ضغط الدم الانقباضي والانبساطي لدى مرضى الشريان التاجي في عينة البحث. كما ساهم برنامج التأهيل المقترح بشكل إيجابي في تحسين كفاءة عضلة القلب لدى مرضى الشريان التاجي في عينة البحث. ويوصي الباحثون بضرورة استخدام برنامج التأهيل المقترح في معاهد علاج مرضى القلب لما له من تأثير إيجابي في رفع كفاءة عضلة القلب.

The Effectiveness of a physical Rehabilitation program post open heart operations for patients with coronary artery

Introduction and research problem:

allah has blessed man with many types of sciences and rhetoric and wanted to honor him, so he honored him with the blessings of reason and faith.allah has provided the mind with many seas of science to sail in endlessly. Among the seas of science, we find sports sciences, including, but not limited to: sports movement sciences, sports psychology, sports training science, and sports health sciences, which aim to elevate sports to their highest level as well as develop athletes in a complete and balanced manner and protect them from the dangers that an individual may be afflicted with. We find the science of sports injuries, through which we can identify the injuries that may occur to athletes and how to prevent them and the first aid methods that must be performed when such emergency sports injuries occur in the stadiums.

Practicing sports exercises does not require a high level of motor abilities, special preparations or talents, which makes it possible to perform for all levels and ages, and it can be performed at any time, and in any place, even at home. It also does not require special tools or capabilities, but can be practiced with minimal capabilities and in all circumstances. The importance of exercises is due to their being one of the important means of educating the body, maintaining the health of the body, and correcting defects and deformities. It is also one of the compensatory means for what is caused by professional work, as it helps in the growth of all parts of the body, and it is also a means of positive rest and maintaining the health and beauty of the body, as it contributes to developing and strengthening the body's muscles and maintains the performance of its muscles and systems in a balanced manner (2: 86).

"Mohamed El-Naggar" (2015) confirms that through the previous philosophy of physical education and sports in society, the importance of sports rehabilitation appeared, and rehabilitation is defined as "restoring or maintaining the lost function of the injured part so that the injured person can easily and smoothly perform his daily needs (12:66).

The principles of rehabilitation aim to restore full function after injury or illness. The differences between rehabilitation of general patients and rehabilitation of athletes are represented in the specific degree (quality). Rehabilitation of patients stops when the individual can practice his life normally, and the continuation of rehabilitation of patients is not limited to reaching a high level of activity only, but must be prepared to meet the specific requirements of practicing his daily life as well. (8:339)

"Abdul Basit Siddiq" (2016) states that rehabilitation is one of the main axes in treating many injuries because it aims to remove cases of dysfunction of the injured part, by taking care of the manifestations of weakness in some muscles, ligaments and joints, and rehabilitation programs must be designed to meet the needs of each injured person in terms of the type and degree of injury, and the more positive the participation of the injured person and his family, the more successful the program will be Rehabilitation, with comprehensive rehabilitation follow-up with feedback through its indicators. The goal of rehabilitation after injury is to help the injured person return to the highest possible level in terms of function and independence, and the general improvement in his quality of life on the physical, psychological and social levels. (7: 7-9)

"Mohamed Kadri and Suham El-Sayed" (2018) explain that the field of motor rehabilitation may include walking, running and sports activities as one of the means to treat some diseases and this is considered to stimulate blood circulation as it is a form of movement. (18: 88)

Rehabilitation programs are considered one of the main axes in the treatment of many injuries because they aim to remove cases of functional dysfunction of the injured part by taking care of the manifestations of weakness in some muscles, ligaments and joints (5: 75)

"Rehabilitation programs" are also considered one of the means of physical therapy and sports movement for the purpose of employing the standardized, purposeful movement, whether in the form of various exercises or functional or skillful physical work, in order to work on restoring the basic functions of the injured organ and rehabilitating it physically to return efficiently to practicing sports activity" (19: 66)

"Iqbal Rasmi Mohamed" (2008) indicates that rehabilitation programs are a group of physical exercises performed through standardized exercises based on selected scientific measurements for the purpose of Returning the affected part to its normal state whenever possible to reach the highest possible level of health. (3:40)

Heart patients are one of the groups that have become actually present in Egyptian society and the global community, as the number of patients has increased significantly in recent years, as this disease has become a result of the individual's life changes and due to some bad habits. Heart disease is not limited to adults only, but rather extends to include different age groups, and these age groups are difficult during childhood. Many scientific studies have confirmed that there is a large group of children with heart disease, and these diseases range between simple and complex cases in which therapeutic intervention is easy and some others are difficult (2:4).

"Mohamed Alawi, Abu Al-Ala Abdel Fattah" (2000) believes that the heart is the source of energy that causes blood to move in the blood vessels, and it works as a pump to which blood comes from all parts of the body in order to push it through the blood vessels again, and the heart is considered one of the most important organs of the circulatory system (13:194).

The American College of Sports Medicine (25) explained that common symptoms of coronary artery disease include chest pain and

shortness of breath. These symptoms arise from a lack of blood supply to the heart. If the lack of blood supply to the heart is mild or moderate, the patient will not feel any symptoms when not exerting any effort. The patient may feel a heaviness in the chest when exerting unusual effort or when exposed to life pressures. Other symptoms that indicate the disease include jaw and arm pain, burning in the chest, nausea, vomiting, and profuse sweating. Most individuals with coronary heart disease may not show any symptoms for decades, while the disease continues to develop during this period before its first signs appear, which are often in the form of sudden angina. Leon et al. (2005) (30) (Hambrecht et al., 2004) (26) have indicated that physical exercise is a key component of cardiac rehabilitation, reduces risk factors, improves functional capacity and prognosis, and enhances psychological well-being and quality of life in patients with coronary artery disease. Haskell (2003) (27) indicates that cardiovascular disease is a multifactorial process and that physical activity, a healthy diet, and avoidance of stress and depression are key components of effective and preventive programs for cardiovascular disease. Aerobic activities, water exercise, walking, and exercise conditioning, which are performed in moderate temperatures, can be useful physical activities for low-risk patients to improve their motivation and enhance exercise for cardiovascular conditioning.

Researchers have noticed that lack of movement, practicing some wrong eating habits, and not practicing sports in a scientifically correct and regular manner have led to the emergence of many modern diseases, such as heart disease, hardening of the arteries, and increased fat. These diseases have spread in a disturbing and eye-catching manner, which requires an effort from researchers to investigate the various aspects to limit the spread of these diseases.

By reviewing the researchers' many scientific references, research and related studies, such as the study of Muhammad Shaaban (2023) (17) Ayman Abdel Tawab (2022) (4) Mohsen Ibrahim, Muhammad Ali, Muhammad Salah (2019) (11) Nashat Abdel Hamid, Amani Shaaban, Mahmoud Fawzy (2019) (23) Volaklis et. al, There was a scarcity in studies that addressed the effect of rehabilitation programs through exercise on coronary artery disease patients after open heart surgery, as far as researchers know. Through the work of researchers in the field of rehabilitation, researchers have noticed that coronary artery disease and heart valve disease patients after open heart surgery need many rehabilitation exercises, but after following up with the doctor and through what was presented and the researcher's review of previous research and

studies, she reached a positive result in the extent of the effect of rehabilitation exercises on coronary artery disease and heart valve disease patients after open heart surgery. Therefore, the researcher resorted to using these exercises because of their effective impact in rehabilitating the heart muscle and the respiratory circulatory system for coronary artery disease and heart valve disease patients. Therefore, the researcher decided to do this Study to identify the extent of the impact of a rehabilitation program on some physiological variables in coronary artery disease patients

Research objective:

The current research aims to design a rehabilitation program for coronary artery disease patients and identify its effect on the physiological variables "systolic blood pressure, diastolic blood pressure, heart muscle efficiency," under investigation

Research hypotheses:

In light of the research objective, the researchers put forward the following hypotheses:

- There are statistically significant differences between the pre- and post-measurement in coronary artery disease patients, the research sample, in the physiological variables "systolic blood pressure, diastolic blood pressure, heart muscle efficiency," under investigation and in favor of the post-measurement.
- There are rates of percentage change in the averages of the post-measurement scores compared to the pre-measurement in coronary artery disease patients, the research sample, in each of the physiological variables under investigation.

Terms used in the research:

Rehabilitation:

Therapeutic and rehabilitative exercises of the injured person to restore functional ability in the shortest possible time by using methods that are appropriate to the type and severity of the injury. (16: 29).

Rehabilitation programs:

They are defined as a group of physical movement activities that contribute to shaping the body and developing its motor ability to achieve specific therapeutic goals and duties according to specific rules that take into account educational foundations and scientific principles. (16:40)

Rehabilitation exercises

Rehabilitation exercises are those that specialize in restoring full function or maintaining the injured part of the body, and depend mainly on identifying the basis of the injury and correcting it and methods of treating it, and the normal injured person is rehabilitated so that he can perform the necessary functions and burdens and his daily needs without disturbances and with ease and comfort (16:59)

Researchers define it as "movements based on scientific physiological and anatomical foundations and are described by this name in order to return the body to its natural state or to a position similar to its previous natural state" Operational definition

Coronary Artery Disease (CAD):

It is that which occurs as a result of the accumulation of cholesterol and fatty deposits (atherosclerotic plaques) on the inner walls of the arteries that feed the heart muscle, which can limit blood flow to the heart muscle by blocking the artery or causing tension and abnormal functions of the artery (31:55)

Research Methodology:

The researchers used the experimental method due to its suitability to the nature of the research using the experimental design for one group following the pre- and post-measurement.

Research Community and Sample:

The research community included children with heart disease aged (45:60) years who visited the National Heart Institute in Imbaba and who underwent heart surgeries and did not suffer from any serious complications after the operation, totaling (30) thirty women. The researchers selected a deliberate sample based on the opinions of the doctors following up on the cases of these women, amounting to (10) women, in order to include them in the program under study. The exploratory study sample was also selected from the same original research community and from outside the basic research sample, numbering (10) women, in order to conduct the exploratory study of the tools used in the research. A number of (10) women were also excluded for not agreeing to participate in the research procedures. Table (1) shows the description of the research sample.

Table (1)
Description of the research sample

Original community		Primary research sample		Exploratory sample		Excluded	
Number	Percentage%	Number	Percentage%	Number	Percentage%	Number	Percentage%
30	100	10	33.33	10	33.33	10	33.33

Moderate frequency distribution:

The researchers verified the extent of the moderation of the distribution of the women in the research sample in light of the following variables: age, medical history, and physical variables of the sample under study. Tables (2) illustrate this.

Table (2)
Arithmetic mean, median, standard deviation and skewness coefficient of the variables under investigation for the basic and exploratory research sample (n = 20)

Variables	Unit of measure	Mean	Median	Standard Deviation	Coefficient of Skewness
Age	Year	**50.71**	**51.00**	**4.07**	**0.87**
Height	cm	**158.14**	**157.00**	**2.41**	**1.70**
Medical history	Year	**5.00**	**5.00**	**1.08**	**0**
Systolic blood pressure	mmHg	**69.50**	**68.00**	**7.45**	**0.60**
Diastolic blood pressure	mmHg	**46.00**	**43.00**	**4.70**	**1.91**
Heart muscle efficiency	%	**64.75**	**69.00**	**11.75**	**1.09−**

It is clear from Table (2) that the values of the skewness coefficients for the variables under study for the basic and exploratory research sample ranged between (1.70: -1.09) and all of them are between (+3, -3), which indicates the moderation of the distribution of data in those variables for the basic and exploratory research sample.

Data collection methods:

The research included the following data collection methods: First: Devices and tools (Appendix 3)

1- **The restameter device to measure height in centimeters**

2- **The echocardiogram device (ECHO):**
The researchers used this device with the help of the cardiologist responsible for performing this test in order to determine the true status of the efficiency of the heart muscle in the research sample.

3- **A device to measure blood pressure:**
The researchers used this mercury pressure device with each patient during the unit by attaching the device to the wrist so that we can

clearly identify the patient's pulse rates and so that it is an indicator for the researchers during implementation.

The proposed rehabilitation program for coronary artery disease patients, research sample (Appendix 4)

1 - The general objective of the program:

Develop a set of rehabilitation exercises for coronary artery disease patients and identify the extent of their impact on the physical variables under study

2- Foundations for developing the program:

- That the practice of the program activities be individual so that we can get full benefit from the program units under study.
- That the program be characterized by taking into account change and diversity to attract the interest of women to continue the activity.
- That the program activities are consistent with the capabilities and nature of the research sample.
- That the program activities allow the sample members to rely on themselves, feel freedom, sense their value, and feel belonging to the group.
- That the selected activities be graded from simple to complex and from easy to difficult so that the sample members can understand them and participate in them positively.
- That the program is characterized by diversity and comprehensiveness so that the sample members can participate with the highest efficiency of their abilities.
- Use tools of various sizes, shapes, and colors so that the sample members accept practicing the activity.
- That the activities are chosen in light of the maturity level of the sample members. - That the factors of security and safety are available during the practice of the program activities.
- Taking into account providing the appropriate place and capabilities to implement the program, while paying attention to security and safety factors to ensure the safety of the research sample.
- Choosing music that is pleasing and motivating for performance.
- The program contents should be interesting, enjoyable, exciting, and use all their senses.

3- Program content:

A- Preliminary exercises: aim to prepare and prepare the research sample and stimulate blood circulation. It consists of a set of simple preparatory activities:

B- Main exercises: include a set of diverse activities (small games and exercises) that achieve the general goal of the research.
C- Final calming exercises: aim to calm the body to reach a state of relaxation through a set of simple and easy sports activities.

Research implementation steps:

Exploratory study:

The researchers conducted a survey study on (10) women from the research community and from outside the original research sample in the period from 6/3/2023 to 6/12/2023 to identify the extent of the suitability of the measurement tools under study by applying them to a survey sample from the research community that has the same specifications as the basic sample, as well as identifying the extent of the suitability of the proposed program for application to the sample under study. The survey study resulted in:

- The suitability of these tools for the research sample, and finding the validity and reliability of the tools used under study.
- The suitability of the activities with the capabilities and potential of the research sample.
- The validity of the devices, tools, and place used for the application.

Pre-measurement:

The researchers conducted the pre-measurement of the research sample on 6/14 and 6/15/2023 AD in the variables (chronological age, medical history, physical variables under study) under study, and the researchers took care to apply the measurements in a uniform manner for all members of the research sample.

The main experiment:

After completing the pre-measurement, the researchers applied the proposed program to the women in the research sample during the period from 6/17/2023 to 9/11/2023 at a rate of (3) units per week, and the unit time is (45) forty-five minutes for a period of (12) weeks, i.e. (36) units (Appendix 6). The researcher committed to implementing the experiment on (Saturday, Monday, Wednesday) of each week throughout the experiment period.

Post-measurement:

The post-measurement of the research sample was conducted on 9/14 and 15/2023 AD in the (physiological variables) under study. This was done immediately after the completion of the application of the program as a whole and under the same conditions that were followed in the pre-measurement.

Statistical method used:

The researchers used the following statistical methods: "arithmetic mean - median - standard deviation - skewness coefficient - correlation coefficient - t-test - percentage change". The researchers used the significance level (0.05) to ensure the significance of the statistical results of the research. The researchers also used the SPSS statistical program to calculate some statistical coefficients.

Presentation, interpretation and discussion of the results:

To achieve the research objective and hypotheses and in light of the research results, the researchers presented the results according to the following:

1 - Significance of the differences between the averages of the pre- and post-measurements among coronary artery disease patients, the research sample, in the physiological variables "systolic blood pressure, diastolic blood pressure, and heart muscle efficiency under investigation, in favor of the post-measurement.

2 - Rates of percentage changes in the averages of the post-measurement scores compared to the pre-measurement among coronary artery disease patients, the research sample, in the physiological variables under investigation.

Table (3)
The significance of the differences between the averages of the pre- and post-measurements in coronary artery disease patients in the research sample in both systolic and diastolic blood pressure (n = 10)

Variables	Unit of measure	Pre-measurement		Post-measurement		Standard error	T-value
		M	A	M	A		
Systolic blood pressure	mmHg	**69.00**	**0.43**	**99.00**	**5.14**	**2.11**	**14.22**
Diastolic blood pressure	mmHg	**46.00**	**1.86**	**69.00**	**5.16**	**2.13**	**10.80**

The tabular value of (t) at a degree of freedom of (9) and a significance level of (0.05) = 1.833

Table (3) shows the following: There are statistically significant differences between the averages of the pre- and post-measurements of the sample under study in both systolic and diastolic blood pressure and in the direction of the post-measurement, as the calculated (t) values are greater than the tabular (t) values at the significance level (0.05).

Table (4)
The significance of the differences between the averages of the pre- and post-measurements in coronary artery disease patients in the research sample in the efficiency of the heart muscle (n = 10)

Variables	Unit of measure	Pre-measurement		Post-measurement		Standard error	T-value
		M	A	M	A		
Heart muscle efficiency	%	64.40	10.48	74.40	5.30	2.44	4.10

The tabular value of (t) at a degree of freedom of (9) and a significance level of (0.05) = 1.833

Table (4) shows the following: There are statistically significant differences between the averages of the pre- and post-measurements of the sample under study in the efficiency of the heart muscle and in the direction of the post-measurement, as the calculated (t) values are greater than the tabular (t) values at the significance level (0.05).

Table (5)
Rates of percentage changes in the averages of the post-measurement scores compared to the pre-measurement scores for the research sample in systolic and diastolic blood pressure and the efficiency of the heart muscle under study (n = 10)

Variables	Unit of measure	Average pre-measurement	Average post-measurement	% change
Systolic blood pressure	mmHg	69.00	99.00	30%
Diastolic blood pressure	mmHg	46.00	69.00	33%
Heart muscle efficiency	%	63.40	73.40	14%

Table (5) shows the following:
- The percentage change rates for systolic and diastolic blood pressure were (30%, 33%)
- The percentage change rate for the efficiency of the heart muscle was (14%).

Second: Interpretation and discussion of the results:

It is clear from the presentation and interpretation of the results that there are statistically significant differences in favor of the post-measurement in all the selected study variables.

A- Interpretation of the results of the first hypothesis, which states that:

There are statistically significant differences between the averages of the pre- and post-measurements among coronary artery disease patients in the research sample in both systolic and diastolic blood pressure, in favor of the post-measurement.

It is clear from Table (3) that there are statistically significant differences between the averages of the pre- and post-measurements for the sample under study in both systolic and diastolic blood pressure, and in the direction of the post-measurement, as the calculated (t) values are greater than the tabular (t) value at the significance level (0.05), as the systolic and diastolic blood pressure for the pre-measurement reached (46.00, 69.00) and in the post-measurement reached (69.00, 99.00), and the percentage of change reached (30%, 33%).

The researchers attribute this result to the fact that the proposed program has a positive effect on improving the systolic and diastolic blood pressure of the sample under study, coronary artery disease patients, through their practice of the activities in the proposed therapeutic program under study, which had a positive and direct effect on the heart muscle.

As shown in Table (4), there are statistically significant differences between the averages of the pre- and post-measurements of the sample under study in the efficiency of the heart muscle and in the direction of the post-measurement, as the calculated (t) values are greater than the tabular (t) value at the significance level (0.05), as the efficiency of the heart muscle for the pre-measurement reached (64.40) and in the post-measurement reached (74.40) and the percentage of change reached (14%).

The researchers attribute this result to the fact that the proposed program has a positive effect on improving the performance of the heart muscle under study in coronary artery disease patients in the research sample, through their practice of the aspects of the activity in the proposed program, which had a positive and direct effect on the heart muscle, as well as the positive interaction of the individuals participating in the program activities helped improve the efficiency of the heart muscle and its variables.

As is evident from the increase in the percentage of change rates in the dimensional measurements over the tribal measurements in all variables, this is due to the proposed program including various and gradual exercises that took into account the scientific and educational foundations, which are diversity, excitement, and gradation from easy to

difficult and from simple to complex, in order to meet the needs and suit the capabilities of the coronary artery disease patients in the research sample.

Through the sports program and the positive results it achieved, the researchers noticed the extent of the need of the coronary artery disease patients in the research sample to satisfy their needs and release their energy through directed motor activity represented in purposeful exercises, and thus their feeling of success in many motor activities related to participation in activities and performing daily skills.

The researchers believe that these results indicate that the proposed program has a positive effect on improving the heart rate under study in the coronary artery disease patients in the research sample, through their practice of the activities in the proposed program, which had a positive and direct effect on improving the heart rate.

Thus, the validity of the first hypothesis is achieved, which states that:

There are statistically significant differences between the pre- and post-measurement of coronary artery disease patients in the research sample in the physiological variables "systolic blood pressure, diastolic blood pressure, heart muscle efficiency" under study, in favor of the post-measurement.

B- Interpretation of the results of the second hypothesis, which states that:

There are rates of percentage change in the averages of the post-measurement scores compared to the pre-measurement scores among coronary artery disease patients in the research sample in each of the physiological variables under study.

It is clear from Table (5) that the percentage change rate in both systolic and diastolic blood pressure was (30%, 33%) and the percentage change rate for the efficiency of the heart muscle was (14%).

The researchers attribute the differences in the percentage change rate to what indicates the extent of the impact of the proposed sports program on some of the physiological aspects under study, as the percentage change rate came as follows: systolic and diastolic blood pressure (30%, 33%) and the percentage change rate for the efficiency of the heart muscle was (14%). This is consistent with the results of "Ronnie Jackson Jacobsen" (2016) (98) and Maryam Muhammad "(2012) (80)", whose most important results indicated the extent of the impact of rehabilitation sports programs on heart patients.

This achieves the second hypothesis, which states that: There are rates of percentage change in the average scores of the post-test measurements compared to the pre-test among coronary artery disease patients in the research sample in each of the physiological variables under study.

Conclusions and Recommendations

First: Conclusions:

In light of the research results, the researchers reached the following conclusions:

1- The proposed rehabilitation program contributed positively to improving systolic and diastolic blood pressure in coronary artery disease patients in the research sample.

2- The proposed rehabilitation program contributed positively to improving the efficiency of the heart muscle in coronary artery disease patients in the research sample.

3- The percentage change rates for each of the following: systolic and diastolic blood pressure (30%, 33%), and the average percentage change rate for the efficiency of the heart muscle (14%), which indicates the positive impact of the program under study.

Second: Recommendations

In light of the research objectives and hypotheses, within the limits of the nature of the sample and the statistical treatments used, and through the results of the experiment and its discussion, the researchers can recommend the following

1- Using the proposed rehabilitation program in heart patients treatment institutes because of its positive impact on raising the efficiency of the heart muscle.

2- Spreading the culture of rehabilitation sports programs because of its clear positive impact on improving some physiological aspects and physical variables in coronary artery disease patients in the research sample.

References List

First: Arabic References:

1. Ahmed Abdel Azim Thabet: The effect of rehabilitation exercises on the motor functions of the spine affected by spondylolisthesis in men, Master's thesis, Assiut University, Faculty of Physical Education, Department of Health Sciences, 2019 AD

2. Ahmed Abdel Fattah Al-Dafrawy: "The effect of a therapeutic recreation program on the rehabilitation of heart patients", unpublished Master's thesis, Faculty of Physical Education for Boys in Haram, Helwan University, 2015.
3. Iqbal Rasmi Muhammad: Sports injuries and methods of treatment, Dar Al-Fajr for Publishing and Distribution, Cairo, 2008 AD
4. Ayman Farouk Makkawi Abdel Tawab: The effect of a proposed exercise program accompanied by taking atorvastatin on some risk factors causing coronary artery disease for the age group 45-55 years, published research, Journal of Sports Sciences, Faculty of Physical Education, Minya University, 2022
5. Hamdi Muhammad Al-Qalyoub: The effect of a proposed program with the use of different methods of stretching on reducing sciatica pain associated with lumbar disc herniation, unpublished doctoral dissertation, Faculty of Physical Education, Tanta University, 2004
6. Samia Khalil Muhammad: Modern Diseases and Therapeutic Sports, Dar Al-Kutub for Publishing, Cairo, 2015
7. Abdel Basset Siddiq Abdel Gawad: New in the treatment and rehabilitation of sports injuries, rehabilitation and treatment programs, Dar Mahi for Publishing, Alexandria, 2016.
8. Ali Jalal Al-Din, Muhammad Qadri Bakri: Sports injuries and rehabilitation, Egyptian Library for Publishing, Cairo, 2011.
9. Kamal Darwish, Qadri Morsi, Imad Al-Din Abbas : Measurement, Evaluation and Match Analysis in Handball, Book Center for Publishing, Cairo, 2002
10. Laila El-Sayed Farahat: Measurement and Testing in Physical Education, Book Center for Publishing, Cairo, 2001.
11. Mohsen Ibrahim Ahmed, Mohamed Ali Mohamed, Mohamed Salah Handawy (2019)() entitled Using Aerobic Training with the Zoladz Equation and Its Effect on Heart Rate and Performance Endurance in Boxers, Published Research, Journal of Sports Sciences, Faculty of Physical Education, Minya University
12. Mohamed El-Naggar Tawfik: The Effect of Rehabilitation Exercises on the Functional Stability of the Ankle after a Tear of the External Ligament, Unpublished Master's Thesis, Faculty of Physical Education for Boys, Helwan University, 2015
13. Mohamed Hassan Alawi, Abu El-Ela Ahmed Abdel Fattah: Physiology of Sports Training, Dar Al-Fikr Al-Arabi, Cairo, 2000.
14. Mohamed Hassan Alawi, Mohamed Nasr El-Din Radwan: Motor Performance Tests, 4th ed., Dar Al-Fikr Al-Arabi, Cairo. 2010

15. Mohamed Sobhi Hassanein: Measurement and Evaluation in Physical Education and Sports, 5th ed., Dar Al Fikr Al Arabi, Cairo, 2005.
16. Mohamed Salah El Din Mohamed: The Effect of a Rehabilitation Exercise Program Using Assistive Devices to Strengthen and Increase the Flexibility of Lower Back Muscles in Volleyball Players, Master's Thesis, Suez Canal University 2019
17. Mohamed Ali Shaaban: The Effect of a Motor Rehabilitation Program on Inflammatory Indicators for Coronary Artery Disease Patients to Improve Quality of Life, Published Research, Scientific Journal of Applied Research in the Sports Field, Cairo, 2023
18. Mohamed Qadri Bakri, Siham El Sayed El Ghamry: Sports Injuries and Rehabilitation, Dar Al Manara, Cairo, 2011.
19. Mahmoud Ismail Al-Hashemi: Exercises and Sports Performances, Modern Book Center, First Edition, Cairo 2018 AD
20. Mahmoud Hussein Mahmoud, Hani Abdel-Ghani Talaba: The effect of endurance training with various motor paths on recovery time and some physical and offensive skill variables among basketball juniors, Assiut Journal of Sports Education Sciences and Arts, Issue 52, Part One, 2020 AD
21. Mahmoud Hamdi Ahmed: Scientific strategy in therapeutic rehabilitation for injuries, Academic Library, Cairo, 2008 AD
22. Maryam Zakouri Muhammad: Level of psychological stress among heart patients, unpublished master's thesis. Faculty of Humanities and Social Sciences, Department of Psychology and Educational Sciences, Qasdi Merbah University, 2012 AD
23. Nashat Abdel Hamid, Amani Shaaban, Mahmoud Fawzy: The effect of a recreational sports program on improving blood pressure and the efficiency of the heart muscle in children with heart disease, published research, Journal of Sports Sciences, Faculty of Physical Education, Minia University, 2019
24. Ministry of Health: Heart Patients Rehabilitation Program, Kingdom of Bahrain, 2016 AD

Second: English references:

25-American College of Sports Medicine. ; ACSM's Guidelines for Exe. Testing and Prescription(7th ed.)Philadelphia: Lippincott Williams& Wilkins2006
26-Hambrecht R, Walther C, Moebius-Winkler S, et al. :Percutaneous coronary angioplasty compared with exercise training in

patients with stable coronary artery disease: a randomized trial. Circulation.109:1371–1378,2004

27-Haskell, W.L: Cardiovascular disease prevention and lifestyle interventions: Effectiveness and Efficacy. Journal of Cardiovascular Nursing, 18 (4), 245–55. 2003

28-Ilic T , Vitosevic B , Rankovic B , Stevic L, Savic T (): THE EFFECTS OF PHYSICAL TRAINING ON CARDIOVASCULAR PARAMETERS AND REDUCTION OF VISCERAL FATTY TISSUE, Acta Medica Medianae , 34 – 37 Vol.46,2017

29-Jacobsen , Roni M Ginde SL , et al can a home –based car diac physical activity program improve the physical function quality of life in children with fontan circulation ? congenit hear dis .2016.

30-Leon A,Franklin B, Costa F ;Cardiac rehabilitation and secondary prevention of coronary artery disease. Circulation. 111:369–376, 2005

31-O. S. Randall and D. S. Romaine, ; The encyclopedia of the heart and heart disease . New York, NY: Facts on File, 2005

32-Volaklis A .K, Spassis A . T, Tokmakidis P.S.:: Land versus water exercise in patients with coronary artery disease: effects on body composition, blood lipids, and physical fitness American Heart Journal Volume 154, Issue 3 , Pages 560.e1-560. 2017