Revista de Ciencias Médicas y de la Vida
Universidad Da Vinci de Guatemala
Facultad de Ciencias Médicas y de la Vida

• e-ISSN: 2958-9533 • p-ISSN: 2960-2696 •

Volumen 3 (1-3) || Año 2025 || e040 **Review Article**

Effectiveness of exercise-based cardiac rehabilitation: A systematic literature review

Dallana Fabiola Luen-Aguilar [1*]
https://orcid.org/0009-0003-0464-388X

Jorge Escobar-Barrios
https://orcid.org/0009-0003-7203-6459

Carlos Rafael Araujo-Inastrilla
https://orcid.org/0000-0001-9441-1721

Open Access

Received: 11/03/2024
Accepted: 01/05/2025
Published: 01/31/2025

Correspondence

* 202402552estudiante@.udv.edu.gt

ABSTRACT

Introduction: Cardiac rehabilitation is a designed program that helps the patient to have a stable life after heart surgery, a heart attack, or other specific problems that merit such rehabilitation. **Objective:** To evaluate the effectiveness of cardiac rehabilitation with exercise in addressing cardiac diseases. **Method:** A systematic review was conducted where, based on a search in databases such as PudMed, Scielo, Cochrane, Dialnet, and Academia.Edu, a group of seven articles could be analyzed. Criteria were established to classify said effectiveness based on the findings of each study. **Analysis and integration of information:** The population used was 1,735 patients, distributed among the populations of the seven studies included. Six of seven selected articles positively impacted the effectiveness of cardiac rehabilitation. The results reduced mortality, heart rate, and blood pressure, among other aspects, for a better quality of life. **Conclusion:** The review reveals generally positive results. Significant improvements in patients' quality of life are noted, and supervised exercises offer more benefits than those performed at home, highlighting the importance of professional monitoring.

Keywords: Cardiovascular Diseases, Cardiac Rehabilitation, Efficacy, Intervention

[1]Estudiante de la carrera de Medico y cirugía. Facultad de Ciencias Médicas y de la Vida. Universidad Da Vinci de Guatemala, Guatemala. Correo electrónico: 202402552estudiante@.udv.edu.gt
[2]Ingeniero Agrónomo. Magister en Innovación y Docencia Superior. Facultad de Ciencias Médicas y de la Vida. Universidad Da Vinci de Guatemala, Guatemala. Correo electrónico: jmescobar@udv.edu.gt
[3]Licenciado en Sistemas de Información en Salud. Facultad de Tecnología de la Salud. Universidad de Ciencias Médicas de la Habana. La Habana, Cuba. Correo electrónico: carlosai@infomed.sld.cu

Cite as:
Luen-Aguilar DF, Escobar-Barrios J, Araujo-Inastrilla CR. Effectiveness of exercise-based cardiac rehabilitation: A systematic literature review. Rev. Cienc. Med. Vida. 2025;3:e040.

Eficacia de la rehabilitación cardiaca con ejercicios. Revisión sistemática de literatura

RESUMEN

Introducción: *la rehabilitación cardiaca es un programa diseñado que ayuda al paciente con el fin de tener una vida estable después de una cirugía del corazón o un ataque cardiaco u otros problemas específicos que ameritan dicha rehabilitación.* ***Objetivo:*** *evaluar la eficacia de la rehabilitación cardiaca con ejercicio para el abordaje de los problemas cardiacos.* ***Método:*** *se realizó una revisión sistemática donde a partir de una búsqueda en bases de datos como PudMed, Scielo, Cochrane, Dialnet y Academia.Edu se pudo analizar un grupo de siete artículos. Se establecieron los criterios para clasificar dicha eficacia en función de los hallazgos de cada estudio.* ***Análisis e integración de la información:*** *la población usada fue un total de 1735 paciente, distribuidos en las poblaciones de los siete estudios incluidos. Seis de siete artículos seleccionados tuvieron un impacto positivo en base a la eficacia de la rehabilitación cardiaca. Los resultados redujeron la mortalidad, la frecuencia cardiaca y la presión arterial entre otros aspectos para una mejor calidad de vida.* ***Conclusión:*** *la revisión realizada revela resultados en general positivos. Destacan las mejoras significativas en la calidad de vida de los pacientes y se observa que los ejercicios supervisados ofrecen mayores beneficios en comparación con los realizados en casa, resaltando la importancia del monitoreo profesional.*

Palabras clave: *Enfermedades Cardiovasculares; Rehabilitación Cardiaca; Eficacia; Intervención*

Efficacité de la réadaptation cardiaque basée sur l'exercice. Revue systématique de la littérature

RÉSUME

Introduction*: La réadaptation cardiaque est un programme conçu pour aider le patient à avoir une vie stable après une chirurgie cardiaque ou une crise cardiaque ou d'autres problèmes spécifiques justifiant une telle rééducation.* ***Objectif****: évaluer l'efficacité de la rééducation cardiaque avec exercice pour traiter les problèmes cardiaques.* ***Méthode****: Une revue systématique a été réalisée où, sur la base d'une recherche dans des bases de données telles que PudMed, Scielo, Cochrane, Dialnet et Academia.Edu, un groupe de sept articles a pu être analysé pour analyser l'efficacité de la rééducation cardiaque avec des exercices. Des critères ont été établis pour classer ladite efficacité en fonction des résultats de chaque étude.* ***Analyse et intégration des informations****: La population utilisée était au total de 1735 patients, répartis dans les populations des sept études incluses. Six des sept articles sélectionnés ont eu un impact positif basé sur l'efficacité de la réadaptation cardiaque. Les résultats ont réduit la mortalité, la fréquence cardiaque et la tension artérielle, entre autres aspects, pour une meilleure qualité de vie.* ***Conclusion****: L'examen effectué révèle des résultats globalement positifs. Des améliorations significatives de la qualité de vie des patients se démarquent et on observe que les exercices supervisés offrent de plus grands bénéfices par rapport à ceux effectués à domicile, soulignant l'importance d'un suivi professionnel.*

Mots-clés*: Maladies cardiovasculaires, Réadaptation cardiaque, Efficacité, Intervention*

Eficácia da reabilitação cardíaca com exercícios. Revisão sistemática da literatura

RESUMO

Introdução: *a reabilitação cardíaca é um programa estruturado que auxilia o paciente a alcançar uma vida estável após a cirurgia cardíaca, um ataque cardíaco ou outros problemas específicos que demandem essa reabilitação.* ***Objetivo:*** *avaliar a eficácia da reabilitação cardíaca com exercícios no manejo de problemas cardíacos.* ***Método:*** *foi realizada uma revisão sistemática a partir de uma busca em bases de dados como PubMed, Scielo, Cochrane, Dialnet e Academia.edu. Foram analisados sete artigos para avaliar a eficácia da reabilitação cardíaca com exercícios. Estabeleceram-se critérios para classificar essa eficácia com base nos achados de cada estudo.* ***Análise e integração da informação:*** *a população analisada incluiu um total de 1.735 pacientes distribuídos entre as populações dos sete estudos incluídos. Seis dos sete artigos selecionados demonstraram impacto positivo quanto à eficácia da reabilitação cardíaca. Os resultados mostraram redução da mortalidade, da frequência cardíaca e da pressão arterial, entre outros aspectos, contribuindo para uma melhor qualidade de vida.* ***Conclusão:*** *a revisão realizada revela resultados geralmente positivos. É possível destacar melhorias significativas na qualidade de vida dos pacientes, e se observa que os exercícios supervisionados oferecem maiores benefícios em comparação com os realizados em casa, ressaltando a importância do acompanhamento profissional.*

Palavras-chave: *Doenças Cardiovasculares, Reabilitação Cardíaca, Eficácia, Intervenção*

INTRODUCTION

Exercise-based cardiac rehabilitation (CR) programs may reduce mortality, but their effects on readmission rates are unclear. [1] Exercise-based CR may benefit patients with myocardial infarction (MI), cerebrovascular disease (CVD), congenital heart defects (CHD), heart failure, and patients undergoing post-revascularization. [2]
Although one of the most effective treatments for chronic diseases is surgery, which can improve the patient's quality of life, these interventions are often highly complex and carry a significant risk to life and varying degrees of mortality. This high complexity and risk make it essential for post-surgical patients to benefit from CR programs since these can be decisive for recovery and reducing the risk of future complications. [2,3]

Following an MI, patients are often referred to a cardiac rehabilitation program, a multifaceted intervention that aims to limit the physiological and psychological impacts of heart disease. It consists of various activities and interventions that offer physical training, education, risk factor modification, symptom control, and decreased risk of reinfarction to help patients maintain or regain an active role in society. [4]

A fundamental part of CR is the performance of therapeutic exercises prescribed by health professionals. It is associated with a lower risk of cardiovascular mortality due to the benefits it provides for maintaining heart rate, blood pressure, and the overall health condition of the patient. [4]

It protects against the recurrence of myocardial events by reducing several physiological risk factors such as high blood pressure, obesity, hyperlipidemia, and insulin resistance. In addition, long-term exercise provides beneficial effects. beneficial effects on the myocardium, resulting in a healthier heart muscle. These effects improve vascular, endothelial, and myocardial health, decreasing the risk of cardiac events and mortality. [4,5]

Various international associations defend the need for CR as part of the treatment since it can reduce the risk of reinfarction or sudden death. It contributes to controlling symptoms, stabilizing or reversing atherosclerotic processes, limiting psychological effects, improving patients' psychosocial and work status, and helping to maintain adherence to optimal treatment in the long term through patient education. [6]

CR involves various activities and interventions that provide cardiac patients with exercise training, education, counseling, and risk factor modification to limit cardiac disease's physical, social, and psychological consequences. [7,8]

Exercise is considered a valuable non-pharmacological intervention modality in CR programs designed to improve cardiorespiratory fitness and general health status in patients with heart disease. CR programs include Moderate-intensity aerobic training (CAT), such as cycling and walking, which is effective in reducing cardiac mortality rates and a broad group of other causes of death. [9,10]

When considering the evidence on the benefits of exercise-based CR, it is crucial to determine how this approach compares to non-exercise treatment for addressing cardiac problems. Despite the reduction in mortality observed with CR programs, their effects on readmission rates remain unclear.

Since CR may benefit patients with myocardial infarction, cerebrovascular disease, congenital heart defects, heart failure, and those post-revascularizations, it is essential to understand the relative efficacy of exercise-based CR compared with non-exercise approaches. Therefore, this review aims to assess the effectiveness of exercise-based cardiac rehabilitation for addressing cardiac problems.

METHOD

A systematic literature review was conducted using the PRISMA *(Preferred Reporting Items for Systematic Reviews and Meta-Analyses)* in 2024, where they were systematized in information sources to collect evidence on the effectiveness of cardiac rehabilitation in patients with heart surgery and patients who have suffered a post-infarction, among other cardiovascular conditions.
The information was obtained from the search through PudMed, Scielo, Cochrane, Dialnet, and Academia.Edu database systems. Search strategies involved keywords and Boolean connectors to reduce the number of articles to a manageable volume and facilitate the reduction of the most relevant ones. The following search strategies were those that provided the main results:

- Cardiac AND Rehabilitation
- Cardiac AND Rehabilitation OR Exercise

- Rehabilitation AND Cardiac AND Treatment
- Rehabilitation AND Cardiac AND Intervention

509 articles were identified. Based on the screening performed by analyzing keywords, titles, and abstracts, 14 articles remained in the review. 25 duplicate articles and 477 were excluded (Table 1). After the complete reading, four articles were excluded, leaving a group of seven articles on which the review is focused (Figure 1).

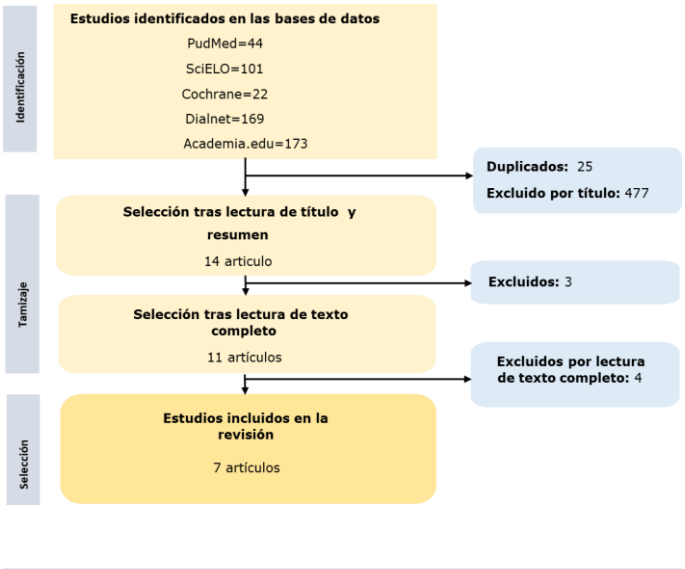

Figure 1. Flowchart of the review according to the PRISMA methodology

The population of the selected articles met the criteria in Table 1. The study population was made up of patients with heart surgery and patients who have suffered post-infarction, heart transplant, myocardial disease, coronary heart disease, and stable angina. Data collection began.

Table 1. Inclusion-exclusion criteria for the selection of articles.

Inclusion	Exclusion
adult patients	Children patients
Cardiac rehabilitation in surgery	Surgical pathologies
post-infarction	Rehabilitation with medication
heart transplant	Rheumatic heart disease
Myocardium	Hospital rehabilitation
Coronary heart disease	Cerebrovascular diseases
Stable angina	Rheumatic heart disease

The OPMER (in Spanish) methodological guide for analyzing medical literature was used to assess the validity of the collected articles. This guide consists of identifying the following elements in each article: "O" for objective, "P" for population, "M" for methodology, "E" for statistics (in Spanish), and "R" for results. In this way, each selected article is evaluated, allowing the methodological guide to assign a rating that facilitates its practical use. 12

The evaluation of the articles in the guide did not reach an exact total point, which lets us know that the articles meet most of the guide's requirements. 12 After applying the guide, each article obtained scores between 16 and 18 out of a maximum of 20, making them suitable for analysis.

Based on the analysis of the selected studies, a final result will be made regarding the seven articles to compare which rehabilitation was more effective, whether with or without exercise. This result will be based on the number of patients and their results in each type.

Table 2 was used as a reference to classify each type of intervention based on its findings, thereby creating a consensus on its efficiency.

Table 2. Classification scale of the selected studies' results

Classification	Heart rate	Blood pressure	BMI	Quality of life	Mortality
Excellent	Significant reduction in rest and activity	Significant decrease in blood pressure	Considerable reduction	Significant improvements	Significant reduction
Good	Moderate improvement at rest and activity	Moderate decrease in blood pressure	Moderate reduction	Moderate improvements	Moderate reduction
Regular	Minor or inconsistent improvements	Mild decrease in blood pressure	Slight reduction	Minor improvements	Slight reduction
Bad	No improvement or worsening	No decrease or increase in blood pressure	No significant reduction or increase	No improvement or worsening	Without reduction or increase

ANALYSIS AND INTEGRATION OF INFORMATION

First article: The impact of exercise-based cardiac rehabilitation was evaluated in 764 patients divided into three groups: control (CG), experimental 1 (EG1), and experimental 2 (EG2). The patients were obese, had hypertension and diabetes mellitus, and were sedentary, and the most common surgical procedures were myocardial revascularization (44.1%) and angioplasty (32.7%). [13]
A significant improvement in anxiety and depression levels was observed in the experimental groups, especially in the GE2 ($p < 0.05$), as well as an improvement in functional capacity according to the NYHA class. The GE2 showed better results in maximum heart rate, body fat percentage, body mass index, and quality of life. In aerobic capacity and grip strength, both experimental groups improved, with the GE1 standing out in grip strength ($p < 0.05$). [13]

Second article: The effects of different exercise-based cardiac rehabilitation programs were analyzed in 689 post-myocardial infarction patients. The programs included supervised and unsupervised therapeutic exercises, training combinations (resistance, strength, and interval), and relaxation programs. Resistance exercise was the most effective method for improving exercise tolerance, whereas the combination of interval and resistance training significantly improved cardiovascular parameters and lipid profile. [14]
Hospital-based supervised programs produced more significant improvements in quality of life than unsupervised home-based programs, although both improved quality of life and exercise tolerance. Improvements in anthropometric variables were more evident in face-to-face programs, although the quality of the studies was moderate, with a high risk of bias. [14]

Third article: 76 patients (41 in CG and 35 in intervention) were analyzed, with a mean age of 59.2 years (82.9% men). Cardiac readmission rates at 5 years were 24% in the CG and 9% in the intervention group ($p=0.068$), while all-cause readmission rates were 42% in the CG and 23% in the intervention ($p=0.085$). Emergency care for cardiac disease was more frequent in the CG (17% vs 11%, $p=0.486$), and intervention patients exercised more regularly and intensely (62% vs 33%, $p=0.088$). [15]
They performed more rigorous strength training, intense aerobic exercise, and high-speed activities such as running or swimming. However, both groups showed a significant deterioration in systolic and diastolic blood pressure, body mass index, waist circumference, HbA1c, triglycerides, and LDL, while an increase was observed in HDL. [15]
Fourth article: Coronary artery bypass surgery is a complex procedure indicated for various cardiac conditions. Symptoms leading to surgery include left central coronary artery disease (25-35%), myocardial infarction (55.9-60.9%), and congestive heart failure (14.2-18.4%). Surgical techniques, including excision, ablation, and reconstructive procedures, have effectively reduced angina and improved long-term survival. [16]

Cardiac rehabilitation was crucial after surgery and contributed to the reduction of morbidity and mortality in 94 patients with ischemic heart disease. Programs that include exercise, nutritional monitoring, and risk factor control have demonstrated better results in achieving patient health. [16]
Fifth article: In this review, the results of a cardiac rehabilitation program in 41 patients with coronary artery disease were evaluated. Of the patients, 68.3% were men, and 31.7% were women. After 12 sessions, the average weight decreased from 71.9 kg to 71.68 kg, and the body mass index (BMI) from 26.79 kg/m² to 26.18 kg/m ^{2}. Functional capacity did not show any relevant changes. However, maximum heart rate decreased significantly ($p < 0.0001$). [17]
Regarding quality of life, there were significant improvements in several dimensions: physical function ($p = 0.011$), bodily pain ($p = 0.002$), general health ($p = 0.001$), vitality ($p = 0.013$), and mental health ($p < 0.0001$). The dimensions of physical role, social function, and emotional role did not show significant improvements. In summary, although there were no relevant weight or functional capacity changes, the program positively impacted the patients' cardiovascular health and quality of life. [17]

Sixth article: The results of a cardiac rehabilitation program were analyzed in 30 patients undergoing percutaneous coronary intervention (PCI). The sample included 73.3% men, with an average age higher than women (58.6 vs. 52 years; $p=0.021$). PCI was performed in 43.3% of cases after failed thrombolysis, 36.7% as an elective procedure, and 6.7% as a primary PCI. [18]

Table 3. Critical criteria were evaluated after reviewing selected articles.

Author	Year	Aim	Methodology	Results	Conclusion
Pereira-Rodriguez et al. [13]	2021	To identify changes in functional capacity, strength, and quality of life after a training program for patients with heart failure.	Randomized controlled trial over 3 years with a sample of 920 patients with heart failure	In grip strength, group 1 improved considerably compared to the group (31±6.4 vs 28±5.0; p=0.001) and the control group (31±6.4 vs 24±9.2; p=0.001). In addition, quality of life improved significantly in the experimental groups compared to the control group. Functional capacity, depression, anxiety, anthropometry, and ejection fraction were also improved.	In patients with heart failure, the use of muscle strength exercises is recommended, which increase functional capacity and quality of life and improve associated variables such as depression and anxiety.
Alvarez-Martinez et al. [14]	2023	To analyze the current scientific literature to evaluate the effectiveness of different therapeutic exercise modalities in the rehabilitation of patients who have suffered an MI.	Literature review of 26 to 195 patients. Of both sexes, except for three, that only included men. Four RCTs did not present losses during the study. The rest ranged	The sample reviewed included 689 patients from different studies affected by myocardial infarction. 80.1% were men.	All post-MI exercise programs analyzed appear to improve exercise tolerance, cardiovascular parameters, anthropometry, and quality of life in isolation, with more significant effects in the case of combined programs. Furthermore, unsupervised programs appear to have less impact on specific variables such as quality of life or BMI.
Santaularia et al. [15]	2022	To evaluate the efficacy of a supervised exercise-based cardiac rehabilitation program on cardiac readmissions in patients with acute coronary syndrome at five years.	Randomized controlled trial	Seventy-six patients were included (41 in the control group, 35 in the intervention group, mean age 59.2 years [standard deviation 10.4], 82.9% men). The 5-year cardiac readmission rates were 24% in the control group vs 9% in the intervention group (p=0.068), and all-cause readmission rates were 42% in the control group and 23% in the intervention group (p=0.085). Emergency care for cardiac disease was more common in the control group (17% vs 11%, p=0.486). Patients in the intervention group exercised more regularly and vigorously.	Patients in the supervised exercise training program were less frequently readmitted for cardiac disease than controls. The reduction was clinically significant for all causes at 5 years, although not statistically significant. Control of cardiovascular risk factors deteriorated in both groups.

Author	Year	Aim	Methodology	Results	Conclusion
Celi-Loaiza et al. [16]	2019	To analyze the techniques, postoperative complications, and cardiac rehabilitation of coronary bypass surgery	Qualitative research. This research was based on methodological aspects that included descriptive information, field documentation, and descriptive exploration.	Coronary bypass surgery is one of the most complex surgeries available, but it is also one of the most effective in solving patients' cardiac problems. It has proven to be effective for reducing angina, stabilizing ventricular function, and increasing long-term survival.	Clogged arteries in the heart, resulting from a poor diet and a sedentary lifestyle, cause fat to accumulate in the veins, obstructing blood flow. This is why a technique of creating a bridge between the clogged artery and the vein, known as coronary bypass, has emerged. This surgery requires commitment from both the patient and the treating physicians.
Hernandez-Vasquez et al. [17]	2021	To evaluate the effect of cardiac rehabilitation program on the quality of life, functional class, and exercise tolerance of patients with coronary heart disease in a medical center in the city of Medellin.	Descriptive, longitudinal, comparative before and after study of the change in quality of life, functional class, and exercise tolerance in patients with coronary artery disease undergoing RC.	Forty-one patients completed 12 rehabilitation sessions, of whom 28 were men (68.3%), with an average age of 61.59 ± 9.5 years. The maximum heart rate achieved had a statistically significant reduction ($p < 0.0001$). Neither functional class nor functional capacity showed substantial changes with the rehabilitation program; weight and body mass index did not change either.	After the rehabilitation program, improvements were observed in the participants' quality of life in terms of physical health, pain, general health, vitality, and mental health.
Cuellar-Gallardo et al. [18]	2019	To determine the effects of cardiovascular rehabilitation in patients with ST-segment elevation acute myocardial infarction who underwent percutaneous coronary intervention.	Clinical trial	There was a positive effect on resting heart rate (66±11 vs. 61±11 beats/minute; $p=0.008$), exercise time in minutes ($p<0.01$), and maximum oxygen consumption (24.2±5.0 vs. 27.6±4.9 ml/kg/min; $p<0.0001$).	There was an improvement in the ejection fraction and a reduction in the diameter of the left ventricle in diastole, although without significant statistical differences. An improvement in the ergometric and echocardiographic parameters was observed after the cardiovascular rehabilitation program, which was more beneficial in patients with arterial hypertension, smoking habits, and percutaneous coronary intervention of two arteries.
Del Prado-de la Torre et al. [19]	2021	The purpose of the study is to evaluate the functional capacity of patients	Literature review	After applying for the rehabilitation program, the ergometric test was modified in 87.8% of patients. In contrast,	Implementing a cardiac rehabilitation program was helpful in most patients. Significant improvement was achieved in the cardiovascular parameters evaluated, which

Author	Year	Aim	Methodology	Results	Conclusion
		with ischemic heart disease who have been rehabilitated with physical therapy, according to the results of the ergometric tracing.		according to the patient's risk level, the cardiovascular status was modified by 68.2% towards low risk, and the functional capacity showed an improvement of 82.9%.	indicated a restoration of quality of life and tolerance to exercise.

After 12 weeks of training, a significant reduction in resting heart rate and a substantial increase in exercise time (8.3±2.5 vs. 10.2±2.0 minutes; p<0.0001) and maximal oxygen consumption (24.2±5.0 vs. 27.6±4.9 ml/kg/min; p<0.0001) were observed. Although left ventricular ejection fraction (LVEF) improved slightly, the change was insignificant (p=0.062). Hypertensive patients and smokers significantly improved the ergometric parameters evaluated [18].

Seventh article: The effects of a cardiovascular rehabilitation program were analyzed in 41 patients with coronary artery disease. Initially, 90.2% presented positive manifestations in the ergometric test; only 2.4% maintained these criteria after rehabilitation. In addition, at the beginning, 90.2% of the patients were at moderate risk and none at high risk. After the program, 78.0% were classified as low risk, showing a significant improvement in cardiovascular status. [19]

Regarding functional capacity, at the beginning of the study, 90.2% belonged to functional class II and 9.8% to class I. Twelve months later, 92.7% of the patients were in class I, which denotes a notable improvement in functional capacity. The relationship between risk levels and functional classes showed that 78.0% of the patients in class I were considered low risk at the end of rehabilitation. [19]

All the results were analyzed to conclude with a single result of the effectiveness of cardiac rehabilitation in 1735 patients. The first article contributed 44.03% of the total population, the second 39.71%, and the rest less than 5.00% each (Figure 2).

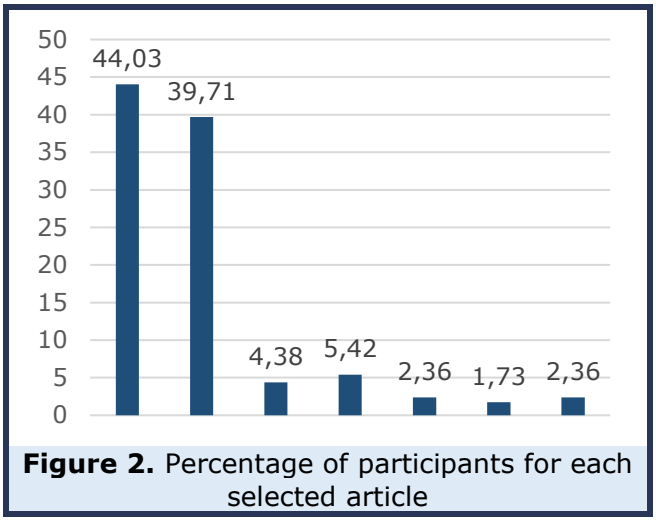

Figure 2. Percentage of participants for each selected article

Of the articles taken to perform the results, six out of seven had a more significant impact than rehabilitation without exercise. In some results, decay was seen due to intense and irregular exercises (such as more rigorous strength training, intense aerobic exercises, and activities such as running or swimming at high speed) or unsupervised exercises at home without control affecting the patient.

On the other hand, most of the results regarding rehabilitation with exercise were notable since most of the patients had notable results such as reductions in heart rate, blood pressure, BMI, quality of life, reductions in mortality, and improvements in health such as physical function, body resistance, general health, vitality, and mental health.

Therefore, studies with excellent and good results regarding the efficiency of CR with physical exercises predominated, with a larger sample of patients recovering with satisfactory results. These results can be seen in Table 4.

Tabla 4. Number of patients and results of the RC of each article, rated with the LIKERT-VALUE scale: rating it as Bad, Average, Good, Excellent.

Article No.	Patient Percentages	Results	Qualification
No.1	44.03%	Significant improvements have been made in heart rate (HR), body mass index (BMI), and quality of life.	Excellent
No.2	39.71%	More significant improvements in quality of life with supervised programs compared to unsupervised home-based programs	Excellent
No.3	4.38%	Due to the intensity and irregularity of exercise, BMI and systolic and diastolic blood pressure (BP) have significantly deteriorated.	Bad
No.4	5.42%	Significant improvement in health and quality of life after post-surgical cardiac rehabilitation.	Regular

No. 5	2.36%	Positive impact on cardiovascular health and quality of life after 12 exercise sessions.	Good
No.6	1.73%	Significant reduction in resting heart rate and improved ergometric parameters, especially in hypertensive patients and smokers.	Good
No.7	2.36%	Significant improvement in quality of life and reduction in risk after the cardiovascular rehabilitation program.	Good

Exercise-based CR programs are effective in patients with coronary heart disease, not only improving their quality of life but also reducing their risk of future cardiac events. These positive impacts include improved classification into lower-risk categories after treatment. [20-22]

One main challenge is maintaining patient adherence to the program in the long term. The intensity and regularity of exercise must be appropriately balanced, as overly intense or irregular exercises can be harmful. Lack of professional supervision can result in incorrect execution of exercises and increase the risk of injury. [23,24]

Patient motivation is also crucial, as are individual differences in health conditions and physical ability, which complicate the design of effective programs. In addition, access to resources and psychological barriers, such as anxiety and depression, can negatively affect participation in the rehabilitation program. [24,25]

CONCLUSIONS

The review of the effectiveness of exercise-based cardiac rehabilitation reveals generally positive results. Significant improvements in patients' quality of life are noted, and supervised exercises offer more benefits than those performed at home, highlighting the importance of professional monitoring.

BIBLIOGRAPHIC REFERENCES

1. García-Conejo C, Roldán-Jiménez C, Ramirez-Pérez L, Díaz-Balboa E, Cuesta-Vargas A. Educación en autocuidado durante programas de rehabilitación cardiaca para pacientes con insuficiencia cardiaca con fracción de eyección preservada: estudio Delphi. Aten Primaria [Internet]. 2024 Dec [citado 2025 Ene 05];56(12):103030. Disponible en: https://doi.org/10.1016/j.aprim.2024.103030.
2. Long L, Anderson L, Dewhirst AM, He J, Bridges C, Gandhi M, et al. Rehabilitación cardíaca basada en ejercicios para adultos con angina estable. Cochrane Libr [Internet]. 2018 [citado 2025 Ene 05]; 2018(2). Disponible en: http://dx.doi.org/10.1002/14651858.cd012786.pub2
3. Rojas-Caballero JA, Romero Massa E, Cogollo-Milanés Z. Impacto de las intervenciones educativas para fomentar la salud en pacientes en rehabilitación cardiaca: revisión sistemática. Aquichan [Internet]. 2023 [citado 2025 Ene 05];23(3):e2333. Disponible en: https://doi.org/10.5294/aqui.2023.23.3.3.
4. Betancourt-Peña J, Portela-Pino I, Amaral-Figueroa M. Factores relacionados con la no adherencia a la rehabilitación cardiaca en pacientes con insuficiencia cardiaca. Rev Clin Esp [Internet]. 2024 Jan [citado 2025 Ene 05];224(1):24-34. Disponible en: https://doi.org/10.1016/j.rce.2023.11.006.
5. Thygesen K, Alpert JS, White HD, Joint ESC/ACCF/AHA/WHF Task Force for the Redefinition of Myocardial Infarction. Universal definition of myocardial infarction. J Am Coll Cardiol [Internet]. 27 de noviembre de 2007 [citado 2025 Ene 05];50(22):217395. https://doi.org/10.1016/j.jacc.2007.09.011
6. Pujalte MF, Richart-Martínez M, Perpiñá-Galvañ J. Análisis de la efectividad de la rehabilitación cardíaca en España: una revisión sistemática exploratoria. An Sist Sanit Navar [Internet]. 2022 [citado 2025 Ene 05]; 45: e0981. https://doi.org/10.23938/ASSN.0991
7. El Missiri A, Amin SA, Tawfik IR, Shabana AM. Effect of a 6-week and 12-week cardiac rehabilitation program on heart rate recovery. Egypt Heart J EHJ Off Bull Egypt Soc Cardiol [Internet]. 14 de octubre de 2020 [citado 2025 Ene 05];72(1):69. https://doi.org/10.1186/s43044-020-00107-8
8. Nowak A, Morawiec M, Gabrys T, Nowak Z, Szmatlan-Gabryś U, Salcman V. Effectiveness of Resistance Training with the Use of a Suspension System in Patients after Myocardial Infarction. Int J Environ Res Public Health [Internet]. Enero de 2020 [citado 2025 Ene

05];17(15):5419. https://doi.org/10.3390/ijerph17155419
9. Lara-Vargas JA, Pérez-Reyes AA, Núñez-Urquiza JP, Navarrete de la O DM, Ilarraza-Lomelí H, Leyva-Valadez EA. et al. Manejo interdisciplinario de la obesidad y el sobrepeso en rehabilitación cardiaca: revisión de la Sociedad Mexicana para el Cuidado del Corazón. Arch. Cardiol. Méx. [Internet]. 2023 Dic [citado 2025 Ene 05];93(4):464-475. Disponible en: https://doi.org/10.24875/acm.22000288.
10. Valls-Lázaro E. Evolución Emocional y en Calidad de Vida Percibida de Cardiópatas mediante Programa de Rehabilitación Cardíaca. Psykhe (Santiago) [Internet]. 2024;33(1):00115. Disponible en: https://doi.org/10.7764/psykhe.2021.44719.
11. Sellen Sanchen E, et al. Rehabilitación cardiaca en mujeres y hombres después de un infarto agudo del miocardio. Rev Finlay [Internet]. 2023 [citado 2025 Ene 05];13(1):67-75. http://scielo.sld.cu/scielo.php?pid=S2221-24342023000100067&script=sci_abstract
12. OPMR. Cómo leer un artículo de Investigación en Ciencias de la Salud [Internet]. Com.mx. 2024 [citado el 3 de noviembre de 2024]. Disponible en: https://medicinauaslp.com.mx/opmer/
13. Pereira-Rodríguez JE, Velásquez-Badillo X, Peñaranda-Florez DG, PereiraRodríguez P, Arrieta-Mercado MA, Marcos-Sánchez JSD. Functional capacity, strength and quality of life after a heart failure training program. Randomized clinical trial. Rev Virtual Soc Paraguaya Med Interna [Internet]. 2021 [citado el 8 de octubre de 2024];8(1):11–24. Disponible en: http://scielo.iics.una.py/scielo.php?script=sci_arttext&pid=S2312-38932021000100011&lang
14. Álvarez-Martínez P, Alonso-Calvete A, Justo-Cousiño LA, González-González Y. Efficacy of the different therapeutic exercise modalities in cardiac rehabilitation after myocardial infarction. A review of the literature. An Sist Sanit Navar [Internet]. 2022 [citado el 8 de octubre de 2024];45(3). Disponible en: https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1137-66272022000300010&lang
15. Santaularia N, Arnau A, Jaarsma T, Torà N, Vázquez-Oliva G. Eficacia de un programa de entrenamiento con ejercicio supervisado en las tasas de reingreso a cinco años en pacientes con síndrome coronario agudo. Un ensayo controlado aleatorizado. Rehabil (Madr, Internet) [Internet]. 2023 [citado el 6 de septiembre de 2024]; 57(1):100720. Disponible en: https://pubmed.ncbi.nlm.nih.gov/35317941
16. Celi-Loaiza XA, Arias-Castro ML, Larco-Villalva EA, Velásquez-Arias RG. Cirugía bypass coronario. Técnicas, complicaciones posoperatorias y rehabilitación cardiaca. RECIMUNDO [Internet]. 31 de enero de 2019 [citado 5 de enero de 2025];3(1):500-21. Disponible en: https://recimundo.com/index.php/es/article/view/383
17. Hernández-Vásquez M, Jaramillo-Gómez J, Vásquez-Trespalacios M, Orrego-Garay J, Duque-González L, Duque-Ramírez M. Efecto del programa de rehabilitación cardiaca en la calidad de vida de pacientes con enfermedad coronaria. Rev. Colomb. Cardiol. [Internet]. 2021 June [cited 2025 Jan 05];28(3): 263-268. Disponible en: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0120-56332021000300263&lng=en .
18. Cuellar-Gallardo ÁA, Gómez-García YD, Castro-Torres Y, Triana-Díaz A, GómezLauchy JM, Gavilanes-Hernández R, et al. Rehabilitación cardiovascular en pacientes con infarto agudo de miocardio con elevación del segmento ST e intervencionismo coronario percutáneo. CorSalud [Internet]. 2019 [citado el 8 de octubre de 2024];11(4):278–86. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2078-71702019000400278&lang
19. Prado de la Torre LM, Cartaya Ortiz E. Influencia de la terapia física en la capacidad funcional de pacientes con cardiopatía isquémica. Medisan [Internet]. 2021 [citado el 1 de octubre de 2024]; 25(3):662–74. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1029-30192021000300662&lang
20. Vilchez A, Molina J, Erriest J, Arregui V, Castro LA, Camilletti J. Entrenamiento de fuerza máxima y su relación con el fitness físico en rehabilitación cardiovascular. Rev Fed Arg Cardiol [Internet]. 2024 [citado 2025 Ene 05];53(3):24-34. https://www.revistafac.org.ar/ojs/index.php/revistafac/article/view/548
21. Markotegi M, Irazusta J, Sanz B, Rodriguez-Larrad A. Effect of the COVID-19 pandemic on the physical and psychoaffective health of older adults in a physical exercise program. Exp Gerontol [Internet]. 2021 Nov [citado 2025 Ene 05];155:111580.
22. García Lady J., Ochoa Germán D., Duperly John. La rehabilitación cardíaca con entrenamiento combinado mejora la fuerza de miembros inferiores después de sólo doce sesiones en adultos mayores. Rev. Colomb. Cardiol. [Internet]. 2024 Aug [cited 2025 Jan 05];

31(4): 230-238. Disponible en: https://doi.org/10.24875/rccar.23000070.
23. Gambó Ruberte E, Chabbar Boudet MC, Albarrán Martín C, Untoria Agustín C, Murlanch Dosset E, Peiró Aventín B, Garza Benito F. Impacto pronóstico de la realización de un programa de rehabilitación cardiaca tras un síndrome coronario agudo. J Healthc Qual Res [Internet]. 2023 Jul-Aug [citado 2025 Ene 05];38(4):206-213. Disponible en: https://doi.org/10.1016/j.jhqr.2023.01.001.
24. Ruiz-Aranjuelo Alejandra, Chabbar-Boudet Maruan C., Gambó-Ruberte Elena P., Albarrán-Martín Carmen, Untoria-Agustín Carmen, Garza-Benito Fernando. Análisis de la adherencia a medio plazo tras la realización de un programa de rehabilitación cardiaca. Arch. Cardiol. Méx. [Internet]. 2023 Jun [citado 2025 Ene 05];93(2):131-138. Disponible en: https://doi.org/10.24875/acm.21000156.
25. Moreno G, Arranz-Escudero A, de la Torre-Lomas N, Munera-Jiménez C, Fernández-Casado G, Tello de Meneses-Becerra R, Sanz-Ayán MP, Izquierdo-García J. Impacto de un programa de rehabilitación cardiaca en la adherencia a la dieta mediterránea y la actividad física en el síndrome coronario agudo. Arch Cardiol Mex [Internet]. 2024 [citado 2025 Ene 05];94(3):349-355. Disponible en: https://doi.org/10.24875/ACM.23000219.

Conflict of interest
The authors declare that there are no conflicts of interest between them, nor with the research presented.

Financing
No specific funding was required for the research.

Contributions from authors
Conceptualization: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios
Research: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios
Data curation: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios
Methodology: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios, Carlos Rafael Araujo-Inastrilla
Project management: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios
Supervision: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios
Validation: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios, Carlos Rafael Araujo-Inastrilla
Visualization: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios, Carlos Rafael Araujo-Inastrilla
Original drafting: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios
Writing-proofreading and editing: Dallana Fabiola Luen-Aguilar, Jorge Escobar-Barrios, Carlos Rafael Araujo-Inastrilla