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## MENCIÓN EN PATOLOGÍAS DEL TÓRAX
## 4º CURSO GRADO EN FISIOTERAPIA

**"Cardiac Rehabilitation, Physiotherapist Function and Control of Cardiovascular Risk Factors. A Systematic Review".**

**"Rehabilitación Cardíaca, Papel del Fisioterapeuta y Control de los Factores de Riesgo Cardiovasculares. Una Revisión Sistemática".**

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# INDEX

## CARDIAC REHABILITATION, PHYSIOTHERAPIST FUNCTION AND CONTROL OF CARDIOVASCULAR RISK FACTORS. A SYSTEMATIC REVIEW

**PURPOSE:** Evaluate the impact of Cardiac Rehabilitation (specially about physical exercise) in patients who suffer from Cardiovascular Diseases.
**METHODS:** A systematic review was undertaken about different type of information and randomized controlled trials. Databases as Medline and other electronic sites were used as the German Association for Health-Related Fitness and Sport Therapy and magazine such as Revista Española de Cardiología.
**RESULTS:** Exercise Training Groups showed changes in most of the studies about objective measures (physical measures, improvement of peak VO2, heart rate, arterial remodeling) and subjective measures (quality of life improvement measured by determined scales).
**DISCUSSION:** Although both groups were treated with the same medical standard treatment, the Exercise Training Groups comparing with non-exercise groups showed changes and improvements in quality of life, prognosis and in risk factors like Hypertension. However, some studies presented limitations which didn't make significant changes in some parameters.
**CONCLUSION:** Controlled, supervised and individualized exercise training for patients in Cardiac Rehabilitation is a key element and possibly one of the most important to take into account in the improvement of this patients who suffer from this kind of pathologies.

**Key Words:** Cardiac Rehabilitation, Coronary Heart Disease (CHD), Chronic Heart Failure (CHF), Risk Factors (RF), Exercise Training (ET).

## REHABILITACIÓN CARDÍACA, PAPEL DEL FISIOTERAPEUTA Y CONTROL DE LOS FACTORES DE RIESGO CARDIOVASCULARES. UNA REVISIÓN SISTEMÁTICA

**Propuesta:** Evaluar el impacto de la RHB Cardíaca (en concreto del ejercicio físico) en pacientes que presentan patología cardiovascular.
**Métodos:** Se llevó a cabo una revisión sistemática sobre diferente tipo de literatura así como de ensayos clínicos aleatorizados. Bases de datos como Medline, otras fuentes electrónicas fueron utilizadas como la German Association for Health-Related Fitness and Sport Therapy y revistas como la Revista Española de Cardiología.
**Resultados:** Analizando y comparando unos estudios con otros se observan determinados beneficios como consecuencia de la realización de entrenamiento y ejercicio físico en las patologías cardiovasculares. Tales resultados son tanto objetivos (medidas físicas, mejora del pico VO2, frecuencia cardíaca, remodelado arterial) como subjetivos (mejora en la calidad de vida valorada con diferentes escalas).
**Discusión:** Aunque ambos grupos en los diferentes estudios son tratados con el mismo tratamiento estándar el grupo de entrenamiento y ejercicio físico comparado con el grupo control mostró cambios en factores como la calidad de vida, pronóstico y factores de riesgo como la hipertensión. Sin embargo, hubo limitaciones en ciertos estudios que no mostraron diferencias significativas en algunos de los parámetros.
**Conclusión:** El correcto ejercicio físico supervisado, controlado y especializado para cada paciente en la Rehabilitación Cardíaca es un elemento clave y posiblemente uno de los más importantes a tener en cuenta de cara a la mejora de la capacidad funcional, la calidad de vida y en la disminuición de mortalidad por este tipo de enfermedades.

**Palabras Clave:** Rehabilitación Cardíaca (RHB), Enfermedad Coronaria (EC), Insuficiencia Cardíaca Crónica (ICC), Factores de Riesgo (FR), Entrenamiento Físico (EF).

## INTRODUCTION

Cardiovascular Diseases (CVD), which are an essential cause of incapability, remains to increase a lot Health Attention Cost and commonly produce death in developed countries. Cardiovascular Prevention, primary or secondary, is one of the most important activities in health care. In fact, its benefits have been demonstrated a notable reduction in morbidity and mortality as a consequence of Cardiovascular Diseases in the last decades.

Cardiac Rehabilitation is an essential component in the control of Cardiovascular risk factors and healthy lifestyle developing habits in patients who suffered from a cardiac ischemic event or other kind of pathologies [1].

In the few last years, Cardiac Rehabilitation has been used as a treatment in Cardiovascular diseases along all over the world. If we have to define this concept, we should use the following meaning: "coordinated sum of interventions required to ensure the best physical, psychological and social conditions so that patients with chronic or post-acute cardiovascular disease may, by their own efforts, preserve or resume optimal functioning in society and, through improved health behaviours, slow or reverse progression disease" [2].

Of course it is a complex program, based in dozens of therapies in which the most important are pharmachologic treatment, psichological, nutritional and dietary, educational, group relaxation and physical exercise. Among these different methods, there is one which is the key in cardiac rehabilitation. It is the exercise training [3-4].

Diverse studies have been published along this recent few years about the efficacy of exercise training in the process of this pathologies. Some of them talked about Coronary Heart Disease, others about Heart Failure, risk factors, quality of life and symptoms and others about prognosis, moribidity and mortality.

Nevertheless, most of them didn't significally demonstrate if exercise training has a big impact in survival and improvement in these diseases. This is due to the fact that there were some drawbackslike lack of results, non-adequate sample size, not all of them were randomized controlled trials, etc. However, all of them agree in following ideas: supervised, controlled and individualized exercise training has in each patient important benefits in quality of life, functional capacity. That is to say, this method can improve the correct diseases development.

The aim of this study is to carry out a Systematic Review to collect information about different studies with the most clinic evidence as possible in order to check the efficacy of cardiac rehabilitation (specially exercise training) used in patients with Cardiovascular Pathologies such as Coronary Heart Disease, Heart Failure and control of Cardiovascular risk factors, carried out and supervised by a professional multidisciplinary team, in which the physiotherapist could be part of.

## METHODOLOGY

### Literature Search

Electronic sources of information was totally used in this study for literature search. Databases like MEDLINE was chosen.

Other type of literature was searched in magazines like Sociedad Española de Cardiología and associations like German Association for Health-Related Fitness and Sport Therapy.

### Quality Assessment

At first, a Systematic Review which assessed the effect of Cardiac Rehabilitation in Coronary Heart Disease was searched. As it presents a study that observed and analyzed randomized controlled trials, it is considered that it has a high level of evidence.

With regard to the randomized controlled trials research, Critical Appraisal Skills Program (CASPe) scale was used to evaluate the quality of information shown in those studies. The points average of the different trials was about 6.83 out of 11 points, reflecting an interest in those studies for the elaboration of this review.

### Study Selection

In Medline evidence database a first search was undertaken with the terms “Cardiac Rehabilitation” AND “Heart Failure” due to the fact of this frequent disease. 487 results appeared. As it was wanted to simplify the s, additional filters were chosen to do it: study type and date of publication. Only randomized controlled trials and 5 last year publications were the boxes filled for those articles. In that moment, 26 results appeared. Only the articles that talked about the effect of doing exercise training against not doing exercise training in Cardiac Rehabilitation in Heart Failure were considered relevant. After reading the article abstracts, 6 studies were considered interesting.

The second search was based in the terms “Cardiac Rehabilitation” AND “Exercise” AND “Risk Factors”. Even though in the beginning there were 508 results, the same additional filters were used: only randomized controlled trials and 5 last year publications to get 23 final results. Other 6 articles were chosen from the 23. If it was not clear which the aim of the study was, a complete text reading was taken in order to understand better.

Once there were obtained some articles that were similar to the aim of this Systematic Review, they were analyzed with a complete text reading. From the 12 studies that were initially obtained, 4 were dismissed because of lack of relevance in results, and 2 of them were dismissed due to the lack of results.

The studies that were selected as relevant had the following criteria:

- Patients with Coronary Heart Disease (CHD) or Heart Failure (HF).
- Continuous supervision and following periods in the patients development.
- All of them included in a Cardiac Rehabilitation program with exercise training.
- With a necessary control group to compare it with the exercise training group.

The main outcomes are the following ones:

- Modification or changes in functional capacity and cardio-respiratory fitness.
- Quality of life and symptoms modification.
- Survival modification.

In the next page, a diagram is detailed about the searching strategy used in this study of Systematic Review. Figure A collects a diagram of Medline research. Figure B shows the relation between Medline research and the other literature search.

# Search Diagram

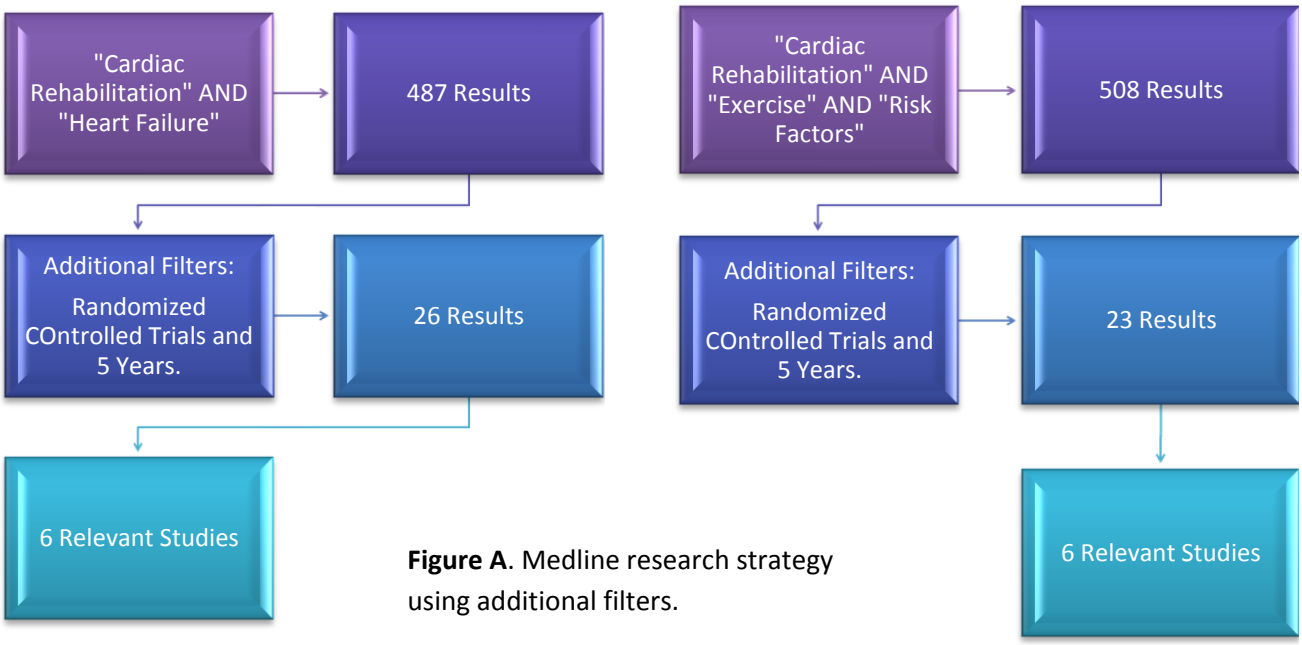



**Figure A**. Medline research strategy using additional filters.

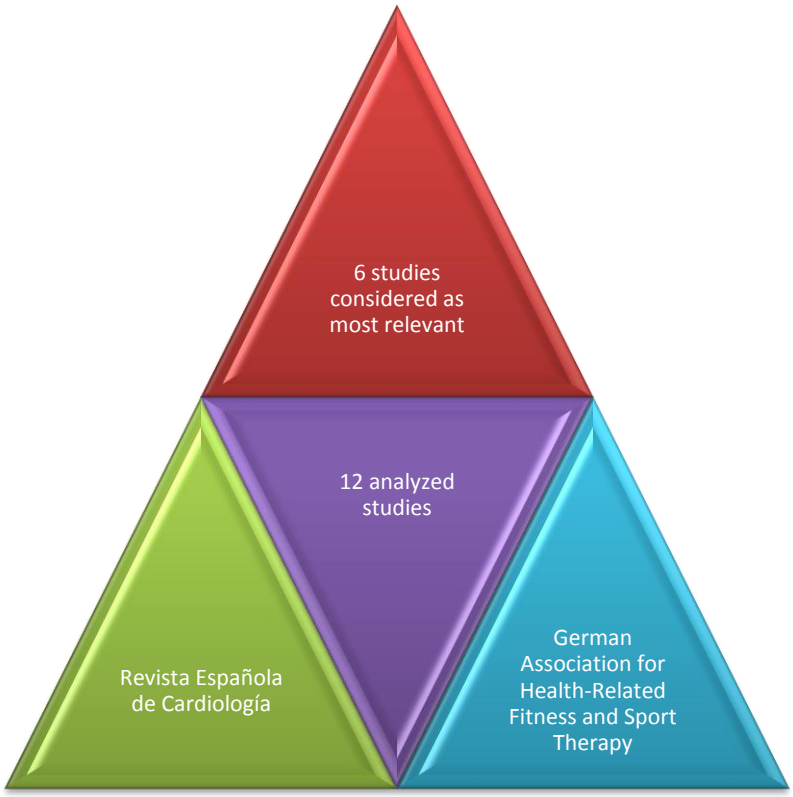



**Figure B:** relation between Medline research and the other literature research, establishing the main point in the 6 relevant studies.

## RESULTS

Cardiac Rehabilitation is considered as a cost-effective intervention in risk reduction of an acute coronary event, owing to the fact that improves prognosis and reduce hospitalizations and health attention cost. In addition, improves life expectancy. Cardiac Rehabilitation after a cardiovascular event is a Class I of the American Heart Association, ESC and American College of Cardiology [5,6].

In regard to the article analysis, the following ones talk about the efficacy of Cardiac Rehabilitation using exercise training and medical standard treatment comparing with a sample of patients that only received standard treatment.

Exercise-based Cardiac Rehabilitation in Coronary Heart Disease

This systematic review and meta-analyses [7] studied 48 publications with a total of 8940 patients with CHD, from which 29 studies used exercise training in cardiac rehabilitation for patients. The age average of patients was about 48-71 years old, with al least 3-6 months minimum of intervention.

Making an average in the relevant studies, exercise training was based in 3.7 sessions per week of about 53 minutes per session approximately, with an intensity of 76% del maximum oxygen uptake (or maximal heart rate). Nonetheless, the elaboration of each study was different comparing to each other. Only 16 studies had completed randomization data, blind randomization was only collected in 8 studies, and follow and development was collected in 33 studies.

Results:

- Clinical Events: Cardiac rehabilitation was associated with a significant reduction in all-cause mortality (odds ratio [OR] = 0.80; 95% de confidence interval [CI]: 0.68 a 0.93) and total cardiac mortality (OR = 0.74; 95% CI: 0.61 a 0.96). That is to say, a reduction in mortality of 20% and 26% in cardiovascular mortality.
- Modifiable Risk Factors: Cardiac rehabilitation was associated with a significant reduction in total cholesterol, systolic blood pressure (-3.2 mm Hg; CI: -5.4 a -0.9 mm Hg) was reduced significantly too although there were no differences in diastolic pressure (-1.2 mm Hg; 95% CI: -2.7 a 0.3 mm Hg). The number of smokers was reduced thanks to this program (OR = 0.64; 95% CI: 0.50 a 0.83).
- Quality of Life: 12 studies assessed quality of life and all of them showed an improvement with Cardiac rehabilitation.

Effects of Cardiac Rehabilitation in Heart Failure (IC)

A common discovery in patients with Heart Failure is the exercise intolerance, which causes a progressive functional deterioration [8]. Despite the fact that various studies were carried out, only a few about Heart Failure demonstrated or tried to demonstrate that Cardiac Rehabilitation is an intervention which improves functional capacity and quality of life. Information about randomized controlled trials that refer to Heart Failure and exercise training was collected.

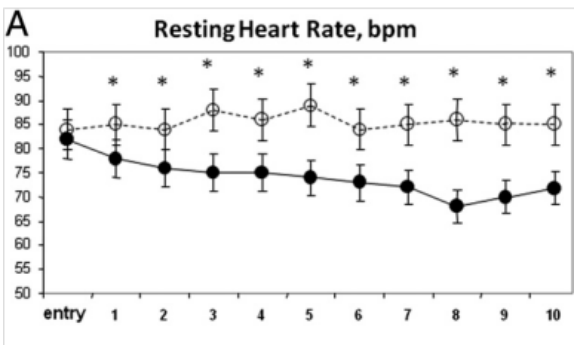
In the study of *Belardinelli et al; Long-term Exercise Training in Heart Failure* [9], a randomized controlled trial with 123 patients was undertaken in Italy and New York. During 10 years was evaluated a supervised exercise training in Heart Failure Class II-III NYHA. Previous randomization in 2 groups, inclusion criteria was a stable condition in the previous 3 months, left ventricle eyection fraction < 40% and enough skills to practice exercise. Exclusion criteria was advanced valve pathology, Diabetes Mellitus or Hypertension not controlled, orthopedic or neurologic problems and renal insufficiency. The Heart Failure cause was ischemic in 80% of patients.

2 groups were established: training group (T) n=63 and control group (NT) n=60. Both received the same pharmacological treatment: angiotensine converting enzyme inhibitors (ACEI), Aspirine, Beta-Blockers, diuretics and statins.

Training methodology consisted in 3 sessions per week of 1 hour per session of physical exercise (15-20 min beginning of warm-up phase of calisthenic and stretching followed by 40 min aerobic exercise on cycloergometer 40 min de ejercicio aérobico).

The following results were obtained:

- Functional Capacity: on study entry there was no difference in the peak VO2 between the 2 groups. However, after 12 months the peak VO2 improved 14.7% in T Group and declined 2.5% in NT Group. At 2 years, the difference between T Group and NT Group was about 3.0 ml/kg per minute (24.6%). At 5 years was about 4.5 ml/kg per minute (27.1%). At 7 years the difference was about 4.2 ml/kg per minute (25.2%). At 10 years was about 3.6 ml/kg per minute (21.8%). As it is shown, the differences were statistically significant and, what is more, the peak VO2 was maintained > 60% in the whole study in the T group, being < 55% in NT Group.
- Heart Rate: watch Table A. A reduction in Rest Heart Rate is observed in the T group (black) compared to the NT Group (white), which practically is maintained.



- Ejection Fraction: This didn't differ between both groups in the first years. Nevertheless, Since the fifth year there was a significant improvement: ejection fraction in exercise group was 41% vs. 34% of the NT Group. At 10 years, the differences between both groups was 28% about the ejection fraction.
- Quality of Life (QOL): with Minnesota Living with Heart Failure Questionnaire scale [10], the average was significantly better for the T group against NT Group (43 vs. 58).
- Cardiovascular Events: there were more frequent cardiac events in NT Group: hospital readmissions were 8 in T group and 25 in NT Group. Cardiac deaths also were more frequent in NT Group (10 vs. 4).

Effects of Cardiac Rehabilitation in Hypertension

In the study of *Maiorana et al; Exercise and Arterial Remodeling* [11] they evaluated the impact of exercise training in artery wall thickness and remodeling in Heart Failure. Some authors suggest that exercise training can induce systemic changes in conduit and artery resistance [12]. In this randomized controlled trial of 12 weeks of duration, 36 patients were chosen: 24 with Coronary Heart Disease and 12 with idiopathic dilated myocardiopathy. All of them had dyspnea class I-III NYHA, with ejection fraction < 50%.

Patients were randomized in 3 groups, despite the fact that all of them received the same pharmacological treatment.

- Resistance Training Group (RT). 3 sessions per week based in muscular endurance training of the 60% 1RM (45 min).
- Aerobic Training Group (AT). 3 sessions of aerobic workload (cycling-treadmill) with 50-60% del peak VO2 (45 min)
- Control Group. Only standard treatment without exercise.

Results show that there were no significant differences between groups in ejection fraction, weight or body mass index.

Nonetheless, the following changes appeared in artery wall thickness:

There was a significant effect after 12 weeks in RT, without significant changes in the AT group. In control Group there was an increased change of the arterial wall thickness (see figure 1).

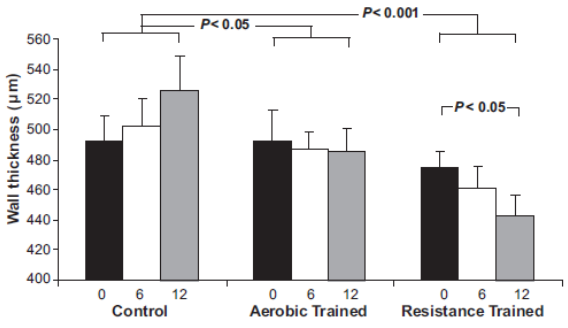



**Figure 1.** Influence of RT and AT on brachial wall thickness compared with the control group. Data are mean±SEM. Black, pre; white, 6 weeks; gray, 12 weeks.

About the Brachial Artery Diameter, it increased after 12 weeks in both RT and AT Groups, with no changes in Control Group (see figure 2).

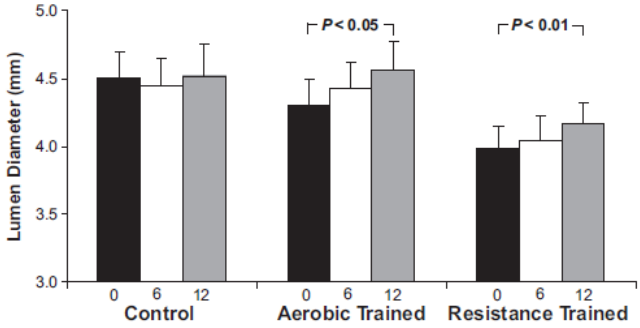



**Figure 2.** Influence of RT and AT on brachial lumen diameter compared with the control group. Data are mean±SEM. Black, pre; white, 6 weeks; gray, 12 weeks.

And the wall:lumen ratio also suffered changes. ere was a reduce in RT Group and a grow up in Control Group, without significant changes in AT group after 12 weeks (see figure 3).

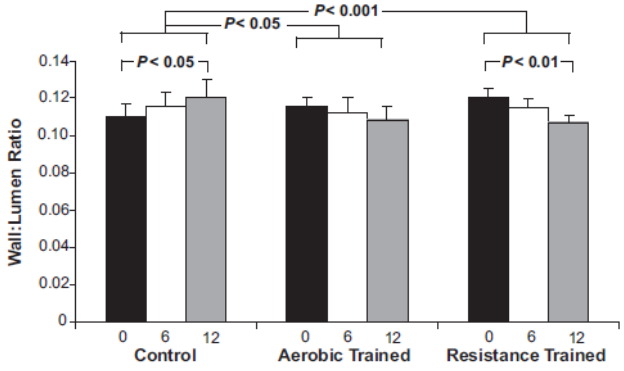



**Figure 3.** Influence of RT and AT on brachial wall-:lumen ratio compared with the control group. Data are mean±SEM. Black, pre; white, 6 weeks; gray, 12 weeks.

Cardiac Rehabilitation in Symptoms such as Angina

The studies previously mentioned established the differences between carrying out Cardiac Rehabilitation and not practicing it. However, it is important to take into account that, to carry out an exercise program, patients own characteristics must be considered. Actually, although these studies thought about this, the randomized controlled trial of Asbury et al "Cardiac rehabilitation to improve physical functioning in refractory angina" [13] of 8 weeks of duration, analyzed if it was safe to make a Cardiac Rehabilitation Program in patients with refractory angina.

At that time, 42 averaged 65year-old patients were recruited and they were randomized into 2 groups: 22 to the intervention group, 20 two the control one. The intervention group did 80 minute sessions in which there were both aerobic and muscular training, El grupo intervención consistió en sesiones de RHB Cardíaca semanales de 80 minutos de duración en los que se incluían ejercicios de entrenamiento aeróbico como muscular, as well as home-exercise.

To assess the changes between both groups, a complete assessment was undertaken: physical measures like resting arterial tension, weight, length, blood sample, 12-lead ECG, monitorized telemetry and progressive Shuttle Walk (PSW) Test. Furthermore, to evaluate quality of life

patients answered different questionnaires such as Anxiety Questionnaire (HAQ) [14], SF-36 [15] and the York Angina Belief's Scale [16] among the most important ones.

In the results of this study there were not big differences in physical skills but it was estimated an improvement in the Progressive Shuttle Walk Test (PSW), having been improved the distance walked by patients in the intervention group. Regarding physiology measures, the control group had a higher wait-hip ratio, heart rate and fasting plasma glucose at baseline. There were no other differences except a reduced Less Density Lipoprotein (LDL) in the intervention group.

*Quality of life*:

Cardiac Rehabilitation Group**:** improved its score in HAQ y York Beliefs of Angina perception. There were no changes in pain.

Control Group**:** the pain increased. Nevertheless, they had less anxiety in HADS Scale y and less worry about their health in HAQ Scale. In addition there were better improvements in SF-36 comparing with the intervention group.

*Angina***:** There are no significant differences. There were no modifications in Angina frequency or severity.

## DISCUSSION

After the study analysis and comparing with each other, we can observe the impact of Cardiac Rehabilitation in Cardiovascular Diseases. Exercise Training in Heart Failure is associated with an improvement in quality of life [17]. As it is seen in the *Meta-analysis of Taylor et al*, Cardiac Rehabilitation improves survival and works against Risk Factors such as cholesterol and Hypertension reducing them. In addition, it's a study with important evidence because firstly it is a systematic review and meta-analysis, secondly it studies randomized controlled trials and thirdly, sample size is big.

In addition, long-term studies like Belardinelli et al, shows more evidence in the data obtained.

Supervised and individualized exercise to each patient has advantages and benefits comparing with a non-exercise standard treatment. On the one hand, objective measure like peak VO2 and Heart Rate improved significatively after 12 months and it was maintained during the 10 year-study in the Cardiac Rehabilitation Group. A reduction in the rest heart rate could show that there is a well autonomic balance [18]. Furthermore, cardiovascular events and hospitalizations were also reduced. On the other hand, improvement in subjective data like quality of life was obtained. It is important to asses if there is a real change and improvement in Functional Capacity due to the fact that it is a strong sign of better survival in patients with cardiovascular disease [19-20]. And what we have also to take into account is that this is the first 10-year-long-term study evaluating the exercise training in this kind of patients.

As it is seen in the other studies, it is important to know which Cardiac Rehabilitation factors are more effective in the improvement of the functional capacity and quality of life. For example, referred about arterial remodeling, *Maiorana et al* established that there are more benefits in Resistance muscular training than aerobic training. Data results demonstrated that patients with resistance training had a growth in Brachial artery diameter, a drop artery wall thickness and in consequence a drop in wall:lumen ratio, while the aerobic training group only suffered a growth in arterial diameter with no changes in the other parameters. Therefore, this situation suggests that resistance training has a stronger improvement in arterial remodeling than aerobic exercise.

Comparing this studies, consideration and reflection is thought about what gets more benefits. However, limitations are presented in these studies. Firstly, the long-term study, in spite of almost all intervention patients had improvements, it is still a small sample size. In addition, although mortality is low in this study, it should be taken into account that most of the patients are young-middle age people and also with Heart Failure class II NYHA (not severe).

Furthermore, in *Maiorana et al*, analyzing the differences between the intervention groups and control group, it is used a simple and small sample size and also the duration in this one is specially short (12 weeks). On the other hand, as it is a study with 3 randomized groups, it would have been more interesting if the authors had only done 2 groups, mixing aerobic exercise and resistance exercise in one of them to demonstrate a better impact in Cardiac Rehabilitation against non-exercise treatment in arterial remodeling.

In spite of this limitations, all of these studies conclude that Cardiac Rehabilitation has more benefits than not carrying out exercise in this patients treatment. Therefore, to know if this kind of therapy can be used in patients with special symptoms like refractory angina results interesting. According to the observed results, patients in the intervention group who did exercise with refractory angina slightly improved their quality of life but there were not changes in physical measures. Perhaps this is due to some limitations, again small sample size and short-term study. Nonetheless, and what is important in this study, neither differences were observed in frequency or severity of angina between the exercise group and control group. This means that, with a correct exercise program it is safety to practice it even with patients who presents Angina [12].

## CONCLUSION

Most of the studies that were looked for in different search, say and agree that Cardiac Rehabilitation is an important part in the patients recovery, quality of life improvement and also survival. It is certain that limitations exist in these studies. Nevertheless, most of them show either objective and subjective data of improvement in the exercise groups. In contrast, the fact that these studies have no blind scenes is certain and decrease the quality. However, as the variables to evaluate should be with active exercise done by the patients, it is difficult to establish a blind measure. Nowadays, more long-term investigations and big sample size are required to get the best evidence as possible about the impact of Cardiac Rehabilitation in Cardiovascular diseases.

In total, all this studies carried out a supervised and individualized program of Cardiac Rehabilitation by experts in this area. There were no articles or better said, there were not found studies that showed the function of a physiotherapist in the rehabilitation program. Nonetheless, this person with the correct knowledge and skills, can indirectly be considered as another member of the multidisciplinary Cardiac Rehabilitation team, carrying out the workload in the physical training, both aerobic training and resistance muscular training.

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