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EXERCISE-BASED CARDIAC REHABILITATION EFFECTIVENESS IN PATIENTS WITH CORONARY HEART DISEASE: A META-ANALYSIS

Abdulrahman Ali Qasem Al Qasim*[1], Hatun Fayez Halawani[2], Slwan Ali O. Alrabaei[3], Almaha Ali M. Atafi[4], Adel Mohammad Hakami[5], Sultanah Hamoud Alruwaili[6], Seham Matar Alotaibi[7], Khaled Ali Ali Hakami[8], Maryam Abdullah Nahas[9], Mohanad Mohammad Banaamah[10], Mohammed Awad Mohammed[11]

[1,2,3,4]Medical Intern, King Abdulaziz University, Jeddah, Saudi Arabia.

[5]Medical Intern, Jazan University, Jazan, Saudi Arabia.

[6]Medical Intern, Al-Jouf University, Sakaka, Saudi Arabia.

[7]Medical Intern, Umm Al-Qura University, Makah, Saudi Arabia.

[8]Medical Intern, Jazan, University, Jazan, Saudi Arabia.

[9]General Practitioner, King Abdulaziz University, Jeddah, Saudi Arabia.

[10]Internal Medicine Resident, R4, Jeddah, Saudi Arabia.

[11]General Practitioner, Ahad Rufaida Hospital, Ahad Rafidah.

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***Corresponding Author**
Abdulrahman Ali Qasem Al Qasim
Medical Intern, King Abdulaziz University, Jeddah, Saudi Arabia.

ABSTRACT

Background & Purpose: Enhancement of exercising capacity via exercising training interventions has, therefore, end up a key thing of the lifestyle and management advice for coronary heart disease patients. The Aim of this work is to provide cumulative data about the effect of exercise-based cardiac rehabilitation in patients with coronary heart disease (CHD). **Methods:** A systematic search was performed of PubMed, Cochrane library Ovid, Scopus & Google scholar to identify Cardiology RCTs, clinical trials, and comparative studies, which studied the outcome of Exercise group versus Usual care group of CHD patients. A meta-analysis was done using fixed and random-effect methods. The primary outcome was all-cause mortality rate. Secondary outcomes were cardiovascular mortality and hospital admission rates. **Results:** A total of 6 studies were identified involving 1242 patients, with 622 patients in Exercise group, and 620 patients in Usual care group. Regarding primary outcome measures, the fixed-effects model of the meta-

analysis study showed highly significant decrease in all-cause mortality rate in Exercise group compared to Usual care group (p = 0.01). Regarding secondary outcome measures, the fixed-effects model of the meta-analysis study showed significant decrease in cardiovascular mortality rate in Exercise group compared to Usual care group (p= 0.036). The fixed-effects model of the meta-analysis study showed non-significant difference in hospital admission rate in Exercise group compared to Usual care group (p > 0.05). **Conclusion:** To conclude, in patients with stable CHD, greater physical activity become related to lower mortality. the largest advantages came about among sedentary patient groups and between people with the highest mortality risk.

KEYWORDS: Exercise-based Cardiac Rehabilitation, CHD.

INTRODUCTION

Coronary heart disease (CHD) is one of the most common varieties of coronary heart disease. It influences the heart through restricting or blocking the flow of blood round it. this may result in a feeling of tightness in the chest (angina) or a heart attack. exercise-based totally cardiac rehabilitation aims to restore people with CHD to health through either everyday exercise alone or a combination of exercise with education and psychological help.[1]

Cardiac rehabilitation (CR) programs are as crucial to complete care of CHD patients and had been given a class I recommendation from the American coronary heart association, the American college of Cardiology, and the European Society of Cardiology, with exercising therapy consistently identified as an important element. way of exercise training stays a cornerstone intervention, global suggestions constantly recommend the provision of complete rehabilitation that consists of education and psychological enter focusing on health and behavior change, risk factor modification, and psychosocial well-being.[2]

Many patients may gain from formal Cardiac Rehabilitation and exercise treatment (CRET) programs. Even though, occasionally, some of the details of formal CRET programs are individualized to fulfill unique needs of certain patients, usually, those programs begin as soon as viable after most important CHD occasions and usually last for 12 weeks, consisting of 3 exercise and education lessons weekly, for a total of 36 education and exercising sessions.[3]

Enhancement of exercising capacity via exercising training interventions has, therefore, end up a key thing of the lifestyle and management advice for coronary heart disease patients.[4]

AIM OF THE STUDY: The Aim of this work is to provide cumulative data about the effect of exercise-based cardiac rehabilitation in patients with coronary heart disease (CHD).

METHODS

This review was carried out using the standard methods mentioned within the Cochrane handbook and in accordance with the (PRISMA) statement guidelines.[5]

Identification of Studies

- An initial search carried out throughout the PubMed, Cochrane library Ovid, Scopus & Google scholar using the following keywords: Exercise-based Cardiac Rehabilitation, CHD.
- We will consider published, full text studies in English only. Moreover, no attempts were made to locate any unpublished studies nor non-English studies.

Criteria of Accepted Studies

- **Types of studies**

The review will be restricted to RCTs, clinical trials, and comparative studies, either prospective or retrospective, which studied the outcome of Exercise group versus Usual care group of CHD patients.

- **Types of participants:** CHD patients.

- **Types of outcome measures**

1. Rate of all-cause mortality (1ry outcome)
2. Cardiovascular mortality (2ry outcome)
3. Hospital admission rate (2ry outcome)

Inclusion Criteria

- ✓ English literature.
- ✓ Journal articles.
- ✓ Between 2005 until 2012.
- ✓ Describing CHD patients having Exercise or Usual care rehabilitation.
- ✓ Human studies.

Exclusion Criteria

- ✓ Articles describing other types of cardiac patients (e.g. heart failure patients).
- ✓ Irrelevance to our study.

Methods of the Review

- **Locating Studies**

Abstracts of articles identified using the above search strategy will be viewed, and articles that appear of fulfill our inclusion criteria will be retrieved in full, when there is a doubt, a second reviewer will assess the article and consensus will be reached.

- **Data extraction**

Using the following keywords: Exercise-based Cardiac Rehabilitation, CHD, data will be independently extracted by two reviewers and cross-checked.

Statistical Analysis

Statistical analysis done using MedCalc ver. 18.11.3 (MedCalc, Ostend, Belgium). Data were pooled and odds ratios (ORs) as well as standard mean differences (SMD), were calculated with their 95 per cent confidence intervals (CI). A meta-analysis was performed to calculate direct estimates of each treatment, technique or outcome. According to heterogeneity across trials using the I^2-statistics; a fixed-effect model ($P \geq 0.1$) or random-effects model ($P < 0.1$) was used.

Study selection

We found 168 records; 108 were excluded based on title and abstract review; 60 articles are searched for eligibility by full text review; 22 articles cannot be accessed or obtain full text; 13 studies were reviews and case reports; 11 were not describing functional outcome; the desired disease not studied in 8 studies leaving 6 studies that met all inclusion criteria (Fig. 1).

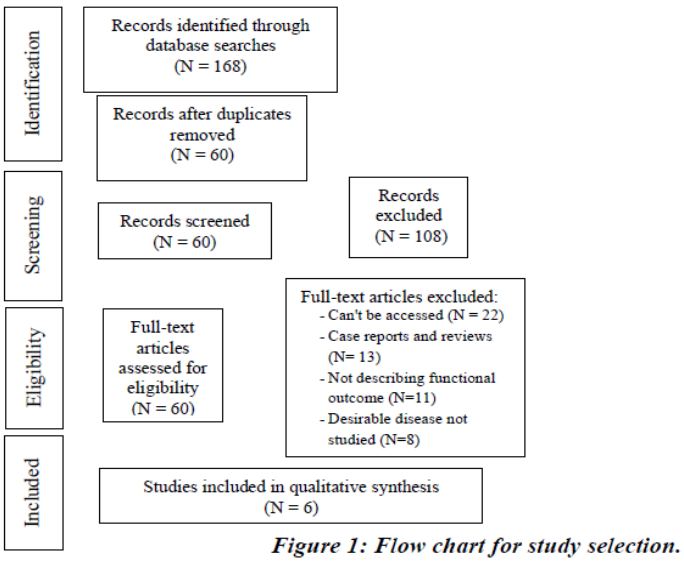

Figure 1: Flow chart for study selection.

Figure 1: Flow Chart for Study Selection.

RESULTS

Descriptive analysis of all studies included (Tables 1, 2)

Table 1: Patients and Study Characteristics.

N	Author	Number of Patients			Age (average years)	Male participants (%)	Follow up time (average years)
		Total	Exercise group	Usual care group			
1	*Montero et al., 2005*	180	90	90	76.9	57.5	10
2	*Aronov et al., 2009*	392	197	195	61.4	73.5	1
3	*Moreno-Palanco et al., 2011*	247	121	126	64.9	74.55	3
4	*Oerkild et al., 2012*	40	19	21	63.5	0	1
5	*Reid et al., 2012*	223	115	108	54.5	87.3	1
6	*Wang et al., 2012*	160	80	80	67	63.5	0.5

#Studies were arranged according to publication year.

Table 2: Summary of Outcome Measures in All Studies.

N	Author	Primary outcome		Secondary outcomes			
		All-cause mortality		Cardiovascular mortality		Hospital admission rate	
		Exercise group	Usual care group	Exercise group	Usual care group	Exercise group	Usual care group
1	*Montero et al., 2005*	7	16	7	14	---	---
2	*Aronov et al., 2009*	---	---	3	6	---	---
3	*Moreno-Palanco et al., 2011*	4	17	1	3	6	13
4	*Oerkild et al., 2012*	4	5	---	---	---	---
5	*Reid et al., 2012*	0	2	---	---	4	6
6	*Wang et al., 2012*	1	3	---	---	---	---

The included studies published between 2005 and 2012.

The total number of patients in all the included studies was 1242 patients, with 622 patients in Exercise group, and 620 patients in Usual care group, while their average follow up time was (2.75 years).

Regarding patients' characteristics, the average age of all patients was (64.7 years), and the average male participants represented (59.4%).

Meta-analysis of Outcome Measures

Data were divided into two groups:

1) Exercise group
2) Usual care group

Meta-analysis study was done on 6 studies which described and compared the 2 different groups of patients; with overall number of patients (N=1242).

Patients who achieved outcome measures were pooled:

Each outcome was measured by

✓ **Odds Ratio (OR)**

- Rate of all-cause mortality (1ry outcome)
- Cardiovascular mortality (2ry outcome)
- Hospital admission rate (2ry outcome)

Regarding primary outcome measure,

We found 5 studies reported all-cause mortality with total number of patients (N=850).

I^2 (inconsistency) was 0% with non-significant Q test for heterogeneity ($p > 0.05$), so fixed-effects model was carried out; with overall OR= 0.347 (95% CI 0.191 to 0.631).

The fixed-effects model of the meta-analysis study showed highly significant decrease in all-cause mortality rate in Exercise group compared to Usual care group ($p = 0.01$).

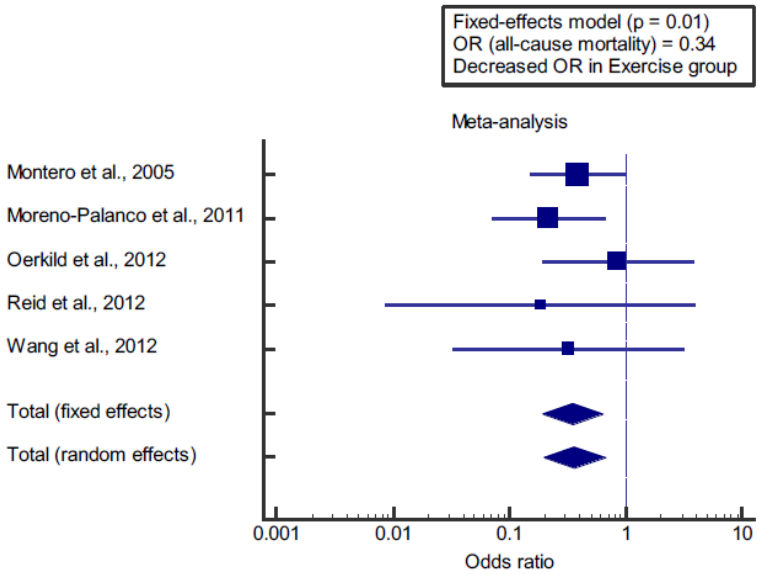

Figure 2: Forest plot of (all-cause mortality rate) on Exercise group vs Usual care group – Odds ratio.

Regarding secondary outcome measures,

We found 3 studies reported cardiovascular mortality rate with total number of patients (N=819).

I^2 (inconsistency) was 0% with non-significant Q test for heterogeneity ($p > 0.05$), so fixed-

effects model was carried out; with overall OR= 0.45 (95% CI 0.213 to 0.95).

The fixed-effects model of the meta-analysis study showed significant decrease in cardiovascular mortality rate in Exercise group compared to Usual care group (p = 0.036).

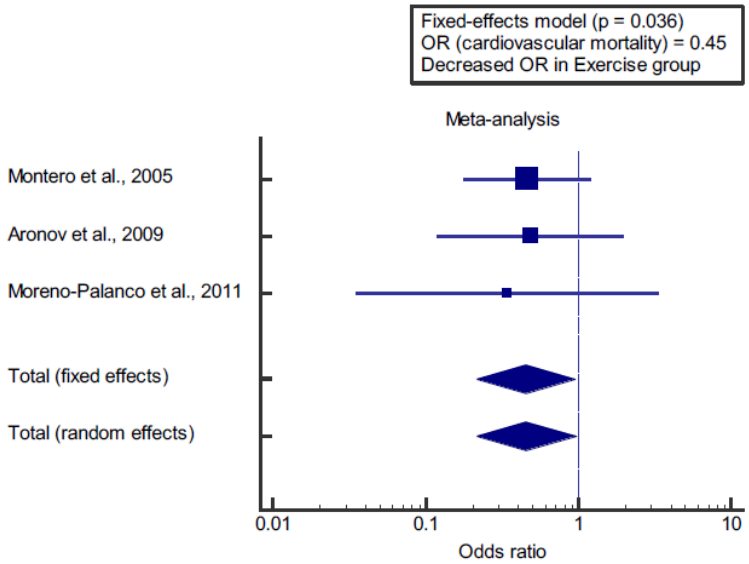

Figure 3: Forest plot of (cardiovascular mortality rate) on Exercise group vs Usual care group – Odds ratio.

We found 2 studies reported hospital admission rate with total number of patients (N=470).

I^2 (inconsistency) was 0% with non-significant Q test for heterogeneity (p > 0.05), so fixed-effects model was carried out; with overall OR= 0.5 (95% CI 0.230 to 1.115).

The fixed-effects model of the meta-analysis study showed non-significant difference in hospital admission rate in Exercise group compared to Usual care group (p > 0.05).

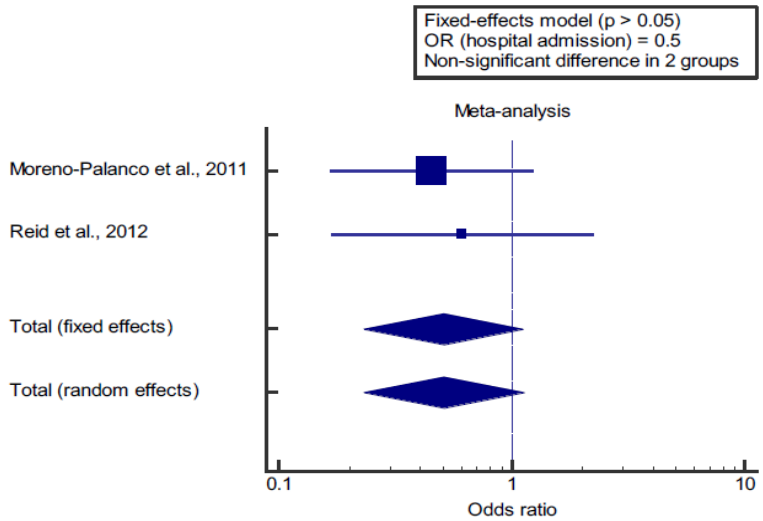

Figure 4: Forest plot of (hospital admission rate) on Exercise group vs Usual care group – Odds ratio.

DISCUSSION

The Aim of this work is to provide cumulative data about the effect of exercise-based cardiac rehabilitation in patients with coronary heart disease (CHD).

Regarding patients' characteristics, the average age of all patients was (64.7 years), and the average male participants represented (59.4%).

Regarding Meta-analysis of outcome measures: Data were divided into two groups **(Exercise group and Usual care group)**.

Regarding primary outcome measure; We found 5 studies reported all-cause mortality with total number of patients (N=850).

The fixed-effects model of the meta-analysis study showed highly significant decrease in all-cause mortality rate in Exercise group compared to Usual care group (p = 0.01) which came in agreement with ***Oldridge 2012***[6] and with ***Goel et al. 2011***[7] and disagreement with ***Lewinter et al. 2015.***[8]

Oldridge 2012[6] reported that This overview of six independent cardiac rehabilitation meta-analyses published considering the fact that 2000 consists of a total of 71 randomized medical trials (n = 13,824 patients) and clearly demonstrates significant clinical outcomes (reduced all-cause and cardiac mortality, nonfatal reinfarction and decreased hospitalization rates) and significant positive changes in modifiable risk factors (overall cholesterol, triglycerides and systolic blood pressure).

Lewinter et al. 2015[8] reported that exercising-based cardiac rehabilitation (EBCR) in patients with HF is associated with significant improvements in workout ability and hospital admission over a minimum of six months follow-up, but not in all-cause mortality.

Goel et al. 2011[7] reported that Participation in CR, noted in 40% (964 of 2395) of the cohort, become related to a significant decrease in all-cause mortality by using all 3 statistical techniques (hazard ratio, 0.53 to 0.55; $P < 0.001$).

Regarding secondary outcome measures; We found 3 studies reported cardiovascular mortality rate with total number of patients (N=819).

The fixed-effects model of the meta-analysis study showed significant decrease in

cardiovascular mortality rate in Exercise group compared to Usual care group (p = 0.036) which came in agreement with ***Oldridge 2012***[6] and with ***Williams et al. 2011***[9] and with ***Stewart et al. 2017***.[10]

Oldridge 2012[6] reported that This overview of six independent cardiac rehabilitation meta-analyses published considering the fact that 2000 consists of a total of 71 randomized medical trials (n = 13,824 patients) and clearly demonstrates significant clinical outcomes (reduced all-cause and cardiac mortality, nonfatal reinfarction and decreased hospitalization rates) and significant positive changes in modifiable risk factors (overall cholesterol, triglycerides and systolic blood pressure).

Williams et al. 2011[9] reported that physical inactivity makes a significant contribution to the extra CHD mortality determined inside the South Asian population in the UK.

Stewart et al. 2017[10] reported that The association between decrease in mortality and greater physical activity was more potent in the subgroup of patients at higher risk expected through the ABC-CHD (Age, Biomarkers, clinical–Coronary heart disease) risk score (p for interaction = 0.0007).

We found 2 studies reported hospital admission rate with total number of patients (N=470).

The fixed-effects model of the meta-analysis study showed non-significant difference in hospital admission rate in Exercise group compared to Usual care group (p > 0.05) which came in disagreement with ***Lewinter et al. 2015***[8] and agreement with ***Taylor et al. 2014.***[11]

Lewinter et al. 2015[8] reported that EBCR in patients with HF is associated with significant improvements in exercise capacity and hospital admission over a minimum of six months follow-up, but not in all-cause mortality.

Taylor et al. 2014[11] reported that This updated Cochrane review helps the conclusions of the previous version of this review that, in comparison and not using a exercising control, exercise-based totally rehabilitation does now not increase or lower the chance of all-reason mortality in the short time period (as much as 12-months' comply with-up) however reduces the risk of hospital admissions and confers critical improvements in health- related quality of lifestyles.

CONCLUSION

To conclude, in patients with stable CHD, greater physical activity become related to lower mortality. the largest advantages came about among sedentary patient groups and between people with the highest mortality risk.

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Conflict of interest

None.

Authorship

All the listed authors contributed significantly to conception and design of study, acquisition, analysis and interpretation of data and drafting of manuscript, to justify authorship.

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