ORIGINAL RESEARCH PAPER

Cardiovascular

# EFFECTIVENESS OF CARDIAC TELEREHABILITATION OVER CENTERBASED CARDIAC REHABILITATION ON VO2PEAK - A METANALYSIS OF RANDOMIZED CONTROL TRIALS.

**KEY WORDS:** Cardiac-telerehabilitation , homebased, wearable sensors, VO2peak.

**Kanchi Dwaipal Mehta** — 2nd Year MPT Student

**Dr. Hardini Prajapati** — Lecturer And PG PhD Guide

**ABSTRACT**

**Introduction:-** Currently we are living in the era of information & technology. Telecommunication technologies have raised the possibility of telehealth intervention delivering homebased cardiac telerehabilitation. A cardiovascular disease poses threat to patient's oxygen uptake [VO2 peak].Cardiac rehabilitation is necessary for cardiovascular patients. But due to distance from rehab centers and transport issues; patient's ratio is relatively low. Cardiac rehabilitation is relatively low. Cardiac rehabilitation is relatively low. Cardiac telerehabilitation is relatively new approach due to contexts of pandemics. The research is aimed to find the effect of cardiac telerehabilitation on oxygen uptake (VO2peak) of CVD patients. **Methods:-** Databases (Google scholar, Researchgate, Pubmed ) were searched from digital platforms from 2014 to September 2023 for articles comparing the effect of homebased cardiac telerehabilitation versus centerbased cardiac rehabilitation on VO2peak. From 200 articles,8 RCTs found according to PRISMA guidelines with same primary outcome; then systematic review has been done for meta-analysis.The Cochrane risk of bias tool was used to check bias of articles. **Results:-** Meta-analysis was done of 8RCTs (1446 patients) were included. Odd's ratio is taken for participants; age-group; effect on VO2peak. The research shows significant improvement on centerbased cardiac rehabilitation. Hedges'g=0.99{effective}, 95% CI, p-value<0.05. Technology is growing fast and helps in promoting homebased cardiac rehabilitation with the help of wearable sensors.

## INTRODUCTION

Cardiovascular diseases (CVDs) are the primary cause of a significant portion of global mortality, responsible for roughly one-third of all deaths [1]. The worldwide impact of CVDs is increasing, with cases rising from 271 million in 1990 to 523 million in 2019, and the overall number of CVD instances has nearly doubled, particularly coronary artery disease (CAD) . CAD primarily results from the advancement of atherosclerosis in coronary arteries, leading to narrowing or blockage, which restricts blood flow and causes cardiomyocyte or myocardial death . The main contributing factors are population growth and aging, presenting substantial challenges in CVD prevention and management.[7]

Cardiac rehabilitation (CR) is a comprehensive, interdisciplinary intervention designed to provide a thorough rehabilitation assessment of a patient's condition, addressing the needs of those with CVD and preventing disease recurrence and progression. CR encompasses various elements, including exercise training, medication guidance, dietary advice, nutritional support, psychological adjustment, and risk factor management[2] .

To enhance care for CAD patients, this multifaceted treatment approach can be combined with proven strategies for evaluating physical function and risk factors, allowing for personalized treatment plans. Research has demonstrated that CR can decrease the risk of subsequent heart attacks by 47%, cardiac-related mortality by 36%, and overall mortality by 26% [6]. Moreover, secondary prevention guidelines highlight the significance of CR for CAD patients, recognizing it as a comprehensive medical monitoring approach to reduce CAD-related mortality, morbidity, disability, and high costs . Although participation in CR is classes IA recommended for CAD patients.[1]

Several factors may contribute to the limited participation and adherence in CR programs, including health complications, distance from healthcare facilities, expensive medical treatments, and time constraints[7]

In the United States, only 20% to 30% of eligible individuals enroll in CR programs . The low rates of participation and adherence to CR can be attributed to various factors, including existing health conditions, distance from healthcare facilities, expensive medical services, and the required time investment.[7]

Cardiac telerehabilitation, a targeted strategy, is employed to address these obstacles and enhance CR adoption rates, effectively transforming the conventional rehabilitation approach into a high-value comprehensive plan. Telerehabilitation encompasses a telemedicine framework, including remote diagnosis, treatment, and monitoring [ 13 ]. These technologies facilitate collaborative involvement of physicians, patients, and medical departments in managing patient health. For individuals with CVD, doctors can track vital signs and cardiac telerehabilitation progress through remote monitoring systems, adjusting CR treatment plans based on patient conditions. By utilizing internet information technology, cardiac telerehabilitation enables patients to undergo rehabilitation at home or in non-hospital settings, unrestricted by time or location. This approach motivates patients and aids in supervision, leading to improved compliance. These factors have contributed to the growing popularity of cardiac telerehabilitation, with comprehensive telemedicine development increasingly focusing on this area. The majority of patients eligible for cardiac telerehabilitation experience a low rate of adverse events during exercise training when properly evaluated beforehand. A review conducted by S tefanakis et al [ 14 ], which analyzed 5 studies on adverse event rates in home telerehabilitation, estimated the incidence of adverse events in the sample to be 1 in 23,823 patient-hours of exercise[4].

The effectiveness of cardiac telerehabilitation has been demonstrated by improvements in the health of CVD patients. However, recent research on telerehabilitation has sought to determine if telerehabilitation influences efficacy over the short term (about three months of follow-up) or the medium term (approximately six months of follow-up) [18–20]. The long-term (greater than one-year follow-up) effects of telerehabilitation are not well documented. Motivation for changing one's lifestyle tends to wane, according to a self-regulation lifestyle program [21]. Patients with CAD experience healing at the same time, which encourages long-term positive adjustments to risk factors and lifestyle. Therefore, assessing telerehabilitation's long-term efficacy is

practically relevant for CR implementation. We predicted that cardiac telerehabilitation could be advantageous in this study because of the documented link between telerehabilitation and its possible positive effects in CAD[5].

**Methodology:-**

- **Design**

The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) statement was followed in the meta-analysis.

Moral Aspects to Take into Account There was no requirement for ethics approval or patient consent because all analyses were based on previously published research.

- **Literature Search**
- The articles were searched on the bases of **PICO** format.
- P=Individuals with CVDs.
- I=Cardiac Telerehabilitation
- C=Centerbased cardiac rehab
- O=Vo2 Peak

- **Eligibility Criteria:-**
- It should be randomized control trials.
- The language should be English.
- Research should be published between duration of 2014-2023.

- **Data Extraction:-**
- **First Stage:-** Title
- **Second Stage:-** Abstracts
- **Third Stage:-** Complete Reading

- **Risk Of Bias Assessment:-**
- The Articles Were Tested According To Chronbach's Alpha Tool.

- **Statistics:-**
- The Analysis Were Done Using Medcalc Statistics Software.

Eligible studies included experimental studies with randomized and nonrandomized designs that examined implementation outcomes of interest in cardiac telerehabilitation among adults (aged ≥18 years) with CHD (i.e., MI, angina, and coronary revascularization) or evaluated the use of cardiac telerehabilitation in routine clinical practice.

Interventions for cardiac telerehabilitation were classified as those in which at least 50% of the program was given by ICT, such as web-based platforms, wireless equipment like sensors, or any type of mobile phone (such as a smart phone or feature phone). Interventions provided as a component of current CR services without substantial continuous involvement from a research team were considered to be implemented in ordinary clinical practice.

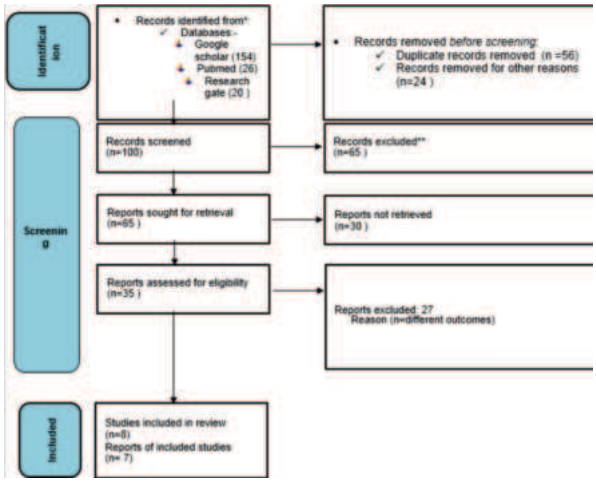
This review does not include pilot studies. Only treatments that had previously passed preliminary testing for viability and were deemed viable by their individual authors for trial testing or practical delivery were included in order to fulfill the objectives.

Grey literature, nonhuman research, conference abstracts, and publications written in languages other than English were also disqualified. Research protocols and systematic reviews were not allowed to be included; however, results papers were looked for pertinent research protocols and pertinent systematic reviews were looked for and mentioned when applicable.

**RESULT:**

- **Data Extraction:-**

Two authors collaborated on the final decision of data extraction, which was summarized in Microsoft Word : (1) study design (eg, first author, year of publication, country, study design, follow-up time), (2) participants (eg, sample size, sex, age, diagnosis), (3) intervention (eg, telerehabilitation group vs control group), (4) change in our protocol-specified outcomes of VO2peak. Which is showed in Figure 1.




- **Peak Oxygen Uptake (VO2 Peak)**

Three studies involving a total of 1446 patients with cardiovascular disease (CVD) investigated the impact of HBCTR on $VO_2$ peak, a measure of maximal oxygen uptake. The results indicated that HBCTR significantly increased $VO_2$ peak when compared to the Centerbased cardiac rehabilitation group showed 0.55±2.155 & HBCTER showed 2.717±3.325, with a standardized mean difference, and P = 0.01 (as shown in Figure 2.

Hedge's g=0.98 which shows that HBCTR is as largely effective. Odd's ratio is 0.89 which shows lesser risk as shown in Figure 3.

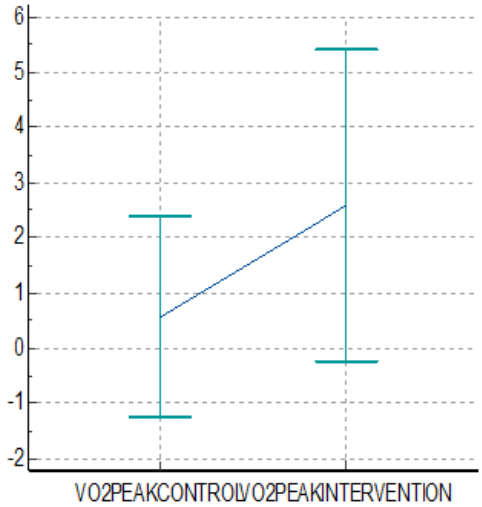



**Figure 2:-** Graph of Vo2 peak [HBCTR VS CBCR]

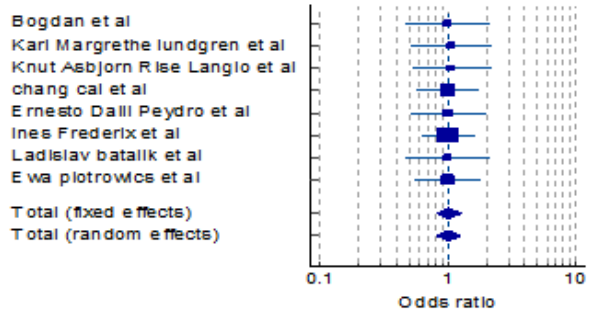


**Figure.-3:-** Odds Ratio

## DISCUSSION:-

Physiotherapy is completely supervised protocol. Cardiac telerebilitation is relatively new Approch surged after COVID19.The VO2 peak shows cardiovascular strength of the patients. A major worldwide health problem, cardiovascular disease (CVD) frequently leads to diminished physical condition and reduced heart function. For the management of CVD, interventions aimed at enhancing heart function and physical health is essential. Exercise capacity, quality of life, and mortality rates have all been demonstrated to improve with cardiac rehabilitation programs incorporate exercise training, dietary counseling, and psychological support.[7]

Exercise treatment, which has been demonstrated to enhance cardiopulmonary function, postpone the advancement of atherosclerosis, ease the symptoms of myocardial ischemia, and lower overall and cardiac mortality rates, is usually the first step in cardiac rehabilitation programs. However, because exercise can be lethal, it is crucial that individuals with CVD do it under supervision.

Cardiovascular disease (CVD) is a major global health concern, often resulting in impaired cardiac function and decreased physical condition. Interventions targeting the improvement of cardiac function and physical condition are crucial for managing CVD. Cardiac rehabilitation programs, which include exercise training, nutritional counseling, and psychosocial support, have been shown to positively impact outcomes such as exercise capacity, quality of life, and mortality rates[6].

Cardiac rehabilitation programs typically begin with exercise therapy, which has been shown to improve cardiopulmonary function, delay atherosclerosis progression, alleviate myocardial ischemia symptoms, and reduce overall and cardiac mortality rates. However, it is important for CVD patients to exercise under supervision as it can be fatal.[1].

Due to a lack of in-person counseling for chronic patients, especially those with cardiovascular disease, the COVID-19 epidemic has made things even more difficult. One of the ongoing problems with cardiac rehabilitation is poor patient compliance. By effectively monitoring physical training, encouraging long-term commitment to therapy, and lowering the danger of viral transmission, Home-based cardiac telerehabilitation (HBCTR) has emerged as a viable remedy[3].

According to a meta-analysis of eight randomized controlled studies with a total of 1446 participants, Meta-analysis shows that Mean Vo2 in HBCTR is 2.717±3.325 where as in CBTR is 0.55±2.155.Hedge's g=0.98 which shows that HBCTR is as largely effective. Odd's ratio is 0.89 which shows lesser risk.

**Piotrowics et al (2015)** stats that patient felt safe even they were rehabilitated at home due to constant monitoring.[5]

## CONCLUSION:-

Homebased cardiac telerehabilitation is more effective then Centerbased cardiac rehabilitation.

## REFERENCES:


1. Feasibility of telerehabilitation for heart failure patients inaccessible for outpatient rehabilitationKari Margrethe Lundgren, Knut Åsbjørn Rise Langlo, Øyvind Salvesen, Paolo Zanaboni, „ Cittanti, Rune Mo, Øyvind Ellingsen, Håvard Dalen, Inger-Lise Aamot Aksetøyhttps://onlinelibrary.wiley.com/doi/abs/10.1002/ehf2.14405
2. A novel model of home-based, patient-tailored and mobile application-guided cardiac telerehabilitation in patients with atrial fibrillation: A randomised controlled trialCheng Cai, Zhipeng Bao https://journals.sagepub.com/doi/abs/10.1177/02692155211032372
3. A randomized controlled clinical trial of cardiac telerehabilitation with a prolonged mobile care monitoring strategy after an acute coronary syndromeE Dalli Peydro, N Sanz Sevilla, MT Tuzon Segarra, V Miro Palau, J Sanchez Torrijo;Clinicalcardiology,2022 https://onlinelibrary.wiley.com/doi/abs/10.1002/clc.23757
4. Effects of a 9-week hybrid comprehensive telerehabilitation program on long-term outcomes in patients with heart failure: the telerehabilitation in heart failure patients …E Piotrowicz, MJ Pencina, G Opolski https://jamanetwork.com/journals/jamacardiology/article-abstract/2755878
5. Home-based telemonitored Nordic walking training is well accepted, safe, effective and has high adherence among heart failure patients, including those with …E Piotrowicz, T Zieli□ski, R Bodalski https://journals.sagepub.com/doi/abs/10.1177/2047487314551537
6. Medium-term effectiveness of a comprehensive internet-based and patient-specific telerehabilitation program with text messaging support for cardiac patients …I Frederix, D Hansen, K Coninx, P Vandervoort https://www.jmir.org/2015/7/e185/
7. Effects of home-based cardiac telerehabilitation programs in patients undergoing percutaneous coronary intervention: a systematic review and meta-analysis Wen Zhong1,2†, Chenying Fu3,4†, Lin Xu1,2, Xin Sun1,2, Shiqi Wang1,2, Chengqi He1,2 and Quan Wei1,2* https://link.springer.com/article/10.1186/s12872-023-03120-2