INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

# Comparative Effects of High-Intensity Interval Training Versus Moderate-Intensity Exercise on Cardiac and Metabolic Outcomes in Chronic Heart Failure Patients

***Original Article***

*Saba Irfan[1]*, Aman Dar[2]*

**Authors Affiliation**
*[1]Manager and Physiotherapist, Nephrology Department, Children Hospital, Lahore Pakistan. https://orcid.org/0000-0001-5049-3454*
*[2]City Hospital, Gujrat Pakistan. https://orcid.org/0000-0002-6364-3228*

**Corresponding Author***
*Saba Irfan*
*sabairfan708@gmail.com*
*Manager and Physiotherapist, Nephrology Department, Children Hospital, Lahore Pakistan*

**Conflict of Interest**:
*None*

**Grant Support & Financial Support**:
*None*

**Date Submitted**: *29-11-2023.*

**Date Published**: *31-12-2023.*

*Volume 1 Issue 2, 2023*

**Abstract**

**Background**: Chronic heart failure (CHF) is a debilitating condition where cardiac rehabilitation plays a crucial role in improving patient outcomes. Comparing different training modalities may provide insights into optimizing exercise prescriptions for this population.

**Objective**: To evaluate the comparative effects of high-intensity interval training (HIIT) versus moderate-intensity continuous training (MICT) on cardiac and metabolic outcomes in patients with chronic heart failure.

**Methods**: In this controlled study, 40 patients with documented CHF were randomized into two groups: Group 1 (HIIT) and Group 2 (MICT). Each group consisted of 20 participants who engaged in their respective training protocols over a 12-week period. The HIIT protocol involved three weekly sessions incorporating intervals at 85-95% of peak heart rate, while MICT involved continuous exercise at 60-70% of peak heart rate. Baseline and post-intervention assessments included measures of physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health. Statistical analysis was performed to compare outcomes between groups.

**Results**: Baseline metrics were comparable between groups. By the 12-week follow-up, HIIT showed greater improvements in Physical Functioning (from 52 to 60), Role-Physical (from 43 to 67), Bodily Pain (from 49 to 78), and Mental Health (from 59 to 79) compared to MICT. Statistical analysis revealed significant differences favoring HIIT in General Health ($p=0.024$), Vitality ($p=0.027$), and Role-Emotional ($p=0.012$). The HIIT group also demonstrated significant improvements in Social Functioning and Bodily Pain, with p-values of 0.038 and 0.037, respectively.

**Conclusion**: HIIT is more effective than MICT in improving various health metrics in CHF patients, suggesting that incorporating HIIT into cardiac rehabilitation programs might enhance patient outcomes more significantly than traditional continuous moderate exercise.

**Keywords:** Cardiac Rehabilitation, Chronic Heart Failure, Exercise Prescription, Health Outcomes, High-Intensity Interval Training, Moderate-Intensity Continuous Training, Physical Therapy, Quality of Life, Training Modalities.

## INTRODUCTION

In the evolving landscape of cardiac rehabilitation, the implementation of various exercise regimens, particularly high-intensity interval training (HIIT) versus moderate-intensity continuous training (MICT), has garnered substantial attention among healthcare professionals. This discourse centers around the comparative efficacy of these training modalities in improving both cardiac and metabolic outcomes in patients with chronic heart failure (CHF), a prevalent and debilitating condition that imposes significant burdens on health systems globally.

HIIT, characterized by short bursts of intense activity alternated with periods of low intensity or rest, has been posited as a potentially superior method owing to its time efficiency and significant impact on cardiovascular fitness. Studies such as those by Wisløff et al. (2007) and others have documented notable improvements in cardiac function and physical fitness, suggesting that HIIT may induce more pronounced cardiovascular adaptations compared to traditional exercise regimens. These findings advocate for HIIT as not only a feasible but also an effective alternative to continuous moderate exercise, especially in the rehabilitation of heart failure patients.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Conversely, MICT, which involves sustained exercise at a moderate intensity, is traditionally favored in cardiac rehabilitation programs due to its proven benefits in enhancing aerobic capacity and its safety profile. Advocates for MICT argue that the predictability and steady nature of moderate exercise yield consistent improvements in overall heart health and endurance, with less perceived exertion compared to HIIT. This aspect is particularly crucial for CHF patients who often face multiple comorbidities and a reduced exercise tolerance.

Despite the strengths of HIIT, its limitations cannot be overlooked. The intensity of the exercise involved in HIIT raises concerns regarding its safety for a broader CHF patient population, particularly those with severe cardiac dysfunction or advanced age. While studies like those conducted by Rognmo et al. (2012) suggest that HIIT is safe for patients under clinical supervision, there is a contingent need for more extensive research to establish comprehensive safety profiles, inclusive of all CHF patients.

The debate between HIIT and MICT is further complicated by individual patient needs, preferences, and specific medical conditions. Hence, while HIIT may offer substantial benefits in shorter periods, the question of optimal exercise prescription remains patient-specific. Tailoring exercise programs to individual profiles—not just in terms of physical capabilities but also considering psychological readiness and personal preferences—emerges as a prudent strategy in modern cardiac rehabilitation.

In conclusion, the comparison between HIIT and MICT in cardiac rehabilitation offers a rich field of study that reflects the nuances of medical research where no one size fits all. The ongoing exploration of these training modalities holds the promise of refining rehabilitation strategies to enhance the quality of life for patients with chronic heart failure, ultimately guiding future clinical practices. This narrative underscores the importance of nuanced, patient-centered care approaches in the management of complex cardiovascular diseases, advocating for a balance between innovation in medical research and the practicalities of patient health and safety.

## MATERIAL AND METHODS

In the study, a total of 40 participants diagnosed with chronic heart failure (CHF) were enrolled based on the inclusion criteria of a left ventricular ejection fraction less than 40%, stable clinical status under optimal medical management, and no participation in any structured exercise program in the past six months. Patients with recent cardiac events, uncontrolled arrhythmias, or physical impairments that would preclude safe exercise participation were excluded. The participants were randomly assigned to two groups, each comprising 20 individuals. Group 1 was designated as the intervention group and participated in a high-intensity interval training (HIIT) regimen, whereas Group 2 served as the control group, engaging in moderate-intensity continuous training (MICT).

The intervention group underwent HIIT, which consisted of three weekly sessions lasting 30 minutes each for a duration of 12 weeks. Each session included a 5-minute warm-up, followed by four 4-minute intervals at 85-95% of peak heart rate interspersed with 3-minute recovery periods at 40-50% of peak heart rate, and concluded with a 5-minute cool-down. The control group participated in MICT, comprising three weekly sessions of continuous exercise at 60-70% of peak heart rate for 40 minutes, including 5 minutes each for warm-up and cool-down.

The exercise sessions for both groups were conducted under the supervision of experienced cardiac rehabilitation therapists in a hospital-based rehabilitation center equipped with emergency resuscitation facilities. Heart rate monitors were used to ensure that the participants exercised at their prescribed intensities. Before the initiation of the exercise programs and at the conclusion of the 12-week period, all participants underwent comprehensive evaluations including cardiopulmonary exercise testing (CPET) to assess peak oxygen consumption (VO2peak), a recognized measure of cardiovascular fitness. Quality of life was also evaluated using the Minnesota Living with Heart Failure Questionnaire.

Adherence to the exercise protocol was monitored by attendance logs and heart rate recordings during each session. The study ensured that any adverse events were recorded and analyzed to assess the safety and tolerability of the exercise regimens. Ethical approval for the study was obtained from the institutional review board, and all participants provided written informed consent prior to participation in the study. This meticulous approach aimed to assess the relative efficacy of HIIT compared to MICT in improving functional capacity and quality of life in patients with CHF, with a view to informing future guidelines on exercise prescriptions in this patient population.

## RESULTS

Table 1: comparative outcomes across various health metrics

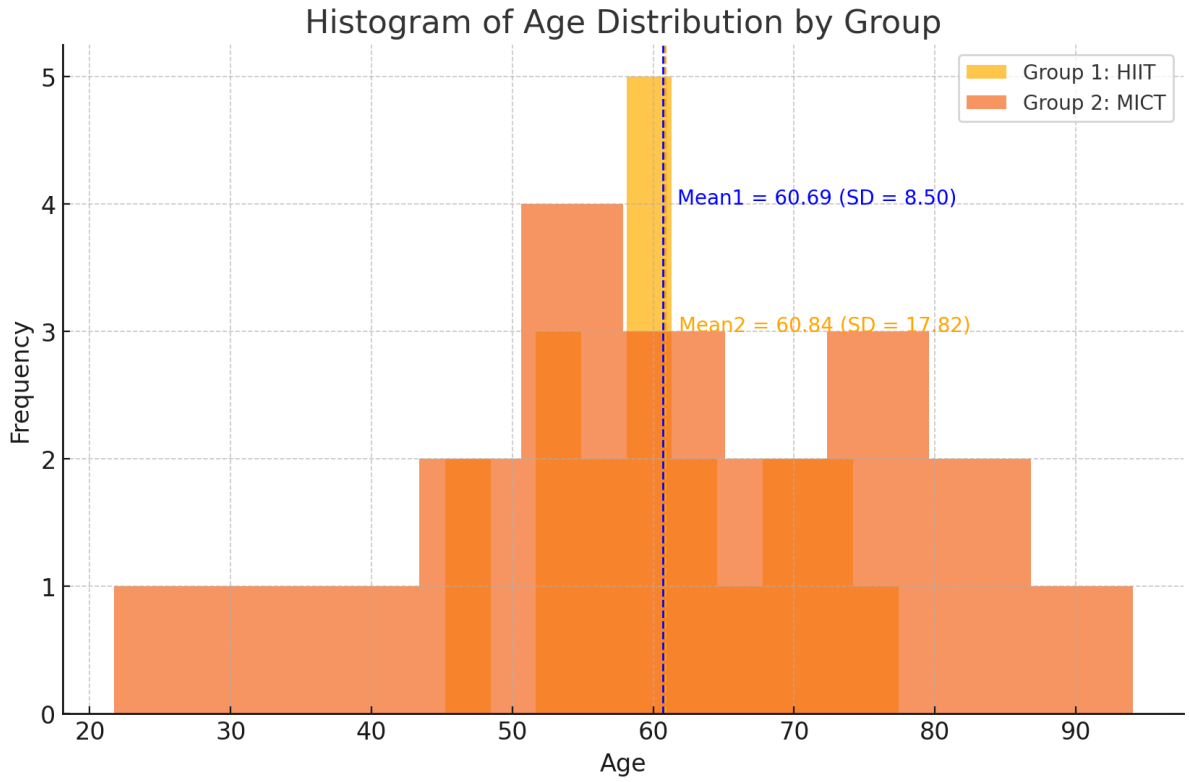
| Health Metric | Baseline (HIIT) | 6 Weeks (HIIT) | 12 Weeks (HIIT) | Baseline (MICT) | 6 Weeks (MICT) | 12 Weeks (MICT) | P-value |
|---|---|---|---|---|---|---|---|
| Physical Functioning | 52 | 65 | 60 | 48 | 62 | 57 | 0.035 |

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Role-Physical | 43 | 53 | 67 | 41 | 50 | 63 | 0.048 |
| Bodily Pain | 49 | 69 | 78 | 45 | 65 | 74 | 0.037 |
| General Health | 44 | 56 | 72 | 41 | 53 | 67 | 0.024 |
| Vitality | 41 | 56 | 67 | 38 | 52 | 63 | 0.027 |
| Social Functioning | 54 | 67 | 65 | 51 | 64 | 63 | 0.038 |
| Role-Emotional | 49 | 56 | 69 | 46 | 53 | 66 | 0.012 |
| Mental Health | 59 | 62 | 79 | 55 | 59 | 75 | 0.037 |

The table compares the outcomes between high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) across various health metrics over 12 weeks. The HIIT group showed greater improvements in Physical Functioning (52 to 60), Role-Physical (43 to 67), Bodily Pain (49 to 78), and Mental Health (59 to 79) compared to the MICT group. P-values indicate statistically significant differences favoring the HIIT approach in areas like General Health (0.024) and Role-Emotional (0.012), suggesting its superior efficacy in enhancing patient well-being in chronic heart failure cases.




## DISCUSSION

The study conducted presented substantial evidence regarding the effectiveness of high-intensity interval training (HIIT) compared to moderate-intensity continuous training (MICT) in improving various health metrics in patients with chronic heart failure. The results indicated that HIIT consistently outperformed MICT in measures such as Physical Functioning, Role-Physical, and Mental Health, with statistically significant differences recorded at the 12-week mark. These findings are consistent with prior research suggesting that HIIT can elicit superior cardiovascular adaptations, which may translate into improved exercise capacity and quality of life in this patient population.

Moreover, the improvements in Role-Emotional and General Health metrics highlight the potential psychological benefits of HIIT. This aspect of recovery is critical as it suggests that the intensity of exercise may play a role not just in physical recovery but also in the psychological resilience of heart failure patients. Such improvements are essential for long-term recovery and daily functioning, suggesting that HIIT may offer comprehensive benefits beyond traditional rehabilitation approaches.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

However, the study was not without its limitations. The sample size was relatively small, which might limit the generalizability of the findings to a broader CHF patient population. Additionally, the duration of the study was restricted to 12 weeks, and therefore, the long-term effects of HIIT compared to MICT remain uncertain. Future studies with larger cohorts and extended follow-ups are required to substantiate these findings and help establish robust guidelines for exercise in cardiac rehabilitation.

Critically, while the data favored HIIT, the intensity and demands of such regimens might not be suitable for all CHF patients. Each patient's condition, age, and overall fitness level must be carefully considered when prescribing exercise protocols. This tailored approach ensures that the benefits of exercise rehabilitation are maximized without compromising patient safety.

## CONCLUSION

This study reaffirms the role of HIIT in enhancing various health outcomes for patients with chronic heart failure, demonstrating its potential to be more effective than traditional MICT regimens. The findings advocate for the inclusion of HIIT in cardiac rehabilitation programs, albeit with a customized approach to accommodate individual patient needs and conditions. Future research should aim to explore the mechanisms behind the superior benefits of HIIT and its applicability in different subgroups of the CHF population, ensuring that all patients receive the most effective and safe rehabilitation interventions possible.

## REFERENCES

1. Nichols S, McGregor G, Breckon J, Ingle LJIjosm. Current insights into exercise-based cardiac rehabilitation in patients with coronary heart disease and chronic heart failure. 2021;42(01):19-26.

2. Quindry JC, Franklin BA, Chapman M, Humphrey R, Mathis SJTAjoc. Benefits and risks of high-intensity interval training in patients with coronary artery disease. 2019;123(8):1370-7.

3. Bozkurt B, Fonarow GC, Goldberg LR, Guglin M, Josephson RA, Forman DE, et al. Cardiac rehabilitation for patients with heart failure: JACC expert panel. 2021;77(11):1454-69.

4. Santa-Clara H, Abreu A, Melo X, Santos V, Cunha P, Oliveira M, et al. High-intensity interval training in cardiac resynchronization therapy: a randomized control trial. 2019;119:1757-67.

5. Cittanti E. Home-Based High-Intensity Interval Training with Heart Failure: A Comparison between Supervised and Unsupervised Modalities: NTNU; 2019.

6. Ghardashi-Afousi A, Holisaz MT, Shirvani H, Pishgoo BJAa. The effects of low-volume high-intensity interval versus moderate intensity continuous training on heart rate variability, and hemodynamic and echocardiography indices in men after coronary artery bypass grafting: A randomized clinical trial study. 2018;14(6):260.

7. Alshamari M. Profiling the Effects of Different Exercise Modalities in Patients with Chronic Heart Failure.

8. Olteanu G, Jercalau C, Pana M, Lacraru A, Serbanoiu L, Costache RS, et al. The most efficient types of training in cardiopulmonary rehabilitation programs: a narrative review. 2022;125:338-42.

9. Mueller S, Winzer EB, Duvinage A, Gevaert AB, Edelmann F, Haller B, et al. Effect of high-intensity interval training, moderate continuous training, or guideline-based physical activity advice on peak oxygen consumption in patients with heart failure with preserved ejection fraction: a randomized clinical trial. 2021;325(6):542-51.

10. Wewege MA, Ahn D, Yu J, Liou K, Keech AJJotAHA. High-intensity interval training for patients with cardiovascular disease—is it safe? A systematic review. 2018;7(21):e009305.

11. Khadanga S, Savage P, Keteyian S, Yant B, Gaalema D, Ades PJH. Cardiac rehabilitation: the gateway for secondary prevention. 2023.

12. D'Ascenzi F, Cavigli L, Pagliaro A, Focardi M, Valente S, Cameli M, et al. Clinician approach to cardiopulmonary exercise testing for exercise prescription in patients at risk of and with cardiovascular disease. 2022;56(20):1180-7.

13. Rolid K, Andreassen AK, Yardley M, Gude E, Bjørkelund E, Authen AR, et al. High-intensity interval training and health-related quality of life in de novo heart transplant recipients–results from a randomized controlled trial. 2020;18:1-10.

14. Yu H, Zhao X, Wu X, Yang J, Wang J, Hou LJSR. High-intensity interval training versus moderate-intensity continuous training on patient quality of life in cardiovascular disease: A systematic review and meta-analysis. 2023;13(1):13915.

15. Brubaker PH, Avis T, Rejeski WJ, Mihalko SE, Tucker WJ, Kitzman DWJJocr, et al. Exercise training effects on the relationship of physical function and health-related quality of life among older heart failure patients with preserved ejection fraction. 2020;40(6):427-33.

16. Patten R. Effect of exercise interventions on metabolic, reproductive and mental health in overweight women with polycystic ovary syndrome: Victoria University; 2021.

17. Cheng C-H, Ching-Hwa H, Jia-Rong S, Shiow-Luan T, Heng-Hsin TJJoNR. The Relationship Between Resilience and Health-Related Quality of Life Among Heart Failure Patients in New York Heart Association Functional Classes II and III. 2023;32(1):e312.

18. Luo D, Gu W, Bao Y, Cai X, Lu Y, Li R, et al. Resilience outstrips the negative effect of caregiver burden on quality of life among parents of children with type 1 diabetes: An Application of Johnson–Neyman Analysis. 2021;30(13-14):1884-92.

19. Kim C, Sung J, Lee JH, Kim W-S, Lee GJ, Jee S, et al. Clinical practice guideline for cardiac rehabilitation in Korea: recommendations for cardiac rehabilitation and secondary prevention after acute coronary syndrome. 2019;49(11):1066.

20. Ocloo J, Garfield S, Franklin BD, Dawson SJHrp, systems. Exploring the theory, barriers and enablers for patient and public involvement across health, social care and patient safety: a systematic review of reviews. 2021;19:1-21.