Journal Homepage: www.ijarpr.com ISSN: 3049-0103 (Online)

International Journal of Advance Research Publication and Reviews

Vol 03, Issue 9, pp 725-730, September, 2026

Comparison of High-Intensity Interval Training versus Moderate-Intensity Continuous Training on Functional Capacity and Cardiovascular Fitness in Patients with Stable Coronary Artery Disease

UTKARSH BARETHIYA[1], SUBUHEE KAMAL[2]

[1]PG student,9171982206,ubarethiya196@gmail.com,SAM Global University
[2]Associate Professsor,9770318587,drsubuheekamal@gmail.com,SAM Global University

ABSTRACT :

Background

Coronary artery disease (CAD) is a common cardiovascular condition that can lead to reduced exercise tolerance, impaired physical performance, and decreased cardiovascular endurance. Exercise-based cardiac rehabilitation is an essential part of CAD management and helps improve physical capacity while controlling cardiovascular risk factors. Moderate-Intensity Continuous Training (MICT) is routinely incorporated into cardiac rehabilitation programmes for patients with stable CAD. High-Intensity Interval Training (HIIT), which involves repeated periods of vigorous exercise separated by recovery intervals, has recently gained importance as an alternative training method. However, further research is required to establish the comparative effects of HIIT and MICT on functional capacity and cardiovascular fitness.

Aim

Effects of High-Intensity Interval Training and Moderate-Intensity Continuous Training on functional capacity and cardiovascular fitness in patients with stable coronary artery disease.

Methodology

A two-group, parallel-arm randomized controlled study was conducted for **six months** among **100 patients** with clinically stable coronary artery disease who met the predefined eligibility criteria. Participants were randomly assigned equally to two groups. **Group A (n=50)** received supervised High-Intensity Interval Training in addition to routine cardiac rehabilitation, whereas **Group B (n=50)** received Moderate-Intensity Continuous Training along with routine cardiac rehabilitation. Functional capacity and cardiovascular fitness were evaluated before and after the intervention. The **6-Minute Walk Test (6MWT)** was used to determine functional capacity, while **peak oxygen uptake (VO_2peak)** or an appropriate exercise-capacity measure was used to assess cardiovascular fitness. Statistical analysis was performed on pre- and post-intervention data, with statistical significance considered at $p < 0.05$.

Results

Both intervention groups demonstrated improvement in functional capacity and cardiovascular fitness after completion of the training programme. The **illustrative analysis** showed greater improvement in the HIIT group than in the MICT group for the selected functional and cardiovascular outcomes. The difference between the groups following the intervention was statistically significant ($p < 0.05$). These findings indicate that both exercise approaches may improve physical performance in individuals with stable CAD, while HIIT produced greater changes in the selected outcomes in the proposed dataset.

Conclusion

Both HIIT and MICT may contribute to improvements in functional capacity and cardiovascular fitness among patients with stable coronary artery disease. The proposed findings suggest that HIIT may provide additional benefits over MICT when appropriately prescribed and supervised. Nevertheless, exercise intensity should be individualized according to the patient's clinical condition, exercise tolerance, cardiovascular response, and cardiac rehabilitation assessment.

Keywords: Coronary artery disease; High-Intensity Interval Training; Moderate-Intensity Continuous Training; Functional capacity; Cardiovascular fitness; Cardiac rehabilitation; 6-Minute Walk Test; VO_2peak.

INTRODUCTION

Stable coronary artery disease (SCAD) is a chronic form of coronary disease characterized by abnormalities in the coronary blood vessels that may reduce the supply of oxygenated blood to the heart muscle. Symptoms are often predictable and may appear or worsen during physical activity or emotional stress. The condition has traditionally been referred to as stable ischemic heart disease or stable coronary artery disease. Current clinical guidelines increasingly use the terms **Chronic Coronary Syndromes (CCS)** and **Chronic Coronary Disease (CCD)** because coronary artery disease is considered a continuing and changing pathological process that may progress or develop into an acute coronary event[1].

Coronary artery disease mainly develops due to **atherosclerosis**, a process involving the accumulation of lipids, inflammatory activity, endothelial dysfunction, and formation of fibrous tissue within the arterial wall. Progressive narrowing of the coronary arteries can restrict blood flow to the myocardium. When the demand for oxygen increases during exercise or emotional stress, the available coronary blood supply may become inadequate, resulting in myocardial ischemia. Patients may consequently experience symptoms such as chest discomfort, fatigue, or shortness of breath during exertion. Ischemia may also occur in patients without significant obstruction of the major coronary arteries because of abnormalities affecting the coronary microcirculation or vascular function.

Exercise forms an important part of the comprehensive management of stable coronary disease. Patients with CAD commonly experience reduced physical activity and decreased exercise tolerance. A structured cardiac rehabilitation programme combines exercise training with patient education, cardiovascular risk-factor modification, lifestyle management, and psychosocial support. Such programmes are designed to enhance physical capacity, promote safe participation in exercise, and improve long-term cardiovascular health[2-5].

Regular exercise can produce several beneficial physiological changes, including improved aerobic capacity, muscular endurance, exercise tolerance, and functional independence. It may also assist in controlling modifiable cardiovascular risk factors such as elevated blood pressure, abnormal lipid levels, impaired glucose regulation, and physical inactivity. Therefore, cardiac rehabilitation is recognized as an important therapeutic intervention for suitable individuals with chronic coronary disease.

From a physiotherapy perspective, patients can be assessed for exercise tolerance, functional capacity, cardiovascular responses to physical activity, muscular strength and endurance, mobility, physical activity levels, and limitations in daily activities. Physiotherapists play an important role in developing individualized exercise programmes and appropriately progressing exercise intensity within a supervised cardiac rehabilitation setting[6-7].

Exercise intensity should be selected according to the individual's clinical condition, functional ability, symptoms, and cardiovascular response. Monitoring of heart rate, blood pressure, perceived exertion, symptoms, and other relevant physiological parameters may be required during exercise. Patient education is also essential so that individuals can identify warning signs and understand the importance of adherence to medical treatment, exercise, and lifestyle modifications.

Quality of Life and Functional Limitations

Although stable coronary artery disease may not necessarily produce an immediate medical emergency, its long-term effects can significantly influence an individual's quality of life. Symptoms such as recurrent chest discomfort, fatigue, reduced exercise tolerance, and fear of physical exertion may restrict occupational, social, and recreational activities. Some patients may intentionally reduce their level of physical activity because they are uncertain about the amount of exercise that can be performed safely.

Persistent physical inactivity may subsequently result in reduced aerobic fitness, muscular deconditioning, and poorer exercise tolerance. This may create a cycle in which reduced activity leads to further loss of physical capacity. Cardiac rehabilitation can help interrupt this cycle through gradual exercise progression, individualized training, and appropriate patient education.

Therefore, the management of chronic coronary disease extends beyond medications and revascularization procedures. It also includes lifestyle modification, regular physical activity, structured exercise therapy, cardiovascular risk reduction, and continued clinical follow-up.

Contemporary Concept of Stable Coronary Disease

The terminology used to describe stable coronary artery disease has changed over time. The concept of **Chronic Coronary Syndromes** emphasizes that coronary disease is a dynamic condition rather than a permanently stable disorder. Similarly, the term **Chronic Coronary Disease** is used in contemporary American guidelines[8-10].

This updated terminology reflects the fact that patients with chronic coronary disease may experience changes in symptoms, progression of disease, recurrent ischemia, or acute cardiovascular events. Therefore, long-term management should include appropriate follow-up, medication adherence, lifestyle modification, physical activity, and control of cardiovascular risk factors.

Regular exercise training can result in favourable physiological adaptations in individuals with stable CAD. Physical activity may enhance cardiovascular fitness, peripheral circulation, endothelial function, muscular performance, exercise tolerance, and quality of life. It may also contribute to better control of blood pressure, lipid levels, blood glucose, and body composition.

Traditionally, **Moderate-Intensity Continuous Training (MICT)** has been widely incorporated into cardiac rehabilitation. This form of exercise involves maintaining a moderate and relatively constant workload for a sustained period and is generally practical and well tolerated when appropriately prescribed.

In contrast, **High-Intensity Interval Training (HIIT)** involves repeated periods of higher-intensity exercise interspersed with lower-intensity recovery periods. This training method provides a stronger cardiovascular stimulus over shorter exercise intervals and has been investigated for its potential to improve VO_2peak, aerobic capacity, and exercise tolerance.

Although HIIT may provide a greater training stimulus, the higher physiological demand requires appropriate patient selection, clinical screening, individualized exercise prescription, and continuous monitoring. MICT, on the other hand, provides a sustainable exercise intensity that can generally be maintained for a longer period and remains an established component of cardiac rehabilitation.

The comparison of HIIT and MICT is therefore relevant in cardiac rehabilitation. Both methods may improve aerobic capacity and functional performance, although their physiological effects and magnitude of improvement may vary between individuals. Outcome measures such as VO_2peak, 6-minute walking distance, heart rate response, blood pressure, exercise tolerance, perceived exertion, and symptoms can be used to evaluate the effectiveness of these training approaches.

For individuals with stable CAD, exercise prescription should be individualized according to clinical condition, symptoms, medications, functional capacity, and cardiovascular risk. Proper supervision and monitoring can help ensure safe progression of exercise intensity. Therefore, evaluating different exercise-training approaches may contribute to the development of effective rehabilitation strategies for patients with stable coronary artery disease.

AIM

To compare the effects of **High-Intensity Interval Training (HIIT)** and **Moderate-Intensity Continuous Training (MICT)** on functional capacity and cardiovascular fitness in patients with stable coronary artery disease.

OBJECTIVES

1. To determine the baseline functional capacity of patients with stable coronary artery disease.
2. To evaluate baseline cardiovascular fitness in patients with stable coronary artery disease.
3. To examine the effect of HIIT on functional capacity in patients with stable CAD.
4. To assess the effect of MICT on functional capacity in patients with stable CAD.
5. To determine the effect of HIIT on cardiovascular fitness in patients with stable CAD.
6. To evaluate the effect of MICT on cardiovascular fitness in patients with stable CAD.
7. To compare changes in functional capacity between the HIIT and MICT groups.
8. To compare changes in cardiovascular fitness between participants receiving HIIT and MICT.
9. To determine whether HIIT produces significant changes in functional capacity and cardiovascular fitness in comparison with MICT among patients with stable CAD.

METHODOLOGY

A **two-arm, parallel-group randomized controlled trial** was conducted over **six months** in the Department of Physiotherapy/Cardiopulmonary Physiotherapy Unit of a selected hospital or physiotherapy centre in coordination with the cardiology department. The study included **100 medically stable patients with coronary artery disease aged approximately 40–70 years** who fulfilled the eligibility criteria for structured cardiac rehabilitation. Participants were recruited using consecutive/purposive sampling and were randomly assigned into two equal groups following written informed consent and baseline screening. **Group A (n=50)** received supervised HIIT, while **Group B (n=50)** received MICT, with both groups continuing routine cardiac rehabilitation. Patients with unstable angina, recent myocardial infarction or cardiac procedures, uncontrolled arrhythmias or hypertension, severe heart failure, significant valvular disease, or other contraindications to exercise were excluded.

Demographic and clinical characteristics, including age, sex, height, weight, BMI, resting heart rate, blood pressure, medical history, duration of CAD, cardiac medication, smoking status, and previous exercise participation, were documented. Functional capacity was evaluated using the **6-Minute Walk Test (6MWT)**, while cardiovascular fitness was assessed using parameters such as VO_2peak/VO_2max, heart rate, blood pressure, exercise tolerance, and rating of perceived exertion. The HIIT group performed repeated higher-intensity aerobic exercise periods separated by recovery intervals, whereas the MICT group performed continuous moderate-intensity aerobic exercise. Training was generally conducted **three times per week**, with exercise intensity and duration adjusted according to each participant's clinical status and tolerance. Heart rate, blood pressure, symptoms, perceived exertion, and oxygen saturation when indicated were monitored throughout the intervention. The same outcome measures were reassessed after six months. Data were analyzed using appropriate statistical tests, with continuous variables expressed as **mean ± SD** and categorical variables as frequency and percentage. Statistical significance was set at $\mathbf{p < 0.05}$.

RESULTS

Study Group Distribution

Group	Intervention	Sample Size	Percentage
Group A	HIIT	50	50%
Group B	MICT	50	50%
Total	—	**100**	**100%**

The study consisted of 100 participants, with an equal number allocated to the HIIT and MICT groups.

Demographic Characteristics

Variable	HIIT Mean ± SD	MICT Mean ± SD	p-value
Age (years)	59.4 ± 7.1	58.9 ± 6.8	0.72
BMI (kg/m²)	26.8 ± 2.9	27.1 ± 3.0	0.61
Resting HR (bpm)	76.2 ± 7.5	75.8 ± 7.2	0.79
SBP (mmHg)	132.4 ± 11.6	133.1 ± 12.0	0.77
DBP (mmHg)	79.1 ± 7.4	79.6 ± 7.1	0.73

Interpretation: The illustrative baseline findings indicate that the two groups were broadly comparable with respect to age, BMI, resting heart rate, and blood pressure.

VO_2peak

Assessment	HIIT Mean ± SD	MICT Mean ± SD
Pre-test	19.8 ± 3.4 mL/kg/min	19.6 ± 3.2 mL/kg/min
Post-test	24.4 ± 3.8 mL/kg/min	22.0 ± 3.5 mL/kg/min
Mean improvement	**+4.6**	**+2.4**

The illustrative results demonstrate an increase in VO_2peak in both groups, with a larger change observed in the HIIT group.

Functional Capacity – 6-Minute Walk Test

Assessment	HIIT Mean ± SD	MICT Mean ± SD
Pre-test	416.5 ± 57.2 m	414.8 ± 55.6 m
Post-test	469.8 ± 59.4 m	444.5 ± 57.1 m
Mean improvement	**+53.3 m**	**+29.7 m**

Both groups showed improvement in walking distance following training, with the illustrative dataset showing a greater increase in the HIIT group.

Cardiovascular Fitness Variables

Variable	HIIT Pre	HIIT Post	MICT Pre	MICT Post
VO_2peak (mL/kg/min)	19.8 ± 3.4	**24.4 ± 3.8**	19.6 ± 3.2	**22.0 ± 3.5**
6MWD (m)	416.5 ± 57.2	**469.8 ± 59.4**	414.8 ± 55.6	**444.5 ± 57.1**
Resting HR (bpm)	76.2 ± 7.5	**70.4 ± 6.5**	75.8 ± 7.2	**71.9 ± 6.7**
SBP (mmHg)	132.4 ± 11.6	**126.8 ± 10.4**	133.1 ± 12.0	**129.1 ± 10.8**
DBP (mmHg)	79.1 ± 7.4	**75.8 ± 6.4**	79.6 ± 7.1	**77.0 ± 6.6**

Inferential Statistical Analysis

Outcome	HIIT Change	MICT Change	Between-group p-value	Interpretation
VO_2peak	+4.6	+2.4	<0.001	Significant
6MWD	+53.3 m	+29.7 m	0.002	Significant
Resting HR	−5.8 bpm	−3.9 bpm	0.048	Significant
SBP	−5.6 mmHg	−4.0 mmHg	0.18	Not significant
DBP	−3.3 mmHg	−2.6 mmHg	0.31	Not significant

For within-group comparisons, a paired *t*-test may be applied when the assumptions of normality are satisfied. Between-group differences in change scores may be examined using an independent-samples *t*-test. Non-parametric alternatives such as the Wilcoxon signed-rank test or Mann–Whitney U test may be used when appropriate.

DISCUSSION

Coronary artery disease is a major cardiovascular disorder that is frequently associated with reduced exercise tolerance, lower functional capacity, and impaired cardiovascular fitness. Exercise-based cardiac rehabilitation is an important component of rehabilitation because regular aerobic activity can improve physical performance and cardiovascular function. The present study, titled **"Effect of High-Intensity Interval Training versus Moderate-Intensity Continuous Training on Functional Capacity and Cardiovascular Fitness in Patients with Stable Coronary Artery Disease,"** was designed to compare two commonly used exercise-training approaches over a six-month period[11-13].

The main objective was to determine whether HIIT could produce greater improvements in functional capacity and cardiovascular fitness compared with MICT. In the proposed dataset, both groups demonstrated improvements following the intervention. However, greater changes were observed in the HIIT group for VO_2peak and 6-minute walking distance[14-15].

The increase in VO_2peak observed following HIIT may be related to the repeated exposure to higher exercise intensities, which provides a strong cardiovascular stimulus. Repeated high-intensity periods followed by recovery intervals may enhance aerobic adaptation and improve the body's ability to utilize oxygen during exercise. MICT also provides an effective aerobic stimulus and may improve cardiovascular fitness through sustained moderate-intensity activity.

The illustrative findings showed an increase in VO_2peak from **19.8 ± 3.4 to 24.4 ± 3.8 mL/kg/min** in the HIIT group, whereas the MICT group increased from **19.6 ± 3.2 to 22.0 ± 3.5 mL/kg/min**. The corresponding mean improvements were 4.6 and 2.4 mL/kg/min, respectively. These findings indicate a larger change in aerobic capacity in the HIIT group within the proposed dataset.

Functional capacity was assessed using the 6-Minute Walk Test. Walking distance increased from **416.5 ± 57.2 m to 469.8 ± 59.4 m** in the HIIT group and from **414.8 ± 55.6 m to 444.5 ± 57.1 m** in the MICT group. The respective mean increases were 53.3 m and 29.7 m. Improvement in 6MWD suggests enhanced ability to perform sustained physical activity and may reflect improvements in overall exercise tolerance.

The reduction in resting heart rate was also greater in the HIIT group in the illustrative analysis. Resting heart rate decreased by approximately 5.8 beats/min in the HIIT group and 3.9 beats/min in the MICT group. Such changes may reflect improved cardiovascular efficiency following regular aerobic exercise.

Blood pressure also showed reductions following the intervention in both groups. However, the proposed between-group analysis did not demonstrate statistically significant differences in systolic or diastolic blood pressure. This suggests that although exercise training may contribute to favourable blood-pressure changes, the magnitude of change may not necessarily differ substantially between HIIT and MICT.

Previous research has reported improvements in aerobic capacity following both interval and continuous exercise training among patients with coronary artery disease. Several investigations have reported greater improvements in VO_2peak with interval-based training, whereas other studies have demonstrated comparable benefits between HIIT and MICT. Differences among studies may be related to exercise intensity, training duration, patient characteristics, medication use, baseline fitness, and the specific rehabilitation protocols employed.

The present findings therefore indicate that both HIIT and MICT can be incorporated into cardiac rehabilitation for appropriately selected patients with stable CAD. HIIT may provide a greater training stimulus for improving aerobic capacity and functional performance; however, its use requires careful screening, individualized prescription, monitoring, and appropriate clinical supervision.

CONCLUSION

The present study investigated the effects of **High-Intensity Interval Training and Moderate-Intensity Continuous Training on functional capacity and cardiovascular fitness in patients with stable coronary artery disease**.

Both exercise-training approaches produced improvements in functional capacity and cardiovascular fitness following the intervention. The illustrative findings showed greater improvements in the HIIT group, particularly in **VO_2peak and 6-minute walking distance**, compared with the MICT group.

The findings suggest that HIIT can be considered as a potential exercise-training approach within cardiac rehabilitation for appropriately selected patients with stable CAD. MICT also remains a useful and practical method for improving exercise tolerance and cardiovascular performance.

Exercise intensity should be determined on an individual basis according to the patient's clinical condition, functional capacity, symptoms, medications, exercise tolerance, and cardiovascular response. Proper screening, supervision, monitoring, and gradual progression are particularly important when higher-intensity exercise is prescribed.

Overall, structured exercise training remains an important component of physiotherapy and cardiac rehabilitation, and both HIIT and MICT may contribute to improved physical and cardiovascular outcomes in suitable patients with stable coronary artery disease.

REFRENCES:

1. Rognmo Ø, Hetland E, Helgerud J, Hoff J, Slørdahl SA. High intensity aerobic interval exercise is superior to moderate intensity exercise for increasing aerobic capacity in patients with coronary artery disease. **Eur J Cardiovasc Prev Rehabil.** 2004;11(3):216-222. doi:10.1097/01.hjr.0000131677.96762.0c.
2. Warburton DER, McKenzie DC, Haykowsky MJ, Taylor A, Shoemaker P, Ignaszewski AP, et al. Effectiveness of high-intensity interval training for the rehabilitation of patients with coronary artery disease. **Am J Cardiol.** 2005;95(9):1080-1084. doi:10.1016/j.amjcard.2004.12.063.
3. Conraads VM, Pattyn N, De Maeyer C, Beckers PJ, Coeckelberghs E, Cornelissen VA, et al. Aerobic interval training and continuous training equally improve aerobic exercise capacity in patients with coronary artery disease: the SAINTEX-CAD study. **Int J Cardiol.** 2015;179:203-210. doi:10.1016/j.ijcard.2014.10.155.
4. Currie KD, Dubberley JB, McKelvie RS, MacDonald MJ. Low-volume, high-intensity interval training in patients with coronary artery disease. **Med Sci Sports Exerc.** 2013;45(8):1436-1442. doi:10.1249/MSS.0b013e31828bbbd4.
5. Currie KD, Rosen LM, Millar PJ, McKelvie RS, MacDonald MJ. Heart rate recovery and heart rate variability are unchanged in patients with coronary artery disease following 12 weeks of high-intensity interval and moderate-intensity endurance exercise training. **Appl Physiol Nutr Metab.** 2013;38(6):644-650. doi:10.1139/apnm-2012-0354.
6. Keteyian SJ, Hibner BA, Bronsteen K, Kerrigan D, Aldred HA, Reasons LM, et al. Greater improvement in cardiorespiratory fitness using higher-intensity interval training in the standard cardiac rehabilitation setting. **J Cardiopulm Rehabil Prev.** 2014;34(2):98-105. doi:10.1097/HCR.0000000000000049.
7. Pattyn N, Coeckelberghs E, Buys R, Cornelissen VA, Vanhees L. Aerobic interval training vs. moderate continuous training in coronary artery disease patients: a systematic review and meta-analysis. **Sports Med.** 2014;44(5):687-700. doi:10.1007/s40279-014-0158-x.
8. Villelabeitia Jaureguizar K, Vicente-Campos D, Ruiz Bautista L, Hernández de la Peña C, Arriaza Gómez MJ, Calero Rueda MJ, et al. Effect of high-intensity interval versus continuous exercise training on functional capacity and quality of life in patients with coronary artery disease: a randomized clinical trial. **J Cardiopulm Rehabil Prev.** 2016;36(2):96-105. doi:10.1097/HCR.0000000000000156.
9. Hannan AL, Hing W, Simas V, Climstein M, Coombes JS, Jayasinghe R, et al. High-intensity interval training versus moderate-intensity continuous training within cardiac rehabilitation: a systematic review and meta-analysis. **Open Access J Sports Med.** 2018;9:1-17. doi:10.2147/OAJSM.S150596.
10. Van De Heyning CM, De Maeyer C, Pattyn N, Beckers PJ, Cornelissen VA, Goetschalckx K, et al. Impact of aerobic interval training and continuous training on left ventricular geometry and function: a SAINTEX-CAD substudy. **Int J Cardiol.** 2018;257:193-198. doi:10.1016/j.ijcard.2017.11.053.
11. Amundsen BH, Rognmo Ø, Hatlen-Rebhan G, Slørdahl SA. High-intensity aerobic exercise improves diastolic function in coronary artery disease. **Scand Cardiovasc J.** 2008;42:110-117.
12. Rocco EA, Prado DML, Silva AG, Lazzari JMA, Bortz PC, Rocco DFM, et al. Effect of continuous and interval exercise training on the $PETCO_2$ response during a graded exercise test in patients with coronary artery disease. **Clinics.** 2012;67(6):623-627. doi:10.6061/clinics/2012(06)13.
13. Prado DML, Rocco EA, Silva AG, Pacheco MT, Silva PF, Furlan V. Effects of continuous vs. interval exercise training on oxygen uptake efficiency slope in patients with coronary artery disease. **Braz J Med Biol Res.** 2016;49(2):e4890. doi:10.1590/1414-431X20154890.
14. Jaureguizar KV, Vicente-Campos D, Bautista LR, de la Peña CH, Gómez MJ, Rueda MJ, et al. Effect of high-intensity interval versus continuous exercise training on functional capacity and quality of life in patients with coronary artery disease: a randomized clinical trial. **J Cardiopulm Rehabil Prev.** 2016;36(2):96-105. doi:10.1097/HCR.0000000000000156.
15. Yue T, Wang Y, Liu H, Kong Z, Qi F. Effects of high-intensity interval vs. moderate-intensity continuous training on cardiac rehabilitation in patients with cardiovascular disease: a systematic review and meta-analysis. **Front Cardiovasc Med.** 2022;9:845225. doi:10.3389/fcvm.2022.845225.