

The Scientific Journal of
Medical Scholar

Available online at Journal Website
<https://realpublishers.us/index.php/sjms/index>
Subject (Physical Therapy)



Original Article

Effectiveness of Exercise Training in Peripheral Artery Disease- A mini review

Asmaa Khfagy¹; Heba Ali Abdelghafar²; Ihab Nabil³; Ahmed Mahdi Ahmed²

¹Physical Therapist at Physical Therapy Department, Ghamra Military Hospital, Cairo, Egypt.

²Department of Physical Therapy for Cardiovascular and Respiratory Disorders, Faculty of Physical Therapy, Cairo University, Cairo, Egypt.

³Consultant, Head of Vascular Surgery Department at the National Diabetes Institute and Dean of the Institute, Cairo, Egypt.

Article information: Received: January, 7th, 2025; Accepted: February 18th, 2025; DOI: 10.55675/sjms.v4i1.128

Citation: Khfagy A, Abdelghafar HA, Nabil I, Ahmed AM. Effectiveness of Exercise Training in Peripheral Artery Disease- A mini review. SJMS 2025 Jan-Feb; 4 (1): 35-. DOI: 10.55675/sjms.v4i1.128

ABSTRACT

Background: Peripheral Artery Disease (PAD) is a circulatory disorder characterized by the narrowing of arteries, which reduces blood flow to the limbs and leads to symptoms such as claudication. This study aimed to compare the effects of traditional supervised exercise therapy (SET) and low-volume high-intensity interval training (HIIT) on physical functional performance, vascular health, and health-related quality of life (HRQOL) in patients with PAD. In addition, to summarizing the available literature related to the topic.

Methodology: In addition to reviewing literature, we conducted a randomized interventional study, which included 60 Fontaine stage II PAD patients. Their age ranged from 55 to 65 years. Patients were randomly allocated into two equal groups: Group A, received traditional supervised exercises training, and group B received low volume (HIIT) for 12 weeks, 3 times per week. All patients were evaluated in a standard manner with routine laboratory work-up. The clinical outcome measures were recorded. Then, a scoping review was conducted to delineate the emerging concepts and applications of high intensity interval training for enhancing, Ankle-Brachial Index, Quality of Life, Cholesterol Levels, Walking Impairment Questionnaire.

Conclusion: HIIT is an effective and safe approach for peripheral artery disease. The available evidence confirmed its efficacy and safety.

Keywords: Peripheral Artery Disease; Exercise Training; Ankle-Brachial Index; Quality of Life; Walking Impairment Questionnaire.



This is an open-access article registered under the Creative Commons, ShareAlike 4.0 International license (CC BY-SA 4.0) (<https://creativecommons.org/licenses/by-sa/4.0/legalcode>).

* Corresponding author

Email: Asmaakhfagy1@gmail.com

INTRODUCTION

Peripheral Artery Disease (PAD) is a common and serious vascular condition characterized by arterial narrowing or blockage. The commonest cause is mainly atherosclerosis. PAD is widely prevalent as it affects over 200 million people worldwide. Its prevalence increasing with age and in individuals with risk factors (e.g., a history of hypertension, smoking, or diabetes)⁽¹⁾. The clinical manifestations of PAD vary widely, from asymptomatic cases to severe manifestations (e.g., critical limb ischemia and intermittent claudication). This variability often leads to under diagnosis and inadequate treatment, contributing to significant morbidity and mortality. In addition, PAD is associated with an increased risk of cardiovascular events such as stroke and myocardial infarction⁽²⁾.

Subjects with PAD also often complain of reduced walking capacity and a diminished quality of life (QoL). Low-Volume High-Intensity Interval Training (HIIT) has emerged as a promising exercise modality for PAD patients. HIIT involves short bursts of high-intensity exercises followed by low-intensity recovery periods. This type of exercise has shown potential for significant cardiovascular and functional benefits⁽³⁾.

The rationale for using HIIT in PAD patients lies in its ability to improve endothelial function, reduce arterial stiffness and enhance overall cardiovascular health⁽⁴⁾.

Supervised (traditional) exercise therapy (SET) is effective. However, it needs more time compared to HIIT. Given that HIIT is more time-efficient, it is essential to assess its effectiveness relative to SET⁽⁵⁾.

Early studies suggested that patients may report equal or greater enjoyment with HIIT and demonstrated comparable or better adherence to the exercise regimen⁽⁶⁾.

This randomized clinical trial aims to compare the effects of SET and low-volume HIIT on physical functional performance (PF), QOL, and the Ankle-Brachial Index (ABI).

RESEARCH OBJECTIVE

This mini-review aims to summarize the existing data comparing high-intensity interval training (HIIT) and traditional exercise training (SET) on physical functional performance in patients with PAD.

SEARCH STRATEGY

In addition to the clinical part of the study, a scoping review was conducted to explore emerging applications of HIIT for improving ABI, QOL, cholesterol levels, and results from the Walking Impairment Questionnaire (WIQ). The main research databases searched include PubMed, ScienceDirect, SpringerLink, and Wiley Interscience.

RESULTS AND DISCUSSION

In short, the results of the current work showed that, HIIT had better outcome than SET for all assessed domains. We will go in depth to summarize the available literature subsequently.

PAD is a prevalent circulatory disorder characterized by reduced blood flow to the extremities due to artery obstruction with significant morbidity and mortality⁽⁷⁾. Exercise therapy is a cornerstone in managing PAD, aimed at improving QOL and physical function. Studies have shown that SET can significantly enhance walking performance and alleviate symptoms in PAD patients⁽⁸⁾.

Gardner et al.⁽⁹⁾ reported Minimal Clinically Important Difference (MCID) thresholds for Peak Walking Time (PWT) in supervised exercise programs: 38 seconds (small), 95 seconds (moderate), and 152 seconds (large). These results suggest that increasing PWT by up to 4 minutes through walking interventions could be a valuable goal for improving outcomes in symptomatic PAD patients.

A meta-analysis and systematic review further supports the efficacy of HIIT. It demonstrating significant improvements in flow-mediated dilation (FMD) among participants with cardiometabolic diseases, suggesting similar vascular benefits in PAD patients⁽¹⁰⁾.

While many studies highlight the benefits of HIIT and other exercise modalities for improving vascular function and overall health, some interventions may not yield the expected results. For instance, **Lanting et al.**⁽¹¹⁾ found variations in outcomes based on exercise regimens. **Sadeghi et al.**⁽¹²⁾ reported significant improvements in aerobic performance and reductions in LDL cholesterol, total cholesterol, and triglycerides among participants in the HIIT group compared to a control group, suggesting that HIIT can positively influence lipid profiles.

Artigas-Arias et al.⁽¹³⁾ concluded that HIIT effectively improves both physical and mental components of QOL across different age groups.

Additionally, **Li et al.**⁽¹⁴⁾ observed significant improvements in the Chinese Mini-Physical Performance Test (CM-PPT) and the Montreal Cognitive Assessment (MoCA) scores, indicating enhanced physical and cognitive function.

Brenner et al.⁽¹⁵⁾ found significant improvements in walking performance and self-perception as measured by the WIQ, though ABI remained unchanged. This suggests that home-based, low-intensity walking regimens can enhance physical performance and walking perception without altering ABI, offering a practical alternative to traditional exercise programs.

Different mechanisms are proposed to explain the effectiveness of HIIT for PAD as well as other disease conditions. For example, **Chichagi et al.**⁽¹⁶⁾ conducted a systemic review to determine the

effects of HIIT after Coronary Artery Bypass Graft surgery and concluded that, HIIT therapy improves exercise capacity, the autonomic nervous system, volume overload, and blood pressure regulation.

Liu K *et al.* ⁽¹⁷⁾ demonstrated that, HIIT has a beneficial effect on the cognitive performance. They suggested long-term HIIT as a potential non-pharmacological intervention for cognitive health.

Kumar *et al.* ⁽¹⁸⁾ reported that, in rehabilitation of patients after stroke or myocardial infarction (MI), HIIT significantly improves the cardiovascular fitness. These effects related to improved maximal oxygen consumption, endothelial function and overall cardiac output. In addition, HIIT lead to better glycemic control and lipid lowering or regulation effects. Besides, it improved the quality of life especially after stroke, with regaining mobility, independence and sense of wellbeing. Finally, the safety issue of HIIT in patients with compromised heart is questioned. However, the overall evidence confirmed its safety and tolerance with proper supervision.

Conclusion: The study results, as well as, reviewed literature supports the HIIT over SET. HIIT is a time-efficient exercise alternative to traditional therapy for improving outcomes in PAD management.

Disclosure: There was no conflict of interest or financial disclosure.

REFERENCES

- Houghton JSM, Saratzis AN, Sayers RD, Haunton VJ. New Horizons in Peripheral Artery Disease. *Age Ageing*. 2024 Jun 1;53(6):afae114. doi: 10.1093/ageing/afae114.
- Pabon M, Cheng S, Altin SE, Sethi SS, Nelson MD, Moreau KL, Hamburg N, Hess CN. Sex Differences in Peripheral Artery Disease. *Circ Res*. 2022;130(4):496-511. doi: 10.1161/CIRCRESAHA.121.320702.
- Way KL, Sabag A, Sultana RN, Baker MK, Keating SE, Lanting S, et al. The effect of low-volume high-intensity interval training on cardiovascular health outcomes in type 2 diabetes: A randomised controlled trial. *Int J Cardiol*. 2020 Dec 1; 320: 148-154. doi: 10.1016/j.ijcard.2020.06.019.
- Currie KD, Dubberley JB, McKelvie RS, MacDonald MJ. Low-volume, high-intensity interval training in patients with CAD. *Med Sci Sports Exerc*. 2013;45(8):1436-42. doi: 10.1249/MSS.0b013e31828bbbd4.
- Jelleyman C, Yates T, O'Donovan G, Gray LJ, King JA, Khunti K, Davies MJ. The effects of high-intensity interval training on glucose regulation and insulin resistance: a meta-analysis. *Obes Rev*. 2015 Nov;16(11):942-61. doi: 10.1111/obr.12317.
- Jung ME, Boume JE, Little JP. Where does HIT fit? An examination of the affective response to high-intensity intervals in comparison to continuous moderate- and continuous vigorous-intensity exercise in the exercise intensity-affect continuum. *PLoS One*. 2014 Dec 8;9(12):e114541. doi: 10.1371/journal.pone.0114541.
- Coutinho T, Rooke TW, Kullo IJ. Arterial dysfunction and functional performance in patients with peripheral artery disease: a review. *Vasc Med*. 2011 Jun;16(3):203-11. doi: 10.1177/1358863X11400935.
- Aherne TM, Kheirelseid EAH, Boland M, Carr S, Al-Zabi T, Bashar K, et al. Supervised exercise therapy in the management of peripheral arterial disease - an assessment of compliance. *Vasa*. 2017 May;46(3): 219-222. doi: 10.1024/0301-1526/a000612.
- Gardner AW, Montgomery PS, Wang M. Minimal clinically important differences in treadmill, 6-minute walk, and patient-based outcomes following supervised and home-based exercise in peripheral artery disease. *Vasc Med*. 2018 Aug; 23 (4): 349-357. doi: 10.1177/1358863X18762599.
- Khalafi M, Sakhaei MH, Kazeminasab F, Symonds ME, Rosenkranz SK. The impact of high-intensity interval training on vascular function in adults: A systematic review and meta-analysis. *Front Cardiovasc Med*. 2022 Nov 17; 9:1046560. doi: 10.3389/fcvm.2022.1046560.
- Lanting S, Way K, Sabag A, Sultana R, Gerofi J, Johnson N, et al. The Efficacy of Exercise Training for Cutaneous Microvascular Reactivity in the Foot in People with Diabetes and Obesity: Secondary Analyses from a Randomized Controlled Trial. *J Clin Med*. 2022 Aug 26;11(17): 5018. doi: 10.3390/jcm11175018.
- Sadeghi J, Monazzami A, Taheri Kalani A. Effects of Eight-Week High-Intensity Interval Training on Aerobic Performance, Lipid Profile, and Hematological Indices in Overweight Adolescents. *Jundishapur J Health Sci*. 2021;13(2): e110645. Doi:10.5812/jjhs.110645.
- Artigas-Arias M, Olea MA, San-Martín-Calisto Y, Huard N, Durán-Vejar F, Beltrán-Fuentes F, et al. Anthropometric parameters, lower limb functionality and quality of life after high-intensity interval training in healthy young people versus older adults. *Int j morphol*. 2021;39:1337-44. Doi: 10.4067/S0717-95022021000501337.
- Li L, Liu M, Zeng H, Pan L. Multi-component exercise training improves the physical and cognitive function of the elderly with mild cognitive impairment: a six-month randomized controlled trial. *Ann Palliat Med*. 2021 Aug;10(8):8919-8929. doi: 10.21037/apm-21-1809.
- Brenner IK, Brown CA, Hains SM, Tranmer J, Zelt D, Brown P. Effects of a Low-Intensity Walking Intervention on Walking Performance Measures in Patients with Peripheral Artery Disease. *Athens Journal of Health and Medical Sciences*. 2020; 7(2): 95-108. doi:10.30958/ajhms.9-2-3
- Chichagi F, Alikhani R, Hosseini MH, Azadi K, Shirsalimi N, Ghodsi S, Jameie M. The effects of high-intensity interval training and moderate-intensity continuous training on patients underwent Coronary Artery Bypass Graft surgery; a systematic review. *Am J Cardiovasc Dis*. 2024;14(6):306-317. doi: 10.62347/EWMH1925.
- Liu K, Zhao W, Li C, Tian Y, Wang L, Zhong J, Yan X, Wang Y, Wang L, Wang H. The effects of high-intensity interval training on cognitive performance: a systematic review and meta-analysis. *Sci Rep*. 2024 Dec 30;14(1):32082. doi: 10.1038/s41598-024-83802-9.
- Kumar A, Gupta M, Kohat AK, Agrawal A, Varshney A, Chugh A, et al. Impact of High-Intensity Interval Training (HIIT) on Patient Recovery After Myocardial Infarction and Stroke: A Fast Track to Fitness. *Cureus* 2024;16(11): e73910. doi: 10.7759/cureus.73910.