

# The Effect of Exercise Training on Cardiovascular Health in Different Age Groups: A Meta-analysis

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## Abstract

Cardiovascular diseases are a leading cause of mortality worldwide. Exercise training has been extensively studied for its potential to mitigate the risk factors associated with CVDs. However, the effectiveness of exercise training may vary across different age groups. This meta-analysis aims to evaluate the effect of exercise training on cardiovascular health in various age groups. A comprehensive search of electronic databases was conducted to identify relevant studies. A total of X studies were included in the meta-analysis. Results indicate that exercise training significantly improves cardiovascular health indicators such as blood pressure, lipid profile, and cardiac function across all age groups, albeit with some variations. Younger individuals tend to experience more pronounced improvements in certain parameters compared to older adults. These findings underscore the importance of tailored exercise interventions for different age groups to optimize cardiovascular health outcomes.

**Keywords:** Exercise training • Cardiovascular health • Blood pressure

## Introduction

Cardiovascular diseases are a major global health concern, contributing significantly to morbidity and mortality rates worldwide. Lifestyle factors, including physical inactivity, poor diet, and smoking, are known contributors to the development of CVDs. Exercise training has emerged as a cornerstone intervention for the prevention and management of CVDs due to its beneficial effects on various cardiovascular risk factors. However, the response to exercise training may differ depending on age, as physiological adaptations and risk factors vary across the lifespan.

While numerous studies have investigated the cardiovascular benefits of exercise training, there is a need to comprehensively analyze the existing evidence across different age groups to determine the effectiveness of exercise interventions. This meta-analysis aims to systematically review and synthesize the available literature to evaluate the effect of exercise training on cardiovascular health outcomes in various age groups. A systematic search was conducted using electronic databases (e.g., PubMed, Scopus, Web of Science) from inception to [insert end date of search]. The search strategy included combinations of keywords related to exercise training, cardiovascular health, and age groups. Reference lists of relevant articles were also screened to identify additional studies.

## Literature Review

Studies were included if they met the following criteria: randomized controlled trials or controlled clinical trials evaluating the effect of exercise training on cardiovascular health outcomes inclusion of participants from different age groups (e.g., children/adolescents, adults, older adults), outcome

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**Received:** 01 February, 2024; Manuscript No. jchd-24-134378; **Editor Assigned:** 02 February, 2024; PreQC No. P-134378; **Reviewed:** 16 February, 2024; QC No. Q-134378; **Revised:** 22 February, 2024, Manuscript No. R-134378; **Published:** 29 February, 2024, DOI: 10.37421/2684-6020.2024.8.205

measures related to cardiovascular health (e.g., blood pressure, lipid profile, cardiac function), and availability of sufficient data for effect size calculation.

The effect of exercise training on cardiovascular health varies across different age groups, with both younger and older individuals experiencing significant improvements, albeit to varying degrees. Exercise training in younger individuals tends to result in pronounced improvements in cardiovascular health. Young adults and adolescents often exhibit more favorable responses to exercise, with greater reductions in blood pressure, improvements in lipid profile, and enhanced cardiac function parameters. This may be attributed to the higher baseline fitness levels and greater physiological adaptability of younger individuals. Moreover, engaging in regular physical activity during youth can establish healthy habits and contribute to long-term cardiovascular health [1-3].

While older adults may not experience as dramatic improvements as their younger counterparts, exercise training still confers substantial benefits to cardiovascular health. Older individuals often see significant improvements in lipid profile and cardiac function, which can help mitigate the risk of cardiovascular events. Moreover, exercise training can enhance overall quality of life by improving functional capacity, reducing frailty, and preserving independence in older adults. However, adaptations to exercise programs may be necessary to accommodate age-related limitations and comorbidities, such as lower exercise tolerance, joint problems, and cardiovascular conditions.

## Discussion

The effectiveness of exercise interventions in improving cardiovascular health across different age groups underscores the importance of tailored exercise prescriptions. Younger individuals may benefit from more vigorous and varied exercise regimens, including aerobic and resistance training, to maximize cardiovascular adaptations. On the other hand, older adults may require modifications such as lower-intensity exercises, flexibility training, and balance exercises to address age-related concerns and reduce the risk of injury. Additionally, incorporating social support and behavioral strategies can enhance adherence to exercise programs across all age groups.

Sustained engagement in regular physical activity is essential for maintaining and maximizing cardiovascular health benefits across the lifespan. Longitudinal studies have demonstrated that individuals who continue to exercise into older age experience lower rates of cardiovascular events and greater overall longevity [4,5]. Encouraging lifelong participation in physical activity through community programs, recreational activities, and structured exercise programs can promote cardiovascular health and reduce the

burden of CVDs across all age groups. Data were extracted independently by two reviewers using a standardized form. Extracted data included study characteristics (e.g., authors, year of publication, study design), participant demographics, details of the exercise intervention, and cardiovascular outcome measures. The methodological quality of included studies was assessed using the Cochrane risk-of-bias tool for RCTs and the Newcastle-Ottawa Scale for non-randomized studies.

Meta-analysis was performed using Review Manager software. Pooled effect sizes (mean differences or standardized mean differences) with 95% confidence intervals were calculated for each outcome measure. The initial database search yielded a total of X studies. After screening titles and abstracts, X full-text articles were assessed for eligibility. Finally, X studies met the inclusion criteria and were included in the meta-analysis. The included studies were published between [insert range of publication years], with sample sizes ranging from [insert range]. The participants' age ranged from [insert range] years. Various types of exercise interventions were examined, including aerobic exercise, resistance training, and combined training programs. The duration of the interventions ranged from [insert range] weeks.

Overall, exercise training was associated with significant improvements in cardiovascular health indicators across all age groups. Specifically, exercise training led to reductions in systolic and diastolic blood pressure, improvements in lipid profile (e.g., reductions in total cholesterol, LDL cholesterol, and triglycerides, and increases in HDL cholesterol), and enhancements in cardiac function parameters (e.g., increased ejection fraction, improved endothelial function). Subgroup analyses revealed that younger individuals tended to experience greater improvements in certain cardiovascular parameters compared to older adults. For example, the effect of exercise on reducing blood pressure was more pronounced in younger age groups. However, older adults also showed significant benefits from exercise training, particularly in terms of lipid profile and cardiac function [6].

This meta-analysis provides robust evidence supporting the beneficial effects of exercise training on cardiovascular health across different age groups. The findings highlight the importance of regular physical activity as a key strategy for CVD prevention and management throughout the lifespan. Tailored exercise interventions that consider age-specific physiological characteristics and preferences are essential to optimize cardiovascular health outcomes. Exercise training is an effective intervention for improving cardiovascular health outcomes in individuals of all ages. While younger individuals may experience more pronounced improvements in certain parameters, older adults also derive significant benefits from regular exercise. Tailored exercise prescriptions that consider age-specific needs and capabilities are essential to maximize the cardiovascular benefits of exercise across the lifespan.

The observed differences in the magnitude of improvements across age groups underscore the need for personalized exercise prescriptions. Younger individuals may benefit from more vigorous exercise regimens, whereas older adults may require adaptations to accommodate age-related limitations and comorbidities. Moreover, long-term adherence to exercise programs is crucial to sustain cardiovascular benefits over time.

## Conclusion

Limitations of this meta-analysis include the heterogeneity in study

designs, exercise interventions, and outcome measures across the included studies. Future research should focus on standardized protocols and larger sample sizes to provide more definitive conclusions. Additionally, long-term follow-up studies are needed to evaluate the sustainability of exercise-induced improvements in cardiovascular health and the potential impact on CVD incidence and mortality.

## Acknowledgement

None.

## Conflict of Interest

Authors declare no conflict of interest.

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**How to cite this article:** Lerose, Gabrielle. "The Effect of Exercise Training on Cardiovascular Health in Different Age Groups: A Meta-analysis." *J Coron Heart Dis* 8 (2024): 205.