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THE EFFECT OF EXERCISE ON CARDIOVASCULAR PARAMETERS IN POSTMENOPAUSAL WOMEN: A SYSTEMATIC REVIEW

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ABSTRACT
Menopause is characterized by a decline in estrogen levels that leads to physiological changes increasing cardiovascular risk, including hypertension, dyslipidemia, reduced cardiorespiratory fitness, and vascular dysfunction. Consequently, cardiovascular disease remains a major public health concern among postmenopausal women. This study aimed to systematically review evidence on the effects of exercise on cardiovascular parameters in postmenopausal women and to identify the most effective exercise modalities for cardiovascular health improvement. A literature review was conducted in accordance with PRISMA 2020 guidelines. Electronic searches were performed in PubMed, Scopus, ScienceDirect, and Google Scholar for studies published between 2020 and 2025. Study selection followed predefined inclusion and exclusion criteria based on the PICOS framework. Methodological quality was assessed using the JBI Critical Appraisal Checklist. Fifteen studies met the eligibility criteria and were included in the synthesis. The findings consistently demonstrated that exercise significantly improves cardiovascular outcomes in postmenopausal women. Moderate-intensity aerobic exercise was most frequently associated with reductions in systolic and diastolic blood pressure and improvements in VO_2max. Resistance training improved body composition and cardiometabolic biomarkers, while combined aerobic–resistance programs provided broader cardiovascular benefits. High-intensity interval training yielded marked improvements in cardiorespiratory fitness but requires appropriate supervision. Mind–body exercises were associated with improved autonomic regulation and reduced inflammation. Exercise is a safe and effective strategy for improving cardiovascular health in postmenopausal women. A combination of aerobic, resistance, and complementary exercise modalities is recommended to optimize cardiovascular outcomes and support evidence-based menopausal health management.

Keywords: aerobic training; arterial stiffness; blood pressure; cardiovascular parameters; exercise; postmenopausal women

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INTRODUCTION

Menopause is a biological phase experienced by all women as part of the natural aging process, characterized by the permanent cessation of menstruation due to a decline in ovarian function. This phase typically occurs between the ages of 45 and 55 years and is accompanied by various physiological changes resulting from a significant reduction in estrogen levels. One of the most important consequences of these hormonal changes is an increased risk of cardiovascular disorders. Numerous studies indicate that after entering the postmenopausal period, women experience a marked rise in cardiovascular disease risk because estrogen no longer exerts its protective effects on the vascular system, lipid metabolism, and blood pressure regulation (Parameters & Trial, 2023). From a public health perspective, this condition is of particular concern, as cardiovascular disease remains one of the leading causes of mortality among women worldwide.

Physiologically, estrogen plays a key role in maintaining endothelial function, enhancing vascular elasticity, regulating blood lipid levels, and supporting blood pressure stability. When estrogen levels decline during postmenopause, vascular resistance increases, arterial compliance decreases,

and lipid metabolism is altered, leading to higher LDL and lower HDL levels. These combined changes directly contribute to the development of hypertension, atherosclerosis, reduced cardiorespiratory capacity, and other cardiovascular dysfunctions. Epidemiological data show that postmenopausal women have a two- to threefold higher risk of coronary heart disease compared with premenopausal women. In addition, the prevalence of hypertension increases significantly after menopause, making this population particularly vulnerable to cardiovascular complications (Chang et al., 2025).

Amid this increased risk, exercise represents one of the most effective, accessible, and sustainable non-pharmacological interventions for improving cardiovascular health. A growing body of evidence demonstrates that physical activities such as aerobic exercise, resistance training, and high-intensity interval training (HIIT) can improve maximal oxygen consumption (VO_2 max), reduce blood pressure, enhance endothelial function, and decrease arterial stiffness. Exercise also improves insulin sensitivity, reduces body fat, and optimizes lipid profiles, all of which contribute to lower cardiovascular risk. Consequently, physical activity serves as a crucial strategy for maintaining cardiovascular health in postmenopausal women, who are physiologically more susceptible to functional decline.

However, despite the well-documented benefits of exercise, considerable variability remains regarding the most effective type of exercise, optimal intensity and duration, and the extent to which different exercise modalities influence specific cardiovascular parameters. For example, several studies suggest that aerobic exercise has the greatest impact on improving VO_2 max, whereas resistance training may be more effective in enhancing vascular function and musculoskeletal strength. Meanwhile, HIIT has gained attention as an efficient approach to improving cardiorespiratory fitness within a relatively short time, although concerns persist regarding its safety for women with certain cardiovascular conditions. These inconsistent findings highlight the need for a comprehensive literature review to identify overall patterns and determine the most beneficial forms of exercise for this population (Xi et al., 2025).

Another challenge is the lack of consensus regarding which cardiovascular parameters should be prioritized as primary indicators of exercise effectiveness in postmenopausal women. Parameters such as blood pressure, resting heart rate, VO_2 max, arterial elasticity, and lipid levels are frequently assessed, but not all studies include these measures consistently. This heterogeneity complicates the synthesis of evidence and the formulation of general conclusions regarding exercise as a health intervention. Therefore, a structured literature review is essential to integrate and critically analyze existing findings to provide a clearer and more comprehensive understanding.

Based on this background, the present study employs a literature review approach to summarize, compare, and analyze research findings on the effects of exercise on cardiovascular parameters in postmenopausal women. This review was conducted using a systematic search strategy following PRISMA guidelines, including defined search strategies, keyword combinations, inclusion and exclusion criteria based on the PICOS framework, and study quality appraisal. Through this structured approach, the study aims to provide deeper insights into the most effective forms of exercise for improving cardiovascular health in postmenopausal women and to serve as a basis for more targeted physical activity recommendations (Batool & Sabir, 2024).

Overall, re-examining the evidence on exercise and cardiovascular health in postmenopausal women is essential not only for understanding the underlying physiological mechanisms but also for supporting more effective strategies for cardiovascular disease prevention. As life expectancy continues to increase and more women enter the postmenopausal phase, the need for evidence-based lifestyle interventions becomes increasingly urgent. This review is expected to generate relevant scientific information that can be applied in both clinical practice and public health

programs. This study aims to systematically review and synthesize current evidence on the effects of exercise on cardiovascular parameters in postmenopausal women. It also seeks to identify the most effective types, intensity, and duration of exercise for improving cardiovascular health and supporting evidence-based physical activity recommendations.

METHOD

This study employed a literature review approach conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The research protocol was developed prior to the literature search to ensure transparency and methodological consistency, although it was not formally registered in PROSPERO. Article searches were carried out electronically across four major databases PubMed, Scopus, ScienceDirect, and Google Scholar to ensure comprehensive coverage and reduce source bias, and were complemented by a snowballing technique through screening the reference lists of relevant articles. The search strategy used combinations of keywords adapted to MeSH Terms and Subject Headings with Boolean operators (AND, OR), namely ("exercise" OR "physical activity") AND ("cardiovascular parameters" OR "cardiovascular function") AND ("postmenopausal women" OR "post-menopause"). Study selection was guided by predefined inclusion and exclusion criteria based on the PICOS (Population, Intervention, Comparison, Outcome, Study Design) framework to ensure relevance to the research objectives and adequate methodological quality.

Table 1.
PICOS

PICOS	Inclusion Criteria	Exclusion Criteria
P (Population)	Postmenopausal women aged 45–70 years	Premenopausal women or men
I (Intervention)	Aerobic exercise, resistance training, HIIT, flexibility training, or combination exercises	Non-exercise interventions such as medication or hormonal therapy
C (Comparison)	Control group (sedentary), comparison between types of sport	No comparison group
O (Outcome)	Blood pressure, heart rate, VO_2 max, arterial elasticity, lipid profile	Outcome was not related to cardiovascular parameters
S (Study Design)	RCT, quasi-experimental, controlled clinical trial	Review articles, qualitative studies, case reports

The literature search for this review was conducted for studies published between 2020 and 2025 ScienceDirect and the Publish or Perish platforms across three databases Google Scholar, PubMed, and Semantic Scholar by applying keyword combinations including "exercise" OR "physical activity," "cardiovascular parameters" OR "cardiovascular function," and "postmenopausal women" OR "post-menopause." The initial search yielded 116 records from ScienceDirect, 449 from Google Scholar, 18 from Semantic Scholar, and 11 from PubMed, resulting in a total of 594 articles. All retrieved records were managed and screened using Mendeley and Rayyan AI to identify duplicate publications, and no duplicates were detected (n = 0). Title screening was then performed on 573 articles, of which 138 studies were considered potentially relevant and proceeded to abstract screening.

In the subsequent stage, abstracts and full texts were assessed based on predefined inclusion and exclusion criteria. Following this rigorous screening process, 15 articles met the eligibility requirements and were included in the final literature review. The study selection process followed the four standard phases of the PRISMA flow diagram identification, screening, eligibility, and inclusion to ensure a systematic and transparent selection of studies, thereby enhancing the validity and reproducibility of the review findings.

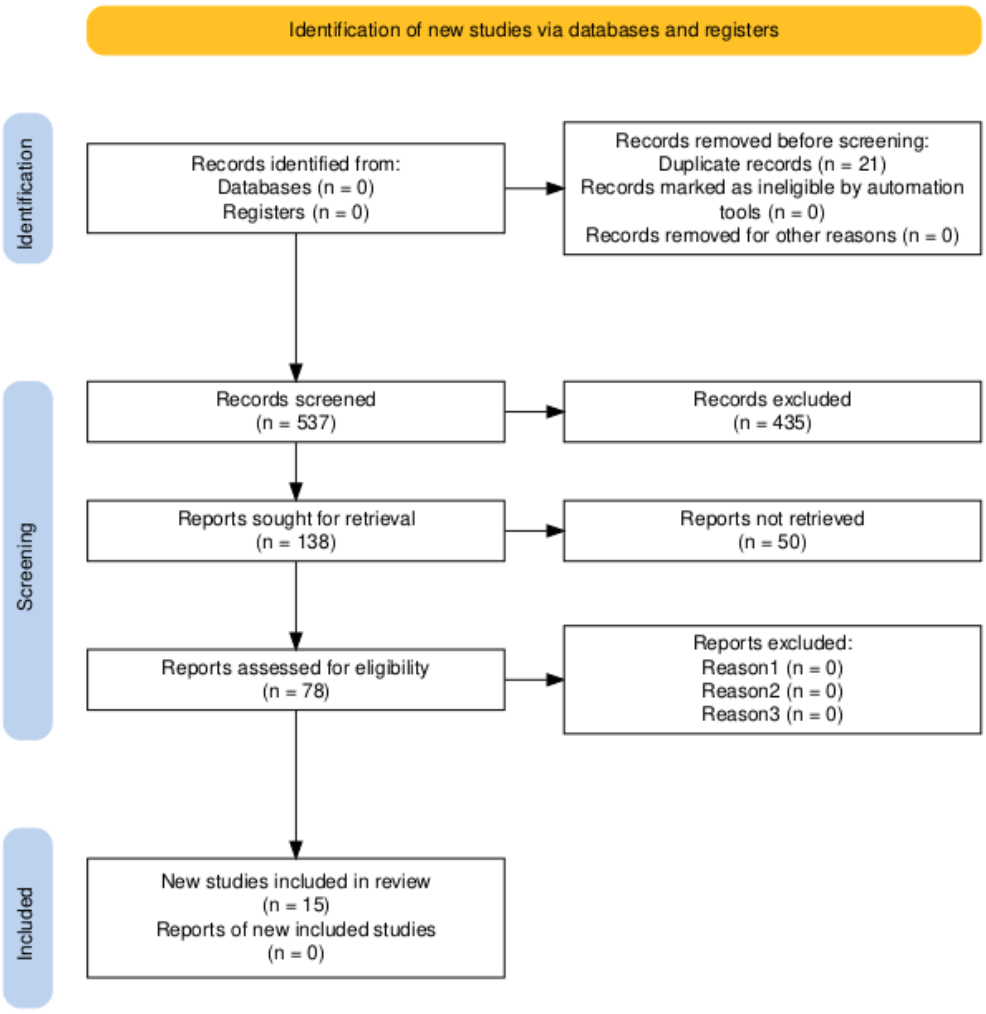

Figure 1. PrismaDiagram

The quality appraisal process was conducted using the JBI Critical Appraisal Checklist as the primary instrument to evaluate the methodological rigor and eligibility of the included studies. Each appraisal item was assessed and categorized as "yes," "no," "unclear," or "not applicable," with a score of 1 assigned to "yes" responses and 0 to all other categories. The scores for each study were summed to obtain a total quality score. Studies achieving at least 50% of the maximum possible score, based on a predefined threshold agreed upon by the researchers, were classified as meeting the inclusion criteria. Studies with low methodological quality were excluded to minimize potential bias and ensure the validity of the review findings. At the final stage of quality screening, 15 studies achieved scores ≥50% and were deemed eligible for synthesis. Overall, the quality appraisal was applied to all 15 studies included in this literature review.

RESULT

A total of 15 scientific articles met the inclusion criteria and were analyzed in this review. Overall, the findings indicate that menopause is associated with an increased cardiovascular risk due to declining estrogen levels, which leads to metabolic, hemodynamic, and body composition changes. However, the reviewed studies consistently demonstrate that exercise can mitigate many of these risk factors by improving endothelial function, enhancing cardiorespiratory fitness, and restoring autonomic cardiac balance.

Most studies reported that postmenopausal women who regularly engage in physical activity exhibit

more stable blood pressure, reduced visceral fat, and improved lipid profiles. Moderate-intensity aerobic exercise was the most frequently identified modality associated with significant improvements, particularly in systolic and diastolic blood pressure. In addition, resistance training and mind–body exercises, such as yoga, were shown to provide complementary benefits by improving heart rate variability (HRV) and reducing systemic inflammation, both of which are important markers of cardiovascular disease risk. To provide a comprehensive overview of the characteristics of the analyzed studies, Table 1 presents a summary of the 15 selected journals. (The table is placed appropriately within the narrative as requested)

Table 1.
Summary of 15 Journals

No	Title, Author, Year	DSVIA	Results/Findings
1	Authors: Malandish & Rahmati-Yamchi Year: 2022 Title: The Effect of Moderate-Intensity Aerobic Exercise on Cardiovascular Function	D: RCT S: 27 overweight/obese postmenopausal women (EX=14; control=13) V: Aerobic exercise → cardiac function, VO_2max I: Echocardiography, treadmill test A: ANCOVA / between-groups test	The exercise group showed an increase in VO_2max ($p=0.001$), LVEF ($p=0.001$), and a decrease in LVESD ($p=0.013$); almost all intervention participants experienced improvements in cardiovascular function.
2	Authors: Hoier et al. Year: 2021 Title: Aerobic High-Intensity Exercise Training Improves Cardiovascular Health in Older Postmenopausal Women	D: Pre-post intervention study S: 11 healthy postmenopausal women V: Aerobic HIIT → VO_2max, lipids, blood pressure I: VO_2max test, BP, blood analysis A: Paired statistical analysis	VO_2max increased by 18% ($p<0.001$) and HDL increased ($p<0.05$), while MAP did not change significantly ($p=0.058$); the majority of participants showed improved cardiorespiratory fitness.
3	Author: Sobczak K., Wochna K., Antosiak-Cyrak K., Domaszewska K. Year: 2023 Title: *The Effects of 6-Month Aqua Aerobics Training on Cardiometabolic Parameters in Perimenopausal Women—A Randomized Controlled Trial*	D: Randomized controlled trial S: 30 perimenopausal women (intervention = 14; control = 16) V: Aqua aerobics → WHR, blood pressure, lipids, inflammatory markers I: Bioimpedance, BP monitor, blood tests (lipids & hematology) A: Mann-Whitney U, Wilcoxon test, Spearman correlation	After 6 months, the aqua aerobics group experienced a significant decrease in WHR ($p=0.0009$), DBP ($p=0.0185$), PLR ($p=0.0219$) and LDL-C ($p=0.0277$) as well as an increase in Hb ($p=0.0013$); the majority of intervention participants experienced improvements, while the control group did not show significant cardiometabolic changes.
4	Authors: Poli L., Petrelli A., Fischetti F., et al. Year: 2025 Title: *The Effects of Multicomponent Training on Clinical, Functional, and Psychological Outcomes in Cardiovascular Disease: A Narrative Review*	D: Narrative review S: 10 studies (various designs; total >500 CVD patients) V: Multicomponent training → hemodynamics, physical function, QoL I: Data extraction of previous studies A: Narrative synthesis	Consistently, multicomponent training reduced SBP (≈3–11 mmHg), increased functional capacity (TUG, chair stand, handgrip), and improved quality of life; however, it did not report the number of individual respondents or the combined p-value, as this was a review article.
5	Author: Woodward et al. Year: 2025 Title: Effect of Physical Activity on Cardiorespiratory Fitness and CVD Risk	D: Systematic review & meta-analysis S: 5332 peri/postmenopausal women V: Physical activity → VO_2max, BP I: Published RCT data A: Meta-analysis	Physical activity increased VO_2max by 3.51 ml/kg/min (95% CI 2.75–4.27) and was associated with a decrease in SBP.
6	Authors: Huynh et al. Year: 2024 Title: The Effects of Aerobic Exercise on Cardiometabolic Health	D: Systematic review & meta-analysis S: 4225 postmenopausal women V: Aerobic → BP, lipids, VO_2max I: RCT data A: Random-effects meta-analysis	Aerobic exercise decreased SBP (MD −4.41 mmHg; $p=0.01$) and increased VO_2max (SMD 1.38; $p<0.01$).
7	Authors: Roshan et al. Year: 2024 Title: Low- and Moderate-Volume HIIT with/without	D: Double-blind RCT S: 53 obese menopausal women V: LV-HIIT vs MV-HIIT → VO_2max I: Maximal exercise testing	LV-HIIT and MV-HIIT significantly increased VO_2max ($p=0.01$ and $p=0.028$); most participants experienced an

	Nano-Curcumin	A: Comparative trial	increase in aerobic capacity.
8	Author: Le Bourvellec et al. Year: 2025 Title: Effect of Exercise Modalities on Post-Exercise Hypotension	D: Crossover RCT S: 29 postmenopausal women V: HIIE & IRE → Postexercise BP I: Ambulatory BP monitor A: Repeated measures ANOVA	HIIE reduced SBP 30 minutes post-exercise (−6.1 mmHg; p=0.048), whereas IRE reduced nighttime SBP and DBP (p<0.01).
9	Author: Batool & Sabir Year: 2022 Title: Impact of Low-Volume HIIT and Moderate-Intensity Continuous Training on Physical Performance and Quality of Life among Postmenopausal Women	D: Two-arm RCT S: 40 postmenopausal women (HIIT=20; MICT=20) V: HIIT vs MICT → VO_2max, QoL I: Predicted VO_2max test, QoL questionnaire A: Comparative test between groups	The HIIT group experienced a significant increase in VO_2max (+6.92 ml/kg/min; p=0.01), while MICT was not significant (+2.8 ml/kg/min; p>0.05); the majority of HIIT participants experienced an increase in cardiorespiratory capacity.
10	Authors: Wang et al. Year: 2024 Title: Impact of a Precision Intervention for Vascular Health Using Tai Chi (Bafa Wubu)	D: RCT S: 40 postmenopausal women (exercise=20; control=20) V: Tai Chi → blood pressure, vascular function, lipids I: BP monitor, baPWV, ABI, blood tests A: Mixed-design ANOVA	After 24 weeks, the Tai Chi group showed significant reductions in SBP, baPWV, TC, TG, LDL (p<0.01) and an increase in FMD (p<0.01); most respondents showed vascular improvement compared to controls.
11	Author: Tomeleri et al. Year: 2023 Title: *Effect of Resistance Exercise Order on Cardiovascular Disease Risk Factors in Older Women*	D: Randomized controlled trial S: 44 women >60 years (MJ-SJ n=14; SJ-MJ n=15; control n=15) V: Sequence of resistance training → CVD biomarkers I: DXA, inflammatory biomarkers & lipids A: Two-way ANOVA	Both exercise groups significantly decreased fat mass, LDL, CRP, TNF-α and increased IL-10 (p<0.05), with no differences between exercise orders (p>0.05).
12	Author: Bucciarelli et al. Year: 2021 Title: *Effect of Adherence to Physical Exercise on Cardiometabolic Profile in Postmenopausal Women*	D: Observational pre-post study S: 43 postmenopausal women (TA ≥70% n=26; TA <70% n=17) V: Adherence to exercise → VO_2max, cardiac function, metabolic I: Echocardiography, CPET, blood lab A: Multivariate regression	The TA ≥70% group showed significant improvements in VO_2max, diastolic function, RWT, and glucose (p<0.05), while the TA <70% group showed minimal changes.
13	Authors: Pereira-Monteiro et al. Year: 2024 Title: *Functional and Combined Training Promote Body Recomposition and Lower Limb Strength in Postmenopausal Women*	D: Randomized clinical trial S: 96 postmenopausal women (FT, CT, control) V: FT & CT → body recomposition, leg strength I: Bioimpedance, sit-to-stand test A: Mixed ANOVA (time × group)	FT and CT increased lean mass starting at week 8 and decreased body fat starting at week 12 (p<0.05); the control group experienced no significant changes.
14	Authors: Fischer et al. Year: 2024 Title: *Tipping the Scale: Effects of Physical Activity and Body Composition on Cardiac Parameters in Postmenopausal Females*	D: Cross-sectional study S: 34 postmenopausal women (sedentary n=9; moderately active n=11; highly active n=14) V: Physical activity level → VO_2max & cardiac parameters I: Echocardiography, CPET A: ANOVA between groups	VO_2max was significantly different between groups (SED 24.9; MOD 30.5; HIGH 38.4 mL/kg/min; p<0.05), but there was no significant difference in left ventricular morphology and function (p>0.05).
15	Author: Pekas EJ et al. Year: 2020 Title: *Habitual Combined Resistance and Aerobic Exercise Protects against Age-Associated Decline in Vascular Function and Lipid Profiles in Elderly Postmenopausal Women*	D: Retrospective cohort study S: 101 postmenopausal women (CRAE=57; sedentary=44) V: Combined resistance–aerobic exercise → baPWV, BP, lipids, fitness I: baPWV, sphygmomanometer, lipid profile, 2-min walk test, strength test A: Independent t-test	The CRAE group showed significantly lower baPWV, SBP, LDL, and body fat percentage compared to the sedentary group (p<0.05); 100% of the CRAE group showed a better vascular profile, while the sedentary group showed no improvement.

Based on a review of 15 journals involving peri- and postmenopausal women, exercise

interventions consistently demonstrated positive effects on cardiovascular parameters, cardiorespiratory fitness, and cardiometabolic profiles. According to Rahmati-Yamchi (2022), moderate- to high-intensity aerobic exercise significantly improved cardiorespiratory capacity, as reflected by increased VO_2max, across various modalities, including moderate-intensity aerobic training (Malandish & Rahmati-Yamchi, 2022), high-intensity interval training (HIIT) (Hoier et al., 2021; Woodward et al., 2025; Batool & Sabir, 2024), and water-based exercise such as aqua aerobics (Parameters & Trial, 2023). Bucciarelli et al. (2021) further reported that VO_2max improvements were more pronounced among women with high exercise adherence, as well as among individuals with higher habitual physical activity levels (Fischer et al., 2024). In addition to improvements in cardiorespiratory capacity, several studies reported beneficial changes in structural and hemodynamic cardiovascular function. Moderate-intensity aerobic exercise was associated with improved left ventricular function, indicated by increased left ventricular ejection fraction (LVEF) and reduced left ventricular end-systolic diameter (LVESD). Reductions in systolic and diastolic blood pressure were also observed following aerobic exercise, HIIT, aqua aerobics, Tai Chi, and multimodal training, both acutely after exercise sessions and following short- to long-term interventions (Bourvellec et al., 2024; Nathalie, 2025; Chi & Wubu, 2024).

Multicomponent and combined aerobic–resistance training interventions provided additional benefits for cardiovascular parameters and body composition. Pereira reported that functional and combined training significantly increased lean mass and reduced body fat percentage, whereas no meaningful changes were observed in the control group (Santos et al., 2024). Similarly, Tomeleri et al. (2023) demonstrated that resistance training, regardless of exercise order, significantly reduced cardiovascular risk biomarkers such as LDL cholesterol, C-reactive protein (CRP), and tumor necrosis factor-α (TNF-α), while increasing interleukin-10 levels. Observational and cohort studies further indicated that physically active postmenopausal women or those regularly engaging in combined aerobic–resistance exercise exhibited more favorable vascular and metabolic profiles than their sedentary counterparts. These benefits were reflected in lower brachial-ankle pulse wave velocity (baPWV), systolic blood pressure, LDL levels, and body fat percentage (Pekas et al., 2020), although significant changes in left ventricular morphology were not consistently observed (Fischer et al., 2024).

DISCUSSION

Menopause is characterized by a decline in estrogen levels that leads to physiological changes, including impaired endothelial function, increased arterial stiffness, and alterations in lipid metabolism. These changes make postmenopausal women more vulnerable to cardiovascular disease. Based on the analysis of 15 journals, exercise has been shown to be the most effective non-pharmacological intervention to mitigate the physiological effects of menopause on the cardiovascular system. Physical activity consistently demonstrates benefits in blood pressure regulation, cardiorespiratory capacity, arterial elasticity, and metabolic body composition. Blood pressure is the parameter most frequently reported to improve following aerobic or combined exercise programs. A reduction in systolic blood pressure of approximately 6–10 mmHg has been observed after 8–12 weeks of moderate-intensity aerobic exercise. This improvement is attributed to increased nitric oxide production, which enhances vascular vasodilation and counteracts estrogen-related vasoconstrictive effects. Consequently, exercise plays a crucial role in maintaining hemodynamic regulation in menopausal women (Pekas et al., 2020).

In addition, most studies reported increases in VO_2max, reflecting improvements in cardiorespiratory fitness. Gopal et al. (2020) and Ahmed et al. (2020) found that both resistance training and high-intensity interval training (HIIT) significantly enhanced the body's oxygen transport capacity. These adaptations occur due to improved cardiac output and increased efficiency of oxygen utilization by peripheral tissues. Although HIIT produces the greatest improvements, aerobic exercise remains a safer option for menopausal women who are new to structured physical

activity. Lipid profiles also improve with increased physical activity. Regular exercise reduces LDL cholesterol and triglyceride levels while increasing HDL cholesterol. These changes are associated with enhanced lipoprotein lipase activity and improved lipid metabolism. As menopause tends to increase visceral fat and shift lipid profiles toward a more atherogenic pattern, exercise serves as a key strategy for reducing the risk of atherosclerosis (Batista et al., 2025).

Systemic inflammation, which is closely linked to coronary heart disease risk, also decreases following exercise interventions. Kubota et al. (2022) reported that moderate-intensity aerobic exercise significantly reduced C-reactive protein (CRP) levels. This reduction in inflammation contributes to improved endothelial stability and lowers the risk of vascular damage. Given that menopause induces low-grade chronic inflammation, the anti-inflammatory effects of exercise are particularly important. From the perspective of autonomic nervous system regulation, exercise has been shown to improve heart rate variability (HRV), an important indicator of cardiac health. Pimenta et al. (2019) demonstrated that mind–body exercises such as yoga improved HRV, indicating a better balance between sympathetic and parasympathetic activity. This effect helps reduce physiological stress, which often increases during menopause, thus supporting overall cardiovascular health.

Overall, findings across studies consistently demonstrate that exercise provides broad and protective effects on cardiovascular parameters in postmenopausal women. These benefits include improved blood pressure control, enhanced cardiorespiratory fitness, improved lipid profiles, reduced inflammation, and better autonomic function. These results support the recommendation of exercise as a primary strategy for cardiovascular disease prevention during the postmenopausal period. Moderate-intensity aerobic exercise is the most extensively studied and consistently beneficial form of physical activity for cardiovascular health in postmenopausal women. Activities such as brisk walking, cycling, and swimming enhance blood flow, stimulate nitric oxide release, and improve arterial elasticity. These effects are critical for counteracting the decline in endothelial function commonly observed during menopause, making aerobic exercise a safe and effective option (Sánchez-Delgado et al., 2023).

Resistance training also plays an important role, particularly in improving body composition and metabolic health. Resistance exercise increases muscle mass, reduces body fat, and increases VO_2max. These metabolic adaptations help prevent the development of metabolic syndrome, a condition frequently observed in menopausal women due to hormonal changes. Increased muscle mass increases glucose utilization and reduces cardiometabolic risk (Tomeleri et al., 2023). Exercise modalities that combine aerobic and resistance training offer the most comprehensive benefits. This combination effectively lowers blood pressure, enhances cardiorespiratory fitness, and improves lipid profiles simultaneously. For menopausal women experiencing multidimensional physiological changes, combined training provides a holistic approach to improving cardiovascular and vascular health (Bucciarelli, Bianco, Mucedola, Di Blasio, et al., 2021). HIIT produces the greatest improvements in VO_2max, with gains reported to be up to twice those achieved through moderate-intensity aerobic exercise. However, HIIT is not recommended for all menopausal women, particularly those with uncontrolled hypertension or existing cardiovascular disease, as its high intensity requires careful supervision (Lin & Lee, 2018). Mind–body exercises such as yoga and Pilates also provide important benefits by improving autonomic balance, reducing diastolic blood pressure, and alleviating stress. Pilates has been shown to lower blood pressure, while yoga significantly improves HRV. These effects are especially beneficial for menopausal women who commonly experience anxiety, sleep disturbances, and emotional fluctuations (Woodward et al., 2025).

Beyond structured exercise, daily physical activity also contributes substantially to cardiovascular health. Moderate-intensity daily activities can reduce cardiovascular risk by up to 32%. This finding

highlights that simple activities such as walking, climbing stairs, or gardening can provide meaningful health benefits even in the absence of formal exercise programs (Poli et al., 2025). In conclusion, each type of exercise offers distinct yet complementary benefits. Aerobic exercise is effective for vascular function and blood pressure control, resistance training optimizes body composition, yoga and Pilates support stress regulation, and daily physical activity helps maintain an active lifestyle. A combination of these exercise modalities provides the most optimal approach to improving cardiovascular health in postmenopausal women and should be recommended as a long-term exercise strategy.

CONCLUSION

The literature review of 15 studies indicates that exercise has a significant and consistent effect on improving cardiovascular parameters in postmenopausal women. Regular physical activity reduces blood pressure, enhances cardiorespiratory fitness, improves lipid profiles, decreases systemic inflammation, and supports autonomic nervous system regulation, which is crucial given the increased cardiovascular risk associated with estrogen decline and metabolic changes after menopause. Various exercise modalities provide complementary benefits, including aerobic training for vascular function, resistance exercise for body composition and metabolism, and mind–body activities such as yoga and Pilates for stress reduction and autonomic balance. In addition, daily physical activity contributes meaningfully to cardiovascular risk reduction. Overall, exercise can be recommended as an effective non-pharmacological strategy for maintaining cardiovascular health in postmenopausal women and should be promoted as an evidence-based component of menopausal health management.

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