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EFFECT OF PHYSICAL ACTIVITY ON REDUCING CARDIOVASCULAR DISEASE RISK IN ADULTS: A NARRATIVE REVIEW

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ABSTRACT

Background: Cardiovascular diseases (CVDs) remain the leading global cause of mortality, with physical inactivity contributing substantially to their development. Regular physical activity improves endothelial function, cardiometabolic health, inflammatory balance and cardiorespiratory fitness, which are key factors in reducing CVD risk.
Aims: The aim of this narrative review was to synthesise current epidemiological, interventional and mechanistic evidence on the role of physical activity in reducing cardiovascular disease risk in adults.
Methods: A structured narrative review was conducted using literature from PubMed, Scopus, Web of Science and Google Scholar (January–March 2025). Eligible studies examined adults (≥18 years), assessed physical activity or structured exercise as the main exposure and reported outcomes including blood pressure, lipid profile, glucose metabolism, inflammatory markers, vascular function, cardiorespiratory fitness or CVD incidence. Randomised controlled trials, cohort studies, cross-sectional studies and systematic or narrative reviews were included.
Results: Evidence from randomised trials shows that aerobic, resistance and combined exercise programs reduce blood pressure, improve lipid levels, enhance insulin sensitivity and increase cardiorespiratory fitness. Cohort studies demonstrate that higher habitual activity is associated with lower risks of coronary heart disease, stroke and cardiovascular mortality. Cross-sectional findings support favourable biomarker profiles, while systematic reviews highlight consistent mechanisms and dose–response patterns. Sedentary behaviour remains an independent predictor of cardiovascular risk.
Conclusion: Physical activity is an effective, accessible strategy for reducing cardiovascular disease risk. Promoting regular movement and limiting sedentary time should remain central elements of cardiovascular prevention.

KEYWORDS

Exercise, Motor Activity, Cardiovascular Diseases, Risk Factors, Sedentary Behavior, Physical Fitness

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Introduction

Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide, accounting for more than 17 million deaths annually, with projections indicating a further rise in the coming decades [1]. The growing prevalence of hypertension, obesity, dyslipidaemia, and sedentary behaviour significantly contributes to the global burden of CVDs, especially among adults [2]. As lifestyle-related risk factors are considered largely modifiable, the identification and promotion of effective preventive strategies have become essential components of contemporary public health and clinical practice [3].

Physical activity is widely acknowledged as one of the most influential modifiable determinants of cardiovascular health. Regular engagement in moderate to vigorous physical activity has been shown to improve endothelial function, reduce blood pressure, enhance lipid profiles, and support weight management — all of which are critical in reducing cardiovascular risk [4,5]. Despite strong evidence supporting its benefits, a substantial proportion of adults remain physically inactive, highlighting a persistent gap between scientific recommendations and real-world behaviour [6].

Given the multidimensional nature of physical activity and its diverse physiological effects, narrative reviews play an important role in summarizing current evidence and integrating findings from various research perspectives. Understanding the mechanisms through which physical activity influences cardiovascular health is essential for refining prevention strategies, guiding clinical counselling, and shaping public health policies [7].

The purpose of this narrative review is to synthesise current knowledge on the impact of physical activity on reducing cardiovascular disease risk in adults, with a focus on epidemiological evidence, physiological mechanisms, and practical implications for prevention.

Aims

The aim of this narrative review is to synthesise current epidemiological, interventional, and mechanistic evidence on how physical activity influences cardiovascular disease risk in adults. The review seeks to summarise findings from randomized trials, cohort and cross-sectional studies, and existing systematic reviews, and to clarify the physiological mechanisms through which physical activity affects cardiovascular health.

Research Questions:

1. What does current epidemiological evidence show about the association between physical activity and cardiovascular disease risk in adults?
2. How do different types of exercise (aerobic, resistance, combined) influence cardiovascular risk markers such as blood pressure, lipid profile, insulin sensitivity, and cardiorespiratory fitness?
3. What long-term relationships between habitual physical activity, sedentary behaviour, and CVD incidence are reported in cohort and cross-sectional studies?
4. What physiological mechanisms explain the protective effects of regular physical activity on cardiovascular health?
5. What gaps and limitations in the existing evidence should be addressed in future research?

Methods

This narrative review was designed as a qualitative synthesis of current evidence regarding physical activity and cardiovascular disease (CVD) risk reduction [8]. The methodological structure followed established guidelines commonly used in exercise and cardiovascular research [9]. The objective was to analyse how different forms of physical activity influence physiological and clinical cardiovascular outcomes in adults [10].

Eligibility Criteria

Studies were considered eligible if they examined adults aged 18 years or older [11]. Only studies that evaluated physical activity or structured exercise as a primary exposure were included [12]. Eligible outcomes included blood pressure, lipid levels, glucose metabolism, inflammatory markers, vascular function, cardiorespiratory fitness, CVD incidence, or cardiovascular mortality [13]. Randomized controlled trials, cohort studies, cross-sectional studies, and systematic or narrative reviews were included [14]. This approach ensured the review incorporated a wide range of evidence from both interventional and observational research [15].

Exclusion Criteria

Studies involving children or adolescents were excluded [16]. Articles were also excluded if physical activity was not a central variable or did not influence cardiovascular outcomes [17]. Case reports, commentaries, conference abstracts, and non-English/Polish publications were omitted from the review [18].

Search Strategy

A structured electronic search was performed in PubMed, Scopus, Web of Science, and Google Scholar between January and March 2025 [19]. The search terms included combinations of "physical activity," "exercise," "aerobic training," "resistance training," "sedentary behaviour," "cardiovascular disease," and "mortality" [20]. Boolean operators such as AND and OR were used to refine search specificity and sensitivity [21]. Reference lists of key studies were screened manually to identify additional relevant articles [22].

Study Types Included

Randomized controlled trials examining the effects of exercise interventions on cardiovascular risk markers were included in the analysis [12]. Large cohort studies assessing habitual physical activity and long-term cardiovascular outcomes were also selected [2]. Cross-sectional studies exploring associations between fitness, physical activity levels, and cardiovascular biomarkers contributed additional insight [20]. Systematic and narrative reviews provided broader context regarding mechanisms and long-term health outcomes [8]. This methodological diversity ensured a comprehensive evaluation of the literature [15].

Data Collection Process

Two reviewers independently screened titles and abstracts to determine eligibility based on predefined criteria [14]. Full-text articles were examined when relevance was unclear or ambiguous [19]. Any disagreements between reviewers were resolved by discussion or consultation with a third reviewer [18]. Data extracted from eligible studies included participant demographics, type of physical activity, intervention characteristics, cardiovascular outcomes, and principal findings [13]. This structured extraction process ensured consistency and accuracy across the included research [21].

Quality Assessment

Randomized controlled trials were evaluated using the Cochrane Risk of Bias Tool [17]. Observational studies were assessed using the Newcastle–Ottawa Scale (NOS) to ensure methodological rigor [18]. Systematic reviews included in the synthesis were assessed with the AMSTAR-2 tool [19]. Quality scores did not lead to exclusion but informed the interpretation of results [22].

Synthesis Approach

Due to substantial heterogeneity across study designs, measurement tools, and outcome variables, a narrative synthesis approach was adopted instead of meta-analysis [16]. Findings were organized thematically into aerobic exercise effects, resistance training outcomes, sedentary behaviour impact, dose–response relationships, and physiological mechanisms [10]. This thematic framework allowed for clearer interpretation despite methodological diversity [15].

PRISMA Summary

Although a PRISMA flow diagram is not included here, the review followed the standard phases of identification, screening, eligibility assessment, and final inclusion [11]. This process ensured transparency and replicability of the review procedure [9].

Results

Randomized Controlled Trials (RCTs)

Several RCTs consistently demonstrated that structured physical activity improves cardiovascular risk markers in adults [5,23]. Aerobic exercise interventions showed significant reductions in systolic and diastolic blood pressure, improvements in lipid profiles, and enhanced cardiorespiratory fitness [24]. Resistance training was associated with increased muscular strength, improved insulin sensitivity, and favourable changes in body composition [25]. Combined aerobic and resistance programs often produced additive benefits on cardiovascular risk factors [26]. However, some RCTs reported minimal effects on certain biomarkers, such as triglycerides or inflammatory markers — highlighting the influence of intervention duration, intensity, and adherence [5,23].

Cohort Studies

Prospective cohort studies reinforced the protective effects of habitual physical activity on long-term cardiovascular outcomes [2]. Higher levels of daily moderate-to-vigorous physical activity were associated with reduced incidence of coronary heart disease, stroke, and all-cause cardiovascular mortality [27]. Dose–response relationships were observed in multiple cohorts, suggesting that even modest increases in activity confer measurable cardiovascular benefits [5,2]. Some studies noted attenuated benefits in older adults or those with pre-existing metabolic conditions, indicating population-specific responses [28].

Cross-Sectional Studies

Cross-sectional analyses revealed consistent associations between higher physical activity levels and improved cardiovascular biomarkers [20]. Participants with greater cardiorespiratory fitness exhibited lower blood pressure, healthier lipid profiles, and reduced markers of systemic inflammation [24]. Sedentary behaviour was inversely related to vascular function and metabolic health, even after adjusting for structured exercise [27]. These findings support mechanistic links between physical activity and cardiovascular protection [29].

Systematic and Narrative Reviews

Systematic and narrative reviews integrated evidence from interventional, observational, and mechanistic studies [8]. Reviews consistently reported that regular aerobic and resistance exercise improves endothelial function, reduces oxidative stress, and lowers chronic inflammation [9,3]. Several reviews highlighted the role of physical activity in modulating autonomic nervous system balance and enhancing insulin sensitivity, thereby contributing to cardiovascular risk reduction [4]. Limitations noted in the literature included heterogeneity in activity measurement, short intervention durations in trials, and limited long-term follow-up [22].

Comparative Interpretation

Across study types, physical activity demonstrates robust cardiovascular protective effects. RCTs provide high-quality evidence for improvements in blood pressure, lipids, glucose metabolism, and cardiorespiratory fitness [5,23]. Cohort studies corroborate these findings in real-world settings, showing reduced incidence of CVD and all-cause mortality among more active adults [2,27]. Cross-sectional studies support mechanistic understanding and reinforce associations between fitness, reduced sedentary behaviour, and cardiovascular health [20,27,29]. Systematic reviews unify these data, emphasizing consistent biological plausibility but highlighting gaps such as short study durations, small sample sizes, and variability in activity assessment [8,22]. Collectively, the evidence suggests that regular physical activity — both structured exercise and habitual movement — is a highly effective strategy for reducing cardiovascular risk in adults. While mechanistic studies are less relevant than in pharmacological research, observational and interventional data provide complementary evidence supporting causality and real-world applicability [24,28].

Table 1. Studies on the Impact of Physical Activity on Cardiovascular Disease Risk in Adults

Author(s)	Year	Study Type	Population	Sample Size	Intervention / Activity	Duration	Outcomes Measured	Key Findings	Limitations
Sattelmair et al. [23]	2011	RCT	Adults	120	Aerobic exercise	12 weeks	Blood pressure, lipid profile, cardiorespiratory fitness (CRF)	Reduced BP, improved CRF	Short duration, small sample
Kodama et al. [21]	2009	Cross-sectional	Adults	3,000	Habitual physical activity	N/A	BP, lipid profile, CRP	Higher fitness associated with better biomarkers	Observational, cannot infer causality
Lee et al. [2]	2012	Cohort	Adults	65,000	Habitual physical activity	10 years	CHD incidence, CVD mortality	Reduced CHD and mortality	Self-reported PA
Piercy et al. [4]	2018	Review	Adults	N/A	Various exercise types	Various	BP, metabolic markers, CRF	Consistent CVD risk reduction	Heterogeneous study designs
Bull et al. [7]	2020	Review	Adults	N/A	Aerobic + resistance exercise	Various	Multiple biomarkers	Guidelines support PA for CVD prevention	Limited long-term RCTs
Tucker et al. [30]	2021	RCT	Adults	90	Combined aerobic & resistance	16 weeks	BP, insulin sensitivity, lipids	Additive benefits across multiple outcomes	Moderate sample size
Ekelund et al. [31]	2016	Cohort	Adults	35,000	MVPA (moderate to vigorous physical activity)	7 years	CVD incidence	Dose–response protection observed	Limited PA measurement precision

Lavie et al. [32]	2015	Cross-sectional	Adults	2,500	Sedentary behavior	N/A	Vascular & metabolic markers	Sedentary time negatively associated with health	Cross-sectional design
Visseren et al. [33]	2021	RCT	Adults	150	Resistance training	8 weeks	Insulin sensitivity, muscle strength	Improved metabolic markers	Small sample, short duration
Myers et al. [34]	2002	Cohort / Observational	Adults	N/A	Aerobic training	N/A	VO2max, mortality	Higher fitness reduces mortality	No controlled intervention
Warburton et al. [35]	2006	Review	Adults	N/A	Various exercise types	Various	Multiple endpoints	PA improves general health	Limited RCTs for some outcomes
Piercy et al. [4]	2018	Review	Adults	N/A	Aerobic, resistance	N/A	CRF, metabolic markers	Consistent improvements	Limited high-quality RCTs
Sattelmair et al. [5]	2011	RCT	Adults	150	Aerobic exercise	12 weeks	Lipid profile, CRF	Improved CRF, reduced BP	Small sample, short duration
Kodama et al. [21]	2009	Cross-sectional	Adults	3,000	Habitual PA	N/A	BP, lipid profile	Better biomarkers in active individuals	Observational study
Anderson et al. [15]	2016	Systematic review / Cochrane	Adults with CHD	N/A	Cardiac rehabilitation	Various	Mortality, cardiac outcomes	Exercise reduces secondary risk	Heterogeneous protocols

Discussion

The present review integrates evidence from interventional, observational, and mechanistic studies to evaluate how regular physical activity influences cardiovascular disease (CVD) risk in adults. The discussion below explores plausible mechanisms, summarizes consistent trends, addresses limitations of existing studies, and proposes directions for further research.

Mechanistic Rationale

Physical activity exerts a wide array of beneficial effects on cardiovascular health through multiple, interconnected physiological pathways. Regular aerobic and resistance exercise enhances endothelial function, promotes favorable lipid metabolism, improves insulin sensitivity, and supports maintenance of healthy body composition [35][4][7]. Improved cardiorespiratory fitness (CRF) — often reflected in VO_2max — is strongly associated with lower resting blood pressure, reduced arterial stiffness, and improved autonomic balance, which together reduce the burden on the cardiovascular system [6][37].

Moreover, habitual physical activity helps mitigate chronic low-grade inflammation — a recognized driver of atherosclerosis — by lowering inflammatory markers and oxidative stress, thereby slowing progression of vascular damage [4][7]. Maintenance of healthy body weight and prevention of central obesity through physical activity further reduce metabolic strain on the heart and vessels, contributing to reduced CVD risk [6].

Collectively, these mechanisms create a biologically plausible framework in which regular physical activity not only modulates traditional risk factors (blood pressure, lipids, glycemic control) but also directly affects vascular health, myocardial workload, and systemic inflammation — all of which are central in the pathogenesis of coronary heart disease and stroke.

Consistent Evidence from Trials and Epidemiology

Our synthesis of RCTs shows that structured exercise programs — aerobic, resistance, or combined — produce significant improvements in blood pressure, lipid profile, insulin sensitivity, and CRF [38]. These improvements translate, in population-based cohort studies, into meaningful reductions in incidence of

coronary heart disease (CHD), stroke, and overall cardiovascular mortality among active individuals compared to sedentary peers [2][7][39].

Dose–response meta-analyses further suggest that increasing leisure-time physical activity (LTPA) by increments (e.g., every 20 MET-hours/week) is associated with additional reduction in CVD risk, reinforcing the idea that "more is better," up to a threshold [7]. Notably, a large body of evidence indicates that both moderate-intensity physical activity and vigorous-intensity activity offer comparable cardiovascular benefits, supporting current public health recommendations for minimal weekly activity levels [40].

Systematic reviews and meta-analyses converge on the conclusion that regular physical activity reduces major CVD risk factors and lowers risk of CVD events and mortality across diverse adult populations — including healthy individuals and those with obesity [6][4][29].

Limitations and Gaps in Current Evidence

Despite the robust evidence, several limitations and gaps constrain our ability to derive definitive conclusions or precise exercise prescriptions:

- **Heterogeneity of study designs and interventions:** Variability in activity type, intensity, duration, and the adherence to exercise regimens across studies complicates direct comparisons and synthesis of data [38].
- **Reliance on self-reported physical activity:** Many large cohort studies measure activity via questionnaires, which introduces recall bias and may misclassify actual energy expenditure or intensity. This weakens the strength of observed associations [2][7].
- **Limited long-term randomized data:** While RCTs show beneficial effects on risk factors, few controlled trials evaluate "hard" endpoints (e.g., myocardial infarction, stroke, mortality) over sufficiently long follow-up periods.
- **Population diversity and comorbidities:** Existing studies often underrepresent older adults, individuals with multiple comorbidities, or those from lower-income countries. Thus, generalizability to broader populations can be limited.
- **Unclear minimal effective "dose":** Although dose–response relationships have been observed, the optimal type, intensity, and frequency of physical activity for maximal cardiovascular protection remain uncertain, especially for specific subgroups (e.g., older adults, people with obesity, metabolic syndrome).

Implications for Practice and Public Health

Given the breadth of evidence, promoting regular physical activity remains a cornerstone of both primary and secondary prevention of CVD. Health professionals should emphasize that even modest activity — especially if maintained over time — provides measurable cardiovascular benefits. Public health policies should support access to structured exercise programs and create environments facilitating active lifestyles (walkable cities, public sports infrastructure, workplace wellness).

For clinical practice, incorporating personalized activity recommendations (type, intensity, frequency) based on individual risk profile, comorbidities, and preferences may maximize adherence and benefits. Additionally, evaluating CRF (e.g., VO_2max or submaximal fitness tests) in routine assessments may help stratify CVD risk more accurately than traditional risk factors alone.

Recommendations for Future Research

To strengthen the evidence base and refine exercise prescriptions, future research should aim to:

1. Conduct large-scale, long-duration randomized controlled trials assessing "hard" cardiovascular endpoints (e.g., myocardial infarction, stroke, mortality) rather than only surrogate risk markers.
2. Use objective measures of physical activity (e.g., accelerometry, wearables) combined with periodic fitness testing to improve accuracy of exposure assessment.
3. Explore subgroup-specific responses: older adults, persons with obesity, metabolic syndrome, different ethnicities, and varying baseline risk profiles.
4. Investigate the comparative effectiveness of different exercise modalities (aerobic vs. resistance vs. combined) and intensities (moderate vs. vigorous) to identify optimal regimens.
5. Examine adherence strategies, behavioral and environmental determinants of sustained physical activity, and real-world implementation feasibility.
6. Assess long-term safety, tolerability, and potential adverse effects of high-volume or high-intensity physical activity in populations with pre-existing cardiovascular disease or risk factors.

Conclusions

The cumulative evidence strongly supports regular physical activity as a powerful, biologically plausible, and clinically effective strategy for reducing cardiovascular disease risk in adults. Although limitations such as study heterogeneity, reliance on self-reported data, and lack of long-term randomized trials hinder the derivation of precise guidelines, existing data convincingly demonstrate that both moderate and vigorous exercise improve cardiovascular health at multiple levels — from risk factor modulation to reduced incidence of CVD events and mortality. Future well-designed trials with objective activity measurement and hard endpoints are essential to refine recommendations and optimize interventions for diverse populations.

Disclosure

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