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The Effect of Physical Inactivity on Inflammatory Markers in the Geriatric Population: A Systematic Review

Akah Roland Tiagha[1], Jude Enoh Eteneneng[1], Benedicta Nkeh-Chungag[1]

1 Department of Biology and Environmental Sciences, Faculty of Natural Sciences, Walter Sisulu University (WSU), Nelson Mandela Drive, Private Bag X1, MTHATHA 5117 Eastern Cape, South Africa.

Email: rakah@wsu.ac.za. Tel: (+27) 687581635

Abstract

Background and Objectives: In the landscape of geriatric health, the intricate relationship between physical activity levels, and cardiovascular health has emerged as a focal point of research and clinical practice. This review aims to provide a comprehensive overview of the effects of physical inactivity on inflammatory markers in the geriatric population, highlighting the significance of preventive strategies and lifestyle interventions to promote cardiovascular well-being in this vulnerable population.

Research Design and Methods: Multiple databases, including PubMed, Scopus, Web of Science, Google Scholar, and Global Health were searched extensively. Studies that examined physical inactivity and cardiovascular inflammatory markers in older adults and outcomes of interest, respectively, among older adults (≥65 years) were included. PRISMA (2020) guided this review, and the findings were synthesized. This systematic review was registered in PROSPERO (CRD42024553602).

Conclusion: Addressing physical inactivity through comprehensive lifestyle interventions is a crucial public health priority. Promoting physical activity among older adults not only holds promise for lowering inflammatory markers but also represents a proactive approach to preventing cardiovascular diseases and fostering healthy aging

Keywords: Physical Inactivity, Cardiovascular Inflammatory Markers, Geriatric Population

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Introduction:

Aging is an inevitable process that brings about a myriad of changes in both the physiological and psychological aspects of an individual's life (1). In old age, maintaining a healthy and active lifestyle becomes increasingly paramount to the health outcomes of older adults. Physical inactivity is a significant modifiable risk factor linked to adverse cardiovascular markers(2,3). Cardiovascular diseases (CVDs), a group of disorders of the heart and blood vessels are the leading cause of death globally with about 17.9 million deaths from CVD in 2019, representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke. Over three-quarters of CVD deaths are found in low and middle-income countries with a higher rate in older adults (3,4). Inflammatory markers are biological

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indicators that signal an increased risk of CVDs (5). These markers are crucial in evaluating cardiovascular disease risk, advancement, and prognosis. One of these key markers is C-reactive protein (CRP), a well-studied inflammatory marker produced by the liver in response to inflammation. Elevated CRP levels are linked to increased cardiovascular risk and can predict heart attacks and strokes. Interleukin-6 (IL-6), a pro-inflammatory cytokine involved in the immune response, is associated with atherosclerosis, hypertension, and other cardiovascular conditions when found at increased levels. Tumor Necrosis Factor-alpha (TNF-α), another pro-inflammatory cytokine, has been associated with endothelial dysfunction and atherosclerotic plaque formation. Interleukin-1 beta (IL-1β) (6-8), drives the onset and progression of atherosclerosis. Monocyte chemoattractant protein-1 (MCP-1) is a chemokine that attracts monocytes to areas of inflammation within blood vessels, contributing to the formation of atherosclerotic lesions and vascular inflammation more pronounced with aging. Heart aging is a continuous and intricate process, with the rate of decline varying among individuals. This decline can be influenced by physiological changes, adaptive responses to prior illnesses or surgeries, as well as the impact of individual lifestyle habits or cardiovascular risk factors. Despite this awareness, physical inactivity has emerged as a pervasive concern among older adults, posing profound implications for their health and quality of life (9, 10).

Based on the World Health Organization (WHO) recommendations, physical inactivity is defined as failure to accumulate at least 150 minutes of moderate physical activity, 75 minutes of vigorous physical activity, or a combination of both intensities per week (10). The American Heart Association recommends 30-60 minutes of aerobic exercise three to four times weekly to promote cardiovascular fitness. Sedentary lifestyles (SL), like waking activity (mainly performed while in a sitting, reclining, or lying posture) with little to no energy expenditure beyond the resting metabolic rate (11). PI and high SL can independently amplify age-related decline in many physiological systems and may affect endurance, muscle strength, flexibility, and cognition. With a prevalence of 50.9% of physical inactivity among older adults in Africa (5, 12, 13), cardiovascular diseases significantly affect health, healthcare systems, and overall quality of life (13).

Print ISSN 2636-3224
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Physical inactivity is a global public health issue that contributes significantly to the burden of disease and disability, particularly within the aging population. Therefore, adopting active living habits emerges as a personal yet essential factor in reducing the onset and progression of chronic conditions related to aging (14, 15). The complex relationship between physical inactivity and adverse health outcomes in older adults calls for a more thorough investigation into the underlying mechanisms that connect sedentary behavior to different physiological and psychological impairments. Hence, our research aims to shed light on the diverse effects of physical inactivity and inflammatory markers on older adults, utilizing insights from existing literature and empirical studies (16). In older adults, the progression of CVD is often exacerbated by age-related changes in cardiovascular structure and function, making the adoption of a physically active lifestyle a crucial component of preventive care. Physical inactivity, characterized by a lack of regular exercise and prolonged sedentary behavior, has been identified as a key determinant in the pathogenesis of cardiovascular risk factors such as hypertension, dyslipidemia, insulin resistance, and obesity in the aging population (14).

By synthesizing the evidence available, this review paper seeks to provide a comprehensive overview of the effects of physical inactivity on cardiovascular health in older adults, highlighting the significance of preventive strategies and lifestyle interventions geared at promoting cardiovascular well-being in this vulnerable population (15). Secondly, we shall examine the role of cardiovascular inflammation in conditions typical of aging and often comorbid with CVD. Finally, bridging the gap between research findings and practical implications, (16) we aim to foster a deeper understanding of the multifactorial nature of cardiovascular health in older adults and advocate for holistic approaches that prioritize physical activity as a fundamental component of cardiovascular disease prevention and management in future research (14-16). The geriatric population faces unique challenges related to physical inactivity and cardiovascular health. This systematic review aims to examine the impact of physical inactivity on cardiovascular inflammatory markers in older adults.

Research Question: What is the relationship between physical inactivity and inflammatory markers in the geriatric population?

Print ISSN 2636-3224
Online ISSN 2636-3232

Objectives: 1. To assess the existing literature on physical inactivity in the geriatric population. 2. To assess the specific inflammatory markers commonly studied with physical inactivity among older adults, determining which markers demonstrate the most significant associations. 3. To analyze how coexisting conditions may influence the relationship between physical inactivity and inflammatory markers, providing insights into the complexity of interactions in the geriatric population. 4. To identify research gaps and recommend areas for further study.

Methods and material:

Our initial search showed no prior studies or ongoing studies published or registered in PROSPERO and systematic reviews or meta-analyses indexed in PubMed on this topic. This systematic review protocol was registered by PROSPERO (registration no. CRD42024553602). Our review focuses on studies reporting the impact of physical inactivity, inflammatory markers, and CVD health in older adults. We followed the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 for the review of data collected from published articles hence there was no need for ethical approval (17-19).

Inclusion Criteria: Geriatric population (65 years and above). Research studies examine the relationship between physical inactivity, inflammatory markers, and CVDs. Studies published in peer-reviewed journals. Articles available in English.

Exclusion Criteria: Studies involving non-geriatric populations. Non-English language publications. Non-peer-reviewed sources.

Exposure: Physical inactivity has been identified as a crucial factor influencing inflammatory markers in the geriatric population, as indicated by findings from this review. This exposure highlights the significance of addressing modifiable factors like sedentary behavior and promoting active lifestyles to mitigate inflammation and reduce cardiovascular disease risk among older adults.

Outcome: The outcome of this review underscores the critical impact of modifiable sedentary behavior on inflammation levels and cardiovascular health

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Online ISSN 2636-3232

among older adults. The findings highlight the importance of promoting physical activity to mitigate inflammation and improve cardiovascular outcomes.
Physical inactivity can lead to a decline in cardiovascular fitness, including a decrease in aerobic capacity and endurance causing older adults to experience difficulties with everyday activities and an increased risk of cardiovascular diseases. It can contribute to unfavorable lipid profiles, such as high levels of low-density lipoproteins cholesterol (LDL), triglycerides, and low levels of High-density lipoproteins cholesterol (HDL). These lipid abnormalities increase the risk of atherosclerosis and cardiovascular events. Obesity and metabolic syndrome can occur due to a lack of physical activity resulting in weight gain and obesity in older adults. Obesity is a major risk factor for developing metabolic syndrome, a cluster of conditions that increase the risk of heart disease, stroke, and type 2 diabetes. Increased risk of cardiovascular events in older adults who are physically inactive are at a higher risk of experiencing cardiovascular events such as heart attacks, strokes, and heart failure. Physical inactivity contributes to the development and progression of cardiovascular diseases.

Search Strategy: Electronic databases to be searched: PubMed, Scopus, Google Scholar, Web of Science, and Global Health.
Search terms: "physical inactivity," "cardiovascular disease," "inflammatory markers," "geriatric population," "older persons." Boolean operators (AND, OR) will combine search terms appropriately. Date range: 2018 to 2024.

Data Extraction: Study characteristics: Title, authors, publication year, study design. Participants: Age, sample size. Intervention/exposure: Definition of physical inactivity, cardiovascular disease status. Outcome measures: Cardiovascular inflammatory markers assessed. Results: Associations between physical inactivity and cardiovascular inflammatory markers.

Data Synthesis: A narrative approach to summarize findings, and meta-analysis will be considered if studies are homogenous concerning methodologies and outcomes.

Quality Assessment: It will be evaluated using the appropriate tool (e.g., the Newcastle-Ottawa Scale for observational studies). Studies will be graded based on criteria like methodology, and reporting quality.

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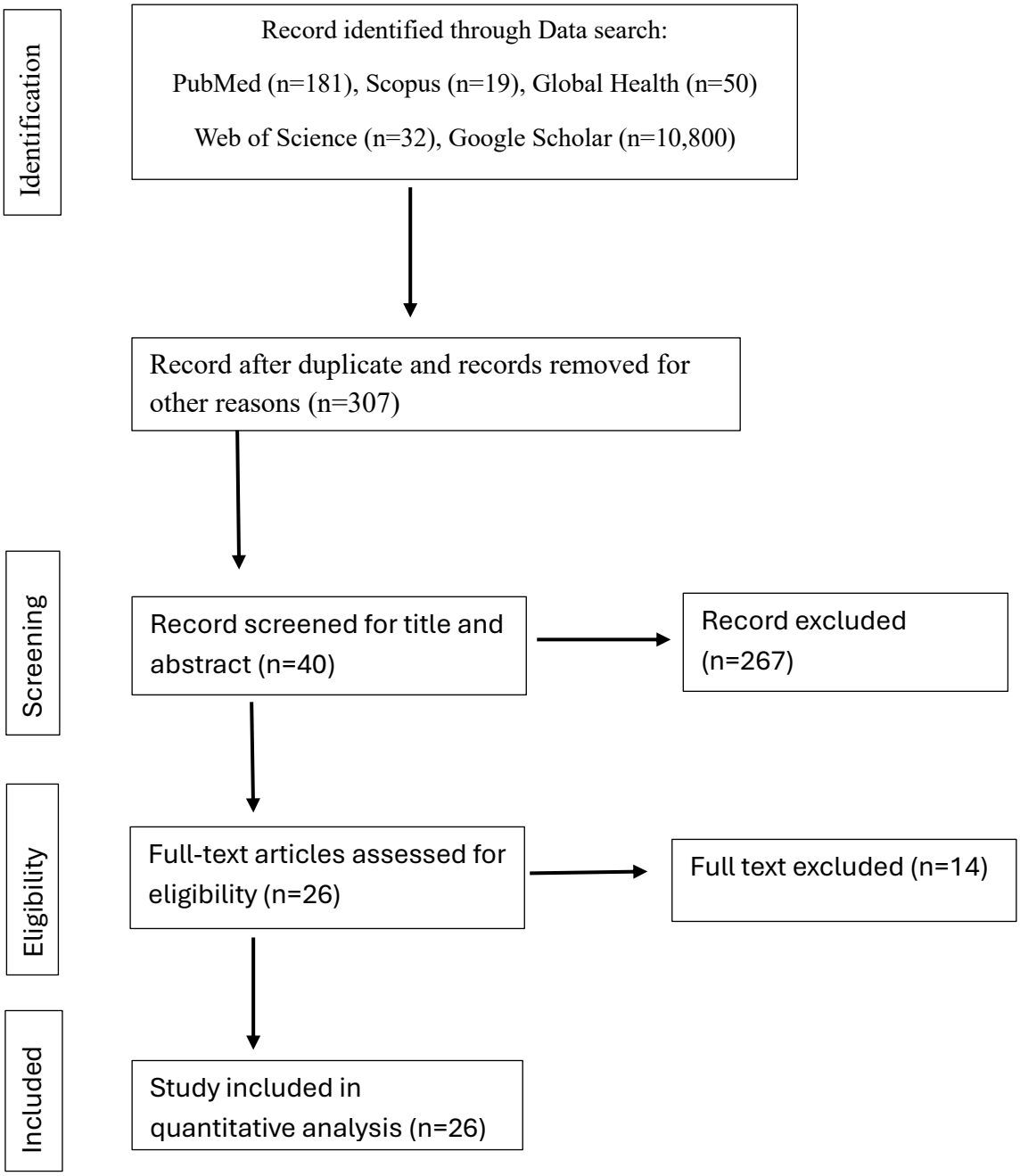

Figure 1: PRISMA diagram for search strategy and study selection process.

Print ISSN 2636-3224
Online ISSN 2636-3232

Results:

Study Characteristics

Twenty-six studies met the inclusion criteria and were incorporated into this systematic review. Fourteen focused on the relationship between physical inactivity and inflammatory markers, while twelve examined various interventions. These findings from various studies highlighted the impact of physical inactivity on inflammatory and metabolic markers in the geriatric population, emphasizing the associated health risks and recommendations for intervention. A prospective cohort study in Mexico by Manrique Espinoza et al. (2022) revealed that physical inactivity is linked to increased levels of C-reactive protein (CRP) and pro-inflammatory cytokines, heightening the risk of atherosclerosis, heart attack, and stroke. Similarly, Wanigatunga et al. (2017) demonstrated through a randomized clinical trial involving 1,635 older adults in the USA that sedentary lifestyles contribute to chronic low-grade inflammation, further escalating cardiovascular disease risks. These studies collectively suggest the importance of engaging in regular physical activity to mitigate inflammation and its associated health risks among older adults. Additionally, other research emphasizes the metabolic consequences of inactivity, such as insulin resistance and adverse lipid profiles. For example, Gill et al. (2019) found that inactivity negatively impacts insulin sensitivity, increasing blood sugar levels and the risk of type 2 diabetes and cardiovascular disease in older adults. Zhang Y and Liu X (2024) demonstrated that physical inactivity is associated with dyslipidemia, characterized by elevated triglycerides and diminished HDL cholesterol, resulting in higher cardiovascular risks. Further findings from Arshinta et al. (2017) linked inactivity to reduced cardiorespiratory fitness and increased abdominal fat, both predictors of cardiovascular issues. These studies highlight the critical need for promoting regular exercise, monitoring body composition, and integrating cardiovascular health strategies into lifestyle modifications for older adults to enhance their overall health and mitigate the risks associated with physical inactivity. The findings are summarised in Table 1.

Print ISSN 2636-3224
Online ISSN 2636-3232

National Institute of Longevity Elderly Science
NILES Journal for Geriatric and Gerontology
Tiagha AR. Inflammatory Markers
Volume 8, Issue 2
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References	Country	Study design/ Sample size	Marker Type	Specific Marker	Effect of Physical Inactivity	Outcome in geriatrics	recommendations
(Manrique-Espinoza *et al.,*2022)(9)	Mexico	Prospective cohort study 600 older adults		Increased CRP and pro-inflammatory cytokines	It is associated with elevated C-reactive protein (CRP) levels, interleukin-6, and TNF-alpha.	Increased risk of atherosclerosis, heart attack, and stroke.	Engage in regular physical activity to reduce inflammation.
Wiśniowska-Szurlej *et al.,* 2022(10)	Poland	cross-sectional study. including 858 older people aged 75					
Gomes *et al.,*2017(11)	community-based populations from 19 countries in Europe plus Israel	cross-sectional analysis with 19,298 older adults	Inflammatory Markers				
Wanigatunga *et al.,*2017(20)	USA	A randomized clinical trial involving, 1,635 men and women who were 70–89 years of age		Chronic inflammation	Sedentary lifestyles contribute to persistent low-grade inflammation, damaging blood vessels and promoting plaque buildup.	Increased risk of cardiovascular diseases.	Incorporate exercise interventions into daily routines.
Schrack *et al.,*2018(21)	Baltimore, USA	Longitudinal Study with 546 women					
Gill *et al.,*2019(22)	Southwestern Ontario, Canada	randomized controlled trial / 118 participants.	Metabolic markers	Insulin resistance	Inactivity worsens insulin sensitivity, raising blood sugar levels and increasing the risk of type 2 diabetes.	Higher prevalence of type 2 diabetes and cardiovascular disease (CVD).	Promote regular aerobic and resistance training to improve insulin sensitivity.
Tian *et al.,*2023(23)	China	China Health and Retirement Longitudinal Study (CHARLS). 5352 middle-aged and elderly people >50 years old					
Espeland *et al.,*2017(24)	North Carolina USA	randomized controlled clinical trial/ 1635 participants aged 70-89					

Print ISSN 2636-3224
Online ISSN 2636-3232

Table 1: Effects of physical inactivity on cardiovascular markers in geriatrics.

References	Country	Study design/ Sample size	Marker Type	Specific Marker	Effect of Physical Inactivity	Outcome in geriatrics	recommendations
Zhang Y and Liu X (2024)(25)	USA	retrospective cohort study with 15076 adults aged 40-79		Dyslipidemia	Physical inactivity results in an unfavorable lipid profile, with elevated triglycerides and low HDL cholesterol.	Increased risk of cardiovascular complications.	Implement lifestyle changes, focusing on diet and exercise to improve lipid profiles.
Zhang Y and Liu X (2024)(25)	USA	retrospective cohort study with 15076 adults aged 40-79	Body Composition	Increased abdominal fat	Physical inactivity leads to the accumulation of visceral fat linked to cardiovascular disease.	Higher risk of obesity-related cardiovascular issues.	Encourage active lifestyles and monitor body composition regularly.
Arshinta *et al.*,2017(26)	Indonesia	quantitative descriptive design/ 63 elderly adults		Reduced cardiorespiratory fitness	Inactivity weakens the heart muscle, reducing its efficiency at pumping blood, and raising heart failure risk.	It decreased overall cardiovascular health and increased frailty.	Incorporate exercises that improve cardiorespiratory endurance.
Bowden *et al.,* 2021(27)	Britain	Experimental study		Endothelial dysfunction	Lack of activity impairs the endothelium, reducing its ability to regulate blood flow and increasing clot risks.	Increased risk of thromboembolic events.	Engage in activities that boost circulation and endothelial function.
Martha A. Sánchez-Rodríguez *et al.*,2021(28)	Mexico	Observational longitudinal study With 177 women	Other factors	Increased oxidative stress	Physical inactivity leads to an imbalance between free radicals and antioxidants, causing cellular damage.	Cellular dysfunction and inflammation.	Promote physical activity to enhance antioxidant defenses.
Awuviry-Newton et al., 2023(29)	Ghana	longitudinal study with 4446 older adults		Elevated blood pressure	Regular activity lowers blood pressure, while inactivity contributes to hypertension.	Increased rates of hypertension and cardiovascular morbidity.	Advocate for regular blood pressure monitoring and physical activity.

Print ISSN 2636-3224
Online ISSN 2636-3232

The findings from various studies aimed at promoting physical activity among older adults through specific strategies and actions. In a randomized controlled trial by Gill et al. (2019) conducted in Southwestern Ontario, Canada, with 118 participants, the researchers emphasized the significance of personalized exercise programs that start with low-intensity activities and gradually increase in intensity. This method ensures an optimal balance between risk and benefit, enhancing both safety and effectiveness for older adults. Similarly, a prospective cohort study by Manrique Espinoza et al. (2022) in Mexico, involving 600 older adults, recommended incorporating endurance, strength, balance, and flexibility training to provide comprehensive health benefits and improve overall fitness and functional abilities. Wanigatunga et al. (2017) highlighted in their randomized clinical trial with 1,635 participants aged 70-89 in the USA that following guidelines of at least 150 minutes of moderate or 75 minutes of vigorous physical activity weekly promotes cardiovascular health and overall well-being.

Additionally, numerous studies identified practical strategies to encourage physical activity. Espeland et al. (2017) found that promoting shorter bouts of activity throughout the day can provide health benefits and be easier to integrate into daily life. Michael et al. (2017) noted in New York that encouraging enjoyable activities like walking, swimming, or gardening can enhance motivation and adherence to physical activity guidelines. Awuviry-Newton et al. (2023) in Ghana emphasized the necessity of addressing barriers by offering transportation assistance or community programs to improve access for older adults. Furthermore, Martha et al. (2021) in Mexico suggested promoting group activities or buddy systems to facilitate social interaction, motivation, and accountability, which can enhance adherence to exercise routines. Zhang Y and Liu X (2024) in the USA advocated connecting older adults with senior centers, fitness facilities, and parks to increase access to suitable programs. Meanwhile, healthcare providers play a critical role by assessing activity levels and offering personalized recommendations for tailored support to maintain physical activity. The use of pedometers, activity trackers, or journals may also boost motivation and accountability, as highlighted by the study by Wiśniowska-Szurlej et al. (2022) in Poland. Lastly, addressing underlying chronic conditions that may impede physical activity is vital, as emphasized by Zhang Y and Liu X, to ensure safe participation and promote overall health for older adults, Table 2.

Print ISSN 2636-3224
Online ISSN 2636-3232

Table 2: Preventive strategies and recommendations on physical inactivity and geriatric

Reference	Study design	Sample size	Strategy	Specific Actions	Rationale/Benefits
Gill *et al.,* 2019 (22)	Southwestern Ontario, Canada	randomized controlled trial / 118 participants.	Promote Personalized Exercise Programs	low-intensity activities and gradually increase.	Ensures optimal risk/benefit balance for older adults, enhancing safety and effectiveness.
Manrique-Espinoza *et al.,*2022(10)	Mexico	Prospective cohort study 600 older adults		Integrate endurance, strength, balance, and flexibility training.	It provides comprehensive health benefits and improves overall fitness and functional ability.
Matsuda *et al.,*2019(30)	Cross-sectional retrospective design			Implement exercises to improve balance and coordination.	Reduces fear of falling, increases confidence, and encourages participation in physical activities.
Wanigatunga *et al.,*2017(20)	USA	A randomized clinical trial involving, 1,635 men and women who were 70–89 years of age	Encourage Regular Physical Activity	Adhere to Guidelines: Aim for at least 150 minutes of moderate or 75 minutes of vigorous activity per week.	Following guidelines promotes cardiovascular health and overall well-being in older adults.
Espeland *et al.,*2017(24)	North Carolina USA	randomized controlled clinical trial/ 1635 participants aged 70-89		Encourage shorter bouts of activity throughout the day.	Short sessions (10 minutes) can yield health benefits and are easier to incorporate into daily routines.
Michael *et al.,*2017(31)	New York, USA	Cross-sectional study with 4832 participants		Promote enjoyable activities like walking, swimming, or gardening.	Enhances motivation and adherence to physical activity recommendations by focusing on pleasurable experiences.
Awuviry-Newton et al., 2023(29)	Ghana	longitudinal study with 4446 older adults	Address Barriers and Facilitate Access	Provide assistance or community programs to overcome transport issues.	Improve accessibility for older adults to engage in physical activities.
Martha *et al.,*2021(28)	Mexico	Observational longitudinal study With 177 women		Encourage group activities or buddy systems.	Fosters social interaction, motivation, and accountability, improving exercise program adherence.

Print ISSN 2636-3224
Online ISSN 2636-3232

Zhang Y and Liu X (2024)(25)	USA	retrospective cohort study with 15076 adults aged 40-79		Connect older adults to senior centers, fitness facilities, and parks.	Increases access to suitable programs and facilities that promote physical activity.
Michael *et al.,*2017(31)	New York, USA	Cross-sectional study with 4832 participants	Healthcare Provider Involvement	Healthcare providers should assess activity levels and provide personalized recommendations.	Ensures tailored guidance and support for maintaining physical activity.
Wiśniowska-Szurlej *et al.,* 2022(11)	Poland	cross-sectional study. including 858 older people aged 75		Encourage the use of pedometers, activity trackers, or diaries.	Enhances motivation and accountability through tracking progress.
Zhang Y and Liu X (2024)(25)	USA	retrospective cohort study with 15076 adults aged 40-79		Address Underlying Conditions: Manage chronic conditions hindering physical activity.	Proper management of conditions like arthritis or heart disease is crucial for safe physical activity participation and overall health.

Print ISSN 2636-3224
Online ISSN 2636-3232

Discussions:

This review demonstrates a consistent and robust relationship between physical inactivity and inflammatory markers among the geriatric population. Inflammation plays a crucial role in the development of atherosclerosis and other cardiovascular diseases, making it a vital target for preventive measures among older adults with various inflammatory markers playing significant roles in its pathophysiology. (9-11, 20, 32). The findings suggest that physical inactivity correlates with increased levels of C-reactive protein (CRP), which indicates systemic inflammation and is associated with an increased risk of events such as myocardial infarction and stroke; Interleukin-6 (IL-6), linked to endothelial dysfunction and atherosclerosis; and Tumor Necrosis Factor-alpha (TNF-α), which contributes to heart failure and plaque instability. Additionally, markers like Interleukin-1 Beta (IL-1β), soluble intercellular adhesion molecule-1 (sICAM-1), and soluble vascular cell adhesion molecule-1 (sVCAM-1) indicate heightened inflammatory responses in the vascular endothelium, while fibrinogen and myeloperoxidase (MPO) reflect thrombosis and vascular inflammation. (21, 22).

Furthermore, it also indicates that physical inactivity can worsen insulin insensitivity (23, 25) leading to an increased risk of type 2 diabetes and cardiovascular disease (29). Sedentary habits are associated with adverse alterations in cholesterol levels, including raised LDL cholesterol and reduced HDL cholesterol. These shifts in lipid composition can encourage the development of atherosclerosis, a condition marked by arterial plaque accumulation that heightens the susceptibility to heart attacks and strokes (24). Reductions in cardiorespiratory fitness and increased abdominal fat are associated with physical inactivity among the geriatric population, which increases frailty and risk of cardiovascular complications (24).

Despite the negative consequences of physical inactivity, there is a positive outlook. The studies recommend incorporating regular aerobic and resistance training to improve insulin sensitivity and cardiorespiratory fitness (33). Encouraging active lifestyles and monitoring body composition regularly, emphasizing the need to engage in activities that boost circulation and endothelial function (27). Additionally, promoting physical activity enhances the body's

Print ISSN 2636-3224
Online ISSN 2636-3232

antioxidant defense system, and advocating for regular blood pressure monitoring can positively impact the overall cardiovascular health of older adults (27, 28). Physical inactivity among the geriatric population increases the risk of cardiovascular disease and other metabolic complications through elevated cardiovascular inflammatory markers (30). Therefore, it is essential to encourage regular physical activity among older adults to improve cardiovascular health, reduce inflammation, and prevent the onset of chronic diseases as outlined in Table 1.

The findings in Table 2 highlight various strategies to promote and sustain physical activity in the geriatric population. It is recommended to implement personalized exercise programs that cater to the unique needs and abilities of individuals (9, 23, 30). These programs should focus on low-intensity activities that progressively increase to achieve an optimal balance of risk and benefits for older adults (34, 35). Incorporating comprehensive exercise routines that integrate endurance, strength, balance, and flexibility training has significant health benefits. These routines improve overall fitness and functional ability, which helps alleviate fears of falling and encourages participation in physical activities (21, 36, 37). It is advisable to include exercises specifically aimed at improving balance and coordination. Additionally, adhering to established guidelines for regular physical activity is crucial for maintaining cardiovascular health and overall well-being in the elderly (35, 38). Encouraging adherence to guidelines by breaking down physical activity into shorter bouts throughout the day can be more manageable and still yield health benefits. Furthermore, promoting enjoyable activities like walking, swimming, or gardening can increase motivation and adherence to physical activity recommendations (33). Transportation assistance programs play a pivotal role in breaking barriers to participation in physical activities for older adults by enhancing accessibility and reducing logistical and financial hurdles. Many seniors face challenges reaching fitness facilities or community centers due to limited mobility or lack of reliable transportation options. By offering free or subsidized transportation services, such as shuttle buses or ride-sharing partnerships, these programs ensure that older adults can easily access exercise opportunities, thereby mitigating isolation and fostering social engagement. Additionally, tailored transport solutions—such as wheelchair-accessible vehicles and trained drivers—can help create a safe and supportive environment, encouraging seniors to embrace physical activity

Print ISSN 2636-3224
Online ISSN 2636-3232

without the anxiety of navigating unfamiliar settings. Ultimately, transportation assistance empowers older adults to prioritize their health and well-being, promoting a more active lifestyle and improving overall quality of life. (39, 40). Healthcare providers can play a key role in assessing physical activity levels and offering personalized recommendations (41). Tools like pedometers, activity trackers, or activity logs can enhance motivation and accountability. Additionally, managing underlying health conditions, such as arthritis or heart disease, is essential for ensuring safe participation in physical activities (40). Promoting and maintaining physical activity among the geriatric population is vital for cardiovascular health, reducing inflammation, and preventing chronic diseases. By incorporating well-rounded exercise programs, addressing barriers, facilitating access to activities, and collaborating with healthcare providers for tailored recommendations, we can improve motivation, adherence, accessibility, and overall health outcomes for older adults.

Limitations:

The main limitation is the scarcity of research focusing on the relationship between physical inactivity, cardiovascular inflammatory markers, and the geriatric population globally. This lack of data may restrict the generalizability of findings. Variations in study methodologies, including sample sizes, measurement techniques for inflammatory markers, and assessment of physical activity levels, can introduce heterogeneity and affect the comparability of results across studies. The risk of bias in individual studies, such as selection bias, measurement bias, or publication bias, could impact the overall reliability and validity of this systematic review findings. Differences in the measurement techniques and assays used to assess inflammatory markers across studies can introduce variability and potential measurement errors. Factors like socioeconomic status, healthcare accessibility, dietary patterns, and preexisting health conditions among elderly individuals may not have been thoroughly examined in the studies included, thereby limiting the comprehension of these contextual factors' implications on the results. Given the predominant focus on developing regions in the research, the generalizability of the findings to other populations or global settings may be constrained. Furthermore, the exclusion of non-English research papers could introduce a language bias, potentially disregarding pertinent research published in other languages about this subject.

Print ISSN 2636-3224
Online ISSN 2636-3232

Awareness of these limitations is essential in interpreting the findings of the systematic review on the effect of physical inactivity on cardiovascular inflammatory markers in the geriatric population and in guiding future research efforts to address these gaps and enhance the understanding of this critical health issue.

Conclusion:

This systematic review emphasizes the critical link between the geriatric population, physical inactivity, inflammatory markers, and cardiovascular health. Healthcare providers, policymakers, and communities can work together to promote healthy aging and prevent cardiovascular diseases in older adults by implementing targeted interventions and lifestyle modifications to increase physical activity levels and reduce inflammation.

Author contributions

Akah Roland Tiagha and Enoh Jude Eteneneng: Identified and screened the included articles, Writing – review & editing, Writing – the original draft, Methodology, and Conceptualization. Benedicta Nkeh Chungag: Writing – review & editing, Methodology, Conceptualization. All authors have read and agreed to the published version of the article.

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Conflict-of-interest statement

The author declares no conflict of interest.

Availability of Data and Material

All articles used for the review have been referenced and available online.

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Print ISSN 2636-3224
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