The Impact of Physical Exercise on Aging Processes: A Comprehensive Literature Review on Muscular Strength, Balance, and Functional Ability in Older Adults

Review Article

Baharuddin Hasan*
Department of Sports Coaching Education, Cenderawasih University, INDONESIA

Kurdi
Faculty of Sport Sciences, Cenderawasih University, INDONESIA

Wilhelmus Batiurat
SD YPPK Santo Petrus ArgapuraJayapura, INDONESIA

Abstract.

Background As the global population of older adults continues to grow, concerns about the health and well-being of this demographic are becoming more pressing. Age-related conditions such as muscle weakness, balance disorders, and decreased functional ability contribute to a higher risk of falls, disability, and overall decline in health. Physical exercise has emerged as a key intervention to counteract these effects and improve health outcomes for older adults.

Objectives This literature review aims to explore the impact of physical exercise on aging, with a particular focus on muscle strength, balance, and functional ability in older adults.

Methods A systematic search was conducted across three major databases: Google Scholar, ScienceDirect, and PubMed, using keywords related to physical activity and aging. Studies that examined the effects of physical exercise on muscle strength, balance, and functional ability in older adults were reviewed. The selection criteria included articles published between 2018 and 2025, focusing on the influence of physical activity in older adults' aging processes.

Results The review found that physical exercise, including resistance training, balance exercises, and aerobic activities, significantly improves muscle strength, balance, and functional abilities in older adults. Resistance training was particularly effective in counteracting sarcopenia, improving muscle mass, strength, and reducing fall risks. Balance training enhanced postural control and stability, thereby reducing fall risks. Aerobic exercises and flexibility routines contributed to improved cardiovascular health, joint mobility, and overall functional independence. Additionally, physical exercise was found to have positive effects on mental health, reducing the incidence of chronic illness and fostering social engagement.

Conclusion Physical exercise is essential for mitigating the effects of aging, enhancing muscle strength, balance, and functional ability in older adults. The combination of resistance, balance, and aerobic exercises provides a comprehensive approach to improving physical and mental well-being, helping older adults maintain independence and quality of life. Given the aging global population, developing accessible and sustainable exercise programs is crucial for promoting healthy aging and improving the overall health of older adults.

Keywords: exercise, aging, muscle strength, elderly.

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*Correspondence: hasanbaharuddin03@gmail.com
Baharuddin Hasan
Department of Sports Coaching Education, Cenderawasih University, Indonesia

INTRODUCTION

B Along with the elderly population, there are certainly concerns for the health and well-being of older adults [1]. Older people are particularly susceptible to the physical and cognitive decline associated with aging, which can greatly impact their quality of life and Independence [2]. Among the most common age-related conditions are muscle weakness, balance disorders, and decreased functional ability, all of which contribute to an increased risk of falls, disability, and decreased overall health [3]. Physical exercise has been recognized as a key intervention to reduce the effects of aging and improve health outcomes for older adults [4]. This literature review aims to explore the impact of physical exercise on

the aging process, with a particular focus on muscle strength, balance, and functional ability in older adults.

Muscle strength is an important component of physical function that tends to decline with age [5]. Reduced strength is referred to as sarcopenia, is one of the main contributors to weakness observed in older adults [6]. Loss of muscle mass and strength can lead to reduced mobility, slower gait, and a high risk of falls [7]. A number of studies have shown that resistance training and other strength-building exercises can help counteract age-related decline [8]. By increasing muscle mass and increasing strength, older adults can maintain their functional independence and significantly reduce the risk of falls and related injuries [9].

Balance is another important component of physical health that deteriorates with age. Age-related changes in the sensory and motor systems can lead to instability and an increased risk of falls [10]. The consequences of falls in older adults can be severe, leading to fractures, hospitalization, and long-term disability [11]. Balance training, such as exercises that challenge postural control and coordination, have been found to improve balance in older adults, assist older adults in maintaining stability during daily activities and reduce the risk of falls [12]. It is critical to identify the most effective types of balance training interventions to ensure the safety and well-being of parents.

In addition to strength and balance, functional abilities play an important role in the overall health of older adults [13]. Functional ability refers to the capacity to perform activities of daily living, such as dressing, bathing, cooking, and managing household tasks [14]. As we progress, the ability to perform tasks in daily activities will become more difficult due to muscle weakness, joint stiffness, and decreased mobility [15]. Physical exercise, especially interventions that combine aerobic exercise, endurance, and flexibility, have been shown to increase functional capacity by improving cardiovascular fitness, joint mobility, and muscle function [16]. Maintaining or improving functional abilities is essential for older adults to live independently and avoid institutionalization.

While the benefits of physical exercise for older adults are well documented, the specific types of exercise and their effects on various aspects of physical function need to be investigated further. Previous research has explored different forms of exercise, including aerobic exercise, strength training, balance exercises, and flexibility routines. However, the question is about which type or combination of exercises is most effective in improving muscle strength, balance, and overall functional ability. This review aims to synthesize the existing literature to provide a comprehensive understanding of how physical exercise can improve quality of life in older adults.

Then, the broader implications of exercise for aging adults go beyond just improved physical health. Physical activity has been linked to many other benefits, including improved mental health, reduced incidence of chronic illness, and increased social engagement. Sports interventions can also foster a sense of empowerment and self-efficacy, which is important for the psychological well-being of older adults. As the older adult population grows, the development and implementation of effective, accessible, and sustainable exercise programs is essential in promoting healthy aging and improving the

overall quality of life of older adults. This review will explore a wide range of benefits that emphasize the importance of regular physical activity in the aging process

METHOD

Search Strategy

The literature search for this study was conducted using three main databases: Google Scholar, ScienceDirect and PubMed. ScienceDirect was chosen because of its broad coverage of scientific literature, especially in the fields of science, engineering, and health. PubMed was chosen because it is a widely recognized indexing system that is often used by researchers around the world to access biomedical and health science literatura [17].

The search strategy involves using a combination of the following keywords: ("exercise OR physical activity OR sports activity" AND older adults OR elderly"). These keywords were chosen to capture relevant publications that discuss the influence of physical activity in the aging process in older adults. The search follows the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) [18], which prioritize transparency and comprehensiveness in systematic reviews [19].

Exclusion Criteria

The following exclusion criteria apply: (1) Articles not published in Scopus or Web of Science indexed journals, (2) Articles in languages other than English, (3) Articles published before 2018 or after 2025, and (4) Articles that do not explicitly influence physical activity in the aging process in older adults.

Procedure

An initial search yielded 3,786 publications: 18,000 from Google Search, 71,780 from ScienceDirect and 107,765 from PubMed. After applying the exclusion criteria, the final number of relevant articles was reduced to 14, with many being excluded due to a lack of specific focus on the influence of physical activity in the aging process in older adults. The remaining articles are extracted and analyzed using Mendeley's software to remove duplicates. A detailed overview of the article selection and screening process is presented in Figure 1.

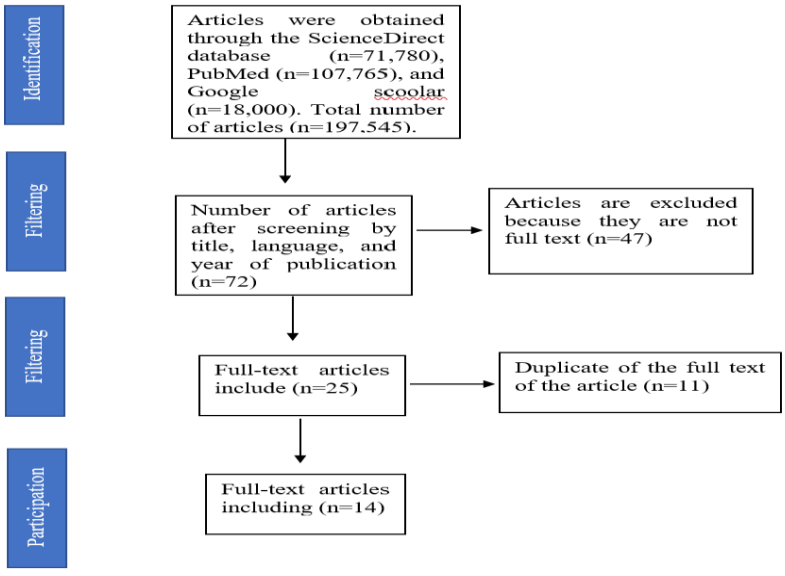

Figure 1. PRISMA Research Flow Diagram

RESULTS AND DISCUSSION

Results

This study reviewed studies related to physical activity and quality of life in older adults. Therefore, only research articles examining physical activity in older adults were reviewed. Based on the review, articles are divided into four categories, namely (i) Author and Year, (ii) Journal Name, (iii) Research Objectives, and (iv) Research Results. This research aims to make a meaningful contribution to the existing literature on the importance of regular physical activity in the aging process, by providing new insights that can guide the development of more effective policies and interventions in the future. The findings are based on a review of 14 articles, which are summarized in Table 1.

Table 1.
Results of the review of articles that match the research theme

Author and year	Jurnal name	Research objectives	research result
[20]	Scientifik Reports	To evaluate the effects of low-volume cycling training on body composition, hemodynamic factors, and functionality in older adults with multimorbidity.	After a 6-week intervention, the exercise group showed significant reductions in blood pressure and waist circumference, and improved muscle mass and functionality, particularly in walking speed and balance.
[21]	Journal of Clinical Medicine	To explore the effects of physical activity on the daily physical function of Chinese middle-aged and older adults, using data from the CHARLS study.	Physical activity (≥600 MET-minutes/week) significantly reduced the risk of impaired daily physical function. The most beneficial activity range was 1800–2999 MET-minutes/week, particularly for men, individuals aged 65+, and those without respiratory disease.
[22]	Journal of Sports Science	To compare the effects of resistance exercise, weight-bearing training, and hydro-gymnastics on muscle strength, flexibility, and quality of life in elderly women.	Resistance training showed the greatest improvements in muscle strength and functional capability, followed by functional training and hydro-gymnastics. All exercise groups showed better results than the sedentary group.
[23]	Frontiers in Aging Neuroscience	To assess the effects of aerobic exercise, cognitive training, and combined training on cognition in physically inactive late-middle-aged adults.	Aerobic exercise improved working memory and attention. Combined aerobic and cognitive training improved attention and attention-speed. No significant improvements were found with cognitive training alone
[24]	Journals of Gerontology - Series B Psychological Sciences and	To investigate how physical exercise impacts dual-task performance in younger-old and older-old adults, and whether	In older-old adults, exercise improved processing speed, and this effect was mediated by cardiorespiratory fitness. Younger-old adults showed

	Social Sciences	improvements are mediated by cardiorespiratory fitness.	improvement in task-set cost but not mediated by fitness
[25]	Journal of Clinical Medicine	To assess the effects of physical training with verbal stimulation on functional performance and the use of free time in older adults living in institutional care.	The functional exercise training with verbal stimulation showed the greatest improvement in functional fitness, gait speed, hand grip strength, upper-limb flexibility, and the use of free-time physical activity, improving quality of life.
[26]	Frontiers in Public Health	To examine the relationship between physical activity and fear of falling (FOF) in community-dwelling older women, and to explore the mediating role of physical fitness.	Moderate-to-vigorous physical activity (MVPA) was negatively correlated with fear of falling (FOF). The relationship was mediated by physical fitness, particularly BMI and grip strength.
[27]	BMC Geriatrics	To analyze the impact of physical fitness on falls among community-dwelling older adults in Taiwan.	Older adults who had fallen three or more times had lower physical fitness compared to those who had not fallen. Grip strength and single-leg standing duration were particularly associated with the risk of falling.
[28]	Frontiers in Physiology	To assess the effects of an app-based physical exercise program on muscular strength, balance, and flexibility in older women.	The app-based physical exercise program significantly improved muscular strength and flexibility, compared to the control group, in women aged 60+.
[29]	BMC Geriatrics	To investigate the combined effects of cognitive and physical exercises on cognition and physical fitness in older adults.	The study protocol aims to determine the superior effect of combined cognitive and physical training on cognition and physical fitness. Results are pending but expected to demonstrate greater benefits than single modalities.
[30]	Clinical Interventions in Aging	To measure the effects of an exercise program on the physical capacities of older adults such as strength, flexibility, balance, and aerobic capacity.	The exercise program showed significant improvements in muscular strength, flexibility, balance, and aerobic capacity in older adults after 12 months, with muscular strength and flexibility showing large effect sizes.
[31]	BioMed Research International	To investigate the importance of physical activity on aging and its role in preventing age-related diseases and	Regular physical activity was found to improve physical function, delay aging processes, and prevent chronic diseases. It was crucial for maintaining

		improving quality of life in older adults.	quality of life and reducing the risk of falls in older adults.
[32]	Journal of Physical Education and Sport	To examine the effects of physical activity on aging processes, including biological age and health status, in older adults.	Participants in the exercise group showed a 8.7-year younger biological age compared to their chronological age, whereas the control group showed a biological age 5.5 years older than their chronological age.
[33]	Gerontology and Geriatric Medicine	To explore the influence of physical activity on strength, balance, and physical functions in community-dwelling older adults in Sri Lanka.	Physical activity significantly enhanced strength, balance, and functional ability. Strength was the most important contributor to improved balance and physical functions in older adults.

Discussion

The impact of physical exercise on the aging process, especially on muscle strength, balance, and functional ability, has been studied extensively and has consistently been shown to be an important factor in maintaining the health and quality of life of older adults. This literature review highlights that physical activity is an important intervention to reduce the common physical and cognitive decline that accompanies aging, such as muscle weakness, balance problems, and decreased functional capacity. As the global population ages, it is becoming increasingly important to adopt strategies that improve the quality of life of older adults, and exercise is one of the most effective ways to achieve this goal. Findings from various studies underscore the importance of incorporating exercise into the daily routine of older adults to address age-related decline and improve overall well-being.

Muscular Strength: Counteracting Sarcopenia

Sarcopenia, age-related loss of muscle mass and strength, is one of the most significant factors contributing to weakness in older adults. This decrease in muscle strength is associated with a variety of adverse outcomes, including an increased risk of falling, loss of mobility, and a decreased ability to perform activities of daily living (ADL). Research conducted by [20] and [34], emphasizes the role of resistance training in counteracting muscle loss and increasing muscle mass. Resistance exercises, such as weightlifting or resistance bands, are especially beneficial because they not only help increase muscle mass but also increase muscle, joint, and bone strength, which in turn helps to increase functional capacity. Regular resistance training can prevent the debilitating effects of sarcopenia by maintaining muscle strength, thus allowing older adults to maintain their independence and avoid injuries associated with muscle weakness. This supports the idea that muscle-strengthening activities are essential for healthy aging and should be incorporated into exercise regimens for older populations.

Balance and Fall Prevention

Balance disorders are one of the most common and dangerous consequences of aging, as they significantly increase the risk of falling, which can lead to severe injuries such as fractures and head

trauma. The review highlights that balance exercise exercises are essential for improving posture control and preventing falls in older adults. Research conducted by [27] and [26] shows that balance exercises such as standing on one leg, walking in tandem, and practicing postural control are effective in improving stability and reducing the likelihood of falling. Since aging is associated with changes in the sensory and motor systems that affect coordination, balance exercises are an important aspect of maintaining stability. The combination of balance training with strength training is very effective in increasing muscle strength and balance at the same time. As shown in the study [35], an integrated approach provides the best results for preventing falls and maintaining overall stability in older adults. Therefore, it is very important that balance training is incorporated into physical activity programs for older adults to minimize the risk of falls.

Functional Ability and Independence

Maintaining functional abilities is at the core of healthy and independent aging. Functional ability refers to the capacity to perform important ADLs, such as eating, bathing, dressing, and walking. As we age, these functions are often impaired due to physical limitations, including reduced muscle strength, joint stiffness, and decreased cardiovascular health. Physical exercise, especially those that combine aerobic exercise, endurance, and flexibility, has been shown to significantly increase functional capacity. Studies conducted by [31] and [23] show that a comprehensive exercise program can improve muscle strength, mobility, and cardiovascular endurance, all of which are necessary to perform daily tasks independently. These findings underscore that exercise is an effective intervention to maintain functional ability, help older adults maintain their independence and prevent the need for care. In addition, interventions that combine multiple exercise modalities have been found to produce the most comprehensive improvements in functional outcomes, emphasizing the importance of a holistic approach to physical activity for older adults.

The Role of Aerobic Exercise

Aerobic exercise, such as walking, cycling, or swimming, plays an important role in improving cardiovascular health, endurance, and overall fitness. As we age, decreased cardiovascular function increases the risk of heart disease, stroke, and other chronic health conditions. The reviewed studies show that aerobic exercise significantly improves cardiovascular health, improves circulation, oxygen delivery, and endurance. However, when combined with resistance training, aerobic exercise provides a more balanced approach to fitness, as it not only supports cardiovascular health but also strengthens muscles and improves balance. The combination of both types of exercise leads to better overall physical health, as shown by [24] and (Wickramarachchi et al., 2023), who found that older adults who participated in aerobic and endurance exercise showed better physical and mental health outcomes. This approach should be prioritized in exercise programs for older adults, as it leads to comprehensive improvements in physical fitness and mental well-being.

Biological Age and Longevity

A particularly interesting finding from the reviewed study is the relationship between physical activity

and biological age. While chronological age is a fixed measure, biological age refers to the actual physiological condition of the body and is a more accurate reflection of an individual's health. Studies such as the one conducted by [32] provide strong evidence that physical exercise can lower biological age, with older adults engaging in regular physical activity showing biological age significantly younger than their chronological age. This reduction in biological age suggests that regular exercise can slow down the aging process, delay the onset of age-related diseases, and potentially extend life expectancy. These findings are particularly important because they position exercise not only as a means to improve quality of life but also as a preventive measure against the biological aging process. Regular physical activity can thus be seen as a strategy to maintain youth at the cellular level, contributing to longevity and improved health.

Psychosocial Benefits of Physical Activity

Finally, it is important to note the psychosocial benefits of physical exercise for older adults. Beyond physical improvement, exercise is closely linked to better mental health, including reducing symptoms of depression and anxiety, improved mood, and improved cognitive function. Physical activity has also been shown to increase social interaction and engagement, which is especially important for older adults who may be experiencing social isolation. The studies reviewed in this article emphasize the role of exercise in promoting mental well-being by increasing self-esteem, reducing stress, and fostering a sense of empowerment and autonomy. Exercise programs that encourage social interaction, such as group fitness classes or community walks, provide an additional layer of benefits by addressing physical and social needs. It highlights the importance of promoting exercise as a holistic approach to health, where the physical, emotional, and social aspects of aging are all considered.

CONCLUSION

This literature review underscores the important role of physical exercise in reducing the aging process, with a particular emphasis on improving muscle strength, balance, and functional ability in older adults. Regular physical activity, including resistance training, balance training, and aerobic activity, has been consistently shown to ward off age-related declines, such as sarcopenia, decreased balance, and decreased functional capacity. Resistance training helps prevent muscle loss, increase strength, and reduce the risk of falls, while balance training improves stability, essential for preventing falls and enabling daily functioning. In addition, aerobic exercise and flexibility improve cardiovascular health, joint mobility, and overall muscle function, ensuring greater independence in older age. Beyond the physical benefits, exercise also supports mental well-being, reduces the risk of chronic disease, and fosters social engagement, contributing to a holistic approach to aging. These findings highlight the need for accessible and sustainable exercise programs that can improve the physical and psychosocial health of older adults, ultimately improving the quality of life and enabling older adults with vitality and independence.

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AUTHOR CONTRIBUTION STATEMENT

HB is responsible for conceptualizing and designing studies, collecting data, and drafting manuscripts. K contributes to the analysis and interpretation of the results. BW is in charge of critical revision of the manuscript. PJR also acts as a correspondence writer, handling all correspondence and revisions related to publications.

CONFLICT OF INTEREST AND FUNDING

There is no conflict of interest

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