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Effects of physical exercise on the elderly: a systematic review

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Abstract

Background: The population of Europe is aging, and the majority of individuals over 65 do not engage in sports activities, spending most of their day in a sedentary position. Consequently, the prevalence of age-related diseases, such as sarcopenia, dementia, osteoporosis, osteoarthritis, falls, frailty syndrome, and depression, is expected to rise.

Aim: This article emphasizes the importance of physical exercise among older adults by presenting evidence on how incorporating or increasing physical activity can help counteract age-related health conditions. Given that this intervention is cost-free and has the potential to significantly improve seniors' quality of life, it represents a highly relevant public health measure.

Material and methods: A systematic review of selected literature was conducted using the PubMed, Google Scholar, and Web of Science databases, using keywords such as: "Exercise in elderly", 'Sarcopenia' and "Physical activity seniors". The analysis focused on peer-reviewed articles published between 2008 and 2025.

Results and Conclusions:

Physical activity provides numerous health benefits for older adults, with moderate- to high-intensity exercise demonstrating particularly significant effects. Resistance exercise is effective against sarcopenia, frailty syndrome, falls, osteoporosis, lumbar pain, depression and anxiety disorders. Aerobic exercise affects lumbar pain, depression and anxiety disorders, and possibly cognitive impairment. Most studies observed these beneficial effects following a 12-week intervention period, at least three times weekly, with individual sessions lasting no less than 60 minutes. Regular exercise is crucial for promoting healthy aging, offering comprehensive

benefits that include reduced all-cause mortality, lower risk of chronic diseases, and decreased likelihood of premature death.

Key words: exercise benefits, seniors, the eldery, sarcopenia, exercise in eldery

Introduction

Europe is experiencing population aging [1]. In Poland, the proportion of people aged 60 and over increased from 17.2% in 2005 to 26.3% in 2023 [2]. This demographic shift is expected to lead to a rise in age-related diseases, including sarcopenia, dementia, osteoporosis, osteoarthritis, falls, and frailty syndrome [3] [4]. Additionally, depression is most prevalent among older adults aged 55–74, affecting 7.5% of women and 5.5% of men in this age group [5].

Aging is a progressive deterioration at the cellular, tissue, and organ levels, leading to a loss of homeostasis, diminished adaptability to internal and external stimuli, and increased susceptibility to disease and death. Physiologically, aging is associated with declining bone mineral density, osteoarthritis, and the development of sarcopenia [4]. Sarcopenia, characterized by loss of muscle mass, strength, and function, contributes to accelerated progression of cardiovascular disease, increased mortality, and a higher risk of falls, all of which significantly impair quality of life [6].

This is particularly significant because muscle mass begins to decline around the age of 35 [4]. In healthy older individuals, just 10 days of continuous bed rest leads to a loss of 1.5 kg of lean body mass (primarily from the lower extremities), a 16% reduction in strength, and a 30% decrease in muscle protein synthesis [7].

When examining an aging muscle cell, it becomes evident that atrophy is accompanied by denervation and a shift from fast-twitch type 2 fibers to slow-twitch fibers, which cluster together as they are innervated by the same motor unit. Immobilization accelerates this process [8].

Eurostat data from 2019 indicate that 62% of individuals aged 65 years and older do not engage in any sports, while only 22% meet the recommended ≥150 minutes of physical activity per week . Sedentary behavior increases with age, with adults over 65 spending an average of 8.5-9.6 hours daily in sedentary positions - making them the most sedentary age group [10].

The elderly face multiple barriers to sports participation. External barriers most frequently reported include insufficient time (48.4% of respondents) and lack of facilities (35%). Internal barriers predominantly involved excessive fatigue (51.7%) and lack of motivation (38.4%). Notably, 38.4% of respondents considered themselves sufficiently active [11].

The article aims to emphasize the importance of physical exercise in the elderly. Present available data illustrating what problems of old age can be tried to counteract by including or intensifying their activity. This is of particular importance, since this interference is free, and can realistically affect the quality of life of seniors.

Research materials and methods

A review of selected literature was conducted in PubMed, GoogleScholar, and WebScience databases, using keywords such as: "Exercise in elderly", 'Sarcopenia' and "Physical activity seniors". This research focused on papers published between 2008 and 2025.

Research results

Most of the disease entities mentioned in the introduction can be prevented through physical activity. Although exercise will not slow the age-related loss of muscle fibers, it induces hypertrophy of the remaining fibers, thereby reducing overall muscle mass loss [4].

Exercise is seen as an essential aspect of our daily routine to maintain overall body and brain health, and lack of exercise is considered a risk for neurological disorders [12]. Older adults who increased their physical activity by at least 35% showed significant improvements in aerobic capacity, walking speed, verbal memory and cognitive function [13].

Individuals engaging in moderate-to-vigorous physical activity demonstrated higher levels of happiness and life satisfaction compared to their less active counterparts, with life satisfaction showing a positive age-related trend [14]. Moreover, elderly people with low levels of physical activity are 23 times more likely to be socially isolated than elderly people with moderate and high levels of physical activity [15].

Sarcopenia

Sarcopenia is common among the elderly, including obese patients. It is estimated that a person loses 10-20% of muscle mass by the 7th decade of life. Particularly in advanced and very advanced age, sarcopenia shows strong associations with frailty syndrome - a condition characterized by diminished physiological reserve and reduced stress resistance. Notably,

among numerous metabolic factors analyzed, reduced thigh muscle mass emerged as the most significant predictor of mortality in the elderly population [16].

Exercise increases the antioxidant response, reduces age-related oxidative stress and pro-inflammatory signals, and promotes the activation of anabolic pathways and mitochondrial biogenesis in skeletal muscle, which prevents a decrease in strength and muscle mass. In addition, exercise improves endothelial function and arterial stiffness by reducing inflammatory signals and oxidative damage in vascular tissue, and causes an increase in antioxidant enzymes and nitric oxide availability [17].

The mainstay of treatment for sarcopenia is to include resistance training and a diet with increased protein up to 1-1.2 g/kg bw/d [18] [19]. 150 min of moderate to vigorous aerobic exercise per week and 60-75 min of resistance training 3 times per week are recommended. Exercise should be tailored to the patient's health capabilities [18].

Twelve weeks of progressive resistance and aerobic exercise resulted in improvements in muscle strength, balance, flexibility and cardiorespiratory fitness in patients with sarcopenia [20].

There is high-quality evidence of the positive and significant effects of resistance training on muscle mass, muscle strength and physical performance. Although low-intensity resistance training is sufficient to induce strength gains, a high-intensity resistance training program is recommended to achieve maximum strength gains 39][21].

Fragility syndrome

Physical activity is considered one of the main strategies to counteract physical impairment associated with frailty in the elderly. Exercise reduces age-related oxidative damage and chronic inflammation, increases autophagy and improves mitochondrial function, myokine profile, insulin-like growth factor-1 (IGF-1) signaling pathway and insulin sensitivity [22]. As a result of frailty syndrome, there is an increased susceptibility to adverse health events [16]. Both moderate and vigorous physical activity have been associated with a lower risk of frailty. In particular, walking as a widely available physical activity with good results is recommended for the prevention of this disease entity [23].

As previously mentioned, lower limb resistance exercise improves muscle strength, physical fitness and metabolism in the elderly, which is crucial in frailty syndrome [24]. That people with this syndrome gain significant benefits from physical activity is clear, but the optimal exercise program to incorporate in this disease has not yet been established [25].

Falls

Annually, one in three seniors over the age of 65 falls [26]. Falls are the leading cause of injury-related mortality and morbidity in the elderly. Physical activity, improves not only strength, but also balance. Pilates has been given special importance in this aspect [[27] [28]. Balance and strength training can effectively reduce risk factors for falls and the number of falls. Moreover, adequate aerobic capacity achieved through aerobic exercise not only improves cardiovascular health, but can also prevent falls by attenuating the fatigue-related decline in postural control during activities of daily living [26] [28].

A sports intervention may also reduce the elderly's fear of falling by increasing their sense of agency and balance [29]. In a study involving people with chronic stroke, 3 months of resistance and balance exercises resulted in improvements in balance after 3 months and walking speed after 3 and 6 months [30].

Simple exercises in the form of Square-Stepping Exercise (SSE), a form of step training, have been shown to be an effective workout for reducing falls, improving gait characteristics, and may be an alternative to conventional physiotherapy [31].

Osteoporosis

Physical exertion is also important in preventing osteoporosis. In this aspect, higher-intensity, varied and resistance exercise appears to be more effective. Typical programs for which a significant intervention effect was detected were undertaken for more than 60 minutes, 2-3 times a week for more than 7 months [31].

Most studies suggest that both weight-bearing and resistance exercise have optimal effects on preventing and treating osteoporosis in the elderly [32]. The National Osteoporosis Foundation (NOF) suggests high- or low-load and muscle-strengthening exercises to prevent osteoporosis. These types of exercises include skipping, jogging and aerobics as high-load exercises, and walking and step aerobics as lower-load exercises. In addition, muscle-strengthening exercises include lifting weights, using elastic exercise bands and exercises involving some resistance against gravity [33][34].

Another study notes that despite the benefits of walking for body composition and cardiometabolic health, it has marginal or no effect on osteoporosis prevention [35] [34].

Low back pain

In chronic lumbar spine pain, i.e., lasting more than 3 months, exercise therapy for symptom relief in the elderly should focus on aerobic, strength and complex exercises based on exercise

cycle (≥12 weeks), exercise frequency (≥3 times per week) and single exercise time (≥60 minutes) [36].

A study comparing the effects of stretching and strength exercises with placebo showed that the stretching and strength exercise groups had greater improvements in pain intensity, disability level, balance ability and quality of life than the placebo group. Lower back instability and hip muscle flexibility improved the most in the stretching exercise group. In conclusion, core stability exercise and hip muscle stretching are effective in improving physical function and activity in patients with low back pain [37].

Dementia and cognitive impairment

The Lancet commission on dementia prevention, intervention, and care has identified 12 modifiable risk factors for dementia and estimates that these factors account for 40% of all dementia worldwide. One of these is physical inactivity, but the list also includes obesity, diabetes and hypertension, which are also positively affected by taking up exercise [38]. This is also supported by another study, in which the dementia detection rate was significantly higher in women who were obese than in those who had a desirable BMI [39]. Incorporating training beyond 12 weeks and aerobic exercise in older people with sedentary lifestyles can effectively delay cognitive decline [40]. One mechanism behind this positive effect of exercise is normal lung function. Significant associations have been shown between lower PEF (peak expiratory flow), reduced physical activity and increased cognitive deficits in the elderly [41]. Another study confirmed that aerobic exercise in the early stages of Alzheimer's disease improves patients' functioning. Exercise-related gains in cardiorespiratory fitness were associated with improved memory performance and reduced hippocampal atrophy [42] [43]. However, conflicting data are available, indicating that aerobic exercise does not slow cognitive impairment in people with mild to moderate dementia [44].

Depression and anxiety disorders

Numerous studies confirm the strong inverse relationship between physical activity and depression in the elderly [45]ty on the incidence of depression, it was shown that only physical exercise lasting more than 3 months had a significant effect on the incidence of improvement. Short-term physical activity lasting less than 1 month had no satisfactory effect [46]. Moreover, mainly intense types of physical activity are associated with fewer depressive symptoms, but also maintaining current activity levels may be important for older adults [47]. Numerous research findings indicate that both aerobic and strength training reduce the risk of depression

as well as anxiety disorders at any age, but this is particularly important for older adults [48] [49]. Reducing anxiety among seniors through exercise is particularly desirable, as it is a simple, inexpensive and effective intervention [50]. Given the possibility of multiple comorbidities among seniors, a water exercise program that also reduces depression and anxiety should be looked into [51].

Table 1. Summary of diseases of old age with characteristics of recommended physical activity: type, intensity, form of activity and time to effect.

Disease entity	Time to effect	Most Beneficial Type of Physical Effort
Sarcopenia	>12 weeks	Moderate and intense physical activity. Resistance exercise. 150 min of moderate to intense aerobic exercise per week and 60-75 min of resistance training 3 times per week.
Fragility syndrome	No data available	Moderate and intense physical activity. Resistance exercise. Walking.
Falls	>12 weeks	Resistance exercises. Balance exercises. Pilates.

		Square-Stepping Exercise (SSE).
Osteoporosis	Over 7 months.	Higher intensity exercises. Resistance including weight bearing. More than 60 minutes, 2-3 times a week for more than 7 months. Jumping, jogging, aerobics, weight lifting, use of elastic exercise bands and exercises involving some resistance against gravity.
Low back pain	≥12 weeks	Aerobic exercises. Strength exercises. Frequency of exercise (≥3 times per week) and duration of a single exercise (≥60 min). Core stability exercise Stretching
Dementia, cognitive impairment	>12 weeks	Aerobic exercise.
Depression and anxiety disorders	>12 weeks	Mainly intense exercise. Aerobic exercise. Strength exercises.

		Exercises in water.

Conclusions

Physical exertion carries a number of benefits for the elderly. Moderate to high intensity exercise appears to be key. Resistance exercise is effective against sarcopenia, frailty syndrome, falls, osteoporosis, lumbar pain, depression and anxiety disorders. Aerobic exercise affects lumbar pain, depression and anxiety disorders, and possibly cognitive impairment, although research is not consistent on this point.

Resistance training is more effective at increasing muscle mass and strength, while endurance training is better at maintaining and improving maximal aerobic power. Based on this evidence, recommendations for adults and older adults should include a balanced program of endurance and strength training performed regularly [52].

The majority of studies reviewed observed measurable effects following a 12-week intervention period. Many of the works recommend exercise at a frequency of at least 3 times a week, with a single workout time of at least 60 minutes. These studies are in line with WHO guidelines on physical activity and sedentary lifestyles, which recommend at least 150-300min of moderate-intensity aerobic physical activity or at least 75-150min of high-intensity aerobic physical activity per week among seniors. For additional health benefits, this activity can be increased. Moreover, the guidelines emphasize that seniors should undertake at least 2-3 days a week of multicomponent physical activity that emphasizes functional balance and strength training of moderate or higher intensity, involving all major muscle groups [53].

Regular physical activity is essential for healthy aging and offers a range of health benefits, including reduced risk of mortality from any cause, chronic disease and premature death. Since physical inactivity is widespread, greater emphasis should be placed on integrating exercise into care plans and developing community partnerships that support exercise opportunities. Older adults should be as physically active as their abilities and health status allow [54].

Disclosure

Author's contributions:

Conceptualization: Karolina Paks, Monika Pelczar, Zuzanna Gajda; Methodology: Jakub Prosowski, Paulina Hetnar; Software: Jessika Schendzielorz; Check: Barbara Starosta, Bartosz

Brzychcy, Karolina Brzychcy; Formal analysis: Ewa Jench, Paulina Hetnar; Investigation: Monika Pelczar, Paulina Hetnar; Resources: Zuzanna Gajda, Jessika Schendzielorz; Data curation: Barbara Starosta, Bartosz Brzychcy; Writing - rough preparation: Karolina Paks; Writing - review and editing: Monika Pelczar, Zuzanna Gajda, Jakub Prosowski; Visualisation: Karolina Brzychcy; Supervision: Karolina Paks; Project administration: Ewa Jench; Receiving funding: not-applicable.

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