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Physical Activity, Cognitive Decline, and Quality of Life in Older Adults

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A B S T R A C T

Objective: This narrative review aims to explore the relationship between physical activity, cognitive decline, and quality of life in older adults, examining the mechanisms by which PA influences these outcomes, summarizing key studies, and identifying differences in impact by type, duration, and intensity of PA.

Methods and Materials: A comprehensive literature search was conducted across multiple electronic databases, including PubMed, MEDLINE, Scopus, and PsycINFO. Inclusion criteria focused on studies involving participants aged 60 and older, examining the effects of PA on cognitive function and QoL, published in English between January 2000 and December 2023.

Results: Physical activity positively impacts cognitive decline and QoL in older adults through improved cardiovascular health, increased neuroplasticity, and enhanced neurogenesis. Key studies indicate that regular PA, especially aerobic and resistance exercises, is associated with better cognitive functioning and slower cognitive decline. The type, duration, and intensity of PA significantly influence its effectiveness, with moderate-intensity and long-term engagement yielding the most substantial benefits.

Conclusion: Physical activity is a vital intervention for promoting cognitive health and enhancing QoL in older adults. Healthcare providers and policymakers should encourage regular PA among older adults, incorporating a variety of exercises to maximize benefits. Future research should focus on establishing causality, exploring optimal PA regimens, and examining the cost-effectiveness of PA programs to inform practice and policy.

Keywords: *Physical activity, Cognitive decline, Quality of life, Older adults, Neuroplasticity, Aerobic exercise, Resistance training.*

1. Introduction

Cognitive decline is a significant concern for the aging population, characterized by a gradual deterioration of cognitive functions, including memory, attention, and executive functioning. This decline can lead to conditions such as mild cognitive impairment (MCI) and dementia, profoundly affecting the quality of life (QoL) of older adults (1, 2). The interplay between cognitive decline and QoL is complex, as cognitive deterioration can reduce

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independence, increase healthcare needs, and diminish social interactions, leading to a cycle of further cognitive and functional decline (3, 4).

Quality of life in older adults encompasses physical, psychological, and social dimensions, all of which can be adversely affected by cognitive decline. Reduced physical functioning and the onset of comorbid conditions often accompany cognitive deterioration, further exacerbating the decline in QoL (5-12). Ensuring a high QoL for older adults is crucial, not only for their overall well-being but also for mitigating the progression of cognitive decline.

Physical activity (PA) has emerged as a critical intervention for promoting cognitive health and enhancing QoL in older adults. Numerous studies have demonstrated that regular PA can delay the onset of cognitive decline, improve cognitive functioning, and reduce the risk of dementia (13, 14). The mechanisms through which PA exerts its beneficial effects include improved cardiovascular health, increased cerebral blood flow, and neuroplasticity, all of which are essential for maintaining cognitive functions (15).

Furthermore, physical activity has been shown to improve mental health, enhance physical fitness, and foster social engagement, all contributing to better QoL (16-18). Interventions incorporating various forms of PA, such as aerobic exercises, resistance training, and balance exercises, have been particularly effective in this regard (Lee et al., 2015; Jeong & Jang, 2017). Moreover, innovative approaches combining cognitive tasks with physical exercises have shown promise in dual-task training, further enhancing cognitive and physical outcomes (19).

The primary objective of this review is to explore and synthesize the existing literature on the relationship between physical activity, cognitive decline, and quality of life in older adults. Specifically, this review aims to:

- Examine the evidence supporting the role of physical activity in preventing or delaying cognitive decline among older adults.
- Investigate the impact of physical activity on the quality of life in this population.
- Analyze the interrelationship between cognitive decline, physical activity, and quality of life.
- Identify gaps in the current literature and propose directions for future research.

By achieving these objectives, this review seeks to provide a comprehensive understanding of how physical activity can serve as a strategic intervention to enhance cognitive health and improve the overall quality of life for older adults.

2. Methods and Materials

2.1 Study Design

To identify relevant studies for this narrative review, a comprehensive literature search was conducted across multiple electronic databases, including PubMed, MEDLINE, Scopus, and PsycINFO. The search strategy was designed to capture a wide range of articles related to physical activity, cognitive decline, and quality of life in older adults. Key search terms included "physical activity," "exercise," "cognitive decline," "dementia," "cognitive function," "quality of life," "older adults," "elderly," and "aging." Boolean operators (AND, OR) were used to combine search terms, and truncation symbols were applied where appropriate to capture all relevant studies.

2.2 Inclusion and Exclusion Criteria

To be included in this review, studies had to meet the following criteria:

Population: Participants aged 60 years and older.

Intervention: Studies examining the effects of physical activity or exercise interventions.

Outcomes: Studies reporting on cognitive decline, cognitive function, or quality of life.

Study Design: Randomized controlled trials (RCTs), cohort studies, case-control studies, and cross-sectional studies.

Language: Articles published in English.

Publication Date: Studies published from January 2000 to December 2023.

Studies were excluded if they:

Focused on populations with severe cognitive impairments at baseline (e.g., advanced Alzheimer's disease).

Did not provide sufficient data on the outcomes of interest.

Were review articles, meta-analyses, editorials, or opinion pieces.

2.3 Data Extraction

Data extraction was conducted independently by two reviewers to ensure accuracy and consistency. The following information was extracted from each included study:

Study characteristics: author(s), publication year, country, study design.

Participant characteristics: sample size, age, gender, health status.

Intervention details: type, duration, frequency, and intensity of physical activity.

Outcome measures: cognitive function (e.g., specific cognitive tests used), cognitive decline (e.g., incidence of dementia), and quality of life (e.g., standardized questionnaires).

Key findings: main results related to the impact of physical activity on cognitive decline and quality of life.

Extracted data were organized into themes to identify common patterns, relationships, and differences across studies. Themes were identified based on the nature of the physical activity interventions, their reported effects on cognitive decline and quality of life, and the mechanisms proposed by the authors of the included studies.

The synthesized findings were integrated into a coherent narrative that highlights the current state of knowledge, areas of agreement and disagreement, and gaps in the literature. This narrative integration was guided by the objectives of the review, emphasizing the interplay between physical activity, cognitive decline, and quality of life in older adults.

3. Cognitive Decline in Older Adults

3.1 Definition and Types of Cognitive Decline

Cognitive decline in older adults refers to a gradual reduction in cognitive capabilities, including memory, attention, executive function, and processing speed. This decline can manifest as normal age-related cognitive changes or more severe forms such as mild cognitive impairment (MCI) and dementia. MCI is characterized by noticeable cognitive deficits that do not significantly impair daily functioning, whereas dementia represents a more pronounced decline affecting the individual's ability to perform everyday activities independently (5, 20-28).

3.2 Types of cognitive decline include:

Normal Age-Related Cognitive Decline: Minor changes in cognitive functions, often affecting memory and processing speed, but not severe enough to interfere with daily life.

Mild Cognitive Impairment (MCI): Greater than expected cognitive decline for the individual's age, but not severe enough to impact daily functioning significantly (29-34).

Dementia: A progressive and debilitating decline in cognitive function, impacting memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgment (25).

3.3 Prevalence and Risk Factors

Cognitive decline is a prevalent issue among older adults, with significant variations across different populations. For instance, approximately 10-20% of adults aged 65 and older have MCI, and around 50 million people globally live with dementia, a number expected to triple by 2050 (3, 21, 22).

Risk factors for cognitive decline include:

Age: The most significant risk factor, with prevalence increasing significantly after age 65 (18).

Genetics: Family history of dementia and genetic predispositions such as the presence of the APOE ε4 allele (5, 25).

Cardiovascular Health: Conditions like hypertension, diabetes, and hyperlipidemia are linked to an increased risk of cognitive decline (25).

Lifestyle Factors: Poor diet, lack of physical activity, and smoking are associated with higher risks of cognitive deterioration (6).

Psychosocial Factors: Low educational attainment, social isolation, and depression also contribute to the risk (16-18).

3.4 Impact on Quality of Life

Cognitive decline significantly impacts the quality of life (QoL) of older adults. As cognitive abilities deteriorate, individuals may experience reduced independence, increased reliance on caregivers, and decreased ability to engage in social and recreational activities (5). This decline in QoL can lead to feelings of frustration, depression, and a sense of loss, further exacerbating cognitive and functional impairments (4).

The psychological impact of cognitive decline includes increased anxiety, stress, and a higher prevalence of depressive symptoms. Socially, affected individuals may withdraw from social interactions due to embarrassment or difficulty in communication, leading to isolation and loneliness (13). Additionally, the financial burden of managing cognitive decline, including medical care, assisted living, and caregiver support, can be substantial, further affecting QoL.

4. Physical Activity in Older Adults

4.1 Definition and Types of Physical Activity

Physical activity (PA) encompasses any bodily movement produced by skeletal muscles that require energy expenditure. For older adults, PA can be broadly categorized into several types, each offering unique benefits:

Aerobic Exercise: Activities like walking, swimming, and cycling that improve cardiovascular fitness (35-37).

Resistance Training: Exercises such as weight lifting that enhance muscle strength and endurance (29, 38).

Flexibility Exercises: Activities like stretching and yoga that improve the range of motion of joints (29, 39).

Balance Exercises: Practices like tai chi and balance drills that help prevent falls by improving stability and coordination (15).

4.2 Recommended Levels of Physical Activity for Older Adults

Health organizations, including the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), provide guidelines for PA in older adults. They recommend:

At least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity per week.

Muscle-strengthening activities on two or more days per week.

Activities that improve balance and prevent falls on three or more days per week, especially for those at risk of falls (20).

4.3 Benefits of Physical Activity on Physical Health

Regular physical activity provides numerous health benefits for older adults, contributing to overall well-being and delaying the onset of chronic diseases. Key benefits include:

Cardiovascular Health: Regular aerobic exercise reduces the risk of heart disease, lowers blood pressure, and improves cholesterol levels (27).

Musculoskeletal Health: Resistance training helps maintain muscle mass, strength, and bone density, reducing the risk of osteoporosis and sarcopenia (40).

Metabolic Health: PA improves insulin sensitivity, helping to manage and prevent type 2 diabetes and metabolic syndrome (7).

Mental Health: Engaging in regular PA is associated with lower levels of anxiety and depression, improved mood, and better stress management (28).

Cognitive Health: Evidence suggests that regular physical activity can enhance cognitive functions, slow cognitive decline, and reduce the risk of dementia by promoting neuroplasticity and cardiovascular health (13, 41).

The multi-faceted benefits of physical activity make it a critical component of healthy aging, offering protective effects against both physical and cognitive decline. Studies have shown that even moderate levels of PA can lead to significant health improvements, highlighting the importance of incorporating regular exercise into the daily routines of older adults (24, 26).

5. Physical Activity and Cognitive Decline

5.1 Mechanisms by Which Physical Activity May Influence Cognitive Decline

Physical activity (PA) is believed to influence cognitive decline through several mechanisms, including improved cardiovascular health, increased neuroplasticity, and enhanced neurogenesis. Regular PA enhances blood flow to the brain, delivering essential nutrients and oxygen that support neuronal health and cognitive function (15). Cardiovascular improvements from aerobic exercise can lead to better overall brain health, reducing the risk of cognitive impairment (27).

Another key mechanism is neuroplasticity, the brain's ability to reorganize itself by forming new neural

connections. Physical activity promotes neuroplasticity, particularly in regions associated with memory and learning, such as the hippocampus. This can help delay the onset of cognitive decline and improve cognitive performance (24). Additionally, exercise-induced neurogenesis, the formation of new neurons, particularly in the hippocampus, contributes to cognitive resilience and repair mechanisms that counteract age-related cognitive deterioration (13).

5.2 Summary of Key Studies Linking Physical Activity to Reduced Cognitive Decline

Numerous studies have highlighted the positive impact of physical activity on cognitive health. For instance, Reas et al. (2019) demonstrated that regular PA is associated with slower cognitive decline in community-dwelling older adults. Their longitudinal study found that participants who engaged in consistent physical activity showed better cognitive performance over time compared to sedentary individuals (14).

Jeong and Jang (2017) conducted a cross-sectional study in Korea that linked higher levels of physical activity with lower instances of cognitive dysfunction (41). Similarly, Liu et al. (2022) found that older adults in rural China who engaged in regular physical activity had better cognitive functioning and slower cognitive decline, emphasizing the universal benefits of PA across different populations (17).

Moreover, Kimura (2023) conducted a longitudinal analysis that identified lifestyle factors, including physical activity, as significant predictors of cognitive health. The study underscored that older adults who maintained an active lifestyle experienced less cognitive decline compared to those with sedentary habits (6).

5.3 Differences in Impact by Type, Duration, and Intensity of Physical Activity

The type, duration, and intensity of physical activity play crucial roles in its effectiveness in reducing cognitive decline. Aerobic exercises such as walking, swimming, and cycling have been extensively studied and are consistently linked to cognitive benefits (26). Resistance training also shows promise, particularly in enhancing executive functions and memory (15).

The duration of physical activity is another critical factor. Long-term engagement in regular PA is associated with sustained cognitive benefits, while short-term interventions may yield limited effects. For instance, the study by You et al. (2019) demonstrated that long-term adherence to an exercise regimen was crucial for observing significant cognitive improvements (28).

Intensity is equally important. Moderate-intensity physical activities have been found to be particularly effective in promoting cognitive health. Liu, Hou, Zhang, and Liu (2022) noted that moderate-intensity activities, such as brisk walking or light jogging, were more beneficial for cognitive functions compared to low-intensity exercises (17).

Overall, a combination of different types of physical activities performed consistently over a long period and at moderate intensity appears to be the most effective strategy for reducing cognitive decline in older adults.

6. Physical Activity and Quality of Life

6.1 Mechanisms by Which Physical Activity Enhances Quality of Life

Physical activity enhances quality of life (QoL) through multiple pathways, including improved physical health, better mental health, and increased social engagement. Regular PA helps maintain physical fitness, reduces the risk of chronic diseases, and enhances mobility, all of which contribute to better overall QoL (7).

Mental health benefits are also significant. Physical activity reduces symptoms of anxiety and depression, enhances mood, and improves stress resilience. These psychological benefits contribute to a more positive outlook on life and greater emotional well-being (18).

Socially, engaging in physical activities often involves group settings, fostering social interactions and reducing feelings of isolation. This increased social engagement further enhances QoL by providing emotional support and a sense of community (16).

6.2 Summary of Key Studies Linking Physical Activity to Improved Quality of Life in Older Adults

Several studies have established the link between physical activity and improved QoL in older adults. For example, Kim, Fredriksen-Goldsen, and Jung (2022) found that physical activity was a significant determinant of QoL among older adults, particularly those with cognitive

impairments. Their study highlighted that regular engagement in physical activities led to better physical functioning and health-related QoL (4).

Li and Li (2022) conducted a longitudinal study that identified physical activity as a protective factor for QoL in older Chinese adults. The study revealed that participants who maintained an active lifestyle reported higher QoL scores compared to their sedentary counterparts (5).

Another study by Chang (2024) explored the feasibility and effects of multi-component exercise interventions on older adults with dementia. The findings suggested that such interventions not only improved cognitive functions but also significantly enhanced QoL by promoting physical health, mental well-being, and social interactions (42).

6.3 Differences in Impact by Type, Duration, and Intensity of Physical Activity

The impact of physical activity on QoL varies by type, duration, and intensity of the exercise. Aerobic exercises are known for their comprehensive health benefits, including enhanced cardiovascular health and overall physical fitness, which are crucial for maintaining a high QoL (27). Resistance training, on the other hand, has been shown to improve muscle strength and endurance, contributing to better mobility and independence in daily activities (40).

The duration of physical activity plays a pivotal role in its effectiveness. Sustained, long-term engagement in physical activities is associated with more pronounced improvements in QoL. For instance, studies indicate that older adults who participate in regular physical activity for several months or years experience significant enhancements in their QoL compared to those who engage in short-term or sporadic exercise (14).

Intensity is another crucial factor. Moderate-intensity physical activities are particularly effective in enhancing QoL. Activities such as brisk walking, swimming, and dancing provide substantial health benefits without imposing excessive strain on the body, making them suitable for older adults (19).

Overall, engaging in a variety of physical activities at moderate intensity over a prolonged period is the most effective approach to improving QoL in older adults.

7. Interrelationship between Cognitive Decline, Quality of Life, and Physical Activity

7.1 How Cognitive Decline Affects Quality of Life and Vice Versa

Cognitive decline has a profound impact on the quality of life of older adults. As cognitive functions deteriorate, individuals often experience a decline in their ability to perform daily activities, leading to increased dependence on caregivers and a reduction in personal autonomy (21). This loss of independence can result in feelings of frustration, helplessness, and decreased self-esteem, all of which negatively impact QoL (5).

Conversely, a higher QoL can positively influence cognitive health. Older adults who maintain a high QoL through physical, mental, and social engagement are likely to experience slower cognitive decline. Positive lifestyle factors such as engaging in stimulating activities, maintaining social connections, and managing stress contribute to better cognitive outcomes (2).

7.2 Role of Physical Activity in Mediating This Relationship

Physical activity plays a mediating role in the relationship between cognitive decline and quality of life by providing both direct and indirect benefits. Directly, PA improves cognitive function through enhanced blood flow, neuroplasticity, and neurogenesis (15). Indirectly, PA enhances physical health, mental well-being, and social engagement, all of which contribute to a higher QoL and, consequently, better cognitive health (18).

Studies have shown that physical activity can mitigate the impact of cognitive decline on QoL. For instance, Bollaert and Motl (2019) demonstrated that older adults with higher self-efficacy for physical activity reported better physical and cognitive functions, which in turn contributed to higher QoL. Similarly, Liu, Pei, and Wu (2022) found that active life engagement, facilitated by regular PA, was associated with better cognitive functioning and higher QoL in rural Chinese older adults (16).

7.3 Summary of Studies Exploring This Interrelationship

Numerous studies have explored the interrelationship between cognitive decline, quality of life, and physical

activity. For example, Kimura (2023) identified lifestyle factors, including physical activity, as significant predictors of cognitive health and QoL. The study emphasized that maintaining an active lifestyle can help preserve cognitive functions and enhance overall well-being (6).

Pitrou, Vasiliadis, and Hudon (2022) investigated the modifying effect of physical activity on the relationship between body mass index (BMI) and cognitive decline. Their findings suggested that regular PA can offset some of the negative effects of higher BMI on cognitive health, thereby contributing to better QoL (23).

Seinsche (2024) examined the effects of home-based interventions using exergames on physical and cognitive functions in community-dwelling older adults. The study highlighted that such interventions not only improved cognitive abilities but also enhanced QoL by providing an engaging and enjoyable form of exercise (43).

Overall, the evidence supports the notion that physical activity serves as a crucial mediator in the relationship between cognitive decline and quality of life. Regular engagement in physical activities can help maintain cognitive health, enhance QoL, and promote overall well-being in older adults.

8. Discussion

The descriptive analysis of the literature reveals that physical activity (PA) has a significant positive impact on cognitive decline and quality of life (QoL) in older adults. The mechanisms through which PA influences cognitive decline include enhanced cardiovascular health, increased neuroplasticity, and neurogenesis (15). Regular engagement in physical activities, especially aerobic and resistance exercises, has been consistently linked to better cognitive functioning and slower cognitive decline (14, 41). Additionally, PA enhances QoL by improving physical health, mental well-being, and social engagement (16-18).

The type, duration, and intensity of PA significantly influence its effectiveness. Moderate-intensity exercises such as brisk walking and swimming provide substantial cognitive and physical health benefits (17). Long-term adherence to PA regimens is crucial for sustained improvements in cognitive function and QoL (28).

Previous reviews and meta-analyses have also highlighted the beneficial effects of physical activity on cognitive health and quality of life in older adults. For instance, a systematic review by Westman et al. (2019) demonstrated that regular PA is associated with reduced cognitive decline and improved physical performance in older adults (44). Similarly, a meta-analysis by Thummasorn et al. (2022) found that resistance training significantly improves cognitive functions and muscle strength, contributing to better QoL (40).

However, this review adds to the existing literature by providing a comprehensive descriptive analysis that explores the specific mechanisms through which PA influences cognitive health and QoL. It also emphasizes the importance of different types, durations, and intensities of physical activity, offering a nuanced understanding of how PA can be optimized for cognitive and quality of life benefits.

The findings of this review have several implications for practice and policy. Healthcare providers should encourage older adults to engage in regular physical activity tailored to their abilities and preferences. Exercise programs should include a variety of activities, such as aerobic, resistance, and flexibility exercises, to maximize cognitive and physical health benefits (15).

Policy makers should develop and support initiatives that promote physical activity among older adults. Community-based programs, accessible exercise facilities, and educational campaigns can help increase awareness and participation in physical activity (6). Additionally, integrating physical activity into routine healthcare for older adults can enhance overall well-being and reduce healthcare costs associated with cognitive decline and related comorbidities (5).

Despite the comprehensive nature of this review, several limitations should be acknowledged. First, the review primarily included studies published in English, which may limit the generalizability of the findings to non-English-speaking populations. Second, the variability in study designs, populations, and measures of physical activity and cognitive outcomes across studies makes it challenging to draw definitive conclusions.

Third, this review did not employ a formal quantitative assessment of study quality, which could introduce bias in the synthesis of findings. Finally, most studies included in this review are observational, which limits the ability to

establish causality between physical activity and cognitive health or QoL.

Future research should focus on addressing the limitations identified in this review. Longitudinal and intervention studies with diverse populations are needed to establish causality and generalize findings. Additionally, standardized measures of physical activity and cognitive outcomes should be used to facilitate comparisons across studies.

Research should also explore the optimal types, durations, and intensities of physical activity for cognitive health and QoL benefits in older adults. Investigating the underlying mechanisms through which PA influences cognitive function and QoL can provide insights for developing targeted interventions. Finally, studies examining the cost-effectiveness of physical activity programs for older adults can inform policy decisions and resource allocation.

9. Conclusion

This review highlights the significant positive impact of physical activity on cognitive decline and quality of life in older adults. Regular engagement in physical activities, particularly aerobic and resistance exercises, is associated with better cognitive functioning and slower cognitive decline (Reas et al., 2019; Jeong & Jang, 2017). Physical activity also enhances QoL by improving physical health, mental well-being, and social engagement (Kwok, Pan, & Farm, 2021; Liu, Pei, & Wu, 2022).

Physical activity is a crucial intervention for promoting cognitive health and enhancing the quality of life in older adults. Its multifaceted benefits, including improved cardiovascular health, neuroplasticity, and mental well-being, make it a vital component of healthy aging. Encouraging older adults to engage in regular physical activity can help mitigate cognitive decline, enhance independence, and improve overall well-being. Future research and policy initiatives should continue to focus on promoting physical activity to ensure a healthier, more active aging population.

Authors' Contributions

F.F. was responsible for conceptualizing the review, defining the inclusion criteria, and leading the writing of the manuscript. Ö.E. contributed to data collection, analysis of the literature, and writing—review and editing of the manuscript. Both authors played a significant role in synthesizing the findings, discussing the implications, and suggesting future research directions. They have both read and approved the final version of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

Ethical standards, including fair use of information and proper citation, were strictly adhered to, maintaining the integrity of the review.

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