

Correlation between Physical Activity and Depression, Perceived Health, Physical Function, and Quality of Life in Older Women with Mild Cognitive Impairment

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Received: August 12, 2023; Revised: October 01, 2023; Accepted: November 03, 2023

Abstract

Background: While the beneficial effects of PA on the mental and physical well-being of elderly individuals are recognized, there has been little focus on its effects on older adults with mild cognitive impairment (MCI). Therefore, the objective of this investigation was to examine the correlations between physical activity (PA) and depression, perceived health, physical function, and quality of life (QoL) among older women with Mild Cognitive Impairment (MCI).

Methods: This study employed a descriptive-correlation design. The statistical population comprised women with MCI (scoring 21 to 24 on the Mini-Mental State Examination) over 65 years residing in nursing homes in Tehran, Iran in 2023. The sample of this study consisted of 334 women (mean age=69.12±3.68) with MCI who were selected using a purposive sampling method. Standard tools were utilized for measuring PA, depression, balance, muscle strength, and QoL, respectively. Perceived health status was assessed using one item. Pearson correlation test and independent t-test were employed for data analysis.

Results: The results showed that 66% of the entire sample suffered from depression. The participants engaged, on average, in 14.69 minutes of moderate physical activity (MPA) per day. Only 22% of the participants met the WHO's guidelines of 30 minutes of MPA daily. It was found that higher MPA was significantly correlated with lower depression ($P<0.001$) and higher perceived health, physical function (both balance and muscle strength), and QoL (all $P<0.001$). On the other hand, higher sedentary time was significantly correlated with higher depression ($P<0.001$) and lower perceived health, physical function (both balance and muscle strength), and QoL (all $P<0.001$).

Conclusions: The results suggested that strategies to improve health-oriented PA status in the elderly with MCI are necessary. In this regard, it is especially recommended that nurses plan recreational physical and sports activities for the elderly in groups or individually so that they can enjoy the benefits of PA.

Keywords: Aging, Cognitive dysfunction, Exercise, Mental health, Quality of life

How to Cite: Hashemi Motlagh S, Alam Z, Dana A, Mokkari Saei S. Correlation between Physical Activity and Depression, Perceived Health, Physical Function, and Quality of Life in Older Women with Mild Cognitive Impairment. Women. Health. Bull. 2024;11(1):11-19. doi: 10.30476/WHB.2024.101371.1265.

1. Introduction

Aging is an inevitable phenomenon encompassing natural changes in various biological, psychological, physiological, environmental, behavioral, and social aspects, ultimately leading to limitations and decreased efficiency in elderly individuals' lives (1). Old age is often characterized by a decline in performance and age-related physical changes, with individuals aged 65 and above classified as elderly by the World Health Organization (WHO) (2, 3). In 2019, the proportion of people aged 65 and over was 9%, projected to reach 12% by 2030, 16% by 2050, and 23% by 2100 worldwide (3).

With advancing age, cognitive changes become

more prevalent, ranging from normal cognitive aging to mild cognitive impairment (MCI) and Alzheimer's disease (4). MCI serves as an intermediary phase between typical cognitive aging and the onset of Alzheimer's disease, aimed at impeding its progression (5, 6). It is characterized by measurable cognitive deterioration in one or multiple cognitive domains, notably episodic memory loss and delayed recall (7, 8). Additionally, older adults with MCI often experience declines in executive functions, working memory, attention, visual processing speed, and language function (9). The prevalence of MCI among individuals aged 65 and above in population studies ranges from 10 to 20 percent (10). Identifying MCI is crucial, as it adversely affects quality of life (QoL) and functional ability and tends to progress into

dementia, making early detection and intervention pivotal in delaying or preventing cognitive decline associated with aging (8-11).

While MCI was previously associated solely with poor cognitive performance, recent research has uncovered additional issues affecting elderly individuals with MCI (12-14). Studies have revealed a high prevalence of depression among this population (12-18). Furthermore, older adults with both MCI and depression tend to exhibit more pronounced cognitive deficits (13, 16), performing weaker in immediate and delayed memory tasks compared to those with MCI alone (19, 20). Significant differences in visual-spatial performance, memory, and executive function have been observed between non-depressed and depressed elderly individuals with MCI (21). The correlation between depressive symptoms and cognitive function in older adults with MCI is significantly higher than those with Alzheimer's disease (22). Older adults with MCI and simultaneous depression progress to dementia more often than those with MCI without depression (23). The annual conversion rate of MCI to dementia has been reported between 25% and 28% in patients with MCI and concurrent depression (5-8).

Depressive symptoms significantly influence the progression to dementia and are associated with QoL in elderly individuals with MCI (13, 15, 18, 20). Depression also correlates with increased medication use, higher non-prescription drug costs, elevated alcohol consumption risk, extended hospital stays, and increased care costs (24, 25). Therefore, addressing depressive symptoms in individuals with MCI is crucial for improving QoL and potentially slowing further cognitive decline. While antidepressants are commonly prescribed, their effectiveness in older adults with MCI and dementia remains inconclusive (26), emphasizing the importance of exploring non-pharmacological interventions such as physical activity (PA). PA has been suggested as a potential therapy for depression (27, 28) and is considered a complementary approach in treatment guidelines for mild to moderate and severe depression (29).

According to WHO recommendations, older adults should engage in a minimum of 30 minutes of moderate physical activity (MPA) daily to enhance overall health (30). An active lifestyle may mitigate aging, with physically active elderly

individuals exhibiting better health and vitality (31). Regular PA helps prevent cardiovascular diseases, diabetes, and other systemic illnesses, contributing to physical and mental well-being. Evidence supported the positive impact of PA on health (32), as it maintains physical and mental well-being, boosts self-confidence and life expectancy, and stimulates the release of serotonin, reducing depression and enhancing QoL (33, 34). Moreover, PA and sports play a valuable role in rehabilitating and managing mental health conditions (31, 35), with regular aerobic exercise shown to alleviate symptoms of anxiety and depression, boost self-esteem, and improve mood (32, 34). Additionally, PA participation improves physical functions in the elderly (33, 34).

While the beneficial effects of PA on the mental and physical well-being of elderly individuals are recognized, there has been limited research on its specific effects on older women with MCI. Hence, this study aimed to explore the associations between PA and depression, perceived health, physical function, and QoL in this particular demographic of older women with MCI.

2. Methods

2.1. Design and Participants

The research employed a descriptive-correlational design; the statistical population of this study comprised women with MCI Mini-Mental State Examination scores ranging from 21 to 24 aged over 65 years residing in nursing homes in Tehran, Iran between January and May 2023.

2.2. Inclusion and Exclusion Criteria

Study participation requirements include 1) providing informed consent, 2) being aged 65 years and older, 3) receiving a diagnosis of MCI (Mini-Mental State Examination scores ranging from 21 to 24), 4) possessing at least elementary literacy, and 5) the absence of other neurological illnesses according to the diagnosis of the nursing home physician. Exclusion criteria for the study encompassed 1) incomplete questionnaire responses and 2) failure to implement the accelerometer protocol fully.

2.3. Procedure

Researchers visited nursing homes in

Tehran, Iran to select participants. Purposive sampling was employed to ensure the sample's representativeness concerning the number of research variables. As a result, 338 women over 65 years (mean age=69.12±3.68) were selected as the research sample. Accounting for potential experimental mortality, distorted questionnaires, and outliers, 344 questionnaires were utilized for data analysis. Upholding ethical principles throughout this study, researchers personally completed all research questionnaires. The research objectives and procedures were communicated to relevant officials and participants before the questionnaire's completion. All participants provided written informed consent, as approved by the university ethics committee (code: IR.IAU.TNB.REC.1401.059).

2.4. Measures

2.4.1. Physical Activity

A modern accelerometer with high validity and reliability measured MPA (36). A conventional protocol was used, involving attaching the device to the right thigh for one week, with removal during sleep, bathing, or any other activities that could potentially harm the device. A counts per minute (CPM) range of ≥1952–5724 was utilized to calculate MPA (36).

2.4.2. Depression

The Geriatric Depression Scale (GDS-15) (37) was applied to evaluate depression. Consisting of 15 questions, responses were recorded in a "Yes/No" format. Depression severity was categorized as usual, mild, moderate, or severe based on scores ranging from 0-4, 5-8, 9-11, and 12-15, respectively. The Persian adaptation of this measurement tool was validated by a panel of 8 specialists (CVI=0.90, CVR=0.92). The scale's reliability was assessed with a Cronbach's alpha coefficient of 0.92.

2.4.3. Perceived Health

Perceived health status was assessed using a single item: "Overall, how would you evaluate your current health condition? Would you consider it to be excellent, good, fair, poor, or inferior?" (Rated on a five-point scale from 1=very poor to 5=excellent). The Persian version of this scale was validated by 8 experts (CVI=1.00, CVR=1.00).

2.4.4. Physical Function

Balance: Participants' balance ability was assessed using Stork's test. This test involved standing on the sole of the superior foot while placing the sole of the other foot on the inner side of the knee of the supporting leg. The test was conducted three times, with the best time recorded. The interval between performances was 3 minutes.

Muscle Strength: Participants sat on a 43 cm-high chair, standing up and sitting down for 30 seconds while placing their hands in front of their bodies on the chest. The number of sit-to-stand repetitions in 30 seconds was considered the score.

2.4.5. Quality of Life

The SF-36 was employed to assess QoL among older individuals (38). Each question was scored from 0 to 100, with higher scores indicating better quality of life. The Persian adaptation of this measurement tool was validated by a panel of 8 specialists (CVI=0.88, CVR=0.90). The scale's reliability was assessed with a Cronbach's alpha coefficient of 0.90.

2.5. Statistical Analysis

Data analysis was conducted using SPSS version 26. Descriptive statistics such as mean, standard deviation (SD), numbers (n), and percentages (%) were used to depict the data. The Kolmogorov-Smirnov test indicated that the data exhibited a normal distribution (all $P > 0.05$). Pearson correlation analysis was conducted to assess the relationships among the variables. Additionally, to determine whether meeting WHO guidelines for PA led to improvements in depression, perceived health, physical function, and QoL, participants were divided into two groups: 1) individuals meeting the daily 30-minute MPA recommendation ("Met" group) and 2) those not meeting the recommendation ("not-met" group). The difference between these two groups was assessed using an independent t-test; the significance level was set at $P < 0.05$.

3. Results

3.1. Demographic Characteristics

The study comprised 334 women and older adults aged over 65 years (Mean age: 69.12±3.68). On

average, participants had resided in nursing homes for 2.75 years. Of these, 113 (34%) had lived for less than three years, 170 (51%) between 3-5 years, and 51 (15%) for more than five years. The sample's average body mass index (BMI) was 25.67 ± 2.29 , indicating they were overweight. Among them, 35 (10%) had a BMI less than 25 (healthy status), 220 (64%) had a BMI between 25 and 27 (overweight status), and 79 (24%) had a BMI greater than 27 (obesity status). Additionally, 285 (85%) were married, 30 (9%) were divorced, and 19 (6%) were widowed. Furthermore, 27 (8%) had a college education, 60 (18%) had high school diplomas, and 247 (74%) had middle school education or less.

3.2. Physical Activity

PA patterns were assessed using accelerometers over one week. The results are shown in Table 1. Results indicated that the range of daily MPA for the entire sample varied from 2 to 45 minutes, with an average of 14.69 minutes per day. It was noted that the WHO's guidelines recommending at least 30 minutes of daily MPA were not adhered to the participants (30). Moreover, MPA showed a significant positive correlation with BMI ($r=0.359$, $P<0.001$), while sedentary behavior exhibited a significant negative correlation with BMI ($r=-0.421$, $P<0.001$).

3.3. Depression

Mean and standard deviation of depression scores are presented in Table 1. The mean depression score for the entire sample was 9.58, indicating a moderate level of depression. Of the participants, 34% had a normal condition, 22% had mild depression, 28% had moderate depression, and 16% had severe depression. Furthermore, 66% of participants experienced depression (mild,

moderate, or severe levels).

3.4. Perceived Health

Mean and standard deviation of perceived health status are demonstrated in Table 1. Participants reported an average perceived health status close to regular (mean=2.88). Specifically, 7% perceived their health as good, 21% as good, 35% as regular, 28% as bad, and 9% as bad.

3.5. Physical Function

Mean and standard deviation of physical function's items are presented in Table 1.

3.5.1. Balance

The average balance performance among participants was 4.92 seconds, ranging from 1 to 10 seconds.

3.5.2. Muscle Strength

The average muscle strength performance was 4.38 repetitions in 30 seconds, ranging from 1 to 7 repetitions.

3.6. Quality of Life

Mean and standard deviation of QoL is presented in Table 1. Participants had an average QoL score of 60.58, ranging from 32.61 to 84.09.

3.7. Correlations between Physical Activity with Depression, Perceived Health, Physical Function, and Quality of Life

Results of Pearson correlation tests are shown

Table 1: Mean and standard deviation (SD) of the research variables across gender

Variable	MPA (minutes/day)	Sedentary time (minutes/week)	Depression	Perceived health	Balance (second)	Muscle strength (number)	QoL
Mean±SD	14.69±5.48	583.93±108.16	9.58±2.14	2.88±0.74	4.92±2.21	4.38±1.30	60.58±9.25

QoL: Quality of Life

Table 2: The correlations between Physical activity with depression, perceived health, physical function and quality of line

	Depression	Perceived health	Balance	Muscle strength	QoL
MPA	$r=-0.527$ $P<0.001$	$r=0.340$ $P<0.001$	$r=0.724$ $P<0.001$	$r=0.638$ $P<0.001$	$r=0.607$ $P<0.001$
Sedentary time	$r=0.416$ $P<0.001$	$r=-0.503$ $P<0.001$	$r=-0.419$ $P<0.001$	$r=-0.471$ $P<0.001$	$r=-0.397$ $P<0.001$

QoL: Quality of Life

Table 3: Mean and standard deviation (SD) of the variables across “Met” and “Not-Met” groups

Variable	Met group	Not-met group	Group differences
Depression	8.47±2.10	10.68±3.42	t=-4.516 P<0.001
Perceived health	3.36±0.87	2.42±0.93	t=3.295 P<0.001
Balance	5.39±1.04	3.21±1.46	t=5.228 P<0.001
Muscle strength	5.20±1.80	2.95±1.25	t=-6.157 P<0.001
QoL	65.23±8.19	52.41±10.08	t=-7.058 P<0.001

Met group: The group who were met, Not-Met group: The group who were not met. QoL: Quality of Life

in Table 2. The results indicated that higher MPA was significantly correlated with lower depression ($P<0.001$), higher perceived health, physical function (both balance and muscle strength), and QoL (all $P<0.001$). Conversely, higher sedentary time was significantly correlated with higher depression ($P<0.001$) and lower perceived health, physical function (both balance and muscle strength), and QoL (all $P<0.001$).

3.8. Depression, Perceived Health, Physical Function, and QoL across “Met” and “not-Met” groups

A total of 22% of participants engaged in more than 30 minutes of MPA daily, while 78% had less than 30 minutes of MPA per day. The results are shown in Table 3. Participants in the “Met” group had significantly lower depression scores than those in the “Not-Met” group ($P<0.001$). Additionally, the “Met” group reported significantly higher perceived health, physical function (both balance and muscle strength), and QoL compared to the “Not-Met” group (all $P<0.001$).

4. Discussion

The aging population presents significant economic, social, and health challenges in the 21st century. Within this context, MCI stands out as a common consequence of aging, often associated with declines in cognitive abilities (4). This study aimed to explore the relationship between PA and depression among older women with MCI, as well as its associations with perceived health, physical function, and QoL. Notably, 66% of the total sample in this study exhibited signs of depression, consistent with prior research (39), underscoring depression as a severe consequence of MCI in older women. These findings emphasized the need for

strategies tailored to address the effects of aging and MCI, mainly focusing on older women.

The study revealed that engaging in PA could potentially mitigate depression among older women with MCI. Despite participants not meeting the WHO’s recommended guideline of 30 minutes of daily MPA, higher levels of MPA were significantly associated with lower depression levels (30). Furthermore, participants adhering to the WHO’s guidelines reported notably reduced depression levels compared to those who did not meet the guidelines (27, 28, 35). Clinical studies have proposed mechanisms explaining the positive impact of PA on depression, including increased levels of serotonin, dopamine, and norepinephrine—commonly referred to as “feel-good” hormones—thus reducing stress and enhancing overall well-being (40).

Moreover, the findings highlighted the positive impact of PA on perceived health and QoL among elderly women with MCI. Increased MPA correlated significantly with higher perceived health and QoL ratings. Similarly, women meeting the WHO’s guidelines for daily MPA reported significantly better-perceived health and QoL than those who did not meet the guidelines, consistent with prior studies (26, 28). This positive effect of PA on QoL may be attributed to increased self-confidence, self-esteem, and physical fitness (33). PA is known to maintain physical fitness, promoting healthy weight, bone density, muscle strength, joint mobility, and overall physiological well-being, thus reducing the risk of falls, a critical concern among the elderly, and strengthening the immune system (34, 35).

Furthermore, the research indicated that higher levels of MPA were associated with better physical function, including balance and muscle strength, in

older women with MCI. These physical abilities are (34) crucial for daily activities and fall prevention in the elderly, suggesting that PA significantly contributes to their well-being and QoL.

Additionally, the study examined sedentary behavior, revealing direct correlations with depression and inverse correlations with perceived health, QoL, and physical function among older women with MCI. Sedentary lifestyles were associated with elevated depression levels and decreased perceived health, QoL, and physical function (35). This underscores the importance of reducing sedentary behavior and increasing PA to enhance the physical and mental well-being of older women with MCI.

4.1. Limitation

While this study benefited from objective measurements of physical activity using modern accelerometers, its cross-sectional design limits causal inferences. Future research should consider intervention studies to explore the effects of various physical activities and sports on elderly individuals with MCI. Moreover, the study's exclusive focus on elderly women in nursing homes in Tehran, Iran, calls for caution when generalizing findings to broader populations. Finally, light and vigorous levels of PA were not used in this study, because according to WHO's guidelines, MPA as well as sedentary behavior are considered as indicators of health-oriented PA for older adults.

5. Conclusion

Findings revealed a high prevalence of depression among participants, with a notable portion failing to meet PA guidelines. However, higher levels of MPA were associated with reduced depression and improved perceived health, physical function, and QoL. These results underscored the significance of PA for older women with MCI, emphasizing the need for strategies to promote health-oriented PA among this demographic characteristic. Particularly in nursing home settings, nurses can play a vital role in planning recreational physical activities, ensuring elderly individuals reap the benefits of PA.

Acknowledgment

We appreciated the participants who took part

in current research.

Ethical Approval

The Ethics Review Board of North Tehran Branch, Islamic Azad University, approved the present study with the code of IR.IAU.TNB.REC.1401.059. Also, written informed consent was obtained from the participants.

Authors' Contribution

Shaghayegh Hashemi Motlagh: Substantial contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the work, drafting the work. Amir Dana: Contributions to the conception of the work, drafting the work and reviewing it critically for important intellectual content. Zahra Alam: Contributions to the conception of the work, drafting the work and reviewing it critically for important intellectual content. Sima Mokkari Saei: Acquisition, analysis, and interpretation of data for the work, drafting the work. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

Conflict of Interest: None declared.

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