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# Associations Between Physical Fitness, Cognitive Function, and Depression in Nursing Homes Residents Between 60-100 Years of Age in South-Western Poland

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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**Background:** Healthy aging depends on physical fitness, cognitive function, and emotional well-being. Reduced physical activity in the elderly impacts daily activities, increasing morbidity risk. Cognitive decline affects learning, attention, and independence. Depression, prevalent among the elderly, correlates with loneliness and affects overall health. Physical fitness positively influences cognitive health and mood. This study examines these associations in Polish nursing homes residents.

**Material/Methods:** We assessed 93 people aged 60-100 years living in nursing homes. The Short Physical Performance Battery (SPPB) test was used to assess physical fitness. The Abbreviated Mental Test Score (AMTS) was used to assess cognitive functions. The Geriatric Depression Scale (GDS) was used to assess depression.

**Results:** In the SPPB test, the mean score was 4.85 points, indicating moderate limitations. On the AMTS, 55% of subjects had cognitive impairment. On the GDS scale, 44% of respondents had depressive symptoms. Seniors without mood disorders were characterized by faster gait compared to those with suspected depressive disorders ($P$=0.036). Men performed significantly better in the whole SPPB test ($P$=0.024) and in the standing up from a chair and gait speed tests ($P$=0.046, $P$<0.001) compared to women. We found a negative correlation between the AMTS test scores and the SPPB gait test scores and age ($P$<0.05) and a positive correlation between the SPPB gait test scores and the GDS scores ($P$<0.05).

**Conclusions:** Older nursing homes' residents in better emotional and cognitive state tended to have faster gait. Men tended to have a higher level of physical fitness compared to women. Older age was associated with worse cognitive state of the examined seniors.

**Keywords:** Aging • Depression • Mental Status and Dementia Tests • Nursing Homes • Physical Fitness

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## Background

The World Health Organization (WHO) defines healthy aging as the process of developing and maintaining functional capacities that enables well-being in old age [1].

One of the determinants of health and well-being is physical fitness, which plays a key role in maintaining independence in performing activities of daily living [2]. The decline in physical activity and exercise tolerance with age is physiological and inevitable [3]. In the elderly, physical fitness is reduced due to loss of muscle mass and strength, impaired balance control, and impaired cardiorespiratory function [3,4]. Muscle endurance, agility, and joint mobility also decrease [3]. This contributes to the deterioration of the functional capacity and difficulties in performing basic and complex activities of daily living [5]. In turn, dependence on others for activities of daily living is associated with an increased risk of morbidity and mortality [5]. The Short Physical Performance Battery (SPPB) test [6] is a screening tool for identifying elderly people at risk of disability or its worsening. The SPPB test is an objective tool providing information about physical fitness, which is reflected in the ability to perform basic activities of daily living [6]. The SPPB test evaluates physical performance in terms of lower-limb strength, static balance, and gait speed [6,7]. The results obtained in the test allow predicting the occurrence of adverse health events such as disability, risk of institutionalization or hospitalization, and death [8,9].

Intellectual performance is essential for healthy aging [10]. Human aging is accompanied by structural and neurophysiological changes in the central nervous system and cognitive decline to varying degrees [11,12]. Research shows that older people (even if they are not affected by diseases) have reduced ability to learn and pay attention, and have worse sensorimotor skills, slower executive functions processing speed, and poorer working memory and orientation in the environment [11,12]. The greatest threat to older people's mental health is cognitive decline and the development of dementia [10]. Older people with cognitive impairment lose their independence [13] and are only able to perform some activities of daily living [14]. They then require continuous care, which has a significant impact on their family members or society, and the associated responsibilities place a significant burden on loved ones [13,14]. Additionally, studies have shown that 30-50% of older people with cognitive impairment have experienced a fall [15,16], and Li et al found their risk of falling is 2.6 times higher compared to older people without cognitive impairment [17]. Moreover, these individuals perform worse in tasks involving balance, gait, and doing 2 different things at the same time [16,17]. One of the tests used to assess cognitive functions in older people is the Abbreviated Mental Test Score (AMTS) [18], which is a reliable and useful tool in screening for possible cognitive impairment [19]. The AMTS was first introduced in 1972 by Hodkinson to assess mental impairment in older people. The AMTS is a 10-item screening questionnaire, which, in its original version, included questions on: the age of the subject, date of birth, current time and year, name of hospital, name of current British monarch, year of commencement the First World War, recall of a previously given address, counting backwards by 1 from 20 to 1, and recognition of 2 people (eg, doctor, nurse) [18].

A healthy emotional state is also an important factor in healthy aging [1]. One of the most common mood disorders occurring in older people is depression [20,21], which is a major public health problem and often contributes to disability [21]. The prevalence of depressive disorders among people aged 65 years and older is 12.3% [22], while its prevalence among primary care patients in Poland is 41% [23]. Among hospital patients and nursing home residents, its prevalence is 15-65%, two-thirds of whom do not receive medical care [23]. The Geriatric Depression Scale (GDS), introduced by Yesavage et al in 1982, is often used to assess depression in seniors, and is used to assess the intensity of depression symptoms in older people. It consists of 30 questions that must be answered yes or no. The questions concern mood, life satisfaction, life situation, self-esteem, activities, and interests [24]. The shortened version of the questionnaire consists of 15 questions (GDS-15) [25].

The risk factors for late-life depression include frailty, multimorbidity, polypharmacy, and critical life events associated with old age, such as the loss of independence or a spouse [26]. Importantly, there is a link between loneliness and morbidity and mortality [27]. Additionally, loneliness is associated with higher levels of stress and the occurrence of depressive symptoms [27]. The death of loved ones, leaving a job, or changing one's place of residence such as living in a nursing home can be associated with loneliness and isolation [28]. Often, admission to a care institution itself leads to a temporary increase in the feeling of loneliness, risk of anxiety and depression, and loss of control over one's life [28]. Depressive symptoms may be one of the forms of adaptation to the excessive demands of the environment [29]. Current research also shows that physical fitness is associated with cognition and depressive symptoms in institutionalized older adults [30,31]. Low levels of strength and aerobic capacity increase the risk of cognitive impairment and depression [30]. Physical fitness is important for cognition and has a positive impact on quality of life in institutionalized older people with dementia [31].

There has been much recent research in Europe and around the world on the physical and cognitive-emotional state of older people living in the community [2,10,17,32,33], but much less research on institutionalized older people [30,31,34], especially in Poland [23,35]. In addition, the associations of depression





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with other health complications remain insufficiently investigated in long-term care facilities and nursing homes [36]. Further research is needed to better understand them. Therefore, an important task in the care of older people, including those living in institutions, is to continuously monitor their physical and cognitive-emotional state [21]. This provides an opportunity to evaluate and compare results with studies by other authors, especially in ever-changing environmental conditions and changing generations around the world.

Therefore, this study aimed to evaluate the association between physical fitness, cognitive function, and depression in 93 nursing homes residents 60-100 years of age in south-western Poland.

## Material and Methods

### Ethics Statement

The research was approved by the Bioethics Commission at the Opole Medical School (permission no. KB/231/FI/2019). Participants were informed about the purpose and methods of the study and the procedures used. All those who wanted to participate in the study signed a document of voluntary and informed consent. The research was carried out under the guidelines of the Declaration of Helsinki and Good Clinical Practice.

### Study Design

The study was conducted in 7 randomly selected nursing homes in south-western Poland between July and September 2022. The studies were conducted before noon by the same researcher. The management of all centers consented to the research.

The STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology) were followed.

### Participants

We enrolled 93 people aged 60-100 years, including 52 women (56%). The mean age of the respondents was 78.13 years (±9.91). The study group consisted of nursing home residents who met the criteria for inclusion in the study. Inclusion criteria included: written consent to participate in the study, minimum age 60 years, ability to move independently (with or without orthopedic equipment) necessary to perform the fitness test, good verbal communication, and no severe cardiovascular disease. Exclusion criteria included: lack of written consent to participate in the study or withdrawal of consent at any stage of the study, acute injuries and infections, other medical contraindications. Of the 555 institutionalized seniors, 20 residents did not consent to the study and 442 did not meet the other inclusion criteria. Therefore, the final study group consisted of 93 nursing homes residents.

### Methods

The Short Physical Performance Battery (SPPB) test was used to assess physical fitness. It assesses physical performance in terms of lower-limb strength, static balance, and gait speed [6]. The SPPB test includes 3 tests, which were performed according to the Polish adaptation [7].

To assess lower-limb strength, a test of standing up from a chair without upper-limb assistance was used, in which the participant places the upper limbs crossed on the chest, then stands up from the chair once. After successfully completing the test, the participant is instructed to repeat this activity 5 times in the shortest possible time. The result of the test is the time in seconds taken to complete the test. Three positions were used to assess static balance: side-by-side, semi-tandem stand, and tandem stand. The test subject was asked to hold the position for 10 seconds. Subsequent positions were adopted only if the previous one was able to be held for 10 seconds. Walking a distance of 4 meters at a normal pace was used to assess gait speed. The result of the test is the time in seconds taken to complete the test [6,7]. In each test, the participant can score from 0 to 4 points: 0 means unable to perform, while 4 means the highest possible performance. The total score therefore ranges from 0 to 12 points and defines a fitness limitation. Obtaining 0-3 points throughout the test indicates severe limitations, 4-6 points indicate moderate limitations, 7-9 points indicate mild limitations, and 10-12 points show no limitations [6,7].

The Abbreviated Mental Test Score (AMTS) in the Polish version was used to assess the state of cognitive functions [18,19]. The test consists of 10 questions. In the Polish version, respondents are asked to state their residential address instead of the name of the hospital; they are not asked to recognize 2 people; instead, in addition to remembering the sample address (which they should give at the end of the test), they still have to repeat it after the respondent. The question about the year in which the First World War started was also changed to the year in which the Second World War started, and the name of the current British monarch was changed to the name of the current Polish president [19]. For each correct answer, the respondent receives 1 point; a maximum of 10 points can be scored: 7-10 points indicate a normal score, 4-6 points indicate moderate impairment, and 0-3 points indicate severe cognitive impairment [18,19].

The short version of Geriatric Depression Scale (GDS) was used to assess the severity of depressive symptoms [24,25]. The scale consists of 15 questions to be answered yes or no. The





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questions relate to mood, satisfaction with life, feelings of happiness, life situation, self-esteem, feeling energised, activities, and interests. For each question the respondent can receive 1 or 0 points [24,25]. A score of 0-5 points indicates the absence of depression, while 6-15 points suggest depression [25].

The respondents also completed the study questionnaire, which included socio-demographic data: date of birth, gender, education, marital status, place of residence, the nursing home unit where they were located, reason for being in a nursing home, and subjective level of physical activity. Height and weight were also measured and body mass index (BMI) was calculated.

### Statistical Methods

Descriptive statistics: mean (M), standard deviation (SD), median (Me), interquartile range (IQR) were calculated for quantitative variables. Results for qualitative variables were presented in percentages of the category of a given variable. Due to the small size of the group and the separate subgroups, nonparametric tests were used for analysis, including the Mann-Whitney U test to compare 2 independent groups (groups of women and men, groups with and without depression), and the Kruskal-Wallis test for comparisons among 3 groups (normal cognitive function, moderate cognitive impairment, and severe cognitive impairment). Spearman's rank correlation analysis was used to assess the relationships among age, AMTS, GDS, SPPB test, chair stand test, balance test, and gait speed test. $P<0.05$ indicated a statistically significant difference, and the results were summarized in tables. All calculations were performed using Statistica version 13.3 (TIBCO, Inc., Tulsa, United States).

## Results

### Descriptive Data

The study group consisted of 93 participants aged 60-100 years, mean age 78.13 years (±9.91), including 52 women and 41 men. The largest percentage of respondents, 44%, had primary education or no education. Only 13% were in a relationship. People from villages or towns with up to 50 000 inhabitants predominated. The vast majority of respondents had 1-4 diseases and did not engage in any physical activity or only exercised occasionally. Detailed data are presented in **Table 1**.

### Main Results

#### *Characteristics of Physical Fitness, Cognitive Function, and Depression*

In the entire SPPB test, the mean score was 4.85 (±2.81) points. Of the 3 tests, the best result was for the 4 m walk test, with a mean of 1.83±1.08 points, followed by the balance test, with a mean of 1.54±1.09 points, and the standing up from a chair without the help of upper limbs test, with a mean of 1.46±1.37 points (**Table 2**).

In the whole SPPB test, 38% of participants scored 0-3 points, indicating severe limitations, followed by 34% with 4-6 points, 20% with 7-9 points, and 8% with 9-12 points, a score indicating no limitations (**Table 3**).

On the AMTS test, which assesses cognitive impairment in the elderly, the mean score was 5.88±2.46 points (**Table 2**). Most subjects (45%) had a normal score (7-10 points), 38% had moderate cognitive impairment (4-6 points), and 17% had severe cognitive impairment (0-3 points) (**Table 3**).

On the GDS scale, which assesses the severity of depressive symptoms in older people, the mean score was 5.44±3.22 points (**Table 2**). A score indicating the absence of depression (0-5 points) was obtained by 56% of the respondents, while the remaining respondents (44%) scored 6-15 points, indicating depressive symptoms and low mood (**Table 3**).

#### *Evaluation of the Associations Among Physical Fitness, Cognitive Function, and Depression*

The SPPB test results were then analyzed according to cognitive function state, mood, and gender. For the 4 m walk test, the direct results in seconds obtained by the participants were included in the analysis due to their higher accuracy.

No significant differences were found between the results of people with normal cognitive function status and people with moderate and severe impairment. The highest scores in the whole SPPB test and in the tests of standing up from a chair and in walking 4 m were achieved by participants with a normal AMTS score. The highest score in the balance test was achieved by participants with severe cognitive impairment and participants with a normal AMTS test score (**Table 4**).

Participants without mood disorders scored slightly better on the SPPB test and the standing up from a chair test compared to those with suspected depressive disorders, but these differences were not statistically significant. Participants without mood disorders obtained results in the balance test similar to those of participants suspected of having depressive disorders. People without mood disorders were characterized by faster gait (on average more than 2 seconds shorter walking time) compared to those with suspected depressive disorders. The difference in gait speed between the groups was statistically significant (**Table 5**).





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**Table 1.** Characteristics of the research group.

| Characteristic | M | SD | Me | IQR |
|---|---|---|---|---|
| **Age** | 78.13 | 9.91 | 79.00 | 70.00-86.00 |
| **Body weight [kg]** | 70.93 | 18.66 | 68.40 | 59.80-78.60 |
| **Body height [m]** | 1.59 | 0.09 | 1.60 | 1.52-1.66 |
| **BMI** | 27.86 | 6.86 | 27.20 | 23.16-31.13 |
| | **n** | | **%** | |
| **Gender** | | | | |
| Women | 52 | | 56 | |
| Men | 41 | | 44 | |
| **Education** | | | | |
| None or primary | 41 | | 44 | |
| Vocational | 16 | | 17 | |
| Secondary | 29 | | 31 | |
| Higher | 7 | | 8 | |
| **Marital status** | | | | |
| Single | 19 | | 20 | |
| Married | 12 | | 13 | |
| Widowed | 53 | | 57 | |
| Divorced | 9 | | 10 | |
| **Place of residence** | | | | |
| City/town of over 50 000 inhabitants | 16 | | 17 | |
| Town with less than 50 000 inhabitants | 33 | | 36 | |
| Village | 44 | | 47 | |
| **Number of diseases** | | | | |
| 0 | 3 | | 3 | |
| 1-2 | 43 | | 46 | |
| 3-4 | 34 | | 37 | |
| 5 or more | 13 | | 14 | |
| **Physical activity** | | | | |
| None | 30 | | 32 | |
| Occasional | 55 | | 59 | |
| Systematic | 8 | | 9 | |
| **Reasons for living in a nursing home** | | | | |
| Poor health requiring medical care | 20 | | 22 | |
| Lack of independence in activities of daily living | 39 | | 42 | |
| Family care failure | 28 | | 30 | |
| Loneliness | 21 | | 23 | |
| Other | 2 | | 2 | |

M – mean; SD – standard deviation; Me – median; IQR – interquartile range, BMI – body mass index.

Men performed significantly better in the whole SPPB test and in the standing up from a chair and gait speed tests compared to women. These differences were statistically significant. Men and women scored similarly in the balance test, and the difference between groups was not statistically significant (**Table 6**). Men and women achieved similar results on the AMTS and GDS test, and the differences between the results were not statistically significant (**Table 6**).

The results in seconds were included in the correlation analysis for the 4 m gait test. The correlation analysis showed a statistically significant negative correlation between the SPPB gait test scores and the AMTS test scores, a statistically significant positive correlation between the SPPB gait test scores and the GDS scores, and a statistically significant negative correlation between age and the AMTS test scores. A better state of cognitive function (ie, higher AMTS test score) was associated with faster the gait speed, and worse severity of depressive symptoms (ie, higher GDS scale score) was associated





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**Table 2.** Characteristics of SPPB, AMTS, and GDS results.

| Variable | M | SD | Me | IQR |
|---|---|---|---|---|
| **SPPB** | 4.85 | 2.81 | 5.00 | 3.00-7.00 |
| **Chair stand test** | 1.46 | 1.37 | 1.00 | 0.00-2.00 |
| **Balance test** | 1.54 | 1.09 | 1.00 | 1.00-2.00 |
| **Gait speed test** | 1.83 | 1.08 | 1.00 | 1.00-2.00 |
| **AMTS** | 5.88 | 2.46 | 6.00 | 4.00-8.00 |
| **GDS** | 5.44 | 3.22 | 5.00 | 3.00-7.00 |

M – mean; SD – standard deviation; Me – median; IQR – interquartile range; SPPB – Short Physical Performance Battery; AMTS – Abbreviated Mental Test Score; GDS – Geriatric Depression Scale.

**Table 3.** Percentage results of SPPB, GDS, and AMTS.

| SPPB | | | |
|---|---|---|---|
| 0-3 points n (%) | 4-6 points n (%) | 7-9 points n (%) | 10-12 points n (%) |
| 35 (38%) | 32 (34%) | 19 (20%) | 7 (8%) |
| **AMTS** | | | |
| 0-3 points n (%) | 4-6 points n (%) | 7-10 points n (%) | |
| 16 (17%) | 35 (38%) | 42 (45%) | |
| **GDS** | | | |
| 0-5 points n (%) | 6-15 points n (%) | | |
| 52 (56%) | 41 (44%) | | |

SPPB – Short Physical Performance Battery; AMTS – Abbreviated Mental Test Score; GDS – Geriatric Depression Scale.

with slower gait speed. Older age was associated with worse cognitive function status of the elderly. No statistically significant relationships were found between the other parameters analyzed (**Table 7**).

## Discussion

The aim of this study was to evaluate the associations among physical fitness, cognitive function, and depression in older nursing home residents in south-western Poland.

An association between gait speed and cognitive function and the intensity of depression was observed in the study group. Those who had a higher AMTS score (ie, less cognitive impairment) were characterized by a faster gait. People who had more depressive symptoms were characterized by a slower gait. No relationship was found between the remaining SPPB tests and the overall result and the AMTS test result and depression.

The results of research by other authors confirm the relationship between walking speed and cognitive functions and also show the relationship between cognitive functions and other components of physical fitness [17,30-33,37]. Bullain et al showed that participants who were unable to complete the gait test (0 points) were almost 30 times more likely to have cognitive impairment compared to those with the fastest walking time (4 points). However, even a slightly slower walking pace (≤1.5 seconds, a change from 4 to 3 points) resulted in a 4-fold greater likelihood of mental deterioration [37]. A Brazilian study of 78 institutionalized elderly women and men found that poor strength and aerobic fitness increase the odds of presenting with impaired semantic fluency/executive function, which may be associated with prodromal dementia. The study assessed physical fitness using the Senior Fitness Test and cognitive function using MMSE test [30]. Li and Harmer also confirmed the association between physical fitness and mental state of the elderly [17]. Veronese et al showed that a poor SPPB test score and slower gait speed predicted cognitive decline. Low gait speed was a predictor of poor cognitive status over a 4-year follow-up period, but other SPPB components were also significantly associated with mental deterioration [33]. Portuguese researchers examined 102 elderly people with an age-related neurocognitive disorder, aged 65-93 years, from 6 nursing homes. The study showed that better physical fitness is important for cognition and autonomous functional





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**Table 4.** SPPB test results depending on the level of cognitive function.

| AMTS | n | M | SD | Me | IQR | *P* |
|---|---|---|---|---|---|---|
| **SPPB** | | | | | | |
| Normal 7-10 points | 42 | 5.43 | 3.04 | 5.00 | 3.00-8.00 | 0.1905 |
| Moderate cognitive impairment 4-6 points | 35 | 4.11 | 2.11 | 4.00 | 2.00-5.00 | |
| Severe cognitive impairment 0-3 points | 16 | 4.94 | 3.30 | 4.00 | 2.50-6.50 | |
| **Chair stand test** | | | | | | |
| Normal 7-10 points | 42 | 1.74 | 1.52 | 1.50 | 0.00-3.00 | 0.1929 |
| Moderate cognitive impairment 4-6 points | 35 | 1.06 | 0.97 | 1.00 | 0.00-2.00 | |
| Severe cognitive impairment 0-3 points | 16 | 1.63 | 1.59 | 1.00 | 0.00-3.00 | |
| **Balance test** | | | | | | |
| Normal 7-10 points | 42 | 1.62 | 1.03 | 2.00 | 1.00-2.00 | 0.6086 |
| Moderate cognitive impairment 4-6 points | 35 | 1.40 | 1.06 | 1.00 | 1.00-2.00 | |
| Severe cognitive impairment 0-3 points | 16 | 1.63 | 1.31 | 1.00 | 1.00-2.50 | |
| **Gait speed test over a distance of 4 m** | | | | | | |
| Normal 7-10 points | 42 | 9.30 | 5.93 | 7.4 | 5.88-10.92 | 0.1367 |
| Moderate cognitive impairment 4-6 points | 35 | 11.30 | 6.46 | 9.3 | 7.18-12.81 | |
| Severe cognitive impairment 0-3 points | 16 | 12.56 | 8.73 | 9.73 | 6.42-17.66 | |

M – mean; SD – standard deviation; Me – median; IQR – interquartile range; SPPB – Short Physical Performance Battery; AMTS – Abbreviated Mental Test Score.

capacity and it has positive repercussions on the quality of life in institutionalized older adults with dementia. The results of the study suggest that the contribution of every component of physical fitness is singular and irreplaceable [31].

The results of other researchers confirm the relationship between physical fitness and the severity of depression symptoms. Other researchers used different physical fitness tests, while they also used the GDS scale to assess the intensity of depressive symptoms [10,30,38]. Yamagata et al assessed the physical fitness of older women in terms of lower-limb strength, knee extension strength, endurance, and gait speed. They found significantly poorer physical fitness on all tests in those with depressive symptoms compared to those without such symptoms [38]. Lee showed a relationship between all Senior Fitness Test components (except the Back Scratch Test) and the score of the Korean version of the GDS scale (GDS-K) in older women. Physical fitness factors were strongly associated with depressive symptoms. This suggests that improving physical fitness may contribute to the prevention of depression [10]. Monteneiro-Junior et al showed a relationship between physical fitness (assessed by Senior Fitness Test) and symptoms of depression. Poor aerobic fitness was slightly associated with depressive symptoms, showing that sedentary institutionalized older adults could be at particular risk for depression [30]. It is important to note that this relationship is multidirectional. Deterioration in physical performance due to aging or illness can be a depressogenic factor, but depressed mood, anhedonia and lack of motivation can also affect functional state and reduce physical performance.

The present study also noted a relationship between age and cognitive function. Older age was associated with lower scores on the AMTS test, indicating greater cognitive impairment. The findings of other authors are mostly consistent with the results obtained in the present study [23,39], showing a





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**Table 5.** SPPB test results depending on the presence of depression.

| GDS | n | M | SD | Me | IQR | *P* |
|---|---|---|---|---|---|---|
| **SPPB** | | | | | | |
| Normal 0-5 points | 52 | 5.06 | 2.64 | 5.00 | 3.00-7.00 | 0.2634 |
| Depressive symptoms 6-15 points | 41 | 4.59 | 3.02 | 4.00 | 2.00-6.00 | |
| **Chair stand test** | | | | | | |
| Normal 0-5 points | 52 | 1.52 | 1.29 | 1.00 | 0.50-2.00 | 0.4361 |
| Depressive symptoms 6-15 points | 41 | 1.39 | 1.48 | 1.00 | 0.00-2.00 | |
| **Balance test** | | | | | | |
| Normal 0-5 points | 52 | 1.54 | 1.04 | 1.00 | 1.00-2.00 | 0.8848 |
| Depressive symptoms 6-15 points | 41 | 1.54 | 1.16 | 1.00 | 0.00-2.00 | |
| **Gait speed test over a distance of 4 m** | | | | | | |
| Normal 0-5 points | 52 | 9.63 | 6.23 | 8.06 | 6.19-10.35 | 0.0369* |
| Depressive symptoms 6-15 points | 41 | 11.84 | 7.13 | 10.35 | 7.02-14.58 | |

M – mean; SD – standard deviation; Me – median; IQR – interquartile range; SPPB – Short Physical Performance Battery; GDS – Geriatric Depression Scale; * $P<0.05$.

relationship between age and cognitive impairment, and older age was associated with a higher prevalence of cognitive impairment [23]. The results of Setiyani and Iskandar's study confirm this relationship, but only in elderly people not living in nursing homes; in nursing home residents, the authors found no correlation between age and MMSE test score [39].

In our study, in the physical fitness tests (with the exception of the balance test), men performed better than women. Other authors who used the SPPB test also showed better physical fitness in men [40-43]. Kaczorowska et al found a better SPPB score in men only for the gait test. They found no significant gender differences concerning the total test and the other individual tests [40]. Bergland and Strand obtained higher scores in men than in women for the total score and gait test in the 65-69 and 70-74 age groups and the standing up from a chair test in all age groups (except the 80+ group). They found no gender differences regarding the gait test of those aged 60-64, 75-79, and 80+ years [41]. Ramírez-Vélez et al found higher scores for men in terms of the gait test, the standing up from a chair test, and the summed results of all tests [42]. Melsæter et al observed better physical fitness in men compared to women in terms of SPPB total score and gait speed. Furthermore, they showed that in men, the SPPB test score decreased by 0.27 points with each year of age and in women by 0.33 points; while gait speed decreased by 0.02 m/s and 0.03 m/s, respectively [43]. Particularly important is the outcome of the gait test, which is worth analyzing not only in terms of points scored, but also in terms of walking speed. It has been proven that a decrease in gait speed of 0.1 m/s is associated with a 10% reduction in the ability to perform basic activities of daily living (ADL) [44].

It is also worth noting the level of physical fitness, state of cognitive function, and prevalence of depression in the studied nursing home residents. Most participants showed severe or moderate limitations in physical fitness, more than half had cognitive impairment, and almost half of the respondents had symptoms of depression.

The results of studies by other authors were consistent with the results obtained in this study and indicate the physical and cognitive limitations [34,39,40,44] and the prevalence of depression [35] in older people living in nursing homes. Relatively low scores on physical fitness tests and the presence of cognitive impairment and depression may be related to place of residence. Physical activity in nursing homes residents related to performing household chores is very limited [40,44]. Therefore, the physical fitness level of institutionalized seniors may be low. On the other hand, nursing homes are most often used by people who are unable to function independently, also due to physical limitations, which may also





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**Table 6.** SPPB, AMTS, and GDS results in male and female groups.

| Gender | n | M | SD | Me | IQR | *P* |
|---|---|---|---|---|---|---|
| **SPPB** | | | | | | |
| Women | 52 | 4.33 | 2.80 | 4.00 | 2.00-5.50 | 0.0243* |
| Men | 41 | 5.51 | 2.70 | 5.00 | 4.00-7.00 | |
| **Chair stand test** | | | | | | |
| Women | 52 | 1.21 | 1.29 | 1.00 | 0.00-2.00 | 0.0463* |
| Men | 41 | 1.78 | 1.42 | 2.00 | 1.00-3.00 | |
| **Balance test** | | | | | | |
| Women | 52 | 1.56 | 1.23 | 1.00 | 1.00-2.50 | 0.8752 |
| Men | 41 | 1.51 | 0.90 | 2.00 | 1.00-2.00 | |
| **Gait speed test over a distance of 4 m** | | | | | | |
| Women | 52 | 12.55 | 7.71 | 9.72 | 7.97-15.32 | 0.0008** |
| Men | 41 | 8.04 | 3.84 | 6.92 | 5.65-10.14 | |
| **AMTS** | | | | | | |
| Women | 52 | 5.58 | 2.48 | 5.00 | 4.00-7.50 | 0.1485 |
| Men | 41 | 6.27 | 2.41 | 7.00 | 4.00-8.00 | |
| **GDS** | | | | | | |
| Women | 52 | 5.42 | 3.22 | 5.00 | 3.00-7.50 | 0.7645 |
| Men | 41 | 5.46 | 3.26 | 5.00 | 3.00-7.00 | |

M – mean; SD – standard deviation; Me – median; IQR – interquartile range; SPPB - Short Physical Performance Battery; AMTS – Abbreviated Mental Test Score; GDS – Geriatric Depression Scale; * p<0.05; ** p<0.001.

**Table 7.** Spearman correlations of age, SPPB, AMTS, and GDS results.

| Variable | SPPB | Chair stand test | Balance test | Gait speed test | AMTS | GDS |
|---|---|---|---|---|---|---|
| Age | -0.09 | -0.08 | 0.02 | 0.11 | **-0.22** | 0.06 |
| AMTS | 0.19 | 0.14 | 0.11 | **-0.27** | – | -0.06 |
| GDS | -0.17 | -0.09 | -0.16 | **0.29** | -0.06 | – |

SPPB – Short Physical Performance Battery; AMTS – Abbreviated Mental Test Score; GDS – Geriatric Depression Scale; significant differences with p<0.05 was marked in bold.

contribute to lower fitness test scores in this group of people. Physical activity and social engagement are protective factors that can reduce cognitive impairment [45]. Meetings with friends, participating in volunteering, sports activities, or passions pursued in a group are associated with better cognitive functioning [14]. Unfortunately, people living in nursing homes tend to have sedentary lifestyles [44] and have limited opportunities to engage in social life. Change of place of residence and living in a nursing home may also be associated with depression [28]. In our study, reasons for living in a nursing home were identified, such as poor health requiring medical care, lack of independence in activities of daily living, family care failure, and loneliness. All these factors may contribute to emotional deterioration, which may explain the increased risk of depression in this social group.

Our results indicate the need to monitor the physical performance and cognitive-emotional state of older people living in nursing homes with appropriate screening tests and careful observation by medical staff and caregivers. If depression and cognitive impairment are suspected, further accurate diagnosis and interventions would need to be applied to avoid the cascade of





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negative outcomes associated with depression and cognitive decline, and to improve the quality of life of this population group.

The study has some strengths. We showed the occurrence of depressive symptoms, the state of cognitive function, and the level of physical fitness and the relationship between them among older women and men living in nursing homes. So far, few works by Polish and foreign authors deal with the occurrence of depression and the state of cognitive function among institutionalized older people. Due to the constantly growing population of elderly people, the problem of maintaining an appropriate level of physical fitness and proper cognitive and emotional state becomes more important. In addition, the physical fitness study we used was conducted in person using a test to assess the physical fitness of older people, not using questionnaires, in which the subjective assessment may not be consistent with the actual state.

The study also has limitations. These include the cross-sectional nature of the study, which makes it impossible to follow the dynamics of change in degenerative processes. In addition, nursing home residents in south-western Poland were examined, which may not give a full picture of the situation in the whole Poland. The methods used also have limitations. The SPPB test does not assess aerobic capacity, which has a significant impact on cognitive functions and quality of life of institutionalized seniors [30,31]. Additionally, only people able to walk and perform the SPPB test were eligible for the study. Therefore, our results do not show the state of cognitive functions and the intensity of depression in all elderly residents of nursing homes, but only in people able to walk. We have no information on cognitive functions and depression in wheelchair users and bedridden people. Further studies of the cognitive-emotional state should also include people unable to move independently. The assessment of physical fitness in people able to perform the test should also take into account other elements of physical fitness, such as aerobic capacity. For a more complete characterization of the health status of institutionalized older people in Poland, it would be necessary to carry out research in nursing homes in other regions of Poland and to cover a larger number of residents.

## Conclusions

There is a relationship between gait speed and cognitive state and depression among the studied older nursing homes residents. Those with better emotional and cognitive state tended to have a faster walking gait.

Additionally, men tended to have a higher level of physical fitness compared to women, and older age was associated with worse cognitive state of the examined seniors.

The results obtained confirm the need for further observations and in-depth analyses regarding the state of cognitive functions, the occurrence of depressive symptoms, and physical fitness in older people and factors associated with them.

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