ORIGINAL ARTICLE

Medical Journal of Western Black Sea
Batı Karadeniz Tıp Dergisi

Med J West Black Sea 2023;7(2): 202-210
DOI: 10.29058/mjwbs.1262316

Evaluation of Factors Associated with Fall History and Fear of Falling in Geriatric Female Patients with Osteoporosis

Osteoporozu Olan Geriatrik Kadın Hastalarda Düşme Öyküsü ve Düşme Korkusu ile İlişkili Faktörlerin Değerlendirilmesi

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Cite this article as: Mengi A and Sualp E. Evaluation of factors associated with fall history and fear of falling in geriatric female patients with osteoporosis. Med J West Black Sea. 2023;7(2):202-210.

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Received
09.03.2023

Revision
04.06.2023

Accepted
06.08.2023

ABSTRACT

Aim: Fear of falling is a common condition in patients with osteoporosis and leads to a decrease in physical performance of patients, causing a vicious cycle. The objective of the study was to determine the frequency of falls, descriptive data regarding falls, and factors associated with falling in female patients with osteoporosis aged 65 years and over, and to evaluate the factors that may affect fear of falling (FoF).

Material and Methods: Ninety eight female patients (mean age: 74.0±5.1 years) were evaluated with descriptive information about fall history and FoF, demographic and clinical data, and routine blood tests. Falls Efficacy Scale International, hand grip strength, the Rivermead Mobility Index, and the Douleur Neuropathique 4 questionnaire scores were compared.

Results: 25-hydroxyvitamin D, vitamin B12, and hand grip strength were lower and hemoglobin A1C level was higher in patients who fell within the last three months (p<0.001, p=0.002, p<0.001, p=0.026, respectively). All patients who fell had FoF, did not live alone, and did not engage in regular physical activity. The majority of the patients who fell had previously been diagnosed with osteoporosis (83.3%) and had poorer sleep quality (p=0.003). Increasing age, late menopause, and living alone had a significant effect on FoF (p=0.026, p=0.010, p=0.006, respectively).

Conclusion: While falling may be associated with serum vitamin D and B12 levels, muscle strength, blood glucose level, regular physical activity, having FoF, living alone, poor sleep quality and previously diagnosed with OP; FoF may be associated with advanced age, age of menopause, and living alone. These results show that falls and FoF are multifactorial events in geriatric patients with osteoporosis.

Keywords: Aging, elderly, falling, fear of falling, osteoporosis

ÖZ

Amaç: Osteoporozlu hastalarda düşme korkusu sık görülen bir durumdur ve hastaların fiziksel performanslarında azalmaya yol açarak kısır bir döngüye yol açar. Bu çalışmanın amacı, 65 yaş ve üstü osteoporozu olan kadın hastalarda, düşme sıklığını, düşmeye ilişkin tanımlayıcı verileri, düşme ile ilişkili faktörleri belirlemek ve düşme korkusunu etkileyebilecek faktörleri değerlendirmektir.

Gereç ve Yöntemler: Doksan sekiz kadın hasta (yaş ortalaması: 74.0±5.1) , düşme öyküsü ve düşme korkusuna ilişkin tanımlayıcı bilgiler, demografik ve klinik veriler ve rutin kan testleri ile değerlendirildi. Hastaların Uluslararası Düşme Etkinliği Ölçeği, el kavrama gücü, Rivermead Mobilite İndeksi ve Douleur Neuropathique 4 anket puanları karşılaştırıldı.

Bulgular: Son üç ay içinde düşen hastalarda 25-hidroksivitamin D, vitamin B12 ve el kavrama kuvveti daha düşük, hemoglobin A1C düzeyi daha yüksekti (sırasıyla, p<0.001, p=0.002, p<0.001, p=0.026).

Düşen hastaların tamamında düşme korkusu vardı, düşen tüm hastalar evde yalnız yaşamıyor ve düzenli fiziksel aktivite yapmıyordu. Düşen hastaların çoğuna (%83.3) daha önceden osteoporoz tanısı konmuştu ve uyku kaliteleri daha kötüydü (p=0.003). Yaşın ilerlemesi, geç menopoz ve yalnız yaşama düşme korkusu üzerinde anlamlı bir etkiye sahipti (sırasıyla, p=0.026, p=0.010, p=0.006).

Sonuç: Düşme, serum D ve B12 vitamini düzeyi, kas gücü, kan glikoz düzeyi, düzenli fiziksel aktivite, düşme korkusu, yalnız yaşama, kötü uyku kalitesi ve önceden osteoporoz tanısı almış olma ile ilişkili olabilirken; düşme korkusu, ileri yaş, menopoz yaşı ve yalnız yaşama ile ilişkili olabilir. Bu sonuçlar düşme ve düşme korkusunun osteoporozu olan geriatrik hastalarda çok faktörlü olaylar olduğunu göstermektedir.

Anahtar Sözcükler: Yaşlanma, yaşlı, düşme, düşme korkusu, osteoporoz

INTRODUCTION

Falls are significant public health problem among older adults and 28.7% of older adults fall at least once a year (1). Although fall occurs accidentally, various factors such as age, sex, physical performance, depression, balance, nocturia, and visual disorders have been associated with an increased risk of falling (2-4). Fear of falling (FoF) is defined as an exaggerated worry about falling or low perceived self-efficacy in preventing falls during daily activities (5). The causes of FoF are also multifactorial and may occur in elderly patients with no previous history of falls (6).

Osteoporosis (OP) is another important cause that has been associated with falls (7). Guidelines for OP recommend that every woman aged 65 years and over should be evaluated for OP (8). Falling is important in patients with OP as it is associated with high morbidity and mortality by causing fractures (9). Falls are predominantly seen in people aged 65 and over. Patients aged 65 years and over who are evaluated for OP should be evaluated in terms of falls and causes of falls, and precautions should be taken for identified causes. FoF is an important problem seen commonly in patients with OP than in patients without OP (1,10). FoF leads to a vicious cycle that results in reduced physical performance, poor balance, and loss of independence in self-care activities (11). FoF should not be overlooked in the management of OP (7).

Determining the factors associated with falling and FoF is important in terms of preventing morbidity and mortality. In studies of patients with OP, factors such as decreased lumbar spine and lower extremity muscle strength, weakened balance, and lower bone mineral density values were associated with falls (12-14). FoF was associated with back pain, awareness of OP presence, and the level of knowledge about OP (15,16). However, we did not encounter a study in the literature which evaluated risk factors of both falling and FoF together in geriatric female patients with OP.

In this research, we aimed to determine the frequency of falls, descriptive data regarding falls, and factors associated with falling in female patients aged 65 years and over diagnosed with OP, while also evaluating the factors that may associate FoF.

MATERIAL and METHODS

This study was conducted with the approval of the Çanakkale 18 Mart University Medical Faculty Clinical Research Ethics Committee (reference number: 24.11.2021/2021-09). Patients who were evaluated for OP in the Physical Medicine and Rehabilitation clinic of our hospital between October 1, 2019 and March 1, 2020 and who met the inclusion and exclusion criteria were included. The study was carried out in accordance with the principles of the Declaration of Helsinki.

Study Design

Medical records of 210 female patients aged 65 and over who were diagnosed with OP and completed the OP evaluation form were evaluated retrospectively. The patients were divided into two groups in terms of the presence of falls. Patients who described falling at least once in the last three months were considered as “falling patients”, and other patients as “patients who did not fall”. Subsequently, the patients were divided into two groups as “patients with FoF” and “patients without FoF”.

Inclusion criteria of the study were as follows: -65 years and over female patients, -OP diagnosis according to the World Health Organization criteria (lumbar spine (anteroposterior), femoral neck and/or total hip T score that lies 2.5 standard deviations or more below the average value for young healthy women according to bone mineral density values) (8), -Having a Functional Ambulation Score (FAS) of 5 (FAS 5 score: the patient can walk independently on flat and uneven floors, stairs, and inclined surfaces) (17).

Exclusion criteria were as follows: patients with infection, chronic inflammatory disease, malignancy history, rheumatic disease (rheumatoid arthritis, systemic lupus erythematosus, etc.), neurological diseases that impair balance and cooperation (such as dementia, parkinsonism, previous cerebrovascular disease), acute compression fracture and spinal pain, regular use of steroids, spinal column deformity (thoracic kyphosis angle ≥40 and Cobb angle ≥10 degrees), severe the cardiovascular or respiratory system illness, chronic renal or liver disease, uncontrolled diabetes mellitus or thyroid disease, postural hypotension, psychiatric disease; those who describe dizziness, tinnitus, hearing loss,

or moderate to severe visual impairment, use of assistive devices for ambulation (walking cane, crutch, etc.), use of lower extremity orthoses or prostheses, describe arthralgia in their lower extremities; non-cooperation and illiteracy patients . The selection of exclusion criteria was also based on several sources (7,10,12,16).

The OP evaluation form was used to collect patient data. This form contained the following: including demographic data (age, Body Mass Index (BMI), marital status, and education level), age of menopause, living alone (yes/no), doing regular physical activity (minimum of 20 minutes three days a week) (yes/no), falling in the last three months (yes/no), having FoF (yes/no), previously diagnosed with OP (yes/no), describing sleep quality (good or poor), and presence of other chronic diseases. 25-hydroxyvitamin D (25(OH)D), parathormone, vitamin B12, and hemoglobin A1C values were evaluated with routine blood tests.

A fall was defined as an event that causes the individual to descend on the floor or other lower level inadvertently (18). Patients who had reported falling in the last three months were asked about the number of falls, the location they fell, and the event they thought caused their fall (19).

FoF was evaluated according to their yes or no answer to question 'Are you afraid of falling?'. The Falls Efficacy Scale International (FES-I), which has a Turkish validity and reliability study, was used to measure the level of FoF during daily activities. Higher score is associated with increased fear, and the cut-off score was determined as 24 (20).

Hand grip strength was evaluated using a Jamar hydraulic hand dynamometer (Sammons Preston, Bolingbrook, IL). Measurements of the patient's dominant hand were taken with the patient in a seated position, the shoulder in adduction and neutral rotation, the elbow in 90 degrees flexion, and the forearm and wrist in neutral position. The average value of three measurements (with approximately 15 seconds intervals between measurements) was recorded (21).

The Rivermead Mobility Index (RMI), which has a Turkish validity and reliability study, was used to evaluate the mobility of the patients. The RMI consists of 15 items, which includes 14 self-reported items and one observational item. It questions a series of hierarchical activities, ranging from turning over in bed to running. A score of 15 indicates no problem in mobility, and a lower score indicates a mobility problem (22).

The neuropathic pain was evaluated with the Douleur Neuropathique 4 (DN4) questionnaire. The DN4 questionnaire consists of 10 items, in which 7 of the items question the symptoms, and 3 items are determined by clinical examination. A total score of 4 or more out of 10 indicates the presence of neuropathic pain (23).

Statistical Analysis

Statistical analyses were performed with SPSS version 19.0 software (IBM Corporation, Armonk NY, USA). Distribution of data was determined using the Shapiro-Wilk test. Continuous variables were expressed as mean ± standard deviation (SD) and minimum-maximum, while categorical variables were expressed as number and percent. The groups were compared using the independent samples t-test or Mann–Whitney U test for continuous variables. Categorical variables were compared using Pearson's Chi-square test and Fisher-Freeman-Halton Exact test. Binary logistic regression analysis was used to evaluate the effect of measurements that were found to be statistically significant between the groups in terms of history of falling and FoF on relevant parameters. p value of <0.05 was considered to be statistically significant.

RESULTS

A total of 98 patients who met the inclusion and exclusion criteria were included in the study. The mean age of the patients was 74.0±5.1 (65.0-86.0) years. While there was a significant relationship between age and FES-I, RMI, and 25(OH)D values (r=0.276, r=-0.207, and r=0.293, respectively), there was a significant relationship between BMI and DN4, hemoglobin A1C, vitamin B12 , and 25(OH)D values (r=0.384, r=-0.239, r=0.329, r=-0.314, respectively). In patients included in the study, there was a significant relationship between age of menopause and vitamin B12 (r=-0.242), between 25(OH)D and RMI, and DN4 (r=0.246, r=-0.251, respectively). A significant relationship was found between vitamin B12 and FES-I (r=0.219), between hemoglobin A1C and DN4, and hand grip strength (r=-0.228, r=-0.285, respectively). While there was a significant relationship between FES-I and hand grip strength, DN4, and RMI scores (r=-0.479, r=0.293, r=-0.496, respectively), there was a significant relationship between DN4 and RMI scores (r=0.347). There was no significant relationship between the other evaluated parameters.

Eighteen (18.4%) of the patients described falling at least once in the last three months. In falling patients, while 25(OH)D, vitamin B12, and strength of hand grip were significantly lower, hemoglobin A1C level was significantly higher (p<0.05) (Figure 1). All patients who described falling did not live alone, had FoF, and did not engage in regular physical activity. The majority of the patients who fell had previously been diagnosed with OP. The number of those who defined sleep quality as poor in falling patients was significantly higher (p<0.05) (Table 1). When patients were analyzed in terms of falling with binary logistic regression analysis, it was determined that all of the variables which were found to be significantly different between the two groups had no significant effect on falling (p>0.05). Seventeen patients fell once and one fell twice within the last three

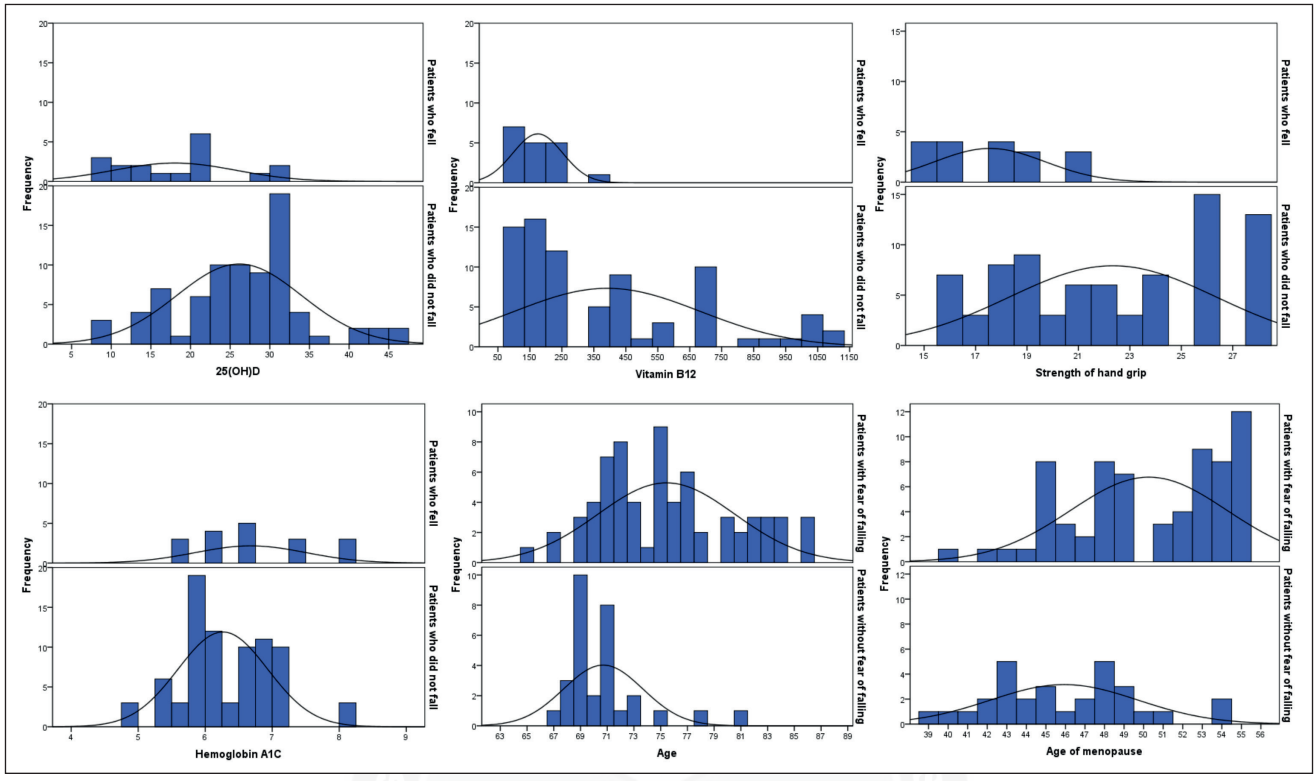

Figure 1: The distributions of the parameters that were significantly different between groups.

months. The falls occurred due to blackout (5.6%), dizziness (33.3%), and tripping (61.1%) on the street (55.6%) and in the kitchen (44.4%).

69.4% (n=68) of all patients had FoF. Mean age and age of menopause were significantly higher in patients with FoF (p<0.001, p<0.001, respectively) (Figure 1). All of the patients who fell had FoF and the number of patients living alone was significantly higher in the patient group with FoF (p=0.002, p=0.003, respectively) (Table 2). When the variables that were statistically significant between the groups were evaluated according to binary logistic regression, age, age of menopause, and living alone were found to have a significant effect on FoF (p=0.026, p=0.010, p=0.006, respectively).

DISCUSSION

In this study, we evaluated female patients aged 65 and over diagnosed with OP. We found that 25(OH)D, vitamin B12, and hand grip strength were lower, while hemoglobin A1C was higher in patients who had a fall in the last three months. All of the patients who fell at least once did not live alone, had FoF, and did not do regular physical activity, while the majority of the patients in the same group had previously been diagnosed with OP and had poorer sleep quality. In patients with FoF, increasing age, late menopause, and living alone had an effect on fear.

Beserra Da Silva et al. compared women aged 60 and over and reported that 51% of patients with OP fell within the last year, while this rate was 29% in the group without OP (12). Hita-Contreras et al. evaluated women between 50-65 years and reported that 34.7% of patients with low bone density had a fall within the last 12 months (10). Another study reported that 34% of patients over 45 years diagnosed with OP had a fall within the last 12 months (24). In our study, patients who fell in the last three months constituted 18.4% of all patients. This result was quite lower than the reported literature. This may be due to our questioning whether patients fell in the last three months instead of the last 12 months. Ganz et al. reported that the fall questioning in the last 12 months has high specificity and low sensitivity (25). In our study, we preferred to question falling in the last three months as we believed that the experience of falling would be remembered more clearly and accurately by patients. The literature has stated that patients do not tend to report falls, and only 49.8% of women who fell in the previous year spoke to their doctors about falls (26). This may have also affected our results.

Barrett-Connor et al. reported that the presence of diabetes was a risk factor for falls. It has been suggested that diabetes may lead to falls by leading to diabetes-related visual impairment and peripheral neuropathy (27). In our study, DN4 scores were similar between both groups,

Table 1: Evaluation of patients in terms of fall.

Characteristics	Patients who fell (n=18)	Patients who did not fall (n=80)	p
Age (year)	72.9±3.4	74.2±5.4	0.847[b]
BMI (kg/m²)	26.3±1.9	26.8±3.9	0.872[b]
Age of menopause (year)	49.8±4.5	48.8±4.4	0.374[a]
25 (OH)D	18.0±7.7	26.1±7.9	<0.001[a]
Parathormone (pg/mL)	60.6±26.2	59.1±29.4	0.850[a]
Vitamin B12 (pg/mL)	174.7±78.1	391.9±290.3	0.002[b]
Hemoglobin A1C (%)	6.7±0.8	6.3±0.7	0.026[a]
Hand grip strength (kg)	17.6±2.1 kg	22.3±4.0 kg	<0.001[b]
DN4 score	1.9±2.9	2.3±2.3	0.506[a]
RMI score	14.8±0.4	14.8±1.8	0.961[a]
FES-I score	31.1±4.4	23.7±9.2	<0.001[b]
Marital status, n (%)			
Married	13 (72.2)	42 (52.5)	0.128[c]
Single or divorced	5 (27.8)	38 (47.5)	
Education level, n (%)			
Primary school	15 (83.3)	51 (63.8)	
Secondary school	3 (16.7)	6 (7.5)	0.332[d]
High school	0 (0.0)	7 (8.8)	
University	0 (0.0)	16 (20)	
Living alone, n (%)			
Yes	0 (0.0)	28 (35.0)	0.003[c]
Doing regular physical activity, n (%)			
Yes	0 (0.0)	43 (53.8)	<0.001[c]
Fear of falling, n (%)			
Yes	18 (100)	50 (62.5)	0.002[c]
Previous diagnosis of osteoporosis, n (%)			
Yes	15 (83.3)	43 (53.8)	0.021[c]
Chronic disease, n (%)			
Hypertension (yes)	9 (50.0)	26 (32.5)	0.162[c]
Diabetes mellitus (yes)	1 (5.6)	9 (11.3)	0.471[c]
Ischemic heart disease (yes)	3 (16.7)	19 (23.8)	0.515[c]
Chronic obstructive pulmonary disease/asthma (yes)	3 (16.7)	9 (11.2)	0.526[c]
Sleep quality, n (%)			
Good	3 (16.7)	44 (55.0)	0.003[c]
Poor	15 (83.3)	36 (45.0)	

Data are presented as mean ± SD and number (percent) where applicable, p value of <0.05 is considered statistically significant.
BMI: Body Mass Index, **DN4:** Douleur Neuropathique 4, **RMI:** Rivermead Mobilityİ Index, **FES-I:** Falls Efficacy Scale International.
[a] Independent samples t- test, [b] Mann–Whitney U test, [c] Pearson's Chi-square test, [d] Fisher-Freeman-Halton Exact test.

and the patients did not have moderate-to-severe visual impairment. Pfeifer et al. found that vitamin D deficiency was associated with a high risk of falling in postmenopausal patients with OP (28). In another study, it was reported that vitamin D supplementation has a preventive effect on falls in elderly adults with low vitamin D levels (29). Vitamin D deficiency has been associated with falls due to reasons such as decreased neuromuscular function, abnormal motor performance, increased body sway, and quadriceps muscle weakness (30). Vitamin B12 deficiency may lead to peripheral neuropathy and poor locomotor function, therefore leading to falls (31). While Lewerin et al. reported a weak association between vitamin B12 and physical performance, another study did not find a relationship between vitamin B12 and falls (31,32). Contrary to what was reported in the literature, we observed that patients with history of falling had lower levels of vitamin B12. We found that all patients who fell were not doing regular physical activity. It is possible that sedentary life may lead to muscle atrophy, resulting in reduced muscle strength. In our study, lower

Table 2: Evaluation of patients in terms of fear of falling.

Characteristics	Patients with fear of falling (n=68)	Patients without fear of falling (n=30)	p
Age (year)	75.4±5.1	70.7±3.0	<0.001[b]
BMI (kg/m²)	26.5±3.7	27.2±3.6	0.398[a]
Age of menopause (year)	50.3±4.0	45.9±3.8	<0.001[a]
25 (OH)D (ng/mL)	23.9±9.3	26.3±6.0	0.268[b]
Parathormone (pg/mL)	60.3±29.0	57.4±28.5	0.651[a]
Vitamin B12 (pg/mL)	318.2±257.4	428.6±308.5	0.069[a]
Hemoglobin A1C (%)	6.3±0.7	6.5±0.7	0.148[a]
Hand grip strength (kg)	21.3±4.3	21.9±3.9	0.459[a]
DN4 score	2.4±2.7	1.9±1.7	0.884[b]
RMI score	14.7±1.9	15.0±0.0	0.223[b]
FES-I score	27.4±9.7	19.6±2.7	<0.001[a]
Marital status, n (%)			
Married	35 (51.5)	20 (66.7)	0.162[c]
Single or divorced	33 (48.5)	10 (33.3)	
Education level, n (%)			
Primary school	46 (67.6)	20 (66.7)	
Secondary school	6 (8.8)	3 (10.0)	0.665[d]
High school	6 (8.8)	1 (3.3)	
University	10 (14.7)	6 (20.0)	
Living alone, n (%)			
Yes	24 (35.3)	4 (13.3)	0.027[c]
Falling in the last three months, n (%)			
Yes	18 (26.5)	0 (0.0)	0.001[c]
Doing regular physical activity, n (%)			
Yes	30 (44.1)	13 (43.3)	0.943[c]
Previous diagnosis of osteoporosis, n (%)			
Yes	40 (58.8)	18 (60.0)	0.913[c]
Chronic disease, n (%)			
Hypertension (yes)	22 (32.4)	13 (43.3)	0.296[c]
Diabetes mellitus (yes)	8 (11.8)	2 (6.7)	0.719[d]
Ischemic heart disease (yes)	16 (23.5)	6 (20.0)	0.700[c]
Chronic obstructive pulmonary disease/asthma (yes)	11 (16.2)	1 (3.3)	0.099[d]
Sleep quality, n (%)			
Good	30 (44.1)	17 (56.7)	0.252[c]
Poor	38 (55.9)	13 (43.3)	

Data are presented as mean ± SD and number (percent) where applicable, p value of <0.05 is considered statistically significant.
BMI: Body Mass Index, **DN4:** Douleur Neuropathique 4, **RMI:** Rivermead Mobilityİ Index, **FES-I:** Falls Efficacy Scale International.
[a] Independent samples t- test, [b] Mann–Whitney U test, [c] Pearson's Chi-square test, [d] Fisher-Freeman-Halton Exact test.

hand grip strength in patients with a history of falling may have been related to both low levels of vitamin D and vitamin B12, and lack of regular physical activity.

In our present study, all patients who had a fall did not live alone, were afraid of falling again, and did not engage in regular physical activity. It may be considered that these patients stopped living alone and avoided physical activity due to FoF again. However, there was no significantly difference between patients in our study with and without FoF in terms of mobility. This finding indicates that patients with OP who had FoF seemed to limit their activities that require more effort, such as physical exercise, but not limit their daily mobility. Resnick et al. reported that the risk of falling is higher in patients who are aware of their diagnosis of OP (15). The awareness of OP diagnosis may lead to self-induced limitation of physical activities in patients,

subsequently leading to deconditioning and increased risk of falling. Takada et al. reported that poor sleep quality was associated with a higher risk of falling (33). Another study found that poor sleep quality caused by short nighttime sleep duration and increased sleep fragmentation was associated with falls in elderly women (34). In our study, the rate of those who defined sleep quality as poor was found to be higher among patients with histories of falls. The association between poor sleep quality and falling may be facilitated by mechanisms such as decreased cognitive function, or balance or gait problems, but lack any data to explain such an association in our study (34) .

In a study by Cangussu et al., 63.1% of falls occurred at home, 31.5% on the street, and 5.4% at work in patients with history of falling within the last year (35). In another study, 62% of falls occurred in or around the home, and falls occurred most frequently in the living room (36). In the same study, falls were most commonly associated with inattention and loss of balance, with just over half of all falls due to tripping or slipping. Most of the falls detected in our current study occurred outdoor and as a result of tripping, and physical causes such as blackout and dizziness were more common. This may be due to the small number of patients evaluated or the patients were a specific patient group diagnosed with OP. The fact that most of the falls are outside may be due to the patients had better physical functions and were more active.

Meyer et al. reported that approximately 44% of patients with OP had a FoF (7). In the same study, OP was associated with the FoF as well as limitations in daily life due to FoF in female participants over 65 years. The rate of FoF in our study was 69.4%. This rate was higher than reported in the literature. The lower rate reported in the aforementioned study may be due to the inclusion of both male and female patients and the wide age range (40-95 years) of the patients who were included. History of falling is considered a significant predictor of developing FoF (5). In our current study, most patients with FoF did not report a fall in the last three months, although all patients with a history of falls also had FoF. Hübscher et al. reported that intensity of back pain increased the FoF in women with OP, independent from vertebral fractures and history of falls (16). In another study, increased FoF in patients with OP was associated with patients' knowledge of their bone mineral density (10). Resnick et al. reported that knowing more about OP was associated with less FoF (15). In our study, the rates of previous diagnosis of OP were similar in patients with and without FoF. This finding indicates that previous diagnosis of OP has no effect on the FoF. Since we did not question patients regarding their level of knowledge of OP, we do not have data on the effect of knowledge on FoF, and this may have affected our results.

Clemson et al. reported that increasing age is one of the main predictors of developing FoF (37). This result is compatible with our study and it may be a consequence of declining physical function with increasing age. In addition, we determined that late menopause and living alone had a significant effect on patients' fear. Elliott et al. reported that FoF was more common among elderly adults who lived alone and elderly adults who lived with others may have more social support, which reduces FoF (38). More social adults may be less likely to restrict their activities due to FoF and better activity can result in increased physical function. However, we do not have any data or explanation regarding the significant effect of late menopause on FoF.

Our study had many limitations. Data regarding falling and related information were based on patients' self-reports. The patients' experiences with falls in the last three months were questioned retrospectively. Although three months may not seem like a long period of time, probably not all falls were reported by patients. There are many factors that may interact with falling and FoF in the elderly population with OP. Due to the complex interaction between these factors, it does not seem possible to evaluate every factor (12). The current study is a cross-sectional study and a causal relationship between the evaluated factors cannot be established. This study only included geriatric female patients with OP. The results cannot be generalized to male patients with OP or to female patients with OP under the age of 65. Another limitation of our study was the small sample size. This was due to strict patient selection criteria, more difficult communication with elderly patients, and patients' refusal to perform the OP evaluation form.

In order to avoid any potential impact on falling and FoF, studies are needed that include patients with OP younger 65 years, periodically monitor the fall experiences of patients, and evaluating the knowledge level of patients about OP. The results of our study may guide future studies that will investigate the cause-and-effect relationship between factors related to falling and FoF in female patients with OP.

Acknowledgment

N/A

Author Contributions

Concept: **Alper Mengi,** Design: **Alper Mengi,** Data Collection or Processing: **Alper Mengi, Emre Sualp,** Analysis or Interpretation: **Alper Mengi, Emre Sualp,** Literature search: **Alper Mengi, Emre Sualp,** Writing: **Alper Mengi, Emre Sualp,** Approval: **Alper Mengi, Emre Sualp.**

Conflicts of Interest

The authors declare no conflict of interest.

Financial Support

N/A

Ethical Approval

This study was conducted with the approval of the Çanakkale 18 Mart University Medical Faculty Clinical Research Ethics Committee (reference number: 24.11.2021/2021-09).

Review Process

Extremely peer-reviewed and accepted.

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