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Factors Associated with Fall Risk in the Elderly

Yaşlılarda Düşme Riski ile İlgili Faktörler

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ÖZ

Amaç: Düşme yaşlı yetişkinlerde çok yaygın olarak görülen önemli bir problemdir. Çalışmanın amacı, yaşlı bireylerde düşme riski ile ilgili faktörleri incelemektir.
Araçlar ve Yöntem: Çalışmada 65 yaş üstü 110 birey incelendi. Bireylerin demografik bilgileri ve son 1 yıl içerisindeki düşme sayıları kaydedildi. Katılımcıların bilişsel becerileri Montreal Bilişsel Değerlendirme (MoCa) Ölçeği ile, anteriyoposterior dinamik denge Fonksiyonel Uzanma Testi (FUT) ile, lateral denge Tandem Duruş Testi (TDT) ile, denge ve düşme olasılığı Berg Denge Testi (BDT), fonksiyonel hareketlilik Zamanlı Kalk Yürü Testi (ZKYT) ile, alt ekstermite enduransı ve fonksiyonel kas gücü 1-Dakikalık otur-kalk Tesi (1-DOKT) ile ve servikal propriosepsiyon stabilizatör ile değerlendirildi.
Bulgular: Katılımcıların yaş ortalaması 71.26±6.20'dir ve son bir yıl içinde 0.41±1.02 düşme yaşamışlardır. TDT süresi: 25.95±7.93 saniye, MoCa: 18.65±4.90, FUT: 21.83±8.38 cm, BDT: 51.11±4.47, ZKYT: 12.01±3.89 saniye, 1-DOKT: 18,61±8,23 tekrar, servikal propriyosepsiyon hatası: % 15.49±13.01 olarak bulundu. Düşme sayısı ile yaş (r=-0.081, p=0.399), boy (r=-0.030, p=0.756), TDT (r=0.144, p=0.134), bilişsel düzey (r=-0.015, p=0.878), BBT(r=-0.079, p=0.414) ve servikal propriyosepsiyon(r=-0.135, p=0.160) arasında istatistiksel olarak anlamlı olmayan negatif bir korelasyon görüldü. Erkekler kadınlara kıyasla daha fazla düşme bildirmiştir ve olasılık oranı 3.14'tür (%95 güven aralığı: 1.21-8.14).
Sonuç: Bu çalışma, yaşlı insanlar arasında düşmelerle ilişkili faktörlere dair değerli bilgiler sunmaktadır. Bulgular, düşmelerde kilit bir faktör olarak cinsiyetin önemini göstermekte ve vücut ağırlığı, denge, servikal propriosepsiyon ve yaşın düşme olasılığı üzerindeki olası etkisini ortaya koymaktadır.

Anahtar Kelimeler: denge; düşme; propriyosepsiyon; yaşlı

ABSTRACT

Purpose: Falls are a significant health concern for older adults. This study aimed to investigate factors influencing fall risk in elderly individuals.
Materials and Methods: A total of 110 participants aged 65 and older were evaluated. Data on demographic characteristics and the number of falls in the past year were recorded. Various physical and cognitive assessments were conducted, including the Montreal Cognitive Assessment (MoCA) for cognitive abilities, Functional Reach Test (FRT) for anteroposterior balance, Tandem Stance Test (TST) for lateral balance, Berg Balance Scale (BBS) for overall balance, Timed Up and Go Test (TUG) for functional mobility, 1-Minute Sit-to-Stand Test (1-MST) for lower extremity strength, and cervical proprioception measurements.
Results: Participants had a mean age of 71.26±6.20 years and experienced 0.41±1.02 falls in the past year. The following mean values were observed: TST time: 25.95±7.93 seconds, MoCA: 18.65±4.90, FRT: 21.83±8.38 cm, BBT: 51.11±4.47, TUG: 12.01±3.89 seconds, 1-MSTST: 18.61±8.23 repetitions, and cervical proprioception error: 15.49±13.01%. No statistically significant correlation was found between fall frequency and age (r=-0.081, p=0.399), height (r=-0.030, p=0.756), TST (r=0.144, p=0.134), cognitive level (r=-0.015, p=0.878), BBT (r=-0.079, p=0.414), and cervical proprioception (r=-0.135, p=0.160). Men reported more falls than women, with an odds ratio of 3.14 (95% CI: 1.21-8.14).
Conclusion: This study provides valuable insights into the factors associated with falls among older adults. The findings highlight the importance of gender as a key factor in falls and reveal the potential influence of body weight, balance, cervical proprioception, and age on fall risk.

Keywords: balance; elderly; fall; proprioception

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INTRODUCTION

The World Health Organization (WHO) reports that the global population of those aged 60 and above is growing in both absolute numbers and as a percentage of the total population. In 2019, the global population of individuals aged 60 and above reached a staggering one billion. The estimated figure for this number is expected to rise to 1.4 billion by 2030 and 2.1 billion by 2050. There are reports indicating that this increase is happening at an unprecedented pace and will continue to speed up in the next ten years, particularly in emerging nations.[1] The proportion of elderly population is also increasing in Turkey. According to the Turkey Statistical Institute reports, the population aged 65 and over increased to 9.9% in 2022. Based on demographic forecasts, the percentage of older adults is projected to be 12.9% in 2030, 16.3% in 2040, 22.6% in 2060, and 25.6% in 2080.[2]

The aging of the population brings with it many problems related to old age. In old age; physiologically, psychologically and socially many changes occur and some major health problems may become apparent. One of the most important problems is falls.

It is important to identify risk factors for such frequent falls. Risk factors for falls are divided into external factors (environmental hazards), intrinsic or patient-induced factors (reduced function due to ageing, adverse effects of diseases and medication) and situational factors (related to the activity, e.g. rushing to the toilet).[3] Environmental factors, either alone or in combination with innate ones, enhance the risk of falls. Falls occur more frequently when higher postural control and mobility are required (e.g., walking on an uneven or slippery surface) and when an elderly person is unfamiliar with the environment (e.g., moving to a new house). Age-related changes can also affect the neurological system, which is responsible for maintaining balance and stability, raising the risk of falls. Age-related eyesight loss, as well as changes in muscular power and velocity, can decrease the capacity to maintain or recover balance in the face of any perturbation (for example, stepping onto an uneven or slippery surface).

Impaired postural stability has been identified as a significant risk factor for falls in the elderly. Complex interactions between several motor, integrative, and sensory systems result in postural stability.[4] Proprioception, muscle strength, and tactile perception may all play a role in older persons' everyday fall prevention and postural stability.[4] For equilibrium to be maintained, muscles must be able to exert enough force. Tactile sense is a crucial source of information for maintaining balance and managing body sway. Proprioception is essential for creating smooth and coordinated motions, maintaining appropriate body posture, and managing balance.[5] According to Lin et al., forward head posture has a negative impact on limits of stability, performance-based balance, and cervical proprioception.[6] Increasing age is associated with decreased cervical ranges of motion (ROM). In addition to an age-related decline in cervical ROM, Lansade et al. found a considerable impairment of cervical proprioceptive capacities with increasing age.[7]

Impaired neurocognitive function is also a significant risk factor for falls. The concept of executive functioning is broad and complex, generally referring to higher-level cognitive abilities. These abilities include planning, strategizing, selectively attending to relevant information, and inhibiting inappropriate responses. On the other hand, dual-tasking refers to our ability to perform two tasks simultaneously, such as talking and walking. Dual-task costs, or poor performance on one or both activities, arise due to our limited cognitive resources. While executive processes can certainly affect an individual's ability to multitask (for instance, by influencing strategies for prioritizing or focusing on tasks), dual-task paradigms are specifically designed to assess the interaction between cognitive and motor functions.[8,9]

Repeated falls, fractures (hip fractures associated with mortality), soft tissue injuries, injuries seriously affecting vital functions, prolonged hospitalisation, loss of function leads to secondary problems such as activity limitations and negatively affects the well-being of individuals.[10] Secondary injuries due to falls and health utilisation of services, health and patient care expenditures are increasing. In addition falls cause high morbidity and mortality rates. In conclusion, there are many preventable risk

factors underlying falls in elderly individuals. Determining which of these preventable risk factors increase the risk of falls more is important in terms of establishing preventive approaches for these risk factors. Considering the increases in current morbidity and mortality rates and the reflection of the increase in health expenditures on the national economy, prevention of falls in elderly individuals, maintaining functionality and independence should be a primary health objective. The aim of our study is to analyse the multiple factors that cause falls in order to make the participation of elderly individuals in the society sustainable and to reduce the costs of health expenditures and to determine the importance of these factors in the risk of falls.

MATERIALS and METHODS

The study, which aimed to investigate the significance levels of indicators that increase the risk of falling in the elderly was completed between March 2023 and September 2023.

This study was approved by Çankırı Karatekin University Science, Mathematics and Social Sciences Ethics Committee (dated 28.06.2022 and numbered 26). The study was conducted in accordance with the principles set out in the Declaration of Helsinki.

Participations

People aged 65 years and over were included who met the inclusion criteria of the study and voluntarily agreed to participate were informed before the study and signed informed consent forms. Individuals with neurological diseases, orthopaedic problems, vestibular disorders and ambulation problems excluded from the study. Participants' demographic information, physical characteristics, fall history (number of falls, type of fall, place of fall), medical history (osteoporosis, osteopenia, sarcopenia, orthostatic hypotension presence), medications, vision and hearing problems, and home-environmental conditions were questioned.

Assessment of Cognitive Status

The cognitive levels of participants were assessed using the Montreal Cognitive Assessment Scale (MoCA). The MoCA is a paper-based assessment instrument that may be completed in around 10 minutes. The examination comprises 8 components. The tasks evaluate visuospatial perception, organizational aptitude, recognition and labeling, short-term memory, attention, linguistic proficiency, abstraction, and orientation. From the test the maximum score that can be obtained is 30. A score of 26 or more is considered normal cognitive level. A score of 26 or more is considered normal cognitive level. The Turkish validity and reliability of the test was evaluated by Özdilek B. and Kenangil G. in 2014.[11]

Dynamic Balance Assessment

Participants' anterioposterior dynamic balance assessed with Functional Reach Test (FRC). The FRC test, which is conducted in a standing position with a fixed base of support, is a rapid, dynamic, single-task evaluation. It is defined as the greatest distance an individual can maintain while reaching beyond arm's length. It was developed by Duncan et al.[12] The participant is asked to stand in a fixed upright position against a wall (not touching). The arm is extended at 90 degrees against the wall and the localisation of the 3rd metacarpal bone is recorded. The participant is asked to reach as far forward as possible without taking a step and the localisation of the 3rd metacarpal bone is recorded. 3. metacarpal bone and the beginning and between their localisations at the end the difference is measured. Functional reach normative data were 26.6 cm for community-dwelling older adults and 15.4 cm for non-community-dwelling older adults.[13]

Tandem Stance Testing

The subject is required to maintain equilibrium while standing, with the hallux of one foot resting on the heel of the other foot, for a duration of 30 seconds. Lateral stability test on this narrowed support surface and impaired lateral stability is a key factor for falls in the elderly.[14]

Berg Balance Scale

The Berg Balance scale is a 14-item evaluate that objectively evaluates balance and the likelihood of falling in people by directly observing their performance. The scale assesses the participants' capacity to sustain their equilib-

rium in a stationary position or during different functional movements within a specific timeframe. In brief, it assesses both the stationary and dynamic components of equilibrium. A score of 0 indicates a lack of capacity to accomplish the task, while a score of 4 indicates successful completion of the task without assistance. Out of 56 possible scores, an overall score is calculated. Scores ranging from 0 to 20 indicate impaired balance, scores ranging from 21 to 40 suggest adequate balance, and scores ranging from 41 to 56 indicate good balance.[15]

Timed Up and Go Test

The Time Up and Go Test (TUGT) is a frequently employed balance assessment that evaluates functional mobility in elderly individuals. The test necessitates a participant to rise, traverse a distance of 3 meters, move around, return, and then assume a seated position. There is a high correlation between the duration of the test and the degree of functional mobility. Research has demonstrated that older individuals who are able to execute transfer tasks related to daily activities in under 20 seconds exhibit independence and are capable of walking at speeds that are considered sufficient. Conversely, elderly individuals who take more than 30 seconds to finish the task generally have a higher level of reliance on others for their daily tasks and rely on assistive aids for walking.[16]

1 Minute Sit to Stand Test

This test provides information on endurance and functional muscle strength of the lower extremities. Participants are asked to get up from a sitting position with arms crossed across the chest and sit and stand as quickly and safely as possible within 1 min. The number of sit-ups completed in 1 min is recorded.[17]

Assessment of Cervical Proprioception with Stabilizer

The muscles in the cervical region are rich in proprioceptors. In addition, this region is a transit route for ascending and descending pathways. Information flows to this region from the upper and lower centers, vestibular centers and cerebellum. For this reason, the cervical region is very important for maintaining balance.[18] The pressurized biofeedback device consists of an air-filled pressure bag and a gauge that displays the associated pressure value and an inflation apparatus used to inflate the bag. It is a simple device that shows changes in the air-filled pressure bag allowing body movements. The pressure bag measures 16.7 x 24 cm and is made of non-elastic material. The pressure is measured between 0-200 mmHg in 2 mmHg intervals. Changes in body position change the pressure and are recorded by this instrument. Thus, information about proprioception is obtained.

Statistical Analysis

The data was analyzed using SPSS 26.0 (IBM, Armonk, NY, USA). Descriptive statistical analysis used frequency and percentage for count data, and mean ± standard deviation for measurement data. Univariate analysis utilized chi-square and t tests, whereas logistic regression analysis was employed for categorical and continuous data, respectively.

The backward technique was employed to screen the characteristic parameters using logistic regression, with a screening standard of 0.05. The likelihood ratio test was used as the test method, with a test level of 0.05.

RESULTS

Table 1 presents a comprehensive overview of the demographic and clinical attributes of the study participants. The demographic characteristics of a population include several factors such as age, gender, education level.

The composition of the sample primarily comprises male participants, accounting for 74.5%, and the remaining 25.5% represents female individuals. The individuals exhibit an average age of 71.26, accompanied by a standard deviation of 6.20, indicating a very uniform range of ages. The prevailing demographic among the participants is individuals who are married, constituting 75.5% of the whole sample. The participants exhibit a range of educational backgrounds, with 62.7% having completed elementary school, 25.5% having completed high school, and 11.8% possessing a bachelor's degree or more.

Table 1. Demographic characteristics of participants.

Variables	Mean±SD	N(%)
Gender		
female		28 (25,5%)
male		82 (74,5%)
Age	71.26±6.20	
Weight(kg)	76.46±12.67	
Height(meter)	168.03±7.28	
BMI (kg/m^2)	27.06±4.10	
Marital status		
single		27 (24,5%)
married		83 (75.5%)
Educational status		69 (62.7%)
elementary		28 (25.5%)
high school		13 (11,8%)
bachelor or above		
Tandem standing (sec)	25.95±7.93	
MoCA (0-30)	18.65±4.90	
Functional reaching score (sec)	21.83±8.38	
Berg Balance Scale (0-56)	51.11±4.47	
Timed Up and Go (sec)	12.01±3.89	
1 minute sit to stand (repeat)	18.61±8.23	
Cervical proprioception error (%)	15.49±13.01	
Falling status (last 1 year)		
None	0.41±1.02	
One or above		

The average duration of tandem standing among participants was around 26 seconds. The mean score of the MoCA was found to be 18.65, indicating a moderate level of cognitive functioning. The sample exhibited considerable variability in cognitive performance, as seen by a standard deviation of 4.90. The mean duration for completing the functional reaching exercise was found to be 21.83 seconds, with a standard deviation of 8.38. The average score obtained by the participants on the Berg Balance Scale was 51.11, accompanied by a reasonably low standard deviation of 4.47, which is considered typical for this particular scale.

The average duration for participants to complete the TUGT was around 12 seconds. The mean number of sit-stand repetitions per minute is 18.61, with a standard deviation of 8.23. The participants demonstrated an average inaccuracy in cervical proprioception of 15.49%. On average, participants experienced a mean of 0.4 falls within the previous year.

Table 2 displays the correlations (r) and corresponding p-values for several variables in connection to the reported number of falls among the participants in the study. These correlations offer valuable insights into the possible associations between these variables and the occurrence of falls.

Table 2. Variables related to the number of falls.

Variables	r	p
Age	-0,081	0.399
Weight(kg)	0.114	0.235
Height (meter)	-0.030	0.756
BMI (kg/m2)	0.127	0.186
Tandem standing (sec)	-0.144	0.134
MoCA (0-30)	-0.015	0.878
Functional reaching score (sec)	0.015	0.875
Berg Balance Scale (0-56)	-0.079	0.414
Timed Up and Go (sec)	0.077	0.422
1 minute sit to stand (repeat)	0.040	0.677
Cervical proprioception error (%)	-0.135	0.160

A statistically insignificant negative connection was seen between age and the frequency of falls (r=-0.081, p=0.399). These results suggest that elderly people, on average, reported a slightly lower number of falls. A statistically insignificant positive correlation (r=0.114, p=0.235) was seen between weight and the frequency of falls. This implies that persons with greater body weight tended to report a higher number of falls, although this relationship did not reach statistical significance. There was a negligible negative correlation between height and the frequency of falls (r=-0.030, p=0.756), suggesting that those with greater height tended to report a little lower number of falls. A little positive connection is once again detected between body mass index (BMI) and the frequency of falls (r=0.127, p=0.186), suggesting that persons with higher BMI values tend to report a slightly higher number of falls.

The study found a negative correlation (r=-0.144) between the duration of tandem standing and the frequency of falls. This suggests that individuals who were able to maintain tandem standing for a longer period of time reported a lower number of falls. However, it is important to note that this connection did not approach statistical significance (p=0.134). In a similar vein, the correlation between scores obtained from the Montreal Cognitive Assessment (MoCA) and the incidence of falls exhibits a negligible value of about zero (r=-0.015). This suggests that there is no statistically significant association between cognitive evaluation scores and the frequency of falls (p=0.878). The study found a negligible association (r=0.015) between the duration of the functional reaching task and the incidence of falls, which was not statistically significant (p=0.875). The observed correlation coefficient (r=-0.079) suggests a negative relationship between the scores obtained on the Berg Balance Scale and the frequency of falls. This implies that persons with higher balance scores tend to report a little lower number of falls. Nevertheless, the observed association does not exhibit statistical significance (p=0.414). There was a positive correlation between the duration of the Timed Up and Go test and the number of falls, however this correlation was not statistically significant (r=0.077, p=0.422). This finding demonstrates that individuals who allocated a greater amount of time to the exam reported a slightly higher incidence of falls. The findings of this study reveal a positive association (r=0.040) between the frequency of sit-to-stand repetitions per minute and the incidence of falls. This suggests that participants who performed a greater number of repetitions reported a higher number of falls. Nevertheless, the observed association does not exhibit statistical significance (p=0.677). In conclusion, there exists a negative connection (r=-0.135) between cervical proprioception error and the frequency of falls. This suggests that persons with lower levels of proprioception error tend to report a reduced incidence of falls. Nevertheless, the observed association does not exhibit statistical significance (p=0.160).

In conclusion, this research demonstrates that while there exist certain associations between specific factors (such as age, weight, and balance) and the frequency of falls, these connections not statistically significance.

The findings of the logistic regression analysis, which attempted to investigate the factors associated with an elevated likelihood of experiencing one or more falls within the previous year, are displayed in Table 3. The study gave odds ratios (OR), together with 95% confidence intervals (CI) and p-values, to evaluate the statistical significance of the connections.

Table 3. Examining the factors that increase the risk of one or more falls in the last year using logistic regression.

Variables	OR	95% CI	p
Gender			
Female (ref)	1		0.018*
male	3.14	1.21-8.14	
Marital status			
single	1.95	0.60-6.28	0.285
married (ref)	1	1	
Educational status			
elementary	1.52	(0.31-7.66)	0.606
high school	2.20	(0.40-12.29)	0.368
bachelor or above (ref)	1		

The logistic regression analysis demonstrates a statistically significant association between gender and the likelihood of experiencing a fall. In this study, it was found that male participants had a significantly higher likelihood of reporting one or more falls compared to female participants, with an odds ratio of 3.14 (95% confidence interval: 1.21-8.14). The observed association between gender and falls is statistically significant (p=0.018*), suggesting that being male is a potential risk factor for falls.

The odds ratio for individuals who were single, compared to those who were married (used as the reference category), was found to be 1.95 (95% confidence interval: 0.60-6.28). Nevertheless, the statistical analysis reveals that there is no significant association between married status

and the risk of falling, as indicated by the p-value of 0.285.

In a similar vein, the odds ratio for individuals with primary school education is 1.52 (95% confidence interval [CI]: 0.31-7.66), but the odds ratio for those with high school education is 2.20 (95% CI: 0.40-12.29). Furthermore, it exhibits a greater decline in comparison to individuals holding a bachelor's degree. Nevertheless, it is important to note that none of these connections exhibit statistical significance, as indicated by the p-values of 0.606 and 0.368, respectively.

DISCUSSION

In our study, in which we examined the factors affecting falls in elderly individuals, no significant relationship was found between the frequency of falls and demographic characteristics, cognitive skills, balance, functional mobility, lower extremity endurance and functional strength and cervical proprioception, while the frequency of falls was significantly higher in male individuals.

The composite sample exhibited predominantly male demographics. Logistic regression analysis provided empirical evidence supporting the idea that being male constitutes a statistically significant risk factor for falls to occur. Specifically, male participants were approximately three times more likely to report falls compared to females. This finding is in line with previous studies showing a higher susceptibility to falls in older men, possibly attributable to differences in muscle mass, gait patterns and other relevant variables.[19,20] However, there is a lack of consistency in a study showing that male participants experience fewer incidents of falls.[21] One study of 14.881 people found that older women were more likely to suffer a fall or fall-related injury than older men.[22] The small number of participants in our study and the fact that the majority of them were men may have led to such a result.

Although there are studies in the literature showing a strong relationship between ageing and fall risk, a negligible relationship was found in our study.[23,24] The absence of a statistically significant link is rather unexpected, given that the study sample had a somewhat narrow age distribution, potentially influencing the outcome.

The observed positive connection, albeit not statistically significant, suggests that there is a tendency for those with higher body weight to experience a greater number of falls. The phenomenon of weight gain among elderly individuals might result in alterations in both balance and gait, hence elevating the susceptibility to experiencing falls. Lockhard et al. found that obese older adults who fell had a significantly altered gait pattern (longer duration of double support and greater variability), a loss of automaticity in walking, and postural instability (i.e., greater sway area and path length and higher sway speed) compared to their counterparts, which increased the risk of falling when perturbed.[25] Further investigation is warranted to explore the correlation between body weight and falls in greater depth, necessitating additional study and a larger sample size.

There was no correlation observed between educational achievement and the risk of falling. There was no statistically significant difference in fall rates between participants with an elementary or high school education and those with a bachelor's degree or higher education. A study involving 232 participants found that less than 6 years of education was a risk factor for falls.[26] In our study, the absence of statistical significance could potentially be attributed to the constrained sample size within each educational category. In order to identify potential correlations between schooling and the risk of falling, it is imperative to utilize larger and more heterogeneous sample sizes.

Impaired neurocognitive function is a significant risk factor for falls. A systematic review of the results of 28 studies concluded that cognitive impairment increases the risk of falls.[27] In our study, there was a non-significant negative correlation between the cognitive functions of the participants and the frequency of falls. This may be due to the good cognitive function of the individuals who participated in our study.

Balance was evaluated comprehensively in our study. Anterioposterior dynamic balance was assessed with the FRT, lateral balance with the TST, balance and fall prob-

ability with the BBT, and functional mobility with the TUG test. In a recent review of validated tools assessing gait, balance and functional mobility to predict falls in older adults, TUG, BBS, walking speed, dual task assessments, single leg stance, FRT, tandem walking and stance, and chair stand test were the most frequently reported assessments. Results of these tests' predictive capacity varied throughout reviews.[28] They stated that no gait, balance, or functional mobility evaluation alone can reliably predict the risk of falls in older persons.

It has been shown that older adults who can complete the task in less than 20 seconds in the TUG test are independent in transfer tasks in daily life activities, have high scores on the BBS, and walk at walking speeds that should be sufficient for mobility in the community.[29] In our study, the functional mobility of individuals who completed the test in an average of 12.01±3.89 seconds was quite good. These results explain the lack of association between the frequency of falls and TUG test results.

In our study, anteroposterior balance of individuals was measured with FRT. In a meta-analysis of 40 studies, it was stated that different FRT values should be used for community older adults or non community older adults.[13] When our study was evaluated on the basis of values suitable for individuals living in the community, it would be correct to say that the anteroposterior balance of our participants was slightly impaired. The same meta-analysis states that this test should not be used to predict the risk of falls in older adults.[13] This is supported by the fact that there was no correlation between FRC test result and fall risk in our study. Studies show that men have significantly better performance than women in both static and dynamic balance performances.[30,31] The fact that our study included more male patients may have resulted in improved FRT outcomes that did not correlate with the incidence of falls.

The clinical tests yielded significant insights into the physical and cognitive capabilities of the subjects. The average balance, as assessed by the Berg Balance Scale, exhibited a commendable level of proficiency. Nevertheless, the results of this study indicate that there was no statistically significant negative link between the scale and fall frequency. This suggests that participants who obtained higher scores on the balance assessment reported a lower incidence of falls. The obtained results align with our initial hypotheses, as it is widely recognized that maintaining good balance serves as a preventive factor against the occurrence of falls.[32]

In our study, the number of sitting and staying in the 1-minute sit and stand test was found to be lower than that reported in the literature for the same age group,[33] but no relationship was found between this test result and the frequency of falls. Moreover, Muehlbauer et al. found that the correlations between balance and muscle function were weak regardless of age, indicating that these components are independent of one another.[34] Therefore, we might infer that muscle strength itself appears to be more significant among patients with certain mobility issues, who are institutionalized, or who frequently fall.

In our study, a non-significant negative relationship was found between cervical joint proprioception error and fall risk. In a study by Reddy et al. it was shown that cervical proprioception and functional mobility were impaired in older adults over 65 years of age and functional mobility was more impaired in older adults with more cervical joint position error.[35] While the impact of cervical parameters on identifying fall risk appears to be somewhat low when compared to established main risk factors that are frequently immutable, more investigation is required to clarify the underlying mechanisms of cervical functions in connection to falls.

The results of the logistic regression analysis indicated that gender exhibited a significant predictive effect on fall risk. The results of this study indicate that male participants exhibited a statistically significant elevated likelihood of encountering one or more instances of falling within the previous year. The findings of this study underscore the significance of incorporating gender-specific interventions into programs aimed at preventing falls.

Limitations

The present study is subject to many limitations. The potential limitation of the sample size in detecting statistically significant associations, particularly in the examination of educational attainment, should be acknowl-

edged. The fact that the study sample was not homogeneous in terms of gender and the small number of individuals in the advanced old age stage is also a limitation.

Conclusion

In summary, this research study offers significant insights into the elements that are linked to falls among the elderly population. The results emphasize the significance of gender as a prominent determinant of falls, shedding light on the potential influence of body weight, balance, and age on the likelihood of experiencing a fall. Additional study is required to expand upon these findings and establish focused fall prevention techniques for older persons. This necessitates the use of bigger and more diverse samples, as well as the consideration of additional pertinent characteristics.

Conflict of Interest

The authors declare that there is not any conflict of interest regarding the publication of this manuscript.

Ethics Committee Permission

This study was approved by Çankırı Karatekin University Science, Mathematics and Social Sciences Ethics Commit-tee (dated 28.06.2022 and numbered 26).

Authors' Contributions

Concept/Design: ZCK, FNS, AÖ, CT. Data Collection and/or Processing: ZCK, FNS, AÖ, CT. Data analysis and interpretation: ZCK, FNS, AÖ, CT. Literature Search: ZCK, FNS, AÖ, CT. Drafting manuscript: ZCK, CT. Critical revision of manuscript: ZCK, FNS, AÖ, CT.

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