A Comparison of Physical Parameters, Functional Performance, and Life Quality in Home-residing and Nursing Home-residing Older Adults with No History of Falls

Evde ve Bakımevinde Yaşayan ve Düşme Hikayesi Olmayan Yaşlıların Fiziksel Parametre, Fonksiyonel Performans ve Yaşam Kalitelerinin Karşılaştırılması

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Abstract

Aim: In this study, we aimed to compare physical parameters, functional performance, and life quality scores in home-residing (HR) and nursing home-residing (NHR) older adults with no history of falls and evaluate the possible correlations between these factors.

Materials and Methods: This cross-sectional study assessed 44 HR and 59 NHR participants by using the Berg Balance Scale, Timed Up and Go Test, Mini Mental State Examination, 30-Second Chair Stand Test, and Nottingham Health Profile (NHP).

Results: No statistically significant difference was found between the NHR and HR participants in terms of lower extremity muscle strength, balance, life quality, functional performance, and mental status ($p>0.05$). Correlation analysis only showed a significant negative relationship between functional performance and lower extremity muscle strength ($r=-0.401$, $p=0.003$) and balance ($r=-0.519$, $p=0.0001$) in the NHR group.

Discussion and Conclusion: Fall risk assessments for HR and NHR elderly should consider various factors including lower extremity muscle strength, functional performance, mental status, and life quality. This study presenting functional performance and life quality data as well as physical parameter measurements is preliminary to further studies from a similarly holistic perspective.

Keywords: accidental falls; aging; life quality; nursing homes; older adults

Öz

Amaç: Bu çalışmada evde (EY) ve bakımevinde yaşayan (BY) ve düşme hikayesi olmayan yaşlıların fiziksel parametre, fonksiyonel performans ve yaşam kalitelerini karşılaştırmak ve bu faktörler arasındaki ilişkiyi araştırmak amaçlanmıştır.

Gereç ve Yöntemler: Kesitsel tipteki bu çalışmada 44 EY ve 59 BY yaşlı; Berg Denge Ölçeği, Süreli Kalk ve Yürü Testi, Mini Mental Durum Testi, 30 Saniyede Sandalyeden Kalkma Testi ve Nottingham Sağlık Profili ile değerlendirildi.

Bulgular: EY ve BY katılımcılar arasında alt ekstremite kas kuvveti, denge, yaşam kalitesi, fonksiyonel performans ve mental durum bakımından istatistiksel olarak anlamlı fark tespit edilmedi ($p>0,05$). Korelasyon analizinde yalnızca BY grupta fonksiyonel performans ile alt ekstremite kas kuvveti ($r=-0,401$; $p=0,003$) ve denge ($r=-0,519$; $p=0,0001$) arasında negatif ilişki bulundu.

Tartışma ve Sonuç: EY ve BY yaşlıların düşme riski değerlendirmelerinde alt ekstremite kas kuvveti, fonksiyonel performans, mental durum ve yaşam kalitesi gibi çeşitli faktörler göz önünde bulundurulmalıdır. Fiziksel parametre ölçümleri yanı sıra fonksiyonel performans ve yaşam kalitesi verileri de sunan bu çalışma, benzer biçimde bütüncül bir perspektiften gerçekleştirilecek daha ileri çalışmalar için öncü niteliktedir.

Anahtar Sözcükler: bakımevleri; kazara düşüşler; yaşam kalitesi; yaşlanma; yaşlı

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INTRODUCTION

Early risk identification is crucial to preventing and decreasing possible falls in older adults. The assessments of increased fall risk among elderly should include careful history-taking and physical examination of functional performance, balance, and quadriceps strength (1,2). The Berg Balance Scale (BBS), Timed Up and Go Test (TUG), and 30-Second Chair Stand Test (30-s CST) help determine balance loss by assessing the physical factors related to functional performance including static and dynamic balance and lower extremity muscle strength (1,2). The individual's history of falls, on which the risk assessments used to rely heavily, is considered insufficient today. Although the literature recommends using the TUG along with questioning, the TUG alone is not adequate to evaluate community-dwelling older adults due to the need for additional balance and muscle strength assessments (3,4).

There have been studies with nursing home-residing (NHR) and home-residing (HR) older adults (5), most of which compare individuals with and without a history of falls. There is still a need for assessing similar risk factors between groups of adults with no history of falls (5). Moreover, as elderly fall risks are also associated with balance, mobility, and functional performance, all of which are effective on daily living activities and thereby life quality (1,2), the assessments should adopt a holistic approach. Again, the literature contains few studies that analyze the relationship between all these factors as a whole (5,6).

For all these reasons, in this study we aimed to compare physical parameters (balance, lower extremity muscle strength, body mass index), functional performance, and life quality scores between HR and NHR older adults with no history of falls and investigate the possible correlations between these parameters.

MATERIALS AND METHODS

For the present cross-sectional study, we initially obtained a list of 200 potential participants from nursing homes in Yalova and its districts. All listed individuals were interviewed and their fall histories were recorded. Following the assessment, we identified 59 individuals with no history of falls. During the following 3 months (April–June 2016), we also contacted HR individuals of similar age (n=77), 44 of whom had no fall history (Figure 1). Accordingly, the participants were selected from HR and NHR older adults in Yalova and its districts by using a simple random sampling method, in which every object principally had the same probability of being chosen. The assessments were made through face-to-face interviews (by AS). The participants who were literate (according to their own statements) were asked to complete the questionnaire form. For the participants who had difficulty reading or who were illiterate, the researcher read the questions and recorded the answers. The inclusion criteria were voluntary participation, being ≥65 years, and not having fallen during the last 12 months. Individuals who were unwilling or unable to give informed consent to participation, who were absent during our visits or not permitted to have visitors, and who had severe hearing disorders or uncontrolled hypertension (systolic blood pressure >160 mmHg) were excluded. Permission from the University of Kocaeli Ethical Commission on Clinical Studies was obtained for this study. All participants gave written informed consent.

Study variables: Participant data concerning age, body mass index (BMI), assistive device use, fall history, and daily drug use were recorded. We then obtained the Mini Mental State Examination (MMSE), BBS, TUG, 30-s CST, and Nottingham Health Profile (NHP) scores of all participants.

History of falls: The participants were asked if they had fallen during the preceding month and year. Interviews were conducted verbally.

The Timed Up and Go (TUG) test: The TUG is a simple test that provides objective and reliable measurements for assessing balance and functional mobility. It also determines fall risk. The TUG score is measured as time in seconds required for the subject to complete the test. Scores >13 seconds are suggestive of a "falling risk." If necessary, use of mobility aids was allowed during the test (6).

The 30-Second Chair Stand Test (30-s CST): This test assesses leg strength and endurance. The subjects are asked to stand up from a sitting position without using their arms. This sequence is repeated as many times as possible over a period of 30 seconds. The seat height

Table 1. General comparison of the two groups

Categories		NHR participants (n=59)		HR participants (n=44)		
		Mean	**SD**	**Mean**	**SD**	**p**
BMI (kg/m²)		28.12	6.08	28.53	7.01	0.750
Age		77.54	8.77	71.05	5.65	**<0.001**
Drug use		5.07	3.82	2.05	1.80	**<0.001**
		n	**%**	**n**	**%**	**p**
Sex	Female	33	55.9	20	45.5	0.293
	Male	26	44.1	24	54.5	
Assistive devise use	Yes	27	45.8	11	25.0	**0.031**
	No	32	54.2	33	75.0	
Chronic illness	Yes	54	91.5	33	75.0	**0.022**
	No	5	8.5	11	25.0	

SD: standard deviation

Table 2. The balance, lower extremity muscle strength, functional performance, life quality, and mental status values of the two groups

	NHR participants (n=59)		HR participants (n=44)			Covariate effects in the model			
Categories	**Mean**	**SD**	**Mean**	**SD**	P_{Places}	$P_{Assistive\ device\ use}$	$P_{Chronic\ illness}$	P_{Age}	$P_{Drug\ use}$
LEMS	8.32	0.869	6.41	0.962	0.110	0.297	0.261	**0.005**	0.186
Balance	39.4	2.47	41.02	2.64	0.619	**0.001**	0.866	0.646	0.387
Life quality	128.91	21.32	145.46	22.81	0.556	0.080	0.483	0.617	0.834
FP	20.94	6.33	25.61	6.77	0.576	0.094	0.137	0.697	0.828
Mental status	23.15	1.15	24.86	1.23	0.077	**0.016**	0.147	0.989	0.452

FP: functional performance; LEMS: lower extremity muscle strength; SD: standard deviation

of the chair is approximately 43 cm, and the person administering the test records the number of the full stands performed (7).

The Berg Balance Scale (BBS): The BBS assesses a person's balance abilities for functional activity. Compared to the other tests, BBS requires more strength because the support surface is reduced. The test consists of 14 items, each of which is scored using a five point-scale, ranging from 0 (lowest) to 4 (highest). BBS scores of 0 to 20 indicate high fall risk; 21 to 40, medium fall risk; and 41 to 64, low fall risk (8).

The Mini Mental State Examination (MMSE): The MMSE provides a global assessment of mental function. The scale, standardized by Güngen et al. in Turkey (9), is easily administered and provides information regarding the degree of cognitive impairment. The maximum possible score is 30 points and higher scores indicate better cognitive status (9). Scores of <24 points (for the Turkish population) are generally suggestive of "abnormal" cognition.

The Nottingham Health Profile (NHP): For the purposes of this study, the Turkish version of the NHP was used to assess the Health-Related Quality of Life (HRQoL) (10). The NHP consists of 38 items concerning physical activity (8 items), sleep (5), emotional reactions (9), social isolation (5), and energy (3). All items are in a Yes-or-No format. Scores for each subscale can range from 0 (perfect health) to 100 (most deteriorated state of health).

Statistical analysis: The descriptive data were expressed as mean±standard deviation, numbers, and percentages. Variables were investigated for normal distribution using the Shapiro–Wilk test. The independent t-test was used to compare the numeric demographic variables of the HR and NHR participants. Pearson's chi-squared test was used to compare the

Table 3. The relationship between BMI, balance, lower extremity muscle strength, functional performance, life quality, and mental status for the two groups

Categories		NHR participants (n=59)			HR participants (n=44)		
		Life quality	Functional performance	Mental status	Life quality	Functional performance	Mental status
BMI (kg/m^2)	r	.235	-.146	.064	.274	-.191	-.046
	p	.087	.293	.646	.106	.264	.788
	df	52	52	52	34	34	34
LEMS	r	**-.416**	**-.401**	**.302**	**-.332**	.050	.305
	p	**.002**	**.003**	**.026**	**.048**	.773	.070
	df	**52**	**52**	**52**	**34**	34	34
Balance	r	**-.506**	**-.519**	**.526**	**-.558**	-.205	**.465**
	p	**.0001**	**.0001**	**.0001**	**.0001**	.230	**.004**
	df	**52**	**52**	**52**	**34**	34	**34**

LEMS: lower extremity muscle strength

categorical demographic variables of the two groups. The demographic characteristics that showed significant differences between the HR and NHR individuals were considered covariate. The two groups' scores of physical parameters, functional performance, and life quality were compared by covariate analysis. In addition, the relationships of physical parameters with functional performance and life quality of the HR and NHR individuals were separately analyzed by partial correlation analysis. $p<0.05$ was considered statistically significant. The analyses were performed using the SPSS (v. 18) software.

RESULTS

The comparison of BMI, age, sex, drug and assistive device use, and history of chronic diseases was performed before the HR and NHR participants were compared in terms of lower extremity muscle strength, balance, functional performance, and life quality. The results are summarized in Table 1, which shows that the mean BMIs and the sex differences were similar between the two groups. Mean age and amount of drug use were significantly higher for the NHR participants, compared to the HR group ($p<0.001$). Moreover, the NHR participants had higher rates of assistive device use and chronic illness ($p=0.031$ and $p=0.022$, respectively). The statistically significant results for lower extremity muscle strength, balance, functional performance, and life quality are highlighted in Table 2.

No significant difference was found between the HR and NHR groups in terms of lower extremity muscle strength, balance, life quality, functional performance, and mental status ($p>0.05$). We investigated the possible effects of age, sex, drug and assistive device use, and chronic illness on these scores and found that lower extremity muscle strength decreased significantly with increasing age ($p=0.005$). The mean mental status scores were significantly lower in those using assistive devices (21.85±1.29) than in those not using assistive devices (25.16±0.975, $p=0.016$). Again, the mean balance scores were significantly lower for those using assistive devices (33.05±2.77) than those not using assistive devices (47.36±2.09) ($p=0.001$).

The relationships between lower extremity muscle strength, balance, functional performance, and life quality were examined separately in the HR and NHR groups (Table 3), after eliminating the effects of age, chronic illness, and drug assistive device use.

Correlation analysis of the data from the NHR adults showed a significant negative relationship between lower extremity muscle strength and NHP values ($r=-0.416$, $p=0.002$) and between lower extremity muscle strength and functional performance ($r=-0.401$, $p=0.003$). A significant positive relationship was found between lower extremity muscle strength and mental status ($r=0.302$, $p=0.026$). Significant negative correlations were found between the balance and NHP values ($r=-0.406$, $p=0.0001$) and balance and functional performance ($r=-0.519$, $p=0.0001$) whereas

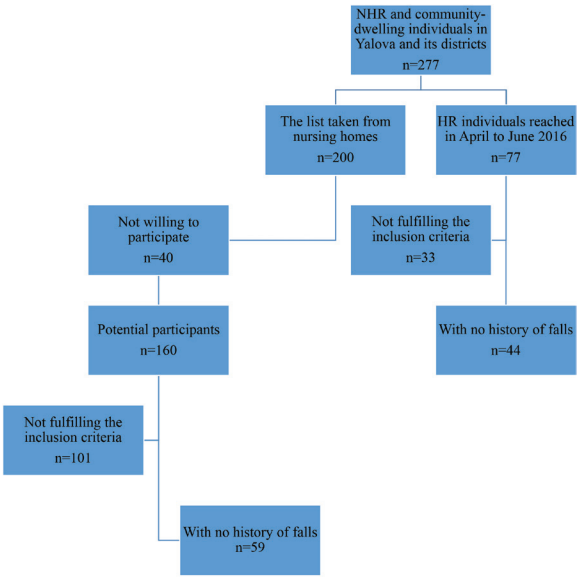

Figure 1. Flowchart of participant recruitment

a positive correlation was found between balance and mental status (r=0.526, p=0.0001).

Correlation analysis of the data from the HR adults showed a significant negative relationship between lower extremity muscle strength and NHP values (r=-0.332, p=0.048) and between balance and NHP (r=-0.558, p=0.0001). A significantly positive relationship was found between balance and mental status (r=0.465, p=0.004). The other correlations between the categories were not significant (p>0.05).

DISCUSSION AND CONCLUSION

This study compared physical parameters (balance, lower extremity muscle strength, and BMI), functional performance, and life quality scores between HR and NHR adults with no history of falls and investigated the possible correlations between these parameters. The mean values of age, assistive device use, chronic illness, and daily drug use were significantly higher for the NHR group, compared to the HR group. However, after eliminating the effects of these factors, we found no statistically significant difference in physical parameters (balance, lower extremity muscle strength, and BMI), functional performance, and life quality between the two groups.

The correlation analysis between physical parameters (balance, lower extremity muscle strength, and BMI), functional performance, and life quality showed that lower extremity muscle strength and balance were related to life quality for all participants, which is consistent with the literature. It has been suggested that the greater dependency due to physical impairment (muscle strength, balance, and functional mobility) among institutionalized older people is inversely related to HRQoL (11–13). Contrarily, Yumin et al. found a significant relationship between balance and life quality among HR individuals only (11).

We found a negative correlation between functional performance and lower extremity muscle strength and balance in the NHR group, although we did not observe the same in the NR group. There are studies indicating that functional performance and balance are more declined in nursing home residents (14,15). A negative effect on functional performance is more commonly observed among NHR adults, compared to community-dwellers (16). Guralnik et al. reported a decline in functional performance and balance in NHR adults, even though there was no accompanying disability (14). In the present study, the relationship between lower extremity muscle strength and functional performance in the NHR group may be explained by declined functional performance due to living in a confined space where most daily needs are met by the institution, negative feelings due to living apart from the family, and low levels of movement (1). The HR individuals have to meet their daily needs themselves as they receive less help, which helps them maintain their functionality (1).

One of the factors for which there was no difference between the groups and different results were obtained in the intragroup relationship analysis was mental condition. There was the same relationship between mental status and balance for both groups. Comparative studies report that in NHR older adults balance and cognitive status are negatively affected by mental status. In HR adults balance is negatively affected by the physical conditions and physiological regression due to aging (11,17,18). Rubenstein et al. found that fall risk was linked with mental status and walking impairment in NHR individuals (17). Balance is an important parameter of movement (11,17,18), and it is known that there is a positive relationship between mental status and movement in older adults

(19). Decreased balance can make the individual asocial; the elderly individual fearing falling may not want to leave his home or his room in the nursing home, indicating the effect of the mental state (11,17–19).

Unlike the HR group, mental status and lower extremity muscle strength were also positively correlated in the NHR group. Guralnik et al. reported lower extremity muscle strength as the most important functionality factor among NHR elderly (14). This is supportive of our views on the relationship between mental status and functionality. As NHR older adults are known to have less chances for functioning compared to HR elderly (19,20), we can think that a positive relationship between lower muscle strength and mental state may increase the rate of movement with socialization (11,14,17,18).

The literature reports that chronic diseases and multiple drug use cause functional limitations, increasing the fall risk (21,22). There have been studies showing both similarities and differences between HR and NHR elderly (1,2). High levels of multiple drug use by NHR adults may cause decreased functional performance and balance loss (21,22). Wu and Ouyang and Matchar et al. found that the number of chronic diseases affected the fall risk (23,24). Unlike these reports, however, in our study we observed that the number of chronic diseases and drugs used did not affect balance and physical performance.

The literature shows that the level of mobility and lower extremity muscle strength are negatively affected as age increases (1,11). Hughes et al. (25) and Ishigaki et al. (1) reported that muscle strength loss became greater with increasing age. Telenius et al. found that muscle strength was an independent correlate of strength decline over 12 years (15). In line with the literature, age was found to affect lower extremity muscle strength in the present study.

Similarly, balance and mental status were found to regress as assistive device use increased. The efficacy of mobility devices in preventing falls has been questioned. A recent systematic review concerning walker use by older adults concluded that there was not sufficient evidence to prove or disprove causation of falls with walker use. Another study shows that mental status is related to assistive device use. There may be a negative effect on balance and mental status when a wrong assistive device is selected (15,19).

Meta-analysis and review studies report that health professionals do not evaluate all factors that may be related to the fall risks of older adults (2). The present study included a combined assessment of physical parameters, functional performance, and life quality. Another important aspect of this study is the finding that the mean TUG values were higher than the cut-off value, although we evaluated older adults without a fall history. Overall, we found no statistically significant difference in physical parameters (balance, lower extremity muscle strength, and BMI), functional performance, and life quality between the HR and NHR groups.

It should also be noted that our study has several important limitations. Due to its cross-sectional design, it could not ascertain the cause–effect relationship among variables. Also, we relied on self-reports in our evaluation of fall history, and thus did not review the official records. Future studies should address these limitations.

In conclusion, fall risk assessments should not be based only on fall history, but balance, lower extremity muscle strength, functional performance, mental status, and life quality should also be considered, using a holistic and multidisciplinary approach (1,2). This study presenting functional performance and life quality data as well as physical parameter measurements is preliminary to further studies from a similarly holistic perspective.

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