Comparison of physical performance of elderly people living at home and in institution

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Research Report

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Purpose: The physical conditions like architectural modifications and social atmosphere that elderly people are in and participation of physical and social activities affect physical performance. The aim of the study was to compare physical performance of elderly people living at home and in institution, and to investigate factors effecting physical performance. **Materials and methods:** Sixty-four elderly people were included to this study (32 elderly people live in Elderly Care Institution of Turgutlu and 32 elderly people living at the same town) between January and April 2004. Demographic data of the elderly people were recorded and mobility (30-second sit-to-stand test), balance (side to side stance test, semi tandem stance test, and tandem stance test) and physical performance (6-minute walk test) were evaluated. **Results:** No difference was found among demographic and physical characteristics between institutionalized group and home group (p>0.05). Six-minute walk test distance for physical performance of the home-dwelling group (505.6±199.4 m) was significantly higher than the institutionalized group (245.2±101.3 m) (p=0.002). Physical performance was correlated with age (p<0.001) and mobility in both groups (p=0.039). **Conclusions:** Results of this study suggested that elderly people who live in institution had lower mobility, balance and physical performance then those who live at home and that age and lower mobility negatively influence physical performance of elderly people.

Key words: Elderly, Physical performance, Mobility limitation, Postural balance.

Evde ve bakım evinde yaşayan yaşlıların fiziksel performanslarının karşılaştırılması

Amaç: Yaşlının içinde bulunduğu sosyal atmosfer ve mimari modifikasyonlar gibi fiziksel durumlar, fiziksel ve sosyal aktivitelere katılım fiziksel performansı etkiler. Çalışmanın amacı evde ve yaşlı bakım evinde yaşayan yaşlıların fiziksel performansını karşılaştırmak ve fiziksel performansı etkileyen faktörleri belirlemekti. **Gereç ve yöntem:** Çalışmaya 64 yaşlı (Ocak-Nisan 2004 tarihleri arasında, 32'si Turgutlu Yaşlı Bakım Evi'nde, 32'si aynı bölgede evde yaşayan) dahil edildi. Yaşlıların demografik bilgileri kaydedilmiş, mobilite (30-sn sandalyeye otur-kalk testi), denge (ayakta dik durma, yarım topuk-burun durma ve topuk burun durma testleri) ve fiziksel performansları (6 dakika yürüme testi) değerlendirildi. **Sonuçlar:** Evde ve bakım evinde yaşayan yaşlıların demografik ve fiziksel özellikleri arasında fark bulunmadı (p>0.05). Evde yaşayan grubun 6 dakika yürüme testi mesafesi (505.6±199.4 m), bakım evinde yaşayan grubun yürüme mesafesinden (245.2±101.3 m) anlamlı olarak daha yüksekti (p=0.002). Fiziksel performansın iki grupta da yaş (p<0.001) ve mobilite düzeyi (p=0.039) ile ilişkili olduğu görüldü. **Tartışma:** Çalışmanın sonuçları, yaşlı bakım evinde yaşayan yaşlıların mobilite, denge ve fiziksel performans düzeylerinin evde yaşayanlardan daha düşük olduğunu ve ileri yaş ile düşük mobilite düzeyinin fiziksel performansı olumsuz etkilediğini gösterdi.

Anahtar kelimeler: Yaşlı, Fiziksel performans, Mobilite limitasyonu, Postüral denge.

Aging is an essential biological process for all life forms. It is described as fraying of the organism, fault and corruption of the vital functions after completion of the maturation of biological chain started with birth.

Several physical and psychological environment factors and life-style of the elderly in addition to genetic factors are effective on reigning of the physiologic changes with age.[1] Architectural regulations and physical conditions at where elderly people live and the social ambience which they are in, going out frequency, doing housework, participation in physical and social activities effect on performance and independence level. Even the chronologic ages of the individuals can be equal, physiologic aging could be different by individual to individual.[1,2]

The accumulation of deficits in the elderly people, such as muscular weakness, decreased balance or neuromuscular abnormalities, result in mobility impairments that may cause falls and difficulties in performing activities of daily living (ADL).[1]

Physical performance is recognized as an important predictor of mortality and morbidity in elderly people. There are some functional measurements for prediction of aerobic capacity. The 6-minute walk (6MW) test is well-established as a valid and reliable measure for elderly people.[3] In a population of healthy elders, 6MW test can be correlated with performance-based measures of functional limitation such as standing balance and chair sit to stand time.

The aim of the study was to compare physical performance of the elderly people living at home and institution and to investigate factors effecting functional performance.

Material and Methods

Subject

In this study, we included 32 elderly people in each group (home-dwelling and institutionalized). The subjects have been living in same town.

Institutionalized elderly people were evaluated in Elderly Care Institution of Turgutlu, İzmir. For home-dwelling group, we phoned elderly people living alone at home and invited them in to the institution. A physiotherapist evaluated convenience of all elderly for inclusion in this study by administering a medical history questionnaire.

Five inclusion criteria were used:
1- 65 years of age or older,
2- Able to tolerate balance, mobility or walking for 6 MW without shortness of breath, chest pain, or joint pain in the legs, neck or back that would limit performance of the 6 MW test,
3- Not dependent on the assistance of another person or an assistive device (e.g. walker, cane, crutch),
4- Non smoker for last 2 years,
5- No history of dizziness.

Approval was obtained from Dokuz Eylül University, Human Ethics Committee before commencing this study, and written consent was taken from all subjects.

Test procedures

Test session continued 45-60 minutes for each elderly adult. Testing was conducted in a quiet area in the institution. Subjects were told to wear comfortable gear and walking shoes.

Demographic data including age, height, weight, medical diagnoses, resting blood pressure (systolic and diastolic), resting heart rate (HR) and respiratory rate (RR) of the older adults were collected. Length of stay in the institution was also recorded for the institutionalized group.

Mobility

Thirty-second sit-to-stand (STS) test is often used as a measure of lower-limb strength in elderly people and those with significant weakness. However, the findings of recent studies suggest that performance in this test is also influenced by factors associated with balance and mobility.[4-6] In this study, we used 30-second STS test to measure mobility. 30-second chair STS test were completed using a standard padded chair without arm-rest. Subjects followed identical STS techniques for this test, with both arms crossed against the chest, starting from the seated position and standing up (leg straight) and sitting down (full weight on the chair). The number of chair stands completed in 30 seconds was calculated.

Balance

Side to side stance test: Subjects were

requested to select a comfortable standing position (feet 10-15 cm apart) on the floor. The test was done with eyes opened; the arms were held in a relaxed position in front of the body with the hands clasped together.[7]

Semi tandem stance test: This test was performed with eyes opened and with one foot placed in front of the other foot. There was a half foot length between feet.[7]

Tandem stance test: This test was performed with eyes opened and with one foot placed in front of the other foot when both feet touching each other. Standing duration without swaying was recorded.[8,9]

Physical performance and functional capacity

The 6MW test is commonly used measuring physical performance and functional capacity in clinical researches.[4,9,10] A 200-foot (30.5 m) institutional corridor was used and marked by colored tape at each end. Maximum distance that a person can walk in 6 minute was measured. A physiotherapist encouraged subjects with the standardized statements "you're doing well", "keep up the good work" and "keep going, only X minute to go" but was asked not to use other phrases. Before and after the walking process, systolic blood pressure (SBP) and diastolic blood pressure (DBP), HR, and RR were measured. For the perception of exercise intensity, the original Borg Scale was used. At the end of the test, the walking distance was recorded. To determine estimated maximum oxygen consumption (VO_2max) following formula was used ($ml.min^{-1}.kg^{-1}$);[10-14]

$VO_2max = 0.02 \times$ distance (m) $- 0.191 \times$ age (year) $- 0.07 \times$ weight (kg) $+ 0.09 \times$ height (cm) $+ 0.26 \times$ RPP ($\times 10^{-3}$) $+ 2.45$

Rate-Pressure Product (PRR) is calculated using the following formula:

RPP = SBP (at the end of 6 MW test) $\times$ HR (at the end of 6 MW test)

Statistical analysis:

The data obtained from the assessments recorded in SPSS Windows (11.0) software package. Chi-square test and Student t-test were used to compare data between the home-dwelling-group and institutionalized group, and Mann-Whitney U test was used to compare the physical performance of two genders. Pearson Correlation Analysis was used to determine the variables correlating with physical performance level. An alpha level of 0.05 was considered significant for all analyses.

Results

Table 1 shows demographic data of both home-dwelling group and institutionalized group. In home-dwelling group, mean body weight was heavier than institutionalized group and the difference was statistically significant ($p<0.05$). On the other hand, there was no significant difference for age, height and body mass index (BMI) between two groups (Table 1) ($p>0.05$).

In home-dwelling group 20 elderly people had diabetes mellitus (only type 2) and 20 had hypertension, in institutionalized group 23 elderly people had diabetes mellitus and 24 had hypertension.

The mean values of 30 second chair STS test and balance test were higher in home-dwelling group than institutionalized group, but except for side by side test ($p=0.006$) no significant difference was found between the groups ($p>0.05$)(Table 2).

The mean 6MW distance was 505.6 ± 199.4 m in home-dwelling group and 245.2 ± 101.3 m in institutionalized group ($p=0.002$). The mean VO_2max value of the institutionalized group was 8.90 ± 3.37 $ml.min^{-1}kg^{-1}$ and home-dwelling group was 13.4 ± 3.5 $ml.min^{-1}.kg^{-1}$. When home-dwelling group and institutionalized group compared, VO_2max was significantly different ($p<0.0001$) (Table 2).

In institutionalized group, physical performance (6MW distance) was well correlated with age ($r=-0.615$, $p<0.0001$), 30-sec chair STS ($r=0.367$, $p=0.039$) and length of stay in institution ($r=-0.477$, $p<0.0001$). In addition, 6MW distance was moderately correlated with BMI ($r=0.317$, $p=0.070$) and was poorly correlated with balance (side to side stance test $r=0.221$, $p=0.223$; semi tandem test $r=0.175$, $p=0.338$; tandem $r=0.204$, $p=0.263$) (Table 3). In this group, when mean 6 MW distance of males (271.7 ± 95.4 m) and females (249.1 ± 202.9 m) were compared, there was no significant difference ($p=0.242$).

In home-dwelling group, functional

Table 1. Demographic data of Home-dwelling group and Institutionalized group.

	Institutionalized group (N=32) X±SD	Home-dwelling group (N=32) X±SD	p
Age (years)	72.5±5.8	69.6±5.8	0.47
Weight (kg)	70.4±9.2	75.4±14.7	0.04*
Height (cm)	165.7±7.4	167.7±6.3	0.43
Body mass index (kg/m^2)	25.1±3.4	26.8±4.8	0.30
	n (%)	n (%)	
Gender			
Female	7 (22%)	11 (34%)	
Male	25 (78%)	21 (66%)	
Diabetes mellitus	23 (72%)	20 (63%)	
Hypertension	24 (75%)	20 (63%)	

* p<0.05.

Table 2. Comparison of the mobility, balance, physical performance and functional capacity between two groups.

	Institutionalized group (N=32) X±SD	Home-dwelling group (N=32) X±SD	p
Mobility			
30-sec chair sit to stand test (n)	12.9±3.3	15.9±3.4	0.72
Balance			
Side to side stance test (sec)	46.6±15.2	54.1±13.3	0.01*
Semi tandem stance test (sec)	46.1±16.8	46.3±14.1	0.77
Tandem stance test (sec)	40.0±17.9	43.0±18.3	0.41
Physical performance			
6-minute walk test distance (m)	245.2±101.3	505.6±199.4	0.00*
VO$_{2max}$ (ml.min^{-1}.kg^{-1})	8.9±3.4	13.4±3.5	0.00*

* p<0.05.

performance (6MW distance) was moderately correlated with age (r = -0.364, p=0.04) and well correlated with 30-sec chair STS test (r =0.611, p<0.0001). However, 6MW test was weakly correlated with BMI (r=-0.070, p=0.970) and balance (side to side stance test r=0.063, p=0.732; semi tandem test r=0.033, p=0.859; tandem r= 0.258, p=0.153) (Table 3). The mean 6MW distance of males was 599.5±188.6 m and the distance of females was 373.5±161.0 m. The 6MW distance test results of males and females were significantly different between two gender (p<0.0001).

Discussion

In this study, we investigated whether there

Table 3. Correlations of the 6-minute walk test with age, body mass index, mobility and balance in institutionalized group and at home-dwelling group.

	Institutionalized group (N=32) r (p)	Home-dwelling group (N=32) r (p)
Age	-0.615 (<0.0001)*	-0.364 (0.004)*
Body mass index	0.317 (0.070)	-0.070 (0.970)
Length of stay	-0.477 (<0.0001)*	
Mobility		
30 sec chair sit to stand test	0.367 (0.039)*	0.611 (<0.0001)*
Balance		
Side to side stance test	0.221 (0.223)	0.063 (0.732)
Semi tandem stance test	0.175 (0.338)	0.033 (0.859)
Tandem stance test	0.204 (0.263)	0.258 (0.153)

* p<0.05.

were differences for mobility, balance and physical performance in elderly people living at home and in institution. Physical performance and functional capacity in home-dwelling group was higher than institutionalized group. Physical performance was correlated with age and mobility in both groups.

Physical conditions at where elderly people lives and the social ambience which they are in, going out frequency, doing housework, participation in physical and social activities effect on functional performance and independence level.[7,11-14]

We reached three studies on elderly people living in different ambiences as our study did.[11-13] Borowiak and Kostka compared quality of life of home dwelling and institutionalized adults. They determined that the demographic and social parameters, physical and cognitive functions affected the quality of life. The outcomes of quality of life were lower in community dwelling group because of the inadequate exercise and obesity.[11]

Bischoff et al. compared mobility of the community-dwelling and institutionalized elderly people. They measured physical mobility by timed up and go test. They determined that community-dwelling elderly women should be able to perform timed up and go test in a shorter duration than institutionalized elderly women.[13] Bito and Fukuhara compared quality of life of community-

dwelling and institutionalized elderly people and used short-form 36 health survey (SF-36). They found that the two groups did not differ with regard to scores on the mental health scale, the vitality scale or the general health perception scale.[12]

Even the descriptive characteristics (age, gender, BMI, chronic disease (hypertension, diabetes type 2) of both two groups are similar, physical performance and functional capacity were lower for institutionalized group then home-dwelling group. Physical performance and length of stay in an institution were strongly and negatively correlated with each other.

Functional capacity is recognized as an important predictor of mortality and morbidity in elderly people. We found that VO_{2max} values were lower in institutionalized elderly people. Because living in institution could raise the risk of morbidity of elderly people, further studies should investigate the improvement strategies for the functional capacity.

It was determined that the obesity had negative effects on functional performance in several studies.[15] The BMIs of the home dwelling group were significantly higher than the other group but BMI and physical performance were not correlated with each other.

There are some studies indicate that gender is a determinative factor on functional independence

level. It was found that the functional level of males was higher then females.[4,16,17]

Lord and Menz reported that males walked farther than females in 6MW test and they determined that 6MW distance was correlated with age in both gender.[17] In the present study, 6 MW distances of men were farther than women and physical performance was correlated with gender in home dwelling group.

In recent studies, it has been reported that a significant correlation exists between 6 MW distance and mobility including standing balance and chair stands.[4,10] In the present study, we found same results that 30-second chair STS test was correlated with 6MW distance in both groups.

Letup of the base of support is an important factor which causes the balance loss therefore increased base of support improves postural stability.[18,19] Nashner indicated that single leg stance (decreased base of support) was very important for activities such as stair climbing and walking.[20] In our study, both two groups did not succeed the test over 60 second; however, we observed that the balance did not affect the physical performance.

Hinman et al. indicated that 63% of elderly people which live in institution or other similar places had mobility problems. According to them, over 60 years of age, mobility speed decreases 12-16% in every 10 year.[21] Saltzman et al. and Mecagni et al. reported that decreased muscle strength caused impairment of walking speed and the harmony of balance and consequently, problems in activities of daily living.[22,23]

In our study, 6MW distance of home group was higher than institutionalized group. Because activities of daily living such as shopping, cleaning up or preparing foods are done by the institution personal and there are no physical or recreational activity programs in the institution, elderly residents mostly concern with their own selves. Elderly people who live at home do these activities by themselves because they do not have any attendants. This condition was thought the reason of the higher outcome values of physical and functional capacity in home group.

Results of this study suggested that the elderly people who live in institution had lower mobility, balance and physical performance than who live at home and, age and lower mobility influence to physical performance of elderly people.

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