Turkish Journal of Geriatrics
2015;18(4):273-279

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Received: 24/07/2015

Accepted: 15/10/2015

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RESEARCH

AGE-AND SEX-RELATED DIFFERENCES IN PHYSICAL FITNESS AND PHYSICAL ACTIVITY LEVELS OF THE PHYSICALLY INDEPENDENT COMMUNITY-DWELLING OLDER ADULTS

ABSTRACT

Introduction: The aim of the study was to assess health-related physical fitness and physical activity levels of young elderly (60–69 years) and old elderly (70–80 years) people and to show the differences with age and gender.

Materials and Method: The level of physical activity was evaluated using the International Physical Activity Questionnaire(IPAQ-short) and each participant completed a battery of health-releated physical fitness tests adapted from ALPHA-FIT test batteries.

Results: A sample of 143 participants aged between 60 to 80 years, of which 70 were in young elderly group (60-69 years) and 73 were in old elderly group (70-80 years) was recruited. One leg stand, figure of eight walk and shoulder neck mobility showed a statistically significant difference ($p<0.05$) between young elderly (60–69 years) and old elderly women (70–80 years). But there is no statistically significant difference in the distance of six minute walk test for the cardiorespiratory fitness between young elderly and old elderly women. Hand grip and shoulder neck mobility showed a statistically significant difference ($p<0.05$) between age groups. In the body composition, no statistically significant difference were observed between two age groups in the waist circumference and BMI regardless of gender. There is no statistically significant difference in the total score of physical activity between young elderly and old elderly men. But a significant difference ($p<0.05$) between young elderly and old elderly women was found.

Conclusions: Our results indicate that women had much more decreased physical fitness and physical activity level with age.

Key Words: Physical Fitness; Physical Activity; Aging; Gender.

ARAŞTIRMA

FİZİKSEL OLARAK BAĞIMSIZ TOPLUM İÇİNDE YAŞAYAN YAŞLI BİREYLERİN FİZİKSEL UYGUNLUK VE FİZİKSEL AKTİVİTE DÜZEYLERİNDE YAŞA VE CİNSİYETE BAĞLI FARKLILIKLAR

ÖZ

Giriş: Bu çalışmanın amacı, genç yaşlıların (60-69 yaş) ve daha yaşlı (70-80 yaş) bireylerin sağlığa bağlı fiziksel uygunluk ve fiziksel aktivite düzeylerini değerlendirmek ve yaşa ve cinsiyete bağlı farklılıkları göstermektir.

Gereç ve Yöntem: Çalışmaya 70'i genç yaşlı grubunda (60-69 yaş) ve 73'ü daha yaşlı grupta (70-80 yaş) olmak üzere 60 ile 80 yaş arası 143 katılımcı dahil edildi. Fiziksel aktivite düzeyi Uluslararası Fiziksel Aktivite Anketi (IPAQ-kısa form) kullanılarak değerlendirildi ve her bir katılımcıya ALPHA-FIT test bataryasından uyarlanan sağlığa bağlı fiziksel uygunluk testleri uygulandı.

Bulgular: Genç yaşlı (60-69 yaş) ve daha yaşlı kadınlar (70-80 yaş) arasında tek ayak üzerinde durma, sekiz şekli yürüyüş ve omuz boyun mobilite testi sonuçlarında istatistiksel olarak anlamlı bir fark bulundu ($p<0.05$). Fakat kardiyorespiratuar uygunluk için, genç yaşlı ve daha yaşlı kadınlar arasında altı dakika yürüme testi sonucunda istatistiksel olarak anlamlı bir fark bulunmadı. El kavrama ve omuz boyun mobilite testlerinde yaş grupları arasında istatistiksel olarak anlamlı bir fark bulundu ($p<0.05$). Vücut kompozisyonunda, cinsiyet ne olursa olsun her iki yaş grubu arasında bel çevresi ve vücut kitle indeksi sonuçlarında istatistiksel olarak anlamlı fark gözlenmedi. Genç yaşlı ve daha yaşlı erkekler arasında fiziksel aktivite toplam puanı arasında istatistiksel olarak anlamlı bir fark yoktu. Ama genç yaşlı ve daha yaşlı kadınlar arasında anlamlı bir fark bulundu ($p<0.05$).

Sonuç: Elde edilen sonuçlar kadınların yaşla birlikte fiziksel uygunluk ve fiziksel aktivite düzeyinin daha fazla azaldığını göstermektedir.

Anahtar Sözcükler: Fiziksel Uygunluk; Fiziksel Aktivite; Yaşlanma; Cinsiyet.

Introduction

Aging is a genetically determined, inevitable process that varies by acquired damage and immunological reactions. Active ageing and the factors that influence this process are important. Analysis of the primary factors influencing active ageing can help develop effective and preventive interventions that allow older adults to maintain an active and healthy life. Physical activity (PA) and physical fitness (PF) are key factors that influence active ageing (1,2).

PF plays a vital role in the health and independence of older adults (3), although it is traditionally associated with young through middle-aged populations. However, the growth of aging population means that it is important for older adults to maintain adequate muscle strength, flexibility, balance and aerobic endurance to accomplish everyday tasks (4). Assessing health-related PF is also important for determining health status.

A decline in the functional status and PA levels is often observed with ageing. Strength, endurance and flexibility problems indicate deterioration in functional health in sedentary older adults, who must therefore expend more effort to perform normal daily activities. PA is important for independent living, prevention of chronic health problems and good quality of life in older adults (4,5).

Globally, the number of older adults is continuously increasing. It has also been estimated that by 2050, 20.8% of Turkey's total population will be elderly. This has been attributed to the increasing life expectancy: in 1980, the average terminal age for Turkish adults was 58 years, while in 2050, it is expected to be 79 years The population of older adults in Turkey is growing rapidly, and Turkey is expected to have the largest older population among all European countries in 2050 (6). This increase in the number and proportion of older adults means that clinicians need more information about factors that influence the continued health of older adults.

There have been numerous studies on the general functioning of older adults and the effects of PA on older adults' health, but there is little published data available in Turkey on the multiple components of PF or PA levels (e.g. intensity, duration and frequency) for older adults in different age groups (4,6). There has recently been increased interest in the importance of PA and PF levels of Turkish older adults with the ageing population, highlighting the importance of gathering this information.

In the present study, we aimed to assess health-related PF and PA levels of older adults a younger elderly group aged 60–69 years and an older elderly group aged 70–80 years and to identify the differences in health-related PF and PA by age and sex.

Materials and Method

Participants

Participants were recruited from Turkey's Ankara Yenimahalle municipality by public notices announcing that physiotherapists would be available to evaluate the health of older adults in a public park. In total, 172 older adults applied to participate. The health status of participants was determined using the health status measurements, including resting blood pressure, heart rate, respiratory rate and body mass index (BMI). A questionnaire about PA and PF tests were conducted with participants that were physically independent (able to walk 10 metres without rest or assistance). As there were potential health risks associated with the PF tests, we excluded participants who had any cardiorespiratory diseases or symptoms. Also older adults with cognitive disorders, who were living in nursing homes were excluded. The final study sample was 143 participants aged between 60 and 80 years (Figure 1). 29 participants were not meeting inclusion crite-

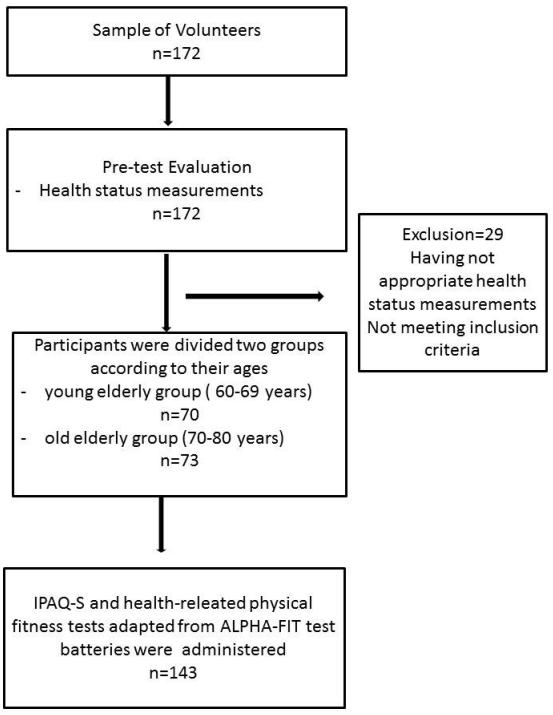

Figure 1— Enrollment of the study.

ria. 17 particitipants had inappropriate health status measurements and 12 participants were dependent on the assistance of a support device (eg, cane, crutch) for walking. The present study was approved by the Ethics Committee of the Turgut Özal University and was performed in accordance with the Declaration of Helsinki. All participants were fully informed of the potential risks and benefits of participation in the study, and gave informed consent to participate.

Testing Procedure

Participants provided general demographic information, completed the short form of International Physical Activity Questionnaire (IPAQ-S) and completed a battery of health-related PF tests adapted from the ALPHA-FIT Test Battery (7). After a general warm-up exercise consisting of 3 min of easy walking and easy lower- and upperbody stretching exercises, the tests were administered in the following order to minimize the effects of fatigue: one-leg stand test, shoulder-neck mobility test, figure-of-eight walk test, hand grip strength test and sit and reach test. After a 5-min break, six-minute walk test was administered. Approximately 45 minutes took to make all the assessments in one participant. Standardized instructions were given to all participants and all examiners were trained about the assessments and tests. All tests were repeated to minimise errors, and the best score of the two test trials was used to evaluate performance.

International Physical Activity Questionnaire (IPAQ)

IPAQ was developed as an instrument for cross-national PA assessment and for standardising the measures of health-related PA population behaviours in different countries and sociocultural contexts. The IPAQ is used to assess habitual PA during the past 7 days. In the present study, we used the Turkish version (8) of the IPAQ short form (IPAQ-S), administered by interview. Time spent in each activity category was derived by multiplying the number of days per week with the minutes per day spent doing the activity, while total weekly PA (metabolic equivalent [MET]-Min week-1) was calculated by multiplying the number of minutes spent in each activity category with the MET score for each activity. Total weekly PA was estimated by weighting the reported minutes per week in each activity category by a MET energy expenditure estimate assigned to each category (8).

The ALPHA-FIT Test Battery

The ALPHA-FIT Test Battery for adults was developed as a part of the project ALPHA (Assessing Levels of Physical Activity and fitness at population level), funded by the European Commission. ALPHA aimed to provide a set of evidence-based instruments to assess the levels of PA and fitness in a comparable way within the European Union. The test battery consists of valid, reliable, manageable and secure field tests that can be used to monitor population health. The tests are based on scientific evidence from currently available international transversal and longitudinal research (7).

We used hand grip strength test, sit and reach test and shoulder-neck mobility test for the evaluation of musculoskeletal fitness. For the assessment of motor fitness, one-leg stand test and figure-of-eight walk test were used. To evaluate the body composition and cardiorespiratory fitness, the measurement of waist circumference, BMI and six-minute walk test were used, respectively.

Statistical Analyses

All statistical analyses were performed with SPSS 15 (Chicago,SPSS Inc.). Kolmogorov–Simirnov/Shapiro–Wilk tests were used to investigate the normality of distribution for the continuous variables. Descriptive statistics were calculated as the mean ± standard deviation (SD) for continuous variables and the number of patients and percent (%) for categorical variables. A Mann–Whitney U test was used to compare the outcomes of measurements between the younger and older groups. A correlation analysis using Spearman's correlation was conducted to examine the relationship between fitness test outcomes and PA level. $P<0.05$ was regarded as statistically significant.

RESULTS

Of the 143 participants, 61 were male (42.7%) and 82 were female (57.3%). Participants were divided into a younger group aged 60–69 years and an older group aged 70–80 years. Demographic and other participant characteristics are presented in Table 1.

When musculoskeletal and motor fitness levels for females were compared, a statistically significant difference was found ($p<0.05$) between females in the young and older groups for one leg stand, figure-of-eight walk and shoulder-neck mobility.

In terms of the musculoskeletal and motor fitness levels of male participants, hand grip and shoulder-neck mobility showed statistically significant differences ($p<0.05$) between the two age groups.

Table 1— Demographic Characteristics of the Participants (mean±sd)

	Men		Women	
Characteristics	**60-69 (n=30)**	**70-80 (n=31)**	**60-69 (n=40)**	**70-80 (n=42)**
Age (years)	64.63±3.20	71.72±1.72	63.10±2.95	73.14±3.50
Marital Status, n (%)				
Single	6 (20.0)	10 (32.2)	4 (10.0)	10 (25.0)
Married	24 (80.0)	21 (67.8)	36 (90.0)	30 (75.0)
Smoking, n (%)				
Current Smoker	4 (13.4)	-	8 (20.0)	-
Non-smoker	13 (43.3)	11 (35.5)	25 (62.5)	42 (100.0)
Former smoker	13 (43.3)	20 (64.5)	7 (17.5)	-
Occupation, n (%)				
Retired	20 (66.7)	26 (83.9)	17 (57.5)	12 (28.5)
House wife	-	-	23 (42.5)	30 (71.4)
Worker	10 (33.7)	5 (16.1)	-	-

No statistically significant differences were observed between the age groups in waist circumference and BMI for either sex. However, average BMI values indicated that both males and females in both age groups tended to be overweight (BMI>25). The PF parameters for the study sample by sex and age group are shown in Tables 2 and 3.

There was no statistically significant difference found in the total PA IPAQ-S scores for males between the younger and older groups. However, a significant difference ($p<0.05$) was found in total PA scores for females between the younger and older groups, indicating that there was a significant decline in total PA score between younger and older females ($p<0.05$). A moderate PA level was more common than a low PA level for both males and females, regardless of age, and no male or female participant reported a high PA level. The total PA scores and PA-level categories for the study sample by sex and age group are presented in Tables 4.

Investigation of sex-related differences in PF parameters found that there were statistically significant differences in the figure-of-eight walk, sit and reach test, hand grip and

Table 2— Differences in the Physical Fitness Parameters in Men and Women within Age Categories of 60–69 and 70–80 Years (mean±sd)

	Men			Women		
Physical Fitness	**60-69**	**70-80**	**p**	**60-69**	**70-80**	**p**
Musculoskeletal Fitness						
Hand grip-right (kg)	38.5±7.1	37.8±1.0	0.401	23.2±6.8	20.4±3.5	0.062
Hand grip-left (kg)	35.9±6.6	38.6±1.5	**0.002***	21.4±5.5	20.4±4.4	0.813
Shoulder-neck mobility-right (cm)	10.1±5.8	8.2±10.0	**0.023***	6.2±6.6	14.6±10.1	**0.000***
Shoulder-neck mobility-left (cm)	13.1±10.2	10.5±6.1	0.567	10.5±8.5	19.3±11.7	**0.001***
Sit-reach (cm)	12.3±13.7	8.9±10.3	0.426	21.2±8.0	18.8±6.5	0.125
Motor Fitness						
One-leg-stand (seconds)	55.1±18.2	45.0±7.7	0.075	47.3±17.1	30.8±19.4	**0.001***
Figüre-of-eight walk (seconds)	5.9±0.9	6.1±0.9	0.295	6.6±1.8	8.2±4.3	
Body Composition						
Waist circumference (cm)	98.2±6.2	98.5±4.3	0.717	97.0±10.9	99.7±9.9	0.296
Body mass index (kg/m^2)	26.2±3.4	26.7±1.2	0.181	28.7±4.4	27.5±3.4	0.504
Cardiorespiratory Fitness						
Six-minute walk (m)	561.6±165.6	540.5±81.6	0.445	531.8±149.0	494.6±99.1	0.175

Table 3— Differences in the Physical Fitness Parameters in Men and Women within Same Age Categories (mean±sd)

	60-69			70-80		
Physical Fitness	**Men**	**Women**	**p**	**Men**	**Women**	**p**
Musculoskeletal Fitness						
Hand grip-right (kg)	38.58±7.12	23.20±6.85	**0.000***	37.83±1.08	20.43±3.56	**0.000***
Hand grip-left (kg)	35.90±6.64	21.45±5.51	**0.000***	38.67±1.52	20.46±4.49	**0.000***
Shoulder-neck mobility-right (cm)	8.26±10.11	6.25±6.66	0.645	10.17±5.83	14.69±10.10	0.201
Shoulder-neck mobility-left (cm)	13.17±10.24	10.56±8.53	0.218	10.50±6.18	19.31±11.73	**0.005***
Sit-reach (cm)	9.03±10.31	21.44±8.09	**0.000***	11.83±13.34	20.00±6.41	**0.016***
Motor Fitness						
One-leg-stand (seconds)	45.17±18.29	47.37±17.19	0.771	55.00±7.77	30.80±19.48	**0.000***
Figüre-of-eight walk (seconds)	5.93±0.92	6.65±1.87	**0.001***	6.17±0.91	8.23±4.32	**0.000***
Body Composition						
Waist circumference (cm)	98.29±6.23	97.02±10.99	0.410	98.50±4.31	99.71±9.95	1.000
Body mass index (kg/m^2)	26.21±3.43	28.77±4.44	**0.030***	26.75±1.29	27.59±3.48	**0.039***
Cardiorespiratory Fitness						
Six-minute walk (m)	561.68±165.6	531.80±149.0	0.370	540.50±81.64	494.64±99.19	0.099

Table 4— Difference in IPAQ-S Parameters in Men and Women within Age Categories of 60–69 and 70–80 Years (mean±sd)

	Men			Women		
Physical Fitness	**60-69**	**70-80**	**p**	**60-69**	**70-80**	**p**
Total Physical Activity (MET)	1015.20±839.76	757.10±361.84	**0.127**	1015.20±839.76	757.10±361.84	**0.127**

	60-69			70-80		
	Men	**Women**	**p**	**Men**	**Women**	**p**
Total Physical Activity (MET)	1015.20±839.76	757.10±361.84	**0.127**	1015.20±839.76	757.10±361.84	**0.127**

	Men		Women	
Physical Actvity Categories, n(%)	**60-69**	**70-80**	**60-69**	**70-80**
Low level	8 (26.7)	11 (35.5)	6 (15.0)	17 (40.48)
Moderate level	22 (73.3)	20 (64.5)	34 (85.0)	25 (59.52)

BMI scores between males and females in the younger group (60–69 years); males performed better in the upper-lower body strength and dynamic balance tests, but women performed better in the flexibility test. In addition, females tended to be more overweight than men. Similar results were observed between males and females in the older group (70–80 years).

Discussion

The findings of the present study showed that static and dynamic balance, flexibility and the level of PA decreased with age in females, while only upper body strength and flexibility decreased with age in males. Our findings also showed no significant change in cardiovascular fitness and body composition with age. This suggests that males, regardless of age, tend to have better fitness and PA levels than females.

In general, five specific components are used to define fitness: muscle strength and endurance, flexibility, body composition, aerobic endurance and balance (1,9). Our study measured all of these PF components. The skeletal muscle changes of ageing affect the functional capacity of muscles, and maximum isometric muscle strength decreases. The reduction in static force is significant after a person reaches 60 years of age;

by the age of 70–80 years, a healthy older adult has 20–40% less static and dynamic force than a young adult (10). Previous studies have reported that the strength of the upper limbs decreases with ageing in both males and females (11). However, our findings showed that the decline in hand grip test scores with age was only significant for males. Rantanen et al. (12) and Bassey (13) found a mean upper limb strength loss of 2% per year for 221 British females aged 65 years and over, while our results found no significant difference in the upper-limb strength of females between the younger and older groups. As our study sample included a number of females that reported they were housewives, it may be that the upper body strength necessary for many common housework tasks (e.g. actions such as hand gripping and lifting) positively affected their upper limb strength and slowed the reduction in muscle strength.

The normal BMI range is recommended to be 18–24 for the general population, with a range of 19–26 accepted as appropriate for people aged 65 years and over (9). In addition, it is often considered to be better for an older adult to have a BMI between 25 and 27, rather than below 25, as a slightly higher BMI may help to protect older adults from osteoporosis (14). In our study, the average BMI values were slightly higher than the recommended range for both males and females.

Hawkins and Wiswell (15) reported a loss of aerobic capacity of nearly 10% per decade. However, our findings showed no change in aerobic capacity with age in both females and males. This result may be explained by the moderate PA level reported by approximately two thirds of our participants (male and female), regardless of age. PA level is important for cardiovascular fitness, and can slow the rate of decline in aerobic capacity. In addition, both male and female participants in our study (regardless of age) walked farther than predicted by the regression equations developed by Enright and Sherrill (16) (male participants aged 60–69 years: 561 m, male participants aged 70–80 years: 540 m (predicted 476 m); female participants aged 60–69 years: 531 m, female participants aged 70–80 years: 494 m (predicted 409 m).

Balance is important in safely performing many of the daily activities that allow older adults to continue to be independent in their community. In our study, scores for the one-leg-stand were higher than the normative scores (9,17). However, our finding that balance test results decreased significantly after the age of 70 years, especially for females, was consistent with the findings of the study by Chen et al (9).

Brach et al. (18) reported a significant relationship between PA over a 14-year period and current functional level in elderly women. In addition, studies measuring the PA of older people have reported that regular PA is effective in reducing the risk factors for, and may potentially avoid, functional deterioration associated with ageing (2,19). Therefore, PA has an important role in maintaining PF. If older adults do not have physically active lifestyles, they expose themselves to the risk of muscle mass reduction and joint motion limitation (20). In our study, females that showed decreased motor and musculoskeletal fitness with age also had significantly decreased PA levels with age.

Our finding that females performed better in flexibility tests is consistent with the findings of King et al. (20) who investigated people aged 65 years and older and found that males had better endurance and strength scores for upper, lower and body tests, while females had better scores in flexibility tests. Demura et al. (21) tested people aged 60–89 years and found that females had lower scores than males in whole strength tests in every age group; females had higher scores in flexibility tests; there were no sex-related differences in body balance. Misic et al. (22) investigated PF in subjects aged 60–98 years, and found that males had higher scores in endurance and strength, while females scored better in coordination, balance and flexibility tests. According to these studies, we can assume that in general: males score better in aerobic endurance; dynamic balance and upper, lower, and body strength tests; females have a higher level of upper, lower and body flexibility and there are no sex-related differences in body balance values. Overall, our findings are consistent with these general assumptions, with males performing better on upper-lower body strength and dynamic balance but females performing better on flexibility tests. This suggests that the commonly-observed typical differences in the PF profiles of young adults do not disappear in older adults.

Our study had some limitations that should be noted. Firstly, we used the IPAQ-S to measure the PA levels. This self-report PA measure may be limited by factors such as social desirability, recall bias and variations in cognitive and memory processes dependent on factors including age, education and sex. Instruments such as accelerometers and pedometers are technically more reliable and objective methods of assessing PA. In addition, we have recruited our study population by public announcements and made the assessments in a public park. This might have caused a bias on the population we have studied. We have probably selected more extrovert, physically healthy, active and more interested, uninhibited elderly. Although we have a good number of participants, the

recruited population does not represent all of the elderly and we cannot provide a comprehensive health-related PF and PA level profile of Turkish older adults based on 143 participants. However, our results provide information about Turkish older adults that may help in designing rehabilitation programmes that include interventions to protect and improve health and independence of older adults.

In conclusion, our results indicate that females experience significantly greater decreases in PF and PA level with age. Rehabilitation programmes and interventions to support the health and independence of older adults should consider sex- and age-related differences in physical fitness and activity.

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