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Functional force differences in elderly people

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ABSTRACT

Objective: This aim of this study was to determine whether there were functional force differences in elderly male and female participants.

Materials and Methods: In the scope of community service practices lesson, 14 females with an average age of 74.2 ± 6.3 years and 17 males with an average age of 72.1 ± 4.3, in Istanbul Pendik Samanyolu Nursing Home Elderly Care Center, participated in this study. Volunteers who were evaluated by the specialist physician of the institution and had enough points in the mini mental state test, and were not dependent on daily life activities were included in the study. Body composition measures, sitting-rising test, mini mental state test and physical function scale were applied to the elderly participants. SPSS v 20 statistical package program was used for statistical evaluations. Kruskal Wallis and Mann Whitney U tests were used for comparison within groups. The significance value was accepted as 0.05.

Results: At the end of the evaluation, there was no difference found between males and females in terms of body weight, sitting-rising and cognitive function. In males, total muscle mass, total body water, physical function and daily life activities were significantly higher compared to females ($p<0.05$), but the BMI and % fat values were significantly lower ($p<0.05$). In contrast, females were found to be closer to the limit of obesity. In daily life activities, it was found that females had higher BMI and % fat value, lower total muscle mass, total body water and physical function scores than males($p<0.05$).

Conclusion: As a result, body composition differences such as total muscle mass, total body water, % fat value in both males and females were found to decrease with decreasing dependence on physical function and daily life activities.

Keywords: Elderly, functional force, life activity, physical activity

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INTRODUCTION

Aging is a process that starts from birth and where functional increases and decreases coexist as in every period of life (1). Aging refers to changes in individuals due to development continuation in later period of life (2).

Everyone desires to have a long life. Many people want to bond such desire with quality life. From the moment aging-induced functional losses begin to affect the quality of life, the importance and contributions of physical activity in human body functions come to the fore. Although it is difficult to say something about how physical activity prolongs individuals' lives, it has been scientifically proven that regular physical

activity improves body functions which are very important and necessary for human life particularly at old age (3).

The weakening in body functions is a known and observed change due to aging. This change, which is observed in all living creatures, is a natural and physiological phenomenon, but it may not be parallel to chronological age. The best example of this situation is the physical capacity differences observed in two individuals with same age. These capacity differences can also affect the speed of functional changes arising due to increasing age (3).

Biologic, sociological, economical and chronological definitions are used to identify the old age. The World Health Organization prefers chronological definition to identify old age period and accepts individuals aged 65 and over as elderly (4). For better aging, studies suggest that we should take good care of our bodies during the youth years and increase our muscle strength keeping our exercise capacity high. The more we contribute to our inborn physical characteristics, the less we experience problems (5).

The needs of an aging population change. Studies report that elderly people use healthcare services more than young population. The need for long-term care services has also increased due to increased incidence of diseases. Elderly people need long time to recover their previous abilities (6).

This study aimed to determine whether there were differences in terms of functional strength in elderly female and male or not. In addition, the differences of body compositions, cognitive functions, daily life activities and physical functions between genders were also determined in the study.

MATERIALS AND METHODS

The study sample consisted of 14 female whose mean age were 74.2 ± 6.3 and 17 male whose mean age were 72.1 ± 4.3. Participants were included in a project for the elderly in Istanbul Pendik Samanyolu Nursing Home and Geriatric Care Center which was conducted within the scope of community service practices course. The volunteers who were examined and assessed by the institution specialist physician, obtained a sufficient score from the mini mental state examination and had no dependence in daily life activities, were included in the study.

Body size and composition measurements: The participants' body height is measured using a digital height gauge having 0.1 cm precision between floor and vertex point in a standing upright position, bare foot, heels adjoined together, placing head at Frankfort horizontal plane and having a deep inspiration (7). In addition, the participants' body mass (W), total body water (TBW), percent fat (fat%) and total muscle mass (TMM) were measured by using TANİTA-TBF-300.

Sit-to-stand test (SST): This test reflects lower extremity strength. In the test, participants stand up and sit down on a chair without pushing off the chair with arms within 30 seconds, then how many times they stand up was recorded. Participants were demonstrated an application at first. They fold their arms across their chests and sit at the center of chair (with a seat height of 43.18 cm) with their back in an upright and straight position, and the feet were seated perfectly on the floor. They stand up from the chair, stand fully as in a standing position and sit back with start command. The repetition in 30 seconds is recorded. Standing and sitting should be done fully. The test regarding whether participants learned or not was checked before scoring. The test is performed after this procedure. The test score was considered as the number of correct stand-ups within 30 seconds (8).

Mini mental state examination (MMSE): This screening test was commonly used for assessing cognitive function. The maximum total score was 30. The first part which was based on verbal answers measures attention, memory and orientation and maximum obtainable score was 21. The second part measured the ability to comply with verbal and written orders, to make a sentence spontaneously and to copy a complex plot. The

maximum score for the second factor was 9. The sensitivity, specificity and reliability of the scale prepared in Turkish have been previously evaluated as 92%, 93% and 0.99, respectively (9).

Physical functioning scale (PFS): This scale, which was used to determine the adequacy of physical functioning in individuals, included 12 questions. The test was used to determine a wide range of functional qualifications ranging from basic activities including bathing and dressing which were necessary in daily life to moderate activities including housework and shopping, and more intensive activities including sports or exercise. The scale was scored as follows: "I can do" = 2 points; "I can hardly do" or "I can do when I receive support" = 1 point; and "I cannot do" = 0 point. The maximum total score for the scale was 24 when adding all answers of 12 questions. The responses to the test were recorded by the researchers. Those with a score of 24 scored "adequate", those who scored between 18-23 were classified as "moderate adequate" and those who scored between 1-17 were classified "less adequate" (10).

Barthel scale (BS): This scale was used to evaluate individuals' daily life activities, and gives the results of evaluation about ambulation, wheelchair use, stair climbing, feeding, dressing, personal care, bathing, toilet use and bowel/bladder control. Those scoring 100 were classified as "independent", those scoring between 91-99 were classified as "slightly dependent", and those scoring between 62-90 were classified as "moderately dependent" (11).

The research data were evaluated using the SPSS 20 Statistical Package Program. The mean and standard deviations of the data were presented. The Kruskal-Wallis test and the Mann-Whitney U test were used for intergroup comparisons and in-group comparisons. The value of statistically significance was considered as 0.05.

RESULTS

Comparison of male and female

No statistically significant difference was found between males and females in terms of age, weight, sit-to-stand test and MMSE scores ($p > 0.05$). Males had higher total muscle mass and total body water mean values than females. Similarly, they had higher physical function and Barthel scale mean scores compared to females. However, they had lower BMI and percentage of body fat mean values than females ($p < 0.05$) (Table 1).

Table 1. The results regarding participants' body compositions and sit-to-stand test, MMSE, Barthel scale and physical functioning scale scores

	Female (n=14)	Male (17)	Z	P
Age	74,2±6,3	72,1±4,3	-1.26	.211
W (kg)	69.9±13.0	67.9±12.7	-.07	.955
BMI (kg/m²)	29.3±3.4	24.8±4.2	-2.89	.003
Fat%	38.6±7.7	23.7±7.8	-3.96	.001
TMM (kg)	42.2±4.3	50.7±7.7	-3.51	.001
TBW (kg)	30.9±3.1	37.1±5.6	-3.48	.001
SST	9.0±2.8	9.7±2.1	-.88	.396
MMSE	24.4±3.3	25.9±3.8	-1.53	.131
PFS score	17.4±4.4	21.5±3.7	-3.18	.001
BS score	93.9±9.7	98.2±6.0	-2.21	.043

Evaluation of participants' physical functioning scale scores

Of male, 9 had "adequate", 6 had "moderately adequate" and 2 had "less adequate" physical functioning. There was no female with "adequate" physical functioning, whereas of females 12 had "moderately adequate" and 2 had "less adequate" physical functioning (Table 2).

Table 2. Evaluation of participants' physical functioning scale scores

	Male			Female		Z(p)	Z1(p1)	Z2(p2)	Z3(p3)
	Adequate	**Moderately adequate**	**Less adequate**	**Moderate adequate**	**Less adequate**				
Age	71.7±5.5	74.6±8.3	5.3±8.3	1.9±8.4	1.8±4.4	-2.18(.02)	2.04(.36)	-.51(.65)	-1.16(.34)
W (kg)	67.0±12.6	71.8±11.3	9.8±1.9	4.4±1.2	2.0±1.0	-1.5(.2)	2.09(.35)	-.34(.77)	-.58(.69)
BMI (kg/m²)	23.8±3.8	26.4±3.9	3.3±0.4	0.6±0.2	7.0±3.5	-1.51(.16)	2.51±(.28)	-1.95(.06)	-.58(.69)
Fat%	23.1±8.1	24.4±5.7	3.3±0.4	0.9±0.4	4.4±1.1	-1.51(.16)	21(.90)	-3.55(.001)	-1.31(.20)
TMM (kg)	49.9±8.7	53.8±5.7	4.2±1.7	3.5±1.5	0.1±3.4	-.76(.53)	6.60(.04)	-3.21(.001)	-1.16(.34)
TBW (kg)	36.6±6.3	39.4±4.3	3.4±2.3	1.8±0.4	9.4±3.9	-.76(.53)	6.60(.04)	-3.17(.001)	-1.16(.34)
SUT	10.7±1.6	9.3±2.3	2.8±1.3	1.4±0.4	2.4±0.4	-2.38(.02)	7.41(.03)	-1.04(.34)	-.92(.49)
MMSE	25.8±3.8	25.7±4.4	7.3±1.7	5.7±3.3	2.0±1.6	-1.92(.1)	26(.88)	-.43(.71)	-2.31(.03)
PFS score	24.0±0.0	21.2±1.4	3.3±2.2	1.4±0.3	2.3±1.2	-2.72(.01)	28.08(.001)	-1.24(.26)	-0.45(.69)
BS score	99.3±2.6	97.4±8.3	6.3±2.3	3.6±1.8	4.5±2.8	-.72(.53)	1.25(.54)	-.71(.65)	-0.77(.49)

Z(p): Difference between female, Z1(p1): Difference between male, Z2(p2): The difference between moderate adequate male and female, Z3(p3): The difference between less adequate male and female.

The mean age of female with "less adequate" physical functioning was higher than that of female with "moderately adequate" physical functioning; however, the physical functioning scale mean score of female with "less adequate" physical functioning was lower than that of female with "moderately adequate" physical functioning ($p < 0.05$). No statistically significant difference was found between these two groups in terms of weight, BMI, fat percentage, total muscle mass, total body water, sit-up test scores, MMSE scores and Barthel scale scores ($p > 0.05$). A statistically significant difference was found between male with adequate, moderately adequate and less adequate physical functioning in total muscle mass, total body water, sit-to-stand test scores and physical functioning scale scores ($p<0.05$). However, no statistically significant difference was found between these groups in terms of age, weight, BMI, fat %, MMSE scores and Barthel scale scores ($p > 0.05$). In addition, no statistically significant difference was found between male with adequate and moderately adequate physical functioning with respect to total muscle mass and total body water, however, their total muscle mass and total water mean values were found to be higher than that of male with less adequate physical functioning. Despite this finding, the sit-to-stand test and physical functioning scale mean scores of male with less adequate physical functioning were found to be lower than that of male with adequate and moderately adequate physical functioning ($p<0.05$). No in-group comparison was made for female because there was no female with adequate physical functioning. Female with moderately adequate physical functioning had higher fat percentage, but lower total muscle mass and total body water than male with moderately adequate physical functioning ($p<0.05$). No statistically significant difference was found between male and female with moderately adequate physical functioning with

respect to age, weight, BMI, sit-to-stand test scores, MMSE scores, physical functioning scale score and Barthel scale scores (p> 0.05).

Females with less adequate physical functioning had higher MMSE mean score than that of male with less adequate physical functioning (p<0.05), but no statistically significant difference was found between the groups with respect to age, weight, BMI, fat percentage, total muscle mass, total body water, sit-to-stand test scores, physical functioning scale scores and Barthel scale scores (p> 0.05) (Table 2).

Evaluation of participants' *Barthel* scale scores

Of the male participants, 13 were "independent", 1 was "slightly dependent" and 3 were "moderately dependent" in daily life activities; whereas, of the female, 7 were "independent", 2 were "slightly dependent" and 5 were "moderately dependent" in daily life activities. The groups were combined due to high number of individuals in slightly and moderately dependent groups, and then a comparison was made between independent and moderately dependent groups. Females with no dependence in daily life activities had higher sit-to-stand test and Barthel scale mean scores than female with slight dependence in daily life activities (p<0.05). However, no statistically significant difference was found between the groups in terms of age, weight, BMI, fat %, total muscle mass, total body water, MMSE scores and physical function scale scores (p> 0.05).

Table 3. Evaluation of participants' Barthel scale scores

	Male		Female		Z(p)	Z1(p1)	Z2(p2)	Z3(p3)
	Independent	Slightly moderate dependent	Independent	Slightly moderate dependent				
Age	73.0±6.8	75.0±4.5	73.0±9.0	78.4±7.8	-1.19.25	.77(.48)	.47(.67)	-.98(.41)
W (kg)	69.1±12.6	59.8±12.2	72.7±16.0	66.4±8.8	-.55(.66)	1.41(.17)	.23(.84)	-.49(.73)
BMI (kg/m²)	25.2±4.2	22.0±3.5	30.2±3.6	28.2±3.2	-.91(.43)	1.39(.17)	2.45(.01)	-2.09(.03)
Fat%	4.4±1.7	8.7±1.7	40.8±4.9	5.8±1.1	.55(.66)	1.18(.26)	3.52(.001)	-1.96(.06)
TMM (kg)	1.1±1.8	8.1±8.0	42.4±5.5	2.0±2.1	-.37(.79)	.65(.55)	2.71(.01)	-1.23(.29)
TBW (kg)	7.4±5.7	5.8±5.2	31.1±4.0	2.1±0.8	-.37(.79)	.62(.55)	2.66(.01)	-1.23(.29)
SST	0.0±1.7	0.8±2.1	10.8±1.6	0.8±2.2	-2.59(.01)	1.26(.24)	1.01(.35)	-.50(.73)
MMSE	6.8±2.9	0.0±4.1	25.5±2.3	3.0±4.0	-1.76(.08)	2.65(.01)	1.46(.16)	-1.25(.29)
PFS score	1.9±3.3	9.0±3.7	19.0±3.7	5.4±4.7	-1.31(.25)	1.32(.24)	2.36(.02)	-1.25(.29)
BS score	0.0±0.0	6.0±11.3	100.0±0.0	6.6±10.6	-2.99(.00)	5.46(.001)	.001(1)	.001(1)

Z(p): Difference between female, Z1(p1): Difference between male, Z2(p2): The difference between independent male and female, Z3(p3): The difference between slightly moderate dependent male and female

Males with no dependence in daily life activities had higher MMSE and Barthel scale mean scores than that of males with slight-moderate dependence in daily life activities (p <0.05); however, no statistically significant difference was found between the groups in terms of age, weight, BMI, fat %, total muscle mass, total body water, sit-to-stand test scores and physical functioning scale scores (p> 0.05). In addition, females with no dependence in daily life activities had higher BMI and fat % mean values, but lower total muscle mass and total body water mean values and lower physical functioning scale mean score than that of males with no dependence in daily life activities (p<0.05). However, no statistically significant difference was found between the groups in terms of age, weight, sit-to-stand test scores and MMSE scores (p> 0.05). The BMI mean value of females with slight-moderate dependence in daily life activities was higher than the BMI mean value of male with slight-moderate dependence in daily life activities (p<0.05). No statistically significant difference was found between the groups in terms of age, weight, fat %, total muscle mass, total body water, sit-to-

stand test scores, MMSE scores, physical functioning scale scores and Barthel scale scores ($p>0.05$) (Table 3).

DISCUSSION

This study aimed to determine the body composition, cognitive function, daily life activities and physical functioning differences between male and female aged over 60 to observe their daily life differences, and to reveal the functional strength, body composition, cognitive function and physical functioning differences between male and female. The study sample included 17 males and 14 females who obtained scores ≥62 and ≥20 from the Barthel daily living activity scale score and the mini mental state examination.

No statistically significant difference was found between male and female in terms of age, weight, sit-to-stand test scores and MMSE scores. Male had higher total muscle mass and total body water mean values, but lower BMI and %fat mean values than female. In addition, female was closer to the obesity limit. Obesity is one of the most important reasons for the development of physical disability in elderly individuals and high BMI leads functional limitation in both elderly female and male (12). Studies reported that females had lower muscle strength and total muscle mass, but higher body fat than male (13). The present study results of muscle strength were different while the results of body composition were consistent with previous studies. This result was assumed to be dependent on the muscle strength test used in the study. Because the sit-to-stand test did not measure the strength directly and did not evaluate the functional strength (10).

Of the participants, 36% had “adequate”, 45% had “moderately adequate”, and 19% had “less adequate” physical functioning. Rikli et al. found that 47% of healthy individuals aged over 60 had “adequate”, 46% had “moderately adequate” and 11% had “inadequate” physical functioning (14). The low physical functioning in the individuals involved in our study might have stemmed from the fact that they live in a nursing home.

The mean age of female with less adequate physical functioning was higher than the mean age of female with moderately adequate physical functioning; however, no statistically significant difference was found between the groups in terms of weight, BMI, fat %, total muscle mass, total body water, cognitive function, daily life activity and sit-up test scores. No statistically significant difference was found between male with adequate and moderately adequate physical functioning in terms of body composition, however, their total muscle mass and total water mean values and sit-to-stand test mean scores were higher than that of male with less adequate physical functioning. In addition, no statistically significant difference was found between the groups in terms of age, cognitive function and daily life activity. These results suggested that physical functioning adequacy were affected from age in female and by total muscle mass, total body water and lower extremity muscle strength in male. Studies reported that the strength decreased with increasing age, which was observed more significantly in male (15).

Female with moderately adequate physical functioning had higher fat %, but lower total muscle mass and total body water than that of male with moderately adequate physical functioning. No statistically significant difference was found between the groups with respect to age, weight, BMI, cognitive function, sit-to-stand test scores and Barthel scale scores.

In addition, female with less adequate physical functioning had lower cognitive function mean score than that of male with less adequate physical functioning; but no statistically significant difference was found between the groups in terms of age, weight, BMI, fat %, total muscle mass, total body water, sit-to-stand test scores and Barthel scale scores. As the level of physical functioning decreased, the body composition differences between genders disappeared. Studies conducted on the relationship between physical fitness, physical activity and functional limitation found that functional limitation was greater in female and individuals with sedentary life style, indicating

that physically active individuals had less functional limitations. These studies also reported that female had fewer limitations in daily living activities than male (16,17).

In this study, 87% of male and 56% of female had no dependence in daily life activities; 3% of male and 18% of female had slight dependence in daily life activities; and 9% of male and 27% of female had moderate dependence in daily life activities. Female with no dependence in daily living activities had higher sit-to-stand test mean score than that of female with slight-moderate dependence in daily living activities; and male with no dependence in daily living activities had higher cognitive function mean score than that of male with slight-moderate dependence in daily living activities. In addition, female with no dependence in daily living activities had higher BMI and fat % mean values but lower total muscle mass, total body water and physical function mean values than that of male with no dependence in daily living activities. Moreover, female with slight-moderate dependence in daily living activities had higher BMI mean value than that of male with slight-moderate dependence in daily living activities. These results indicated that independence in daily life activities was affected by lower extremity strength in female and by cognitive function in male. In addition, the degree of independence in daily life activities decreased while the body composition differences between genders disappeared. However, no study was found to support this result.

CONCLUSION

Body composition differences between female and male including total muscle mass, total body water and body fat % disappeared when dependence in physical function and daily life activities decreased.

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