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ORIGINAL ARTICLE

Relationship between Hand Grip Strength and Functional Disability of the Elderly Living in Nursing Homes in Kerman, Southeastern Iran

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ABSTRACT

Functional disability refers to conditions in which a person is not able to fulfill the daily chores and activities on his/her own or requires assistive devices to perform them. The objective of this study was to investigate the functional disability of the elderly in Kerman, Southeastern Iran and its relationship with handgrip strength. This cross-sectional study was conducted on 110 elderly participants (58 man and 52 woman) living in nursing homes in Kerman in 2014. Data were collected using functional disability standard questionnaire and Jamar Dynamometer so as to measure grip strengths of the elderly. Moreover, data were analyzed by statistical tests at a significance level of 0.05 using SPSS software. The measured grip strength of women was significantly lower than that of men ($P< 0.05$). The grip power of the women in the age group of 60 -70 yrs was approximately equal with the grip power of men in the age group of 90 -100. With age increase, grip strength would decline in both genders. Furthermore, there was a strong and direct correlation between functional ability and handgrip strength. In addition, there was a significant relationship between the increase in functional disability of the elderly and decline in their grip strength.

KEYWORDS: *Functional disability, Grip strength, Elderly*

INTRODUCTION

Ageing is a period in the biological process of all beings including the human being which takes place after the middle-age period [1]. The ageing process involves certain physical, mental, psychological, social and functional changes for humans. People over 60 yrs of age are referred to as the elderly who deserve considerable attention as one of the vulnerable groups of society due to the numerous problems they encounter [2]. The elderly in Iran constituted 7% of the population in 2008 and this percentage is predicted to increase to 12% by 2025 and will form one third of the population by 2050 [3].

One of the problems that the elderly are faced with is their state of health. WHO has determined the level of physical activity as the first health indicator of a community [4]. Functional decline is a common complication in older adults,

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associated with low mobility and physical activity [5].

Low physical activity and disability of the elderly would lead to osteoporosis and some other unpleasant diseases [6]. A number of different factors have been detected as the barriers to physical activity for the elderly including disease and various types of disabilities [7]. Disability is defined as impairment in daily activities or needing help in at least one basic activity of daily living [8]. Such impairment would result in older adults being dependent, needing the help of others and need of health care in performing their tasks [9]. This dependence would always make the elderly desperate, disappointed and secluded which in many cases lead to diseases like depression and psychosis. The level of disabilities vary as per certain conditions and features of people including their age and gender [10]. The disabilities encompass a wide range including visual, hearing, memory as well as functional disability. In functional disability, a person is not able to fulfill the daily chores and activities on his/her own or requires assistive devices to perform them [11]. These disabilities would increase costs of caring and the economic pressure on health and treatment system and impinge the quality and style of life of the elderly and their families [12].

One of the factors effective on causing functional disability in people is hand grip strength. Grip strength is defined as the power of the combined contraction of the extrinsic and intrinsic muscles of the hand that flex the joints of the hand [13]; it reflects the total power of upper extremities muscles and is also correlated with other muscles of body [14]. In hand grip strength, the hand is fisted with four fingers on one side and thump on the other side exerting forces to the determined tools [15]. Hand grip strength is also taken into account as a very important factor in diagnostic tests [16]. It can even help predict post-surgical complications and losses, general inabilities and aging consequences such as disabilities [17]. In this regard, the information relevant to grip strength is applied so as to determine the treatment needs [15].

Considering the growth of ageing population rate from 1.7% to 3% in the last two decades in Iran, the number of persons with disabilities is also expected to increase. Therefore, the aim of the present study was to determine hand grip strengths of the elderly living in nursing homes in Kerman so as to detect its relationship with their functional disability; hoping that the results of this study guide the authorities to make more efficient policies in order to improve the present status.

MATERIALS AND METHODS

In this cross-sectional study done in 2014, the required data were collected by visiting the elderly nursing homes in Kerman southeastern Iran. Since there were 4 nursing homes in Kerman and the number of samples was sufficient (150 persons), all persons living in nursing homes were taken into the study using census. In order to control the conditions and improve the accuracy of the study, all measurements and data collections were done at the times of day when there was no interference with the services provided by the personnel.

The objectives and nature of the study as well as the procedures and the time needed for tests were all explained to the participants and their consent to participate in the study was orally obtained. So as to measure hand grip strength, Hydraulic Dynamometer, model SH5001 was utilized. Measurements were taken according to the standard instructions recommended by American Society of Hand Therapists (ASHT).

The body postures of the subjects during the hand strength tests were defined as sitting, arms attached to the torso not rotating, the elbow flexed at 90 degrees, the forearm in horizontal position and the wrist in 0-30 degrees of extension and 0-30 degrees of ulnar deviation.

First the grip strength of the right hand and then that of the left hand were measured using Jamar Hydraulic Dynamometer. Moreover, in order to standardize the hand grip span, the handle of Dynamometer was adjusted to second position for all subjects. The instruments for measuring grip strength were calibrated by the manufacturers. Meanwhile, the calibrations were checked regularly throughout the study.

The evaluation of functional disability of the elderly was undertaken using functional disability questionnaire [17] which consisted of 7 items each with three-choice answers including “independently”, “with the help of others” and “dependently” out of which only one answer was to be chosen. The 7 items were as follows: 1. Walking across a small room, 2. Bathing or taking shower, 3. Doing personal hygiene such as brushing hair and teeth or washing the face, 4. Dressing, doing zippers and buttons and wearing shoes, 5. Eating with spoon and fork, cutting food and drinking from a glass, 6. Getting out of bed and sitting on a chair and 7. Toileting. The score considered for each field of disability was 0-2 and the total score of functional disability was 0-14. Based on their scores, the participants were classified into three categories in such a way that those gaining the score of 0-5 were classified as having high functional disability, the score of 5-9.5 were known as having moderate functional disability and finally those with the score of 9.5-14 were regarded as having low functional disability.

The collected data were analyzed using SPSS 16 (Chicago, IL, USA). All the quantitative variables followed normal distribution rules. Hence, the relationship between dependent and

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independent variables was analyzed with 95% confidence interval using parametric tests. In addition, for all tests the level of significance was considered as $P < 0.05$.

RESULT

From all of 150 older adults living in nursing homes, 110 persons of whom 58 (52.7%) participants were men and 52 (47.3%) were women. The average ages of men, women and the whole population were 73.70 (1.046), 77.19 (1.046) and 75.35(1.056) yr old, respectively. Table 1 represents the frequency distribution of the participants, according to gender and age.

Mean and standard deviation of handgrip strength for the elderly living in nursing homes in Kerman were determined according to gender and age group as depicted in Table 2. The maximum grip strength was for the elderly in the age group of 60-70 yr while the minimum grip strength was detected for those in the age group of 90-100 yr. The grip strengths of women in both hands were significantly lower than those of men ($P< 0.05$). So according to Figure 1, the grip of power the hands of women in the age group 70-60 yr (Right hand= 11.5 kg, Left hand= 9.5 kg) was approximately equal with his grip of power of men in the age group 100-90 yr (Right hand=11.5 kg, Left hand=7 kg). Table 2 presents the values of hand grip strength for both elderly men and women.

The data of grip strength for men was detected between 9-45 kg in the right hand and between 5-38 kg in the left. For women, the data of grip strength was calculated between 2-21 kg in the right hand and between 1-20 kg in the left (Table 3). Besides, the results were calculated as the 5th, 50th and 95th percentiles of the elderly's right and left hand grip strengths and represented in Table 3.

In this regard, an inverse Pearson correlation was identified with a high level of significance ($P<0.0001$) between the grip strength of the right hand and age ($r=-0.56$) and between the grip strength of the left hand and age ($r=-0.60$). Moreover, one way ANOVA (Analysis of variance) test suggested that the hand grip strengths were also significantly different among various age groups ($P<0.05$).

The results acquired from the analysis of the standard questionnaire of functional disability are reported in Table 4.

Table1. Distribution of elderly in the study according to sex and age groups

Age groups (yr)	Men		Women	
	Number	Percent	Number	Percent
60 – 70	27	46.6	17	32.7
70 – 80	14	24.1	10	19.2
80 – 90	13	22.4	23	44.2
90 – 100	4	6.9	2	3.8
Total	58	52.7	52	47.3

Table 2. Differences grip strength in the elderly

Grip Strength	Men		Women		P-value	Mean difference
	M	SD	M	SD		
Right hand	22.74	1.075	7.61	4.34	0.0001*	15.13
Left hand	18.06	9.32	5.30	4.33	0.0001*	12.76

Independent sample T-test

Table 3. The 5th, 50th and 95th percentiles of the elderly's hands grip strengths (kg)

Percentiles	Men		Women		Total	
	Right	Left	Right	Left	Right	Left
Fifth	10	6	3.00	1.0	3	1.00
Fiftieth	24	20	6.50	4.0	11	8.00
Ninety-fifth	42	35	16.05	14.7	40	31.45

Table 4. Distribution frequency and percentage of disability elderly in se

Fields of functional disability	Independent(%)	With the help of others(%)	Dependent(%)
Walking	61 (55.0)	48 (43.6)	1 (0.9)
Bathing	8 (7.3)	76 (69.1)	26 (23.6)
Personal Hygiene	46 (41.8)	63 (57.3)	1 (0.9)
Dress up	69 (62.7)	41 (37.3)	0 (0.0)
Eating	88 (80.0)	22 (20.0)	0 (0.0)
Getting up from bed	75 (68.2)	33 (30.0)	2 (1.8)
Toileting	17 (15.5)	64 (58.2)	29 (26.4)

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The results of investigating the effect of age on grip strength (of right and left hands) revealed that for the elderly men and women, with age increase, the grip strength would significantly decline (Fig.1).

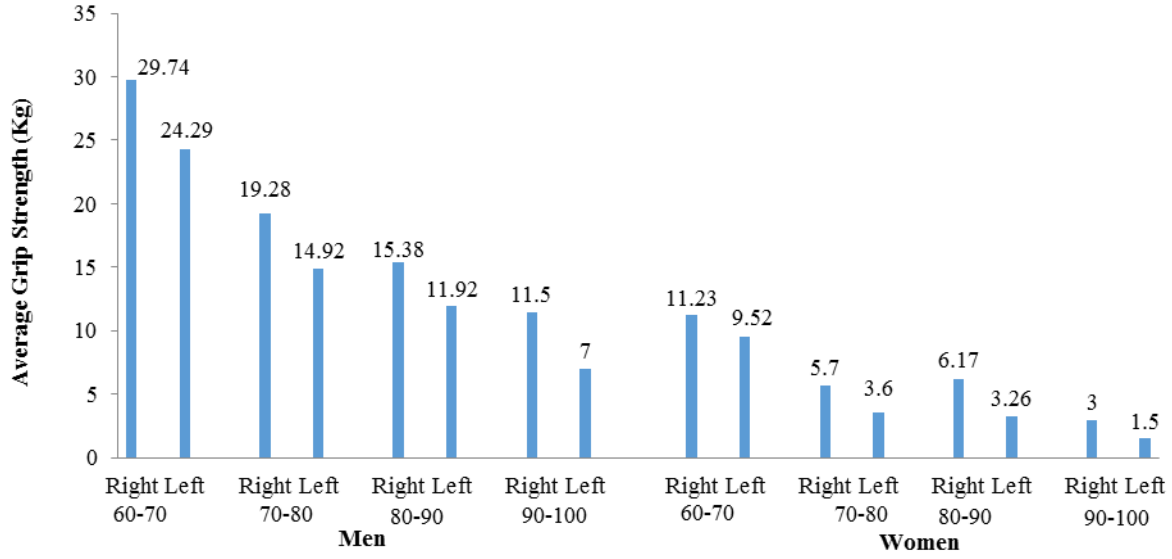

Fig.1. Comparison The grip strength right hand and left hand in men and women based on age groups

The elderly were most dependent on others for bathing and toileting while for dressing and eating they were least dependent on others. Most of the elderly could independently accomplish certain activities such as eating (80%), Getting out of bed and sitting (68.2%) and dressing (62.7%). The mean of all disabilities are depicted in Fig.2 according to gender and age group.

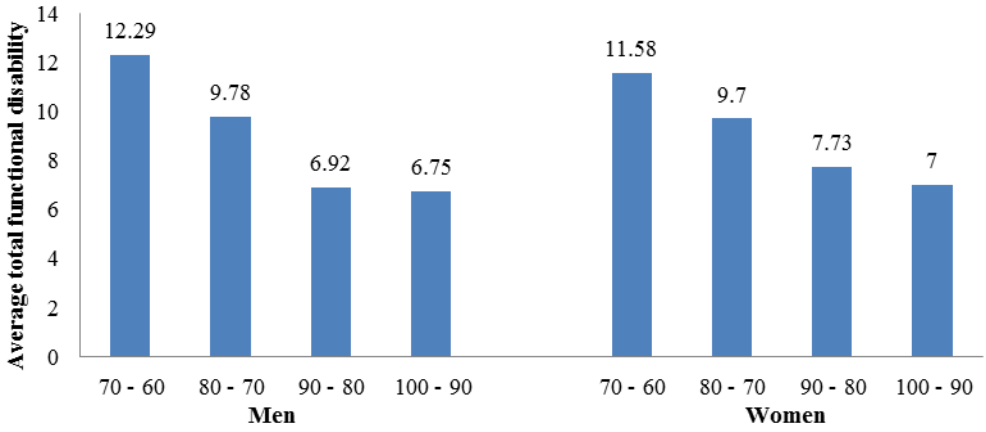

Fig.2. Average total functional disability of the elderly according to sex and age groups

According to the Table 4, men were functionally less disable than women in performing their daily chores and activities. Spearman correlation coefficient suggested a strong and direct correlation between functional ability and hand grip strength (for left hand r=0.63 and for the right hand r=0.60).

DISCUSSION

Functional disability has a multifactorial origin and regarding the great number of interfering factors, it is not possible to precisely define the role of each effective factor. The effective factors could be classified as physical, psychological, individual, gender- based etc. In this study, the functional ability as relevant to hand grip strength was investigated for both men and women who were totally similar considering the ergonomic variables and environmental conditions (nursing homes). A few percentages of the elderly had severe functional disability. The maximum total score of disability was 14. The mean disability score was calculated as 10.1 (±2.94) for men and 9.42 (±2.69)

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for women which suggested a moderate disability for women and a low one for men. It was further revealed that with age increase, the disability of the elderly would increase while their hang grip strength would decline.

There was an evident relationship between gender and disability in such a way that the mean of the scores acquired by women indicated a moderate to severe disability while for men it suggested a low one and there was determined a significant difference between the two values. The results of this study were also in agreement with those of the previous studies in a way that the research conducted demonstrated the occurrence of debilitating and chronic disease more in women compared with men which was due to physiological differences between men and women such as lower lung capacity, lower muscle strength and density and lower bone density. These systems also tended to atrophy more quickly in women than in men [19].

Concerning hand grip strength, the previous studies also confirmed the general impression that men are stronger than women. Desrosiers et al. revealed the difference in grip strength with respect to gender concluding men to have stronger grip strength than women [20]. Hand grip strength of healthy people would develop in both genders by the third decade of life but would decrease continuously further on. Such declination, however, was believed to begin sooner in women [21]. The results of the present study were also compatible with the results of other studies and proved the grip strength of women to be significantly lower than of men in both hands [20, 21]. According to Figure 1, the grip of power the hands of women in the age group 60-70 yr (Right hand= 11.5 kg, Left hand=9.5 kg) was approximately equal with his grip of power of men in the age group 100-90 yr (Right hand= 11.5 kg, Left hand= 7 kg).

The age of people plays a prominent role in the development of most disabilities and diseases. In the present study, age had a significant relationship with functional disability and the decrease in hand grip strength ($P<0.05$). It was, thus, considered as an effective factor since it would raise the level of disability and decline the hand grip strength with its increase. In a study, about 20% of the elderly over 70 yr old and 50% of those over 80 faced difficulty performing their daily activities and chores [22]. While approximately 8% of the elderly aged over 75 years required the help of others for leaving the house/ going outside, this ratio increased to 28% in people over 85 years of age [22]. Although different studies in different societies do not agree on the age in which people are supposed to have maximum grip strength, most studies asserted the last age group i.e. the ninth decade of the elderly's life as the age of having minimum grip strength, irrespective of gender. The present study, similarly, verified this point and determined the age group of 60-70 yr as the period in which both men and women had maximum grip strength. Desrosiers et al. also reported a constant decrease in hand strength with age increase from 60 to 80 yr or more [20]. Functional disability is relevant to other areas of disability as well and can pose a very negative effect on different aspects of life. The present study demonstrated that functional disability of the elderly had a significant relationship with the increase in their grip strength. The results were compatible with those of the study by Taghipour et al. since they proved functional disability to influence various dimensions of the elderly's lives. They believed disabilities to be the source of increase in costs of caring and the economic pressure which would further affect the quality and style of life of the elderly and their families [23]. Furthermore, residents' disabilities and lack of stimulation are perceived to threaten their quality of life [24].

CONCLUSION

With increasing age, the hand grip strength would decline. Moreover, a significant relationship between the increase in functional disability of the elderly and the reduction of their grip strength was detected. Because with age increase these disabilities become more intense, it is essential for the relevant authorities to take some measurements with the aid of physiotherapy, doing exercise, better nutrition etc. to help the elderly improve their hand grip strength and continue their lives without functional disability.

It is necessary to design devices for the elderly that use of their independently based on the best performance and according to the grip strength in the elderly.

This research was the first attempt in Iran to investigate the relationship between functional disability of the elderly and their hand grip strength; thus, it emphasizes the necessity to conduct more researches in various parts of the country to get more precise conscious of the elderly's disabilities and to make more efficient policies.

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