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Evaluation of activities of daily living and its relationship with hand grip strength and pinch strength among the Indian bengalee elderly population

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Abstract

Problems: The present investigation was made to evaluate the activities of daily living and its relationship with the strength parameters. Experimental approach: Total 236 elderly persons were selected for the study having the age range 60 years and above. Activities of Daily Living (ADLs) was evaluated by Katz index of independence. Strength parameters (i.e. hand grip strength and pinch strength) were measured in standard instruments by standard technique. Major findings: Maximum percentage of elderly subjects can independently done their activities of daily living. In ADL status ranking or scoring, 85.6% of subjects belongs to 6 scores of independence. A higher percentage (86.8%) of female subjects belongs to 6 scores of independence than that of the male subjects. A higher percentage (85.8%) of urban subjects belongs to 6 scores of independence category. The hand grip strength and pinch strength values were significantly decreases ($p < 0.001$) from the highest ADL status scoring to the lowest ADL status scoring category. There was a significant positive correlation ($p < 0.001$) between the strength parameters and ADL status scoring.

Conclusion: The present study concluded that in the selected population maximum percentage of elderly persons were independent in their ADL status with 6 scores of independence. Female subjects scores higher in ADL status than male subjects. On the other hand urban subjects scores higher than rural subjects. There was a positive correlation found between ADL status scoring and strength parameters (hand grip strength and pinch strength).

Keywords: Activities of Daily Living (ADL), ADL scoring or ranking, Hand grip strength, Pinch strength, Elderly

Introduction

Geriatric population is increasing in most of the countries of the World which in turn through the challenges towards the society to adapt and maximize the health as well as functional capacity of older people^[1]. In the developing countries the number of elder people who are not able to look after themselves any longer is estimated to increase four fold by the year 2050^[2]. A variety of recommendations has been made by WHO which are age-friendly and can be implemented for the benefit of the geriatric population^[3]. One of those recommendations include the measures that can be introduced to enhance the independence of the elderly.

The term activities of daily living (ADLs) refer to the daily activities of self-care within the place of residence of an individual, the outdoor environments or both. The ability or inability to perform the ADLs is an important measurement of functional status of an individual^[4]. Independence and quality of life both the terms may not mean the same. In developing countries preserving functional ability is of particular importance not only for elderly people but also for their families, where they often make a significant contribution to the family welfare and income by direct or indirect involvement in tasks, so that the younger adults get free for wage-earning. Functional status is a basic domain of gerontological assessment⁵, several specific questionnaires for the assessment of ADL were developed and are commonly utilized^[5, 6, 7, 8].

Upper extremity muscle strength can be most commonly assessed by measuring hand grip strength. Previous studies indicated that decrease muscle mass and muscle size is one of the processes that will decrease hand grip strength^[9, 10, 11] which in turn reduces the capacity to

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carry out activities of daily living (ADLs) among elderly and thus influencing the quality of life [6, 12, 13, 14]. Though it is crucial to maintain muscle strength throughout life to reduce functional limitations that might be closely relate to early death among the geriatric population [15]. But an aged person must be convinced that he or she must remain independent and active. Geriatric population should be positively encouraged not to lose interest in the joys of life. They should be imbued with the motto "serve and not to be served" [16].

In the last few years health care planners and the government have started taking measures to address age related issues. But despite of that there is still an inadequacy of aged data regarding health of the elderly. More and more research is needed in this regard among the developing countries especially in India. In the present study and attempt was made to evaluate the activities of daily living and its relationship with strength parameters among the Indian Bengalee elderly population.

2. Materials and Methods

2.1 Location of the study and sample selection-

The present study was conducted in different municipal areas of Midnapore town and different villages under Midnaporesadar sub-division of paschimmedinipur, West Bengal, India.

People aged 60 years and above were selected for the study from different urban and rural areas. Stratified multiple-stage sampling was adopted to randomly select 250 number of subjects. At last 236 were completed (the response rate was 94.4%) for all the parameters, including 115 (48.7%) male and 121 (51.3%) female. Among the selected subjects almost half of the subjects were taken from urban areas 113 (47.9%) and half from rural areas 123 (52.1%).

2.2 Ethical consideration-

The objectives and procedures of the study were clearly explained to the elderly persons and the signed consent was obtained by all subjects. An approval was obtained from the Institutional Ethical Committee (Human ethical committee of Vidyasagar University). A purposive sample of the elderly population was drawn from different urban and rural areas. The elderly persons were recruited from their respective homes.

2.3 Inclusion and Exclusion criteria-

Healthy subjects without having any known acute illness, not having undergone any recent surgery are participated in the study. However the subjects having health problems related to old age are included within the study.

Persons who had visual, hearing, or cognitive impairments; or a history of cancer, physically handicapped were excluded from the study. Subjects those who receiving artificial enteral or parenteral nutrition also were excluded.

2.4 Parameter studied-

2.4.1 Measurement of hand grip strength

The static hand grip strength of the subjects was measured by using maximal grip with the help of a Hand Grip Dynamometer (Lafayette, USA). Before taking the measurement the subject was requested to stand in a comfortable position. The subject was asked to squeeze the dynamometer as hard as possible without moving the rest of the body. Thus the final grip strength was measured for both hand and the reading was taken from the dynamometer scale,

when the pointer was no longer moved.

2.4.2 Measurement of pinch strength

The pinch strength of the subjects was determined by a pinch gauge. The strength of both right and left hands was determined. Pinch strength of the subjects was determined in the same way as the hand grip strength was determined.

2.4.3 Evaluation of activities of daily living (ADL)

The Katz Index [17] of independence in Activities of Daily Living (ADL) is the most appropriate instrument to assess functional status as measurement of the subject's ability to perform activities of daily living independence in questionnaire method. The index ranks adequacy of performance in the 6 functions of bathing, dressing, toileting, transferring, continence and feeding. Subjects are scored yes/no for independence in each of the 6 functions. On the basis of that scores allotted for the ADL status the selected population were divided in three categories (6 scoring categories, <5-4 scoring categories, <4-2 scoring categories) (slightly adapted from Katz *et al*) [18].

2.5 Statistical analysis

Data were summarized into mean and standard deviation values using Microsoft Excel (Office 2010). The differences were determined by studying the level of significance after performing t-tests between two groups and one way ANOVA for three groups using Tukey's test. The relationships were determined by performing correlation coefficient. Standard statistical software package [Statistical Package for Social Science (SPSS) Version 20.0] was used during those analyses.

3. Results

Table 1 showed the presentation of frequency (%) of the activity of daily living (ADL) status among different groups of the selected elderly population. It was observed from the results that a maximum percentage of subjects among the selected population can independently done their activities of daily living. It was observed from the results that there was a gender wise difference of ADL status among the selected elderly population. The results depicted that for bathing, transfer and feeding activities a higher percentage of male subjects can do their activities independently than that of the female subjects (75.7%, 84.3%, and 77.4% respectively). But in all other activities a higher percentage of female subjects showed independence in ADL status than that of the male subjects (dressing 73.6%, toileting 79.3%, continence 73.6%). It was observed from the area wise comparison that a higher percentage of urban subjects can independently did the bathing, toileting and transfer (75.2%, 80.5, 92.0% respectively) activities than that of the rural subjects. However in other activities opposite results had seen except in case of continence where both areas had showed same results of independence.

Scoring of ADL status was also done for both gender wise and area wise distribution (Table 2). It was observed from the results that a maximum percentage (85.6%) of subjects belongs to 6 scores of independence. When comparison was done between male and female subjects, it was observed from the results that a higher percentage (86.8%) of female subjects belongs to 6 scores of independence that that of the male subjects. In area wise presentation a higher percentage (85.8%) of urban subjects belongs to 6 scores of independence category than that of their rural counterpart.

Table 3 showed the gender wise and area wise comparison of hand grip strength and pinch strength among the selected elderly population. It was observed from the results that male subjects showed significantly higher ($p<0.001$) hand grip strength and pinch strength values than that of the female subjects for both hands. In area wise comparison it was observed from the results that there was no significant difference observed between urban and rural areas for both the strength values. An attempt was made in the study to find out the difference of

hand grip strength and pinch strength values among the three ADL status scoring groups (Table 4). The results depicted that the hand grip strength and pinch strength values were significantly decreases ($p<0.001$) from the highest ADL status scoring to the lowest ADL status scoring for both hands. Table 5 showed the relationship between hand grip strength and pinch strength with ADL status scoring. It was observed from the results that there was a significant positive correlation ($p<0.001$) between the strength parameters and ADL status scoring.

Table 1: Presentation of Frequency (%) of the activity of daily living (ADL) status among different groups of the selected population

Activities		Frequency (%)				
		Total (n=236)	Gender wise (n=236)		Area wise (n=236)	
			Male (n=115)	Female (n=121)	Urban (n=113)	Rural (n=123)
Bathing	I	176 (74.6)	87 (75.7)	89 (73.6)	85 (75.2)	91 (74.0)
	A	39 (16.5)	15 (13.0)	24 (19.8)	20 (17.7)	19 (15.4)
	D	21 (8.90)	13 (11.3)	8 (6.61)	8 (7.08)	13 (10.6)
Dressing	I	170 (72.0)	81 (70.4)	89 (73.6)	76 (67.3)	94 (76.4)
	A	35 (14.8)	19 (16.5)	16 (13.2)	22 (19.5)	13 (10.6)
	D	31 (13.1)	15 (13.0)	16 (13.2)	15 (13.3)	16 (13.0)
Toileting	I	182 (77.1)	86 (74.8)	96 (79.3)	91 (80.5)	91 (74.0)
	A	40 (16.9)	21 (18.3)	19 (15.7)	19 (16.8)	21 (17.1)
	D	14 (5.93)	8 (6.96)	6 (4.96)	3 (2.65)	11 (8.94)
Transfer	I	197 (83.5)	97 (84.3)	100 (82.6)	104 (92.0)	93 (75.6)
	A	36 (15.3)	18 (15.7)	18 (14.9)	9 (7.96)	27 (22.0)
	D	3 (1.27)	0 (0)	3 (2.48)	0 (0)	3 (2.44)
Continenence	I	165 (69.9)	76 (66.1)	89 (73.6)	79 (69.9)	86 (69.9)
	A	71 (30.1)	39 (33.9)	32 (26.4)	34 (30.1)	37 (30.1)
	D	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Feeding	I	181 (76.7)	89 (77.4)	92 (76.0)	84 (74.3)	97 (78.9)
	A	43 (18.2)	14 (12.2)	29 (24.0)	26 (23.0)	17 (13.8)
	D	12 (5.08)	12 (10.4)	0 (0)	3 (2.65)	9 (7.32)

Table 2: Presentation of Frequency (%) of different scoring based on the activity of daily living (ADL) status among different groups of the selected population

Distribution of subjects		Scoring		
		6	<5-4	<4-2
Total (n=236)		202 (85.6)	17 (7.20)	17 (7.20)
Gender wise	Male (n=115)	97 (84.3)	8 (6.96)	10 (8.70)
	Female (n=121)	105 (86.8)	10 (8.26)	6 (4.96)
Area wise	Rural (n=123)	104 (84.6)	5 (4.07)	14 (11.4)
	Urban (n=113)	97 (85.8)	13 (11.5)	3 (2.65)

Table 3: Comparison of hand grip strength and pinch strength according to different groups of the selected population

Distribution of subjects	Body side	Gender	HGS (Kg)	PS (kg)	t values	
					HGS (Kg)	PS (kg)
Gender wise (Male=115, Female=121)	Right Hand	Male	16.0±5.76	10.0±1.83	9.544**	14.037**
		Female	9.36±4.09	6.74±1.98		
	Left Hand	Male	15.3±6.28	9.77±2.08	9.708**	13.754**
		Female	8.52±3.88	6.36±1.83		
Area wise (Urban=113, Rural=123)	Right Hand	Urban	12.9±7.44	8.15±2.74	0.680 NS	2.423 NS
		Rural	12.3±4.24	8.51±2.30		
	Left Hand	Urban	11.8±7.20	7.90±2.75	0.462 NS	1.719 NS
		Rural	11.9±5.11	8.13±2.44		

** $p<0.001$ NS=Not Significant HGS=Hand Grip Strength PS=Pinch Strength

Table 4: Comparison hand grip strength and pinch strength among the groups of different scoring based on the activity of daily living (ADL) status.

Scoring	HGS (Kg)		PS (Kg)	
	Right Hand	Left Hand	Right Hand	Left Hand
6 (n=202)	15.5±6.10	12.7±6.09	8.99±2.12	8.58±2.35
<5-4 (n=17)	9.35±0.49	6.65±1.32	4.94±0.16	5.09±0.69
<4-2 (n=17)	7.00±1.06	4.65±1.00	4.09±0.40	4.24±0.69
F values	25.113 **	23.042 **	75.705 **	47.100 **

** $P<0.001$

Table 5: Correlation between hand grip strength and pinch strength with ADL status scoring.

	HGS (Kg)		PS (Kg)	
	Right Hand	Left Hand	Right Hand	Left Hand
Scoring	0.40 **	0.38 **	0.58 **	0.50 **

4. Discussion

Present study depicted that the maximum percentage of elderly subjects can independently done their activities of daily living in the selected elderly population. In the present population 74.6% of the subjects were able to manage having bath independently, 72.0% were able to dress themselves up independently, 77.1% were able to manage their toilet activities independently, 83.5% were able to move independently from one place to another, 76.7% were able to feed themselves independently and these findings of the present study is in agreement with the study of Sekhon and Minhas [19].

Among six types of activities, a higher percentage of males had perform the bathing, transfer and feeding activities independently than that of the females. But in other three activities (i.e. dressing, toileting and continence) a higher percentage of females performed independently than that of the males. In area wise comparison a higher percentage of urban elderly subjects can independently did the bathing, toileting and transfer activities but in feeding and dressing activities rural elderly subjects showed the higher percentage of independence (except in case of continence where no difference was observed).

Scoring of ADL status was done and a maximum percentage of elderly subjects belongs to 6 scores of independence among the selected population. A higher percentage of females belongs to 6 scores of independence than that of the males. Which indicates that the proportion of the elderly having ADL disability was much higher for males than for females in the selected population. The findings of the present study was in disagreement with some of the previous studies [15, 20].

Difference was also observed between areas and the results showed that a higher percentage of urban subjects belongs to 6 scores of independence category than that of their rural counterpart. Previous studies also support the findings of the present studies [21, 23]. In justification those studies explained that differences in compositional variables including those representing domains of socio-economic status, health care access, health behaviors and social engagement. So that might be a cause for the difference between areas.

Activities of daily living is commonly used as a predictor for muscle strength among elderly [24]. On the basis of that in the present study an attempt was made to evaluate the hand grip strength and pinch strength among the selected elderly population. The results showed that males had significantly higher hand grip strength and pinch strength values than the females for both hands. Similar gender difference was seen in previous studies among elderly [25, 26, 27, 15].

No significant difference was found between urban and rural areas.

The results depicted that the strength values were significantly decreases from the highest to the lowest ADL status scoring (6, <5-4, <4-2 scoring respectively) for both hands.

Significant positive relationship was found between ADL status scoring and muscular strength parameters. Which indicates the higher the muscular strength the higher the ADL status scoring among the selected elderly population. The findings of the present study is in agreement with some previous studies [28, 29, 15]. Similar trends of results found in

another study where they investigate the association of grip strength and activities of daily living in elderly population and the results of that study concluded that there was an association between ADL and hand grip strength [30].

5. Conclusion

In the present study an attempt was made to evaluate the activities of daily living (ADL) status and its relationship with the strength parameters among the Indian Bengalee elderly population. ADL status was compared between genders and so also between areas. In the selected population maximum percentage of elderly persons were independent in their ADL status with 6 scores of independence. Female subjects scores higher in ADL status than male subjects. On the other hand urban subjects scores higher than rural subjects. There was a positive correlation found between ADL status scoring and strength parameters (hand grip strength and pinch strength). Apart from the findings there were some limitations in the present study. Say for example the nutritional status, pain related discomfort, arthritis, seasonal variations etc. could be included in the study which could better interpret the findings. So there is a future scope for the study with prospective study design.

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