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Association Between Hand Grip Strength and Cognitive Function in Geriatric Population

Mohammad Mahmoud Yossof Al-sayed Dawood [*1], Yousri Rajab Abd El-majeed [2], Ali Abd El-Fattah El-Nabawy [3], Yasser A. El Kerdasy [1, 4]

[1] Department of Geriatric Medicine, Bab-Elsheria University Hospital, Cairo, Egypt
[2] Department of Rheumatology and Rehabilitation, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
[3] Department of Psychiatry, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
[4] Department of Hepatogastroenterology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

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*Corresponding author
Email: modawood996@gmail.com

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ABSTRACT

Background: In terms of global disability and mortality, neurological illnesses are second only to cardiovascular disease. People over the age of 60 are disproportionately affected by the global epidemic of cognitive decline. Cognitive decline is predicted to rise as the world's population ages; thus, policymakers and governments should pay close attention.

Aim of the work: The research set out to measure the connection between weak hand grips and dementia in the elderly.

Patients and Methods: This was across sectional study; hundred participants, aged above sixty years are taken from Sayed Galal University Hospital. Hand grip strength [HGS] is measured by sphygmomanometer.

Results: There was a statistically significant [p-value < 0.001] decreased HGS in patients with impaired MMSE [median = 132, IQR = 117 – 160] when compared with patients of normal MMSE [median = 165.5, IQR = 146.25 – 186.5].

Conclusion: This research established a connection between handgrip strength variations and mental performance. Our big longitudinal research found that weaker handgrips predicted worse cognitive function.

Keywords: Hand grip strength; Cognitive function; Geriatric.

INTRODUCTION

The percentage of seniors in the total population is rising. An estimated 6.9 million Egyptians would be above the age of 60 that year, according a report from the Middle East News Agency. By 2050, the global population is predicted to reach an all-time high of 1.5 billion [1].

The prevalence of the elderly population means that geriatric disorders are becoming more pressing. Common, difficult, and expensive health issues in the elderly are known as geriatric syndromes [2].

Hand grip strength [HGS] is an indicator of skeletal muscular strength and fitness that goes beyond only the strength of the upper limb muscles. Additionally, it is a measure of nutritional health. Geriatric syndrome [2] includes HGS as one of its components.

One of the most outstanding hypotheses has been the "brain-related prevalent cause," which proposes that non-cognitive factors [like muscle strength] are associated with cognitive factors because they also have central nervous system engagement [3]. The nature of the relationship between strength of muscles and cognition is still unknown.

In this light, the current research looks at how a person's hand grip strength relates to their mental acuity as they become older.

This study aimed to determine whether there is a connection between weak hand grips and dementia in the elderly.

PATIENTS AND METHODS

Hundred participants, aged above sixty years are taken from Sayed Galal University Hospital. The sphygmomanometer is used to evaluate hand grip strength [HGS]. At rest, the sphygmomanometer is rolled into a cylinder that the patient may easily grasp. The cuff is then inflated to 20 mmHg, and the patient squeezes the cuff as tightly as possible [4].

All patients are given the Standardized Mini-Mental Test [SMMT] to assess their level of mental clarity. Those who finished the whole exam successfully would have gotten a score of 30. Scores between 18 and 24 indicated moderate dementia, whereas scores below 18 indicated severe dementia [5, 6].

Statistical analysis: Statistical Package for the Social Sciences [SPSS] version 24 was used to analyze the data. Percentages and frequencies were used to represent qualitative data. If the numbers were normally distributed, they were written as mean ± SD, and if they weren't, they were written as median [IQR]. Mann Whitney U test [MW] was used when contrasting two categories [for data that doesn't follow the normal distribution]. Pearson's correlation coefficient [r] was used when data correlation was applied. When the Probability [P-value] was less than 0.05, it was deemed significant; and when it was more than 0.05, it was deemed inconsequential.

RESULTS

Patients' demographic information is summarized in Table 1. There was a total of 120 patients, with 60 being female and 40 males. Patients' average body mass index was 23.4 ± 2.3 kg/m^2 with minimum BMI of 20 kg/m^2 and maximum BMI of 28 kg/m^2. As regard activity hours per week, the mean activity hours in all studied patients was 54.8 ± 38.9 hours/week with minimum activity of 10 hours/week and maximum activity of 150 hours/week. As regard chronic diseases, there were 20 patients [20%] with 1 disease, 36 patients [36%] with 2 diseases, 8 patients [8%] with 3 diseases and 8 patients [8%] with 4 diseases while there were 28 patients [28%] with no chronic diseases in all studied patients.

All patients investigated had their MMSE profiles summarized in Table 2. All individuals tested had an average MMSE of 23.5 ± 2.8, with a range from 19 to 29. There were 68 patients [68%] of impaired cognitive status and the remaining 32 patients [32%] showed normal cognitive status.

The characteristics of all patients with HGS are included in Table 3. All patients had an HGS between 100 and 195, with a mean of 146.4 ± 28.2.

Table [4] shows statistically significant [p-value < 0.001] decreased HGS in patients with impaired MMSE [median = 132, IQR = 117 – 160] when compared with patients of normal MMSE [median = 165.5, IQR = 146.25 – 186.5].

Table [1]: Description of demographic data in all studied patients

		Studied patients [N = 100]	
Sex	Male	40	40%
	Female	60	60%
BMI [kg/m²]	Mean ±SD	23.4 ± 2.3	
	Min - Max	20 – 28	
Activity [hours/week]	Mean ±SD	54.8 ± 38.9	
	Min - Max	10 – 150	
Chronic diseases	Non	28	28%
	1 disease	20	20%
	2 diseases	36	36%
	3 diseases	8	8%
	4 diseases	8	8%
Marital status	Single	56	56%
	Married	44	44%
Income	Low	24	24%
	Middle	40	40%
	High	36	36%
Education	Low	16	16%
	Middle	40	40%
	High	24	24%
	Collage	20	20%

Table [2]: Description of MMSE in all studied patients

		Studied patients [N = 100]	
MMSE	**Mean ±SD**	23.5 ± 2.8	
	Min – Max	19 – 29	
MMSE interpretation	**Impairment**	68	68%
	Normal	32	32%

Table [3]: Description of HGS in all studied patients

		Studied patients [N = 100]
HGS	**Mean ±SD**	146.4 ± 28.2
	Min – Max	100 – 195

Table [4]: Correlation between HGS and MMSE results in all studied patients

		MMSE		Stat. test	P-value
		Impaired [N = 68]	**Normal [N = 32]**		
HGS	**Median**	132	165.5	**MW = 384**	**< 0.001***
	IQR	117 – 160	146.25 – 186.5		

MW: Mann-Whitney test; *: significant

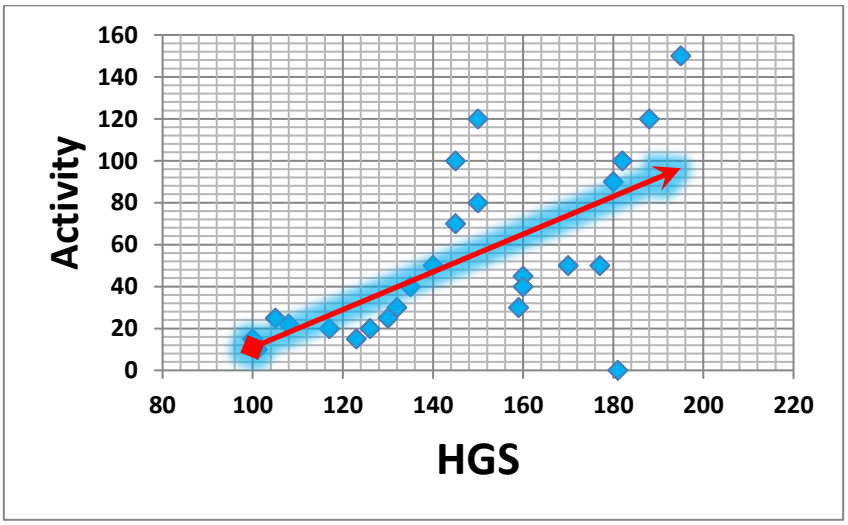

Figure [1]: Positive correlation between HGS and activity

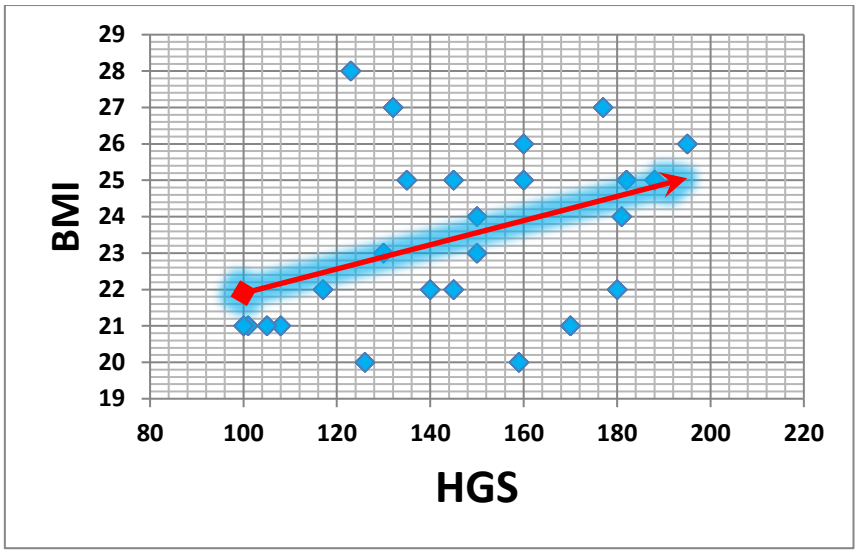

Figure [2]: Positive correlation between HGS and BMI

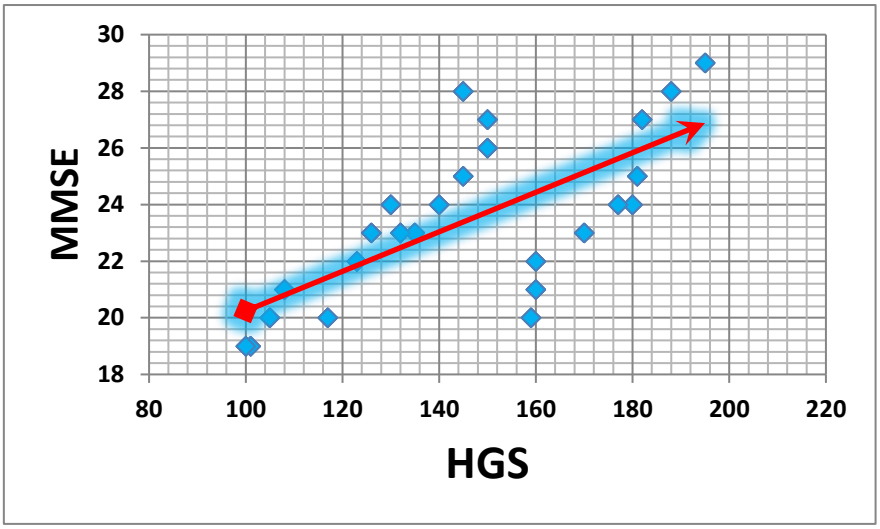

Figure [3]: Positive correlation between HGS and MMSE

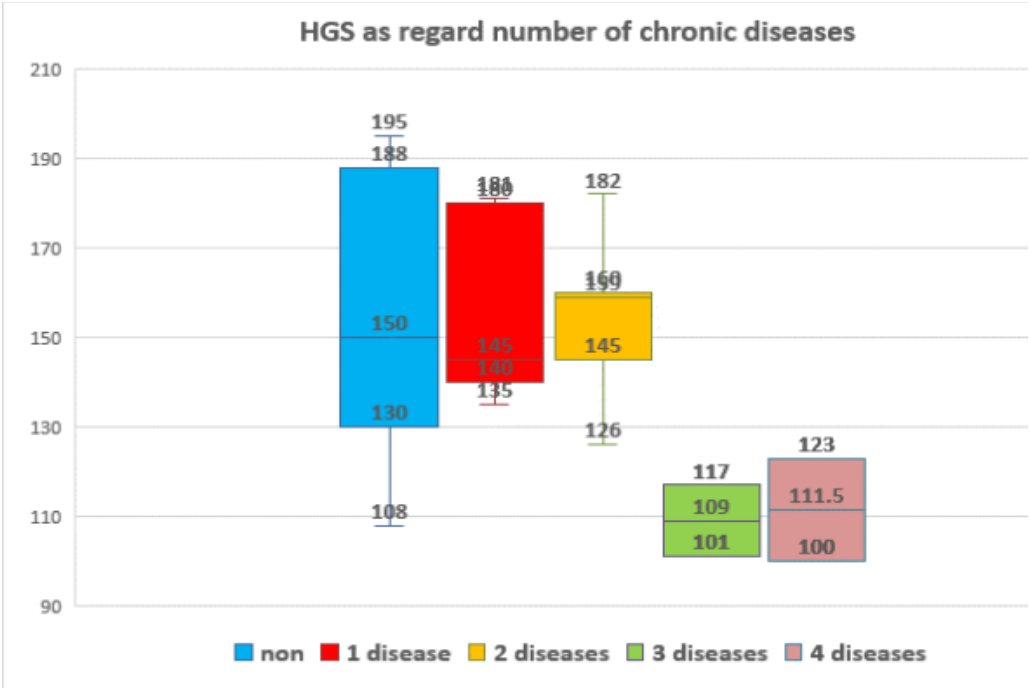

Figure [4]: Correlation between HGS and number of chronic diseases in studied patients

DISCUSSION

In older individuals, there is still some dispute about the direction of the connection between handgrip strength and cognition. Longitudinal research is necessary to determine the direction of the association's causation [7].

All patients were accurately described in terms of demographic information in the present investigation. There was a total of 120 patients, with 60 being female and 40 males. Regarding body mass index, the mean BMI of all patients tested was 23.4 2.3 kg/m^2, with a low of 20 kg/m^2 and a high of 28 kg/m^2. As regards activity hours per week, the mean activity hours in all studied patients were 54.8 ± 38.9 hours/week with minimum activity of 10 hours/week and maximum activity of 150 hours/week. As regard chronic diseases, there were 20 patients [20%] with 1 disease, 36 patients [36%] with 2 diseases, 8 patients [8%] with 3 diseases and 8 patients [8%] with 4 diseases while there were 28 patients [28%] with no chronic diseases in all studied patients.

It was also shown by **Björk *et al.*** [8] that out of a total of 1750 participants, 989 were male and 761 were female, which is consistent with our own results. There were statistically significant differences between the groups with respect to every sociodemographic variable except for hand-grip strength and age. Outside of individuals with just a high school diploma or less, more men than women obtained advanced degrees.

According to **Thomas *et al.*** [9], 1431 people were included in the final tally, with 48.8% being males and 51.2% being women, and the average age being 69.8 ± 9.9 years. There were 1,431 people in the study; 596 [41%] had AD, 288 [20%] had MCI, and 547 [38%] were healthy controls. Males were more likely to have greater height [$P < 0.01$], education years [$P < 0.01$], and body mass index [BMI; $P = 0.034$] than females, but no other differences were found between the sexes. The MMSE, MoCA-BC, and ACE-III-CV scores of men and women did not vary significantly [all $P > 0.05$], however men fared better than women on the ADL and the FAQ. The average handgrip strength of men was 31.0 ± 8.6 kg, whereas that of females was just 20.

All of the patients in this research fit the MMSE definition. All individuals tested had an average MMSE of 23.5 ± 2.8, with a range from 19 to 29. There were 68 patients with impaired cognitive state [68%], while 32 individuals with normal cognitive status made up the remaining 32%. a detailed account of HGS in every patient who was analyzed. All patients had an HGS between 100 and 195, with a mean of 146.4 ± 28.2.

Results from the MMSE were shown by **Taekema *et al.*** [10]. For men, the unadjusted analysis showed a substantial decline in cognitive performance across all handgrip strength levels compared to the reference group 1. The unadjusted analysis showed a decrease in the bottom 50th percentile of handgrip strength for women only in groups 3 and 4, relative to the control group.

In addition, **Wu *et al.*** [11] reported that, across all participants, cognitive function declined significantly after the first wave of the survey [all $p < 0.001$], but that it rose for both sexes with increasing levels of education relative to the elementary school norm. Furthermore, both men and women in rural regions exhibited worse cognitive performance than their urban counterparts.

Functional deterioration in self-reported instrumental activities of daily living may be slowed by cognitive training, according to a single-blind randomized controlled experiment with a 5-year follow-up conducted by **Yang *et al.*** [12]. As a result, measuring handgrip strength has been proposed as a practical measure in geriatric practice for tracking the deterioration of cognitive function.

In addition, **Alyssa *et al.*** [13] found that maintaining adequate handgrip strength and cognitive function necessitates working to improve the quality of life for the elderly. Maintaining a healthy BMI may be accomplished by eating well. Muscle mass, grip strength, and mental acuity are all maintained by eating well. This is consistent with studies showing that people with a body mass index [BMI] of 18.5 or below has an insufficient intake of macronutrients [proteins, lipids, and carbs], leading to chronic energy shortage and a poor status.

For every 5 kg reduction in hand grip strength, **Amaral *et al.*** [14] found a 1.10-fold increase in the risk of a decline in cognitive function. Another research found that the risk of developing MCI increased by a factor of 1.41 if participants had low hand grip strength. Low hand grip strength was also associated with a high incidence of MCI.

We discovered that the HGS of patients with impaired MMSE was significantly lower

than that of individuals with normal MMSE. There is a strong positive relationship between HGS and action [r = 0.76]. There is a positive link between HGS and BMI, and it is statistically significant [r = 0.4]. The positive association [r = 0.68] between the HGS and MMSE is very significant [p < 0.001].

This agreed with what was observed by **Ahrenfeldt *et al.*** [15] on the correlation between hand grip strength and CERAD-measured cognitive impairment. There was a statistically significant difference between having a strong hand grip and having a low risk of cognitive impairment after taking into account factors such as age, sex, and race.

Choudhary *et al.* [16] have shown that there is a correlation between body mass index and deterioration in cognitive function as measured by the difference in MMSE scores. Smaller reductions in MMSE scores were linked with greater handgrip strength in the top tertile compared to the bottom tertile among obese women [p = 0.009], but this was not the case among non-obese women. In addition, the level of deterioration in cognitive function correlated linearly with the strength of the handgrip in obese women [p = 0.048].

We identified a strong association between HGS and the prevalence of chronic illnesses in the current investigation.

However, after controlling for confounding variables, **Livingston *et al.*** [17] found no significant relationships between MMSE scores and handgrip strength across numerous regression analyses. A significant regression coefficient [0.3142 in men and 0.2685 in women] were found between groups with stable or increasing handgrip strength and those with stable or reduced strength. Lower MMSE ratings were seen in both sexes with worse handgrip strength.

The relationship between weight and grip strength was shown to be significant [p = 0.013] in a study by **Fritz *et al.*** [18] The risk of cognitive deterioration was lower in obese women with strong handgrip strength compared to those with poor handgrip strength. There was no statistically significant correlation between strong handgrip strength and mental deterioration in women who were not overweight.

Conclusion: Our research shows a negative correlation between hand grip strength and cognitive decline; this discovery raises the possibility of a common underlying mechanism, which may be confirmed by a large-scale prospective clinical trial. This research established a connection between handgrip strength variations and mental performance. Our big longitudinal research found that weaker handgrips predicted worse cognitive function. Treatment and prevention techniques for cognitive impairment in clinical settings may benefit from further research into the processes behind the correlation between strength of handgrip and cognitive impairment.

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