Original Research Open Access

The Significant Relationship between Education and Cognition among Elderly Patients at Ain Shams University Hospitals

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Abstract

Background: Low educational level is a well-established risk factor for Alzheimer's disease, and higher educational level may play a role in reducing the risk of age-related cognitive decline and protect against dementia..

Objective*:* to study the relationship between education and cognition among elderly patients at Ain Shams University Hospitals.

Methods*:* A case control study including 90 elderly (30 with normal cognition ,30 with MCI ,30 with early stage dementia) at Ain Shams University hospitals. Cognitive assessment was done using the Cambridge Cognition Examination (CAMCOG) and the relationship between Education and Cognition was assessed among the different groups.

Results*:* Using the validated Cambridge Cognition Examination cut offs for (normal cognition above 89, MCI between (78 and 89), early stage dementia below 78. We found that higher level of education was associated with better CAMCOG performance.

Conclusion: The results suggest that education is robustly associated with level of cognitive function and that the former association primarily accounts for education's correlation with risk of cognitive impairment and dementia in old age.

Background

Aging is inevitable for all living creatures; however, it seems that an individual's behavior and interaction with the ambient environment could mitigate the rate at which an individual moves toward the point of performance disturbance. Education [1]and occupation [2]are modifiable factors and their impact on deceleration of cognitive decline dynamics or postpone the time point of cognitive decline during aging.

Cognitive impairment usually leads different forms of dementia that contribute to disability and loss of independence[3], thus greatly affecting the quality of life of older adults [4]

Risk of dementia is reduced by higher levels of educational attainment at younger ages[5], higher levels of education in early adulthood are associated with superior performance on measures of cognitive function [6].

Cognitive and brain reserves explain the protective effect of education on normal and pathological aging by indirect pathways such as increased awareness or/and funds for personal health care, pro-health behaviors, occupation attainment, more funds on physical, mental and social activities which could enhance individual health, what in turn would be related to less rapid cognitive decline [7].

More years of education is associated with higher functional cognitive performance, which makes the brain networks more efficient and increases the ability of dealing with environmental difficulties, compensating for cognitive and motor deficits [8].Age exerts a direct effect on cognitive functioning [9].

Education is positively associated with better health, longer life, and better cognitive performance in later life [10].

Specifically, having less education is a strong risk factor for cognitive impairment and dementia, whereas having more education protects against faster rates of cognitive decline [11].

Recent data has shown that education is more than simply the number of years of schooling. Cognitive function can be affected by quality of education during childhood , especially among those with less than 12 years of schooling [12].

Previous studies demonstrate that education can influence performance on cognitive tests, and lower education levels are associated with faster cognitive decline with aging [13,14].

Aim of the work:

The aim of our study was to identify the relationship between education and cognitive performance among the elderly subjects attending the Ain Shams University Hospitals and determine the effect of education on decreasing normal age-related cognitive decline and risk of dementia.

Methods

A case control study was done on 90 subjects recruited from elderly at Ain Shams university Hospital. All participants were interviewed after giving an informed consent. The participants underwent the comprehensive geriatrics assessment including; demographic data, past medical history.

The subject also underwent cognitive function assessment using the Cambridge Cognition Examination (Roth et al.,1986) (CAMCOG) Arabic version. Assessment of physical function using activities of daily living (ADL) and instrumental activities of daily living (IADL) was also done.

Subjects were categorized by (CAMCOG) into 3 groups (**normal cognition** above 89, **MCI** between (78 and 89), **early stage dementia** below 78) **.**

Participants were categorized into 4 groups regarding the level of education **illiterate**, **less than 6 y education**, **6-15 y education**, **highly educated** (more than 15y) .

The co-morbidities involved in our study were respiratory and cardiac diseases, hypertension, diabetes, osteoarthritis, liver and kidney diseases .

Inclusion criteria were: Elderly above 60 years old. We excluded patients with hearing and visual impairments .Subjects who were unwilling to participate in the study were also excluded.

Data obtained was analyzed to identify the relationship between education and cognition , and whether the level of education is related to the subjects' cognitive status.

Data management and analysis

Data were revised, coded, entered on computer and analyzed using SPSS package version number 20. Quantitative data were described as mean, standard deviation (SD) and range values. One-way ANOVA test followed by post-hoc test was used for comparing quantitative variables between groups. Qualitative data were expressed as frequencies (n) and percentage (%). Chi square and fisher exact test were used to test association between qualitative variables. P-value $\leq$ 0.05 was considered significant.

Results:

Table [1] shows that study participants' age ranged between 60 to 90 years old , Male 54.4% , Female 45.6% , 20% of the population were smokers , 61.1% Retired . Concerning the residence, most of the cases (70%) lived with their families. Regarding the marital status, less than half of the cases (44.4%) were married. Participants were categorized by level of education (highly educated more than 15 y 28.9%, 6-15 y education 28.9% , less than 6 y education 17.8% , Illiterate 24.4%).

Table [3] shows mean score of Cambridge of normal group (91.2+1.1), MCI (82.6 + 4), early dementia (70.1 + 3.9) .

Table [2,4] Age was significantly affecting cognitive decline, in our study, mean age in normal group (68$\pm$ 7) , in MCI group (68$\pm$ 8) and in early stage dementia group (75 $\pm$ 9) with significant (p value .000) with Pearson Correlation -.389 which indicate medium correlation .

Table [5] shows female gender had more risk for cognitive decline than male, mean score of CAMCOG in male 84 while in female 78 with significant (p value .002).

Table [6] shows a highly statistically relationship between education and cognitive status. education decreased normal age-related cognitive decline, mean score of CAMCOG in illiterate 74.7, less than 6 y education 74.9, 6-15 y education 83.5, highly educated more 15 y 88.6 with highly significant (p value .000) .

Table [7] shows associated comorbidities in different groups which aren't significant in our study.

Table 1. Socio-demographic characteristic in the sample

		N	%
Groups	Normal	30	33.3%
	MCI	30	33.3%
	Early dementia	30	33.3%
Sex	Male	49	54.4%
	Female	41	45.6%
Age			70 + 9 (60 – 91)
Occupation	Retired	55	61.1%
	Housewife	35	38.9%
Education	Illiterate	22	24.4%
	less than 6 y education	16	17.8%
	6 -15 y education	26	28.9%
	highly educated more than 15 y	26	28.9%
Residence	Alone	27	30.0%
	With family	63	70.0%
Marital status	Married	40	44.4%
	Widow	47	52.2%
	Divorced	1	1.1%
	Single	2	2.2%
Habits	non-smoker	50	55.6%
	Smoker	18	20.0%
	Ex-smoker	22	24.4%

Table 2. Socio-demographic characteristic in relation to groups

		Normal		MCI		Early dementia		P value
		N	%	N	%	N	%	
Sex	Male	21	70.0%	18	60.0%	10	33.3%	.002*
	Female	9	30.0%	12	40.0%	20	66.7%	
Age †		68 + 7 (60 – 91)		68 + 8 (60 – 88)		75 + 9 (60 – 88)		.000*
Occupation	Retired	23	76.7%	20	66.7%	12	40.0%	.011*
	Housewife	7	23.3%	10	33.3%	18	60.0%	
Education	Illiterate	0	0.0%	9	30.0%	13	43.3%	.000*
	less than 6 y education	2	6.7%	4	13.3%	10	33.3%	
	6 -15 y education	10	33.3%	10	33.3%	6	20.0%	
	highly educated (more than 15y)	18	60.0%	7	23.3%	1	3.3%	
Residence	Alone	9	30.0%	10	33.3%	8	26.7%	.853
	With family	21	70.0%	20	66.7%	22	73.3%	
marital status #	Married	18	60.0%	12	40.0%	10	33.3%	.103
	Widow	12	40.0%	17	56.7%	18	60.0%	
	Divorced	0	0.0%	1	3.3%	0	0.0%	
	Single	0	0.0%	0	0.0%	2	6.7%	
Habits	non-smoker	13	43.3%	16	53.3%	21	70.0%	.185
	Smoker	7	23.3%	5	16.7%	6	20.0%	
	Ex-smoker	10	33.3%	9	30.0%	3	10.0%	

Table 3.Classification Of Each Group As Regard Cambridge Cognition Examination (CAMCOG)

	Groups		
	Normal	MCI	Early dementia
	Mean + SD (Min – Max)	Mean + SD (Min – Max)	Mean + SD (Min – Max)
score of Cambridge	91.2 + 1.1 (90 – 93)	82.6 + 4 (78 – 89)	70.1 + 3.9 (65 – 77)

Table 4. Relationship between Age and Cambridge Cognition Examination (CAMCOG)

		Age
score of Cambridge ex	Pearson Correlation	-.389**
	Sig. (2-tailed)	.000
	N	90

Table 5. Relationship between Sex and Cambridge Cognition Examination (CAMCOG)

	sex				Independent t test	P value
	Male		Female			
	Mean	Standard Deviation	Mean	Standard Deviation		
score of Cambridge ex	84.0	8.6	78.0	9.2	3.162	.002*

Table 6. Relationship between Education and Cambridge Cognition Examination (CAMCOG)

	education								ANOVA	P
	Illiterate		less than 6 y education		6-15 y education		highly educated more 15 y			
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation		
score of Cambridge ex	74.7	7.3	74.9	8.2	83.5	8.2	88.6	5.5	19.427	.000*

Table 7. Comparison between groups in relation to associated comorbidities .

		groups						P value
		Normal		MCI		Early dementia		
		N	%	N	%	N	%	
old stroke	No	28	93.3%	29	96.7%	27	90.0%	.868
	Yes	2	6.7%	1	3.3%	3	10.0%	
DM #	No	15	50.0%	11	36.7%	14	46.7%	.557
	Yes	15	50.0%	19	63.3%	16	53.3%	
HTN #	No	12	40.0%	14	46.7%	8	26.7%	.266
	Yes	18	60.0%	16	53.3%	22	73.3%	
HF #	No	22	73.3%	23	76.7%	25	83.3%	.638
	Yes	8	26.7%	7	23.3%	5	16.7%	
AF	No	26	86.7%	27	90.0%	23	76.7%	.439
	Yes	4	13.3%	3	10.0%	7	23.3%	
COPD	No	25	83.3%	28	93.3%	30	100.0%	.065
	Yes	5	16.7%	2	6.7%	0	0.0%	
CKD	No	26	86.7%	26	86.7%	25	83.3%	1.000
	Yes	4	13.3%	4	13.3%	5	16.7%	
BPH	No	26	86.7%	25	83.3%	27	90.0%	.925
	Yes	4	13.3%	5	16.7%	3	10.0%	
BA	No	29	96.7%	28	93.3%	26	86.7%	.493
	Yes	1	3.3%	2	6.7%	4	13.3%	
Osteoarthritis #	No	22	73.3%	21	70.0%	23	76.7%	.843
	Yes	8	26.7%	9	30.0%	7	23.3%	
CLD #	No	24	80.0%	25	83.3%	25	83.3%	1.000
	Yes	6	20.0%	5	16.7%	5	16.7%	

DISCUSSION

Cognitive function represents an important health dimension for researchers on aging because it significantly affects independence and quality of life among older adults. Higher educational attainment is associated with greater levels of cognitive performance, as well as with a reduced risk of dementia and Alzheimer's disease. Wang et al. [16] reported an increased risk for dementia among adults over the age of 65 with low education levels .

Earlier, educational experiences may provide the necessary knowledge, understanding, skills, and competencies for establishing a lifetime of participation in cognitive challenges. In fact, individuals with higher levels of educational attainment tend to allocate more time and put forth more effort when engaging in intellectually complex activities [17].The effect of education was persistent, stable, and substantial across essentially all domains of cognition, ranging from general mental status to perceptual speed and working memory. These findings indicate that schooling help one meet new challenges and solve new problems through analysis, evaluation, and reasoning and transform into higher-order cognitive skills that remain throughout one's life [18].

This study included 90 elderly, with ages ranging from 60-90 divided into normal cognition ,MCI ,early stage dementia. The current study is a case control study to determine relationship between level of education and cognitive performance in elderly in El Demerdash Hospital. Our study found that less education in early life is a risk factor for age-related cognitive decline with highly statistically significant relationship ,with a much stronger influence than age itself that showed medium correlation , so higher education levels may contribute to an increased cognitive performance. Chen *et al.* reported that AD group was significantly older than the MCI and control groups ($P = 0.002$), also the AD group had fewer years of education, but the differences were not statistically significant ($P = 0.064$) . Zahodne et al. [19] had found that older adults who are highly educated had better cognition early in life and retained higher levels of cognition in subsequent years.

This study showed relationship between sex and cognitive decline (p value .002) and this agreed with Bonsang et al.[20] who reported gender differences in cognition are the result of bio psychosocial interactions through the life course , lower educational attainment among women compared to men explained differences in cognitive function between men and women. Lipnicki et al [21] repoted strongest association with sex was for memory ($p < 0.001$), with females performing better than males. Males tended to perform better than females on all other cognitive measures. The co-morbidities involved in our study were respiratory and cardiac diseases, hypertension, diabetes, osteoarthritis, liver and kidney diseases which were not significant maybe due to small sample size.

All reviewed studies demonstrated that education was related to better performance across most, if not all cognitive domains [22,23,24,25] That agrees with studies by Lenehan et al. [26] that showed that education can influence performance on cognitive tests, and lower education levels are associated with faster cognitive decline with aging. Several other studies, including those by Amieva et al. [27] and Santos et al. [28]also concurred with our results. Bennett et al [29] reported education appears to diminish the effects of AD pathology on cognition. Bosma et al. [30] reported that a lower level of education was associated with more rapid decline in measures of processing speed and verbal memory. Similarly, Cullum et al. [31] reported that age-related

decline in memory was associated with lower levels of educational attainment. Alley et al. [32] found that higher levels of education were associated with slower decline in global cognitive function. Lipnicki et al. [33] Lower educational status associated with poor executive function, correlated with a lower speed on motor tasks. In contrast, Proust-Lima et al. [34] reported that individuals with higher the education declined at a faster rate. Similarly,Van Dijk et al.[35] found no significant differences in rates of decline in global cognition in older people as a function of education. However, Berggren [36] reported initial education-related differences in cognitive performance may result in individual differences in the age of onset of lost functional independence in late life.

Several important factors linking education and cognitive function are healthy lifestyle, Life experiences, social factors, and nutrition. Education enables one to develop a healthy lifestyle, activity engagement, a critical component of successful aging [37]. Although education may help to continue engagement in intellectually demanding environments across the life course, it is also the "choices we make, not chance, that determines our fate" [38] .

Conclusion

Lower education is associated with an increased risk for dementia . Further, the level of education that was most associated with dementia risk varied considerably by age, gender.

Ethical considerations

Informed consent was taken from every elderly participating in this study. The study methodology was reviewed and approved by the Research Review Board of the Geriatrics and Gerontology Department, Faculty of Medicine, Ain Shams University.

Declarations

- **Consent for publication:** "Not applicable"
- **Funding:** There has been no significant financial

support for this work that could have influenced its outcome.

- **Disclosure statement:** The authors state that they have no competing interests.
- **Data Availability Statement:** The datasets generated and analyzed during the current study are available from the corresponding author on request**.**

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