

Effect of Educational Level on Cognitive Abilities of Elderly

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Abstract

The research was conducted to examine the impact of educational level on the functional cognitive abilities of the elderly. The sample consisted of 70 participants, older than 60 years. The participants were divided into two groups, participants with dementia, and participants without dementia. All participants responded individually, on the questions in Arizona Battery for Communication Disorders of Dementia (ABCD). The results have shown that educational level significantly predicted functional cognitive abilities. Education influences the creation of cognitive reserves. Bigger cognitive reserves mean a slower progression of the cognitive decline, which is especially important for people with dementia.

Keywords: cognitive abilities, education, elderly, dementia

1 INTRODUCTION

Aging is a process that is accompanied by changes in an individual's cognitive competencies and functionality. In the developed countries of the world, there has been an increase in life expectancy, and this increase is both a social achievement and a challenge [1]. An individual's health and quality of life are closely linked to a person's cognitive functioning [2]. Several factors can affect one's cognitive functioning, but especially interesting are those that appear to have a positive relationship to development or may be classified as prevention factors. A person's level of education is one of the factors that influence cognitive functioning and is receiving great attention [3],[4],[5].

Researchers around the world are researching older people's cognitive functioning because they believe that cognitive function has a significant impact on the quality of life [6]. Cognitive changes can affect a person's day-to-day functioning, and a better understanding of the process of cognition can help clinicians distinguish normal from disease states [7].

Cognitive processes include products of modular processing between stimuli and responses and are derived from, among others, language-related knowledge. Other cognitive processes include attention, awareness, cognition, communication, executive, language, memory, perception, problem solving, reasoning [8]. From the behavior of a person, it can be deduced which processes are in the background of cognition, or which processes are disrupted [9]. Many studies suggest that elderly have more difficulty learning new content, exhibit less effective thinking skills, respond more slowly to all types of cognitive tasks, and are more sensitive to interfering information than younger adults [10].

Mild cognitive impairment and dementia are conditions in which the decline in cognitive abilities is very manifesting in the clinical picture. Mild cognitive impairment is a condition between normal cognition and dementia, in which functional abilities are preserved [11]. Dementia indicates a disorder of cognitive activity resulting from changes in brain function [12]. However, even the elderly who do not have mild cognitive impairment or dementia may experience subtle aging-related cognitive changes [7]. Unfortunately, these changes often remain unrecognized by family members or caregivers [2].

The aim of this research was to examine the impact of educational level on the functional cognitive abilities of the elderly.

2 METHODOLOGY

2.1 Participants

The study included 70 participants, over 60 years of age. The subjects were divided into two groups, subjects with dementia (N=40) and subjects without dementia (N=30). The average age of participants with dementia was 80 years and one month, while the average age of participants without dementia was 78 years and one month. This average difference of two years with a 95% confidence level was not significant ($t=1.54$; $df=68$; $p=0.128$). The total sample consisted of more female (70%) than male respondents (30%). The results of the chi-square test showed that there was no significant difference in gender representation ($\chi^2=0.625$; $df=1$; $p=0.429$).

Medical records were used to determine the presence or the absence of dementia and causes (vascular dementia and dementia due to Alzheimer's disease).

3 RESEARCH TOOLS AND DATA COLLECTION

The research was conducted in health care and social care institutions. Arizona Battery for Communication Disorders of Dementia (ABCD) (Bayles and Tomoeda, 1993) was applied to determine functional abilities. ABCD examines five areas: mental status, episodic memory, linguistic expression, linguistic understanding (language comprehension) and visuospatial construction. All respondents were individually examined.

The examiner paid attention to conditions that may affect the test results, such as auditory word discrimination deficit, visual-perceptual problems, visual agnosia, illiteracy, depression, and apraxia. To assist the examiner in identifying these difficulties, the ABCD battery contains screening tasks: Speech Discrimination, Visual Perception and Literacy, Visual Field, and Visual Agnosia. The Hamilton Depression Rating Scale (Hamilton, 1960) was used for screening for depression, and the Western Aphasia Battery-Revised (Kertesz, 2007) for scanning apraxia. Respondents who had a deficit of auditory word discrimination, visual-perceptual problems, visual agnosia, who were illiterate, depressed (score above 13), or apraxic were excluded from the examination.

Participants had no history of neurological and psychiatric illness, and no history of alcohol or drug abuse. Data of educational level were obtained from the participants without dementia themselves, or the caregivers for participants with dementia.

All the participants provided signed informed consent before they were subjected to the research procedures. For respondents with dementia, written consent was given from caregivers.

3.1 Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS®) software package version 24.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics parameters were calculated. The Chi-squared test was used for testing differences between two groups of participants in relation to gender and educational level. Linear regression analyses was used to predict relationship between educational level of participants and their functional cognitive abilities. A statistical level of 95% ($p<0.05$) was considered the significance limit for all statistical tests.

4 RESULTS AND DISCUSSION

The analysis of the educational status of the participants shows that the most participants in both groups had completed elementary school (51.4%), followed by high school (32.9%), while only one respondent without dementia had a college degree (Table 1). The comparison of the study groups did not reveal any significant difference between the respondents in the educational level ($\chi^2=2.26$; $df=3$; $p=0.52$). The number of illiterate persons older than 10 years of age, marked since 1971, was 23.2%, has been steadily declining to 2.8% in 2013 [16]. Although Bosnia and Herzegovina is today among the countries where adult literacy rates are near 100% according to UNESCO Institute for Statistics (UIS) data [17], the majority of older people living in Bosnia and Herzegovina and the surrounding countries have a lower level of education (illiterate, only basic knowledge in reading and writing or have primary school) [18,19].

Table1. Frequency of participant with and without dementia in relation to Educational level

		Level of Education					Total
		Reading and writing without formal education	Primary (elementary) school (8 years total)	High school (11-12 years total)	College and University degree (>12 years total)		
Group	Participants with dementia	N	7	21	12	-	40
		%	17.5%	52.5%	30%	-	100%
	Participants without dementia	N	3	15	11	1	30
		%	10%	50%	36.7%	3.3%	100%
Total		N	10	36	23	1	70
		%	14.3%	51.4%	32.9%	1.4%	100%

Analyzing the educational status of participants by gender, it can be seen that most of the female respondents in both groups had completed primary school, with more female participants who had no formal educations, but only basic skills in reading and writing in the group with dementia. Male respondents without dementia were slightly more educated than those with dementia (Fig.1 and Fig.2).

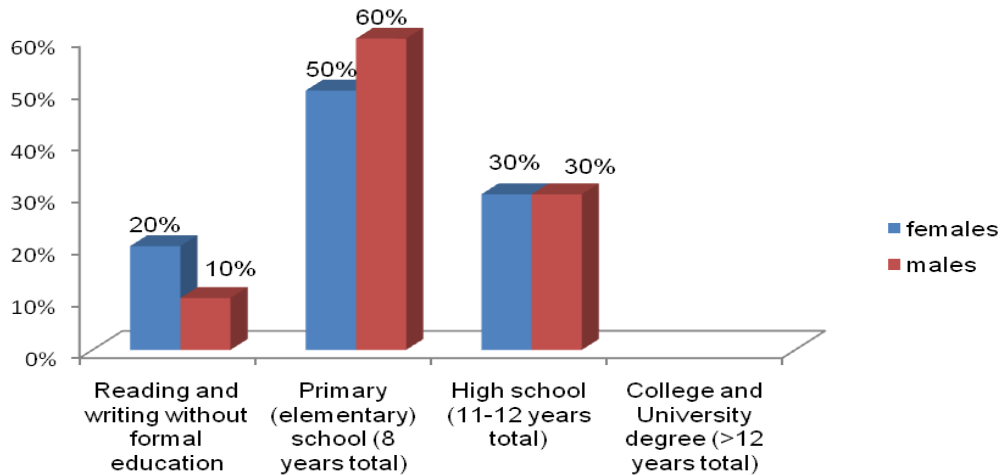


Fig 1. Educational level of participants with dementia in relation to gender

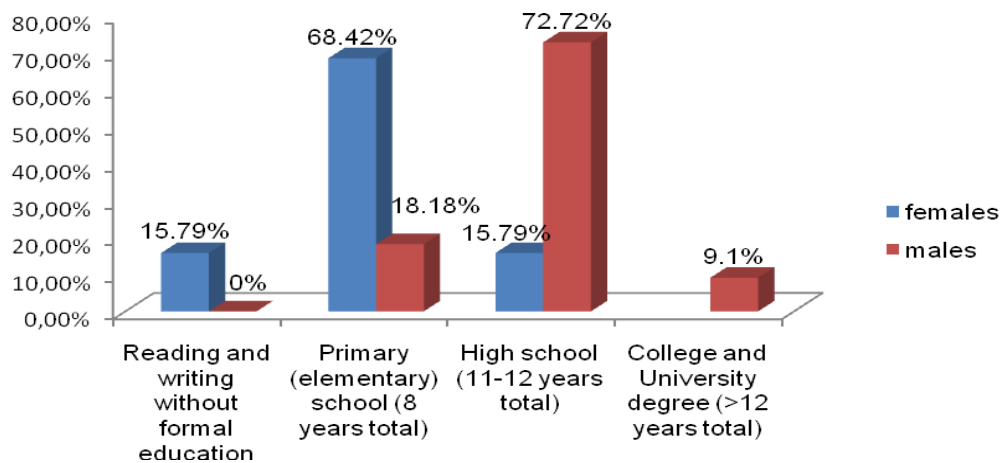


Fig 2. Educational level of participants without dementia in relation to gender

Female respondents in this study had a lower educational level, while male respondents were more likely to have completed high school or college. These results are in line with data from the Agency for Statistics B&H [16], which states about 0.8% of illiterate men and 4.8% illiterate women. Even though

the number of literate people in the world is constantly increasing, according to the UIS [17] data from 2016, 750 million adults are still lacking in reading and writing skills, of which two-thirds are females. The backwardness of women at lower levels of education is drastic [18]. The increased number of elderly women with dementia who have not had formal education indicates the possibility of the impact of early deprivation, perhaps a lower brain "reserve", which allowed dementia to occur at an earlier age [20].

Linear regression analysis was used to test if educational level significantly predicts participant's functional cognitive abilities. The results of the regression indicated the educational level in the group of participants with dementia (Table 2) explained 35.3% of the variance ($R^2=0.353$, $F(1,38)=5.4$, $p<0.025$). It was found that education level significantly predicted functional cognitive abilities ($\beta=0.35$, $p<0.025$).

In the present study, the significant positive impact of education level on the functional cognitive skills of the respondents was maintained in the group of respondents with dementia. Education, age, and cultural background are factors that can have an important impact on cognitive functioning and behavior [21]. Education is thought to be associated with better cognitive performance. However, the link between educational level and aging-related cognitive changes is still not fully understood and there are conflicting findings [22, 23]. People with better education generally also have better living conditions, healthier lifestyles and have easier access to health services [24].

Table 2. Regression analysis summary for level of education predicting Total functional cognitive abilities in participants with dementia

Variable	B	95% CI	β	t	p	
(Constant)	12.3	[10.69 13.91]		15.44	<0.001	
Level of Education	1.41	[0.18, 2.64]	0.35	2.32	0.025	
Model	R	R Square	Adjusted R Square	Std. Er.E	df	F
1	0.353	0.125	0.10	2.6	1,38	5.4

However, in the group of participants without dementia (Table 3) thus it was not found that educational level significantly predicted functional cognitive abilities ($\beta =0.3$, $p<0.114$). The results of the regression indicated the educational level in the group of participants without dementia explained 29.5% of the variance ($R^2=0.295$, $F(1,28)=2.7$, $p<0.114$).

The subject of researches for many years is how the level of education has related to a higher prevalence in persons with dementia [25]. A higher rate of illiterate people 15.67% versus 7.16% of literate people were found in six countries with dementia respondents in Latin America [26]. García et al. [25] from Spain found a similar relationship between illiterate and literate people with dementia. The risk of developing dementia decreases with educational level increasing. Dementia is more commonly diagnosed in people with lower educational status, while it is less commonly reported in persons with higher education [27]. Accordingly, illiteracy can significantly affect cognitive performance [28]. A higher level of education means that a person is more likely to compensate for the difficulties that are arising from neurodegenerative changes [29]. Highly educated individuals are more tolerant of neurodegenerative pathological processes and are less likely to suffer from dementia for this reason. Even after stroke, there are fewer individuals with high education who will develop dementia [24]. A lower level of education is among the major risk factors for Alzheimer's type of dementia. Higher educational level can therefore be classified as a prevention factor. The first signs of cognitive decline can be seen in highly educated subjects as early as 15 to 16 years before the development of dementia. In people with lower educational status, the first signs of cognitive decline may be observed slightly later, about seven years before the development of dementia [30]. A study of 872 brain donors found that higher levels of education were associated with a reduced risk of dementia. Although a higher level of education did not protect individuals from developing vascular and neurodegenerative pathology, it did seem to mitigate the impact of pathology on the development of dementia [23]. Although cognitive performance is not directly related to reading and writing skills, it is related to verbalization and skills that are learned and further enhanced during the school [31]. Education can affect a person's vocabulary and other cognitive abilities. Lower educational level is a predictor of lower results on language and knowledge tests [29]. Level of education, in addition to aging and gender, is cited as a very significant factor in the onset of dementia [20]. Schooling has a significant impact on the mechanisms of cognition, and in this context, illiteracy becomes much more than an inability to read and write [25]. The cognitive abilities of illiterate people measured by standard neuropsychological tests are significantly affected by schooling. Literacy, in a way, changes the brain's organization of cognition [32].

There are many factors that may be associated with a higher prevalence of dementia in illiterate persons, such as low cognitive reserves, insufficient risk control for cerebrovascular disease, difficulties in cognitive evaluation, and poor adaptation of neuropsychological tests for a specific population, but also income, socioeconomic factors, type of childhood development, life expectancy [25].

Table 3. Regression analysis summary for level of education predicting total functional cognitive abilities in participants without dementia

Variable	B	95% CI	β	t	p
(Constant)	21	[20.39 21.67]		64.65	<0.001
Level of Education	0.35	[-0.09, 0.8]	0.3	1.63	0.114

Model	R	R Square	Adjusted R Square	Std. Er.E	df	F
1	0.295	0.087	0.05	0.83	1,28	2.7

5 CONCLUSIONS

Changes that occur in the brain during aging can lead to a person's cognitive decline, however, certain factors can slow or reduce that decline. The results of this study showed that the majority of older respondents in Bosnia and Herzegovina have completed primary school or possess only basic reading and writing skills, without formal education. The elderly men are slightly ahead of the women, and more often have completed high school or college. Older men with no dementia have a slightly higher educational level than older people with dementia. The level of education was found to significantly predict functional cognitive abilities. Higher levels of education are related to stronger cognitive reserves, which is especially important for people with dementia at some point in their lives. These cognitive reserves can mean a slower progression of the disease and longer retention of independence in performing daily tasks and activities, which is one of the goals of treatment for people with dementia. It should also be emphasized that besides of having a positive impact on cognitive abilities, education has positive effects on the social status of the person as well as the economic development of the country, which should be a priority for countries with low economic status such as Bosnia and Herzegovina. By investing in a person's education, we invest in the future, because not only does it improve the economic status of a country, it also improves the quality of life of its inhabitants and is prevention factor for certain diseases that develop in old age.

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