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EVALUATION OF MEMORY FUNCTION OF ALZHEIMER PATIENTS (MONOLINGUAL, BILINGUAL) AND NORMAL PEOPLE BY REVERSE NUMBER TEST

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ABSTRACT

This research evaluates the memory performance of (monolingual, bilingual) Alzheimer patients and normal individuals through a digit backward test. The present research is applied and retrospective. It is causal comparative in its data collection. Its statistical population comprised (monolingual and bilingual) Alzheimer patients living in nursing homes or centers for caring Alzheimer patients in Fars province (2017). 90 people were considered as sample, including 60 people with (monolingual, bilingual) Alzheimer and 30 normal people as a comparison group. The measuring tools of the research were the psychological status questionnaire of the MMSE test and the digit backward span test (DBST) for working memory (WM). As for analyzing the data, this research used descriptive statistics such as mean, standard deviation, frequency, and minimum and maximum percentages according to the questions and hypotheses. Univariate analysis of variance test was used at the inferential level. The findings showed there is a significant difference between memory spans in all groups. The average of the group of normal individuals is higher than the bilingual ones with Alzheimer, and the average of the group of bilingual individuals with Alzheimer's is more than the group of monolingual ones with Alzheimer's.

Keywords: *Alzheimer's, Multilingualism, Forgetfulness, Mental processes.*

INTRODUCTION

One function of language is its role in the mental health of humans and society. A healthy thought is fully and maximally manifested based on linguistic abilities. Language, as a means of communication and expression of identity, has a significant role in the development and emergence of human thinking and inner impressions, which shows the importance of the mental health aspect of language. The activity of speech therapy and its similar fields is not only associated with the restoration and health of a person's language, but mental health and improvement is considered in them more than language health.

Alzheimer's disease is a brain dysfunction in which the patient's mental abilities gradually decline. This disease is a progressive and destructive abnormality of the brain, which is clinically defined as a decrease in memory and finally a decrease in mental functions. These deficits may include speech impairment, movement disorders, perceptual impairment, or executive function impairment. These changes result from more intense states in daily functions (Kamat et al., 2005). Kaplan and Sadock (2010) define Alzheimer as a progressive dementia in which there is

no known reversible factor and consider this disorder to include cognitive deficits with behavioral problems.

The new findings of medical science in the neuroscience, brain and cognitive sciences show that some normal behaviors and actions as normal daily activities can be effective in brain and cognitive diseases. Any damage to the brain, whether it is because of injury, disease or old age, causes a decline in cognitive affairs. Some activities, based on the theories of Stern (2002), are like exercise for the mind or the physical part of the brain and so keep the body and brain healthy and fresh, like other sports. Thus, a prepared and healthy brain can better resist and compensate for the damage to this organ.

The more mentally active a person is, the lower the capacity of the brain to suffer from failure and neurological and cognitive disorders. This theory argues that multilingualism, or the ability to speak more than one language, may help protect against mental and cognitive decline in late life. Several recent studies have also shown that the onset of dementia in multilingual individuals is later than in monolingual ones. Two examples are the studies of Carik et al. (2012) and Bialystok et al. (2007).

Bilingualism or multilingualism are terms for speaking two or more languages. Usually, the native language or the first language of the speakers is one of their two languages, and this causes them to be called bilingual (Skooten, 2006). Bilingualism, or learning a second language or even more, is also an activity that, as a very useful mental activity, challenges the mind and can prevent the occurrence and progress of Alzheimer's disease.

More precisely, bilingual individuals look for signs situationally to determine which language should be used in order to understand the environment. The other language, all the words and its belongings should be removed and controlled. These processes of selecting, applying, and inhibiting are some mental activities that exercise the brain to a high degree (Bialystok, 2004).

Bilingualism and Multilingualism

Bilingualism or multilingualism is a multifaceted phenomenon, and more detailed studies are still needed to determine all the features and aspects of bilingualism and multilingualism, and the abilities and weaknesses of bilingual or multilingual individuals. Since speaking and using two different languages has a positive effect on the cognitive abilities of the brain (Jesner, 2008; Keshavarz and Astaneh, 2004), some researchers think that bilingual individuals may have, in some aspects and mental characteristics superior to monolingual individuals.

As Hakuta's (1986) theory explains, it was thought for a long time that bilingualism in childhood affects the developing mind, and it was believed that the consequences were negative for children and learning two languages would be confusing for them. A study by Peal and Lambert (1962) reported that French-monolingual or English-French bilingual children in Montreal performed differently on tests. The authors expected to find lower scores in the bilingual group on language tasks but equivalent scores on non-verbal, spatial functioning. Instead, they found that bilingual children, especially those who needed reorganization, were superior to most tests. This unexpected difference between monolingual and bilingual children has proved in studies a significant advantage for bilingual children in their ability to solve linguistic problems based on

understanding concepts, such as a difference between the form and meaning relevant for linguistic awareness (Ben Zeev, 1977).

Research Background

Veisi, Grossi Farshi and Babapour Khairuddin (2013) compared the personality traits of bilingual and monolingual individuals. This research compares personality traits among bilingual and monolingual individuals. They selected 400 male and female students (200 bilingual and 200 monolingual) as random sampling at convenience and used the NEO_FFI short form personality trait questionnaire to collect information. The research used multivariate analysis of variance and Pearson's correlation test and t-test to analyze the data. The overall results show that the average personality traits (except neuroticism) of bilingual individuals are with alpha ($p<0.01$) higher than the average personality traits of monolingual individuals.

Amini Masoleh, Bafandeh and Ahmadi (2016) seek to find in their research, comparing cognitive flexibility and metacognitive beliefs among bilingual and monolingual Turkish, Azeri and Persian speaking individuals, an answer to whether the findings of the previous researches on the role of bilingualism in the improvement or decline of children's cognitive functions are generalizable to adult Azeri-Persian bilinguals. 61 subjects took part in Wisconsin card sorting test to measure flexibility and MCQ-30 (Memory Compensation Questionnaire) questionnaire. The results showed that the cognitive flexibility of bilingual individuals is significantly higher than that of monolinguals. The bilingualism can play an important role in increasing cognitive flexibility.

One way to increase brain activity is to learn a second language. Therefore, examining the relationship between these two phenomena, i.e. Alzheimer and multilingualism, helps possibly in the treatment and prevention of this disease and perhaps saving the lives of many individuals. Some practical reasons for the necessity of this research are the number of infected individuals in Iran and the world, the annual expenses incurred by the government and society because of this disease, and the wide spread of its complications in all social classes.

Chertkow et al. (2010) studied a sample of 632 patients diagnosed with probable Alzheimer's disease and found an almost 5-year delay in bilingual patients. Research on an immigrant group found a significant effect on patients who spoke three or more languages. That bilingualism or multilingualism is associated with a delay of 4 to 5 years in the onset of Alzheimer's disease symptoms has been recorded samples over 1000 patients.

Kardan Halvai and Vahedi (2012) in *bilingual education, individual rights and educational justice* state that bilingualism is a global phenomenon that exists in most countries of the world. The term bilingualism is usually used for individuals or communities that use more than one language in the communication; an education that emphasizes the use of a language other than the child's mother tongue as an educational medium is bilingual education. Educational systems in different countries may take different approaches to this phenomenon. The education system in the country is not exempted from this and it faces many difficulties regardless of the language problems. There is no compatibility between educational methods and rules of child's psychological development and the curriculum is only for classroom and educational use. The researchers of this article have tried, after defining bilingualism, to enter the subject of bilingual

education and examined its different dimensions. The article of has presented some suggestions for improving the education of bilinguals at the end.

Khalili Shalebaran (2013) examines the theories, approaches, and strategies of bilingual education. He argues the supporters of bilingual education believe that literacy in the local language should come before learning a second language. This will make children literate in basic subjects in their own language and learn them in their own language before teaching English. The methods of becoming bilingual are: natural method, educational method, acquisition in everyday life and academic learning. Many linguists have classified bilingualism into different types according to the time of the beginning of bilingualism and the ability and degree of linguistic mastery. Those literacy skills that a person learns in the native language are transferred to other languages too. If we do so, then the intellectual, linguistic and cultural capital of our society will increase. Since teaching the mother tongue is the most basic right of every nation and minority, issuing an official license to teach it in the educational system reduces the feeling of deprivation and discrimination among ethnic groups and minorities.

As for the cognitive and social consequences of bilingual education, Kaqalaghi (2009) argues that bilingualism, whether in its modern form or in its traditional form, has raised issues for educational systems; answering them needs detailed and comprehensive investigations so that the child can promote bilingualism in the school as a manifestation of the national pride while having a sense of self-worth and self-confidence as an important and vital asset for humans. This article is examines bilingual education in three different structures, each of which has different consequences on individual's thinking, emotions and social relations.

Khaleghi and Sheikh Milani (2010) argue in their research, cognitive and social consequences of bilingual education, that this phenomenon, like most social phenomena, has some cognitive and social consequences. Socially, second language learners, who are academically trained English language learners in this article, have more favorable social conditions in the society because of mastering the second language, having more communication skills, and the range of relationships with more individuals. These individuals experience emotional tensions and disturbances during training. These consequences are because of not understanding the material and lack of effective communication with professors. In conclusion, these individuals experience unfavorable psychological change. Cognitively, the individuals under study have a higher range of information and are more success in expressing their thoughts because these individuals are more flexible in thinking. Bilingualism is supposedly a positive phenomenon by responding to needs such as mutual understanding of cultures, communication and help in recognizing linguistic and cultural diversity.

Zandi, Arefi and Aminpour (2008) studied the writing skills of bilingual children (Kurdish and Turkish) in primary schools (a case study in Mahabad). They first measured their linguistic efficiency and then measured the demographic variables in order to measure the writing skills of bilingual children. Linguistic efficiency in this research means sentence length and sentence complexity. The measurement of linguistic efficiency is based on counting the number of words, simple and complex sentences. All fourth and fifth-grade students of Mahabad make up the statistical population of this research. The results showed that there is no statistically significant difference between Kurdish and Turkish bilingual students' writing skills. Literacy of parents

(father) has a significant effect on the writing skills of bilingual students. Gender has a significant difference between the writing skills of male and female students.

Perani et al. (2016) investigated brain metabolism in the effect of multilingualism on cognitive performance. 85 Alzheimer's patients took part in the research in two bilingual and monolingual groups. As the results of neurological tests showed, not only bilingualism but also the duration of mastery of the second language has a significant effect on delaying the onset of Alzheimer's disease.

Bialystok et al. sought to find an answer to the question: what evidence is there for the effect of bilingualism or multilingualism on mental performance? They reported that bilingualism in children (2001) and adults (2006, 2004) increases specific skills of cognitive control and attention; the languages cause greater attention to monolingual production, and this greater cognitive demand increases the development of a higher level of attentional control. These results raise whether these highly practiced and developed skills in the bilinguals may have a positive effect on old individuals being exposed to dementia. Preliminary evidence is in favor of this conclusion, as reported in a study by Bialystok (2007). They studied the symptoms of dementia in 184 patients, half of whom were bilingual, and reported that the delay in the onset of symptoms was over 4 years in bilinguals compared with monolinguals.

MATERIALS AND METHODS

The present study is a retrospective applied research and causal-comparative in collecting data.

The population under study in this research are patients with Alzheimer's disease living in nursing homes or centers on the care of Alzheimer's patients in Shiraz. Their Alzheimer's disease in the second half of 2017 was such that medically they were sick. These patients are examined comparatively based on the bilingualism.

The statistical sample of this research comprised 60 men and women with Alzheimer's disease, monolingual Persian speaking, bilingual or multilingual individuals, and 30 normal individuals in Shiraz. The participants were in the age range of 45 to 75 years. All the participants with Alzheimer's disease were at a level of disease where they visited a doctor or treatment or care center at least once because of Alzheimer's disease and were recognized by the doctor as a patient with Alzheimer's disease. Sampling by random method at convenience occurred in 2017.

An equal number of normal individuals were selected, after identifying the main patients taking part in the test, as the comparison group (control group), almost all of them were family members of the patients. The doctors accompanying this research have confirmed the physical and mental health of these individuals.

The exclusion criteria were the old people who did not have education and those who, based on the approval of the neurologist and the information in the medical records of older adults, had problems with vision, hearing, movement, and any other problem other than Alzheimer's. We checked the medical records of the old people in nursing homes in Shiraz. The research psychologist gave, after this initial screening, the explanations to them about the objectives and the process of the research in order to get permission from the families of older adults to take

part in the test. It is noteworthy that implementing this research was with no physical and social harm to older adults.

The required information was collected through field methods. The primary tool of this research was digit backward test (DBT) for assessing the working memory (WM) span (Hudson, 1966).

Working memory (WM) span test with digit backward test (DBT) (Hudson, 1966)

This test determines the capacity of working memory. The numbers from 2 digits to 8 digits are spelled out; the participants must listen carefully to the invigilator while reading and do not use their pens. Then they will have a few moments to write what they have heard in reverse in their appropriate place or to repeat it orally. Two numbers are read from each digit.

This task contains 21 series of numbers, which are presented in 7 sections with 2 attempts. The numbers in each section are 3-4-5-6-7-8 and 9, respectively. Two attempts of each series contain simply 5 numbers and continue in the same way until the end. For example, the first attempt in the first part, where each series contains 3 numbers, comprises the numbers 3-8-9 and the second attempt contains the numbers 1-3-6. The second part also includes two attempts (attempts 4-5 and 6), but this time each attempt contains 4 numbers. Attempt 4 includes the numbers 2-5-0-4, attempt 5 includes 4 numbers 1-8-6-3, and attempt 6 also includes 4 numbers 9-2-7-5. Thus, the number of digits increases in three attempts until in attempts 19, 20 and 21 (seventh part) the number of digits in each attempt reaches 9 (for example, these 9 numbers in attempt 19 are 0-7-1-8-3-6-3-4-5).

The procedure is: the experimenter reads the digits one number per second in a loud and clear voice, and he gives ten seconds to the participant after reading each series to remind and repeat the digits upside down and vice versa. The task is stopped when the participant cannot correctly remind and repeat both attempts of a section.

Tafi and Shahabi (2016) conducted research in Iran to identify the predictability of working memory for Alzheimer's disease. The research population comprised old people over 60 years old in Qazvin. A sample of 148 people (75 men and 73 women) with an average age of 67.4 years were selected by sampling method at convenience to measure memory capacity through digit backward test (DBT).

Alvi et al. (2004) and Gathercole et al. (2004) have used this tool to measure the short-term accumulation of verbal information, which shows the validity of the suitable construct according to experts. The retest validity of this test was reported as 0.81 in the research of Alvi et al. (2004) and 0.81 in that of Gathercole et al. (2004). Vahid Nejati (2009) in Iran used this test in an old sample.

Finally, this research used descriptive statistics, such as average, minimum and maximum standard deviation, according to the questions and hypotheses. It used analysis of variance test at the inferential level.

RESULTS AND DISCUSSION

Demographic information of the participants

Table 1. Frequency and percentage of respondents by education

Group	Education	Frequency	Percentage
Normal individuals	Diploma & lower	18	60
	BSc & higher	12	40
	Total	30	100
Bilingual individuals with Alzheimer's disease	Diploma & lower	16	33.53
	BSc & higher	14	64.46
	Total	30	100
Monolingual individuals with Alzheimer's disease	Diploma & lower	19	33.63
	BSc & higher	11	64.36
	Total	30	100

As you can see in Table 1, the highest frequency in diploma level and below is among monolingual Alzheimer's patients, and the highest frequency in high level of education belongs to the bilingual Alzheimer's group.

As you can see in Table 2, the average memory span of monolingual Alzheimer's patients is M = 1.96, and the highest is M = 4.16 for normal individuals.

Table 2. Mean and standard deviation of memory span

Variable	Group	Mean	Standard deviation
Memory span	Normal individuals	4.16	0.6
	Bilingual individuals with Alzheimer's disease	2.8	0.76
	Monolingual individuals with Alzheimer's disease	1.96	0.41

Research Hypothesis Test

Performance in memory spans of (monolingual, bilingual) Alzheimer's patients differs from normal individuals.

Univariate analysis of variance test was used to investigate this research hypothesis. But the assumption of equal variance was investigated using Levine's test before performing the analysis. Table 3 gives the results.

Table 3. Results of Levine's test based on the assumption of equal variance of the groups

Variable	F	Df1	Df2	p

Memory span	1.07	2	87	0.14

As you can see, the results of Levine's test are not significant, so the assumption of equality is maintained and the analysis of variance test is usable.

Table 4. Results of analysis of variance test to compare cognitive performance in groups

Index		SS	DF	MS	F	P
Memory span	Intergroup	02.74	2	01.37	89.61	0.001
	Intra-group	*93.35*	87	41.0		
	Total	*95.109*	89	-		

As Table 4 shows, there is a significant difference between the average memory span scores in the compared groups. The results of the LSD follow-up test show which groups have a significant difference.

Table 5. Results of LSD follow-up test to compare memory span between groups

Variables	Groups	Difference of averages	Standard deviation error	P
Memory span	Normal and bilingual individuals	1.36	0.16	0.001
	Normal and monolingual individuals	2.2	0.16	0.001
	Bilingual and monolingual	0.83	0.16	0.001

As the results of Table 5 show, there is a significant difference between memory spans in all groups. A look at the averages shows that the average of the group of normal individuals is higher than the bilingual ones with Alzheimer's and the average of the bilingual group of individuals with Alzheimer's disease is higher than the monolingual ones with Alzheimer's disease.

CONCLUSION

Alzheimer's disease is a brain dysfunction in which the patient's mental abilities gradually decline. This disease is a progressive and destructive abnormality of the brain, which is clinically a decrease in memory and in mental functions. These deficits may include speech impairment, movement disorders, perceptual impairment, or executive function impairment. These changes result from more intense states in daily functions (Kamat et al., 2005).

This disease besides the many problems that causes for the patient including the inability to perform daily tasks, forgetting essential issues such as home address, the location of household objects, and the problems it causes for those around him, can even lead to the death of the patient. This shows the importance of finding more useful ways to prevent, slow down the progression and deal with Alzheimer's disease.

Iran, like many other countries, is an aging country and the percentage of old people is increasing. The percentage of retired people will be higher than the current time in the coming years. Taking care of the physical, mental health of the old and retired people in the society is a serious need of every society.

As for the research hypothesis that the memory performance of (monolingual, bilingual) Alzheimer's patients differs from normal individuals, the results of Levine's test were not significant, as in the first hypothesis. Hence, we used analysis of variance. The results showed that there is a significant difference between the average memory span scores in the compared groups. The LSD test showed that there is a significant difference between the memory spans in all groups. The average of the group of normal individuals is higher than the group of bilingual individuals with Alzheimer's disease and the average of the group of bilingual individuals with Alzheimer's is higher than the group of monolingual individuals with Alzheimer's.

A high percentage of individuals with Alzheimer's do not know the ways of preventing this disease. Therefore, informing individuals about it can be very important. Introducing ways to improve mental performance such as different mental activities can be very effective, activities such as learning music, intellectual games such as chess, etc. Learning a second language as a working procedure can also be introduced to individuals to improve brain function, which, of course, has expanded a lot in recent years.

Thus, researchers and activists in older adults health can improve or prevent Alzheimer's disease and similar mental and brain diseases in older adults by designing a suitable system and providing the conditions for learning a second language for older adults in a fun way and as a hobby. Government organizations responsible for older adults and social health can plan learning a second language or other similar mental activities as part of comprehensive public programs, especially for adults, as a preventive and general approach to improve the general health of the society.

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