



Diabetes and its predictive role in the incidence of Alzheimer's disease

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Introduction: Diabetes is the fifth cause of death in most countries of the world and Causing disability, high cost of treatment and increased mortality. Some studies indicate that one of these complications of diabetes is the development of Alzheimer's disease. So this study was done to the aim of determine the predictive role of diabetes in the development of Alzheimer's disease in diabetic patients admitted to hospitals Three cities from Khuzestan province. **Materials and methods:** This study is a retrospective cross-sectional analytical descriptive study. The study included a survey of 1855 cases of diabetes patients admitted to hospitals in Shoushtar, Behbahan, and Abadan, which was conducted by eight investigators. The records of these patients diagnosed with diabetes and referring to medical centers in the mentioned cities during 2015-2017, which were extracted from medical records of city hospitals and entered the study. The data in this study included demographic, laboratory and clinical data of patients. Then, Data were entered into SPSS software version 17 and analyzed by descriptive statistics, analytical tests and significant level of $P < 0.05$. **Results:** The study included 1855 individuals with diabetes with an average age of 57.00 ± 46.23 years. Of these, 1122 (60.4%) were female and the rest were male. In terms of job, the highest percentage was related to free employment with 653 people (35.2%). In this study, 258 (13.9%) of those with diabetes also had Alzheimer's disease. And a statistically significant relationship was found between jobs with those with Alzheimer's disease (0.003). There was a significant relationship between diabetes and those with Alzheimer's disease ($p = 0.006$). But there was no significant relationship between diabetes and those with a history of cardiovascular disease ($p = 0.09$). **Conclusion:** In this study, there was a significant relationship between diabetes and those with Alzheimer's disease. Therefore, this study showed the risk of Alzheimer's disease in diabetic patients in the three counties. Therefore, follow-up is needed to prevent diabetes. And measures to change lifestyles, such as the use of aerobic exercise, a healthy diet should be done. Also, regular referral to the Doctor should be done in these patients.

INTRODUCTION

Diabetes is the fifth cause of death in most countries of the world, causing disability, high costs of treatment and increased mortality (1). This disease is a chronic, metabolic disease and clinically and genetically heterogeneous Which is characterized by increased levels of blood glucose and metabolic disorders of carbohydrates, proteins and lipids (2,3). Inappropriate combination (low physical activity and unhealthy foods) has increased the uncontrolled prevalence of diabetes in the world (4,5). In 2014, the global prevalence of diabetes among adults older than 18 years was estimated at 9%. (6). Also, about 2 percent of the general population of Iran and 7.3 percent of people over 30 have diabetes. This disease is associated with many complications, which in many cases is not reversible (7). One of these complications of diabetes is the development of Alzheimer's disease (8). Alzheimer's

disease is a chronic progressive and debilitating brain disorder that has a profound effect on memory, intelligence and self-care. Alzheimer's causes include a progressive deficiency in brain glucose, energy metabolism, cellular skeletal system, myelin retention, and nerve flexibility (8,9,10). Evolving evidence supports the concept that in Alzheimer's disease, metabolic disturbances are signaled by insulin deficiencies and insulin-like growth factor (IGF) (11). Given the demographic situation of Iran which is about 31 million middle-aged, In the next two decades, older people will form a large population. On the other hand, the increase in Alzheimer's in the elderly will lead to the spread of this disorder and the adverse effects and adverse effects in the next two decades. And in the Madmoli et al study, Alzheimer's prevalence is almost all in diabetic patients over 60 years old, which can be indicative of the risk of developing Alzheimer's disease in diabetic patients (8,12,13). And that planning to increase the level of health of patients requires an examination of the disease and its risk factors to prevent its possible complications, and also So far, few studies have been conducted to investigate the risk of Alzheimer's disease in diabetic patients in Khuzestan province. Therefore, the aim of this study was to determine the predictive role of diabetes in Alzheimer's disease in three cities of Khuzestan province during 2015-2017.

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Table 1 Demographic characteristics of patients with diabetes and its association with Alzheimer's disease and history of diabetes by using Chi-square and Chi-square Pearson tests

Variable	Classification	Number	Percentage	Relationship with the history of diabetes P value	Relationship with the Alzheimer's disease P value
sex	Male	733	39.6	p <0.0001	0.07
	Femle	1122	60.4		
Marital status	Married	988	53.2	0.08	p=0.005
	Single	667	35.9		
	Wife died	200	10.7		
Education	Illiterate	242	13.0	p=0.001	0.06
	Illiterate-middle school	689	37.1		
	Diploma	791	42.6		
	Bachelor's degree and higher	133	7.1		
occupation	Free	653	35.2	0.009	0.003
	Unemployed	322	17.3		
	Employee	687	37.0		
	housewife	193	10.4		
The economic situation (Monthly-Tomans)	Up to 1.5 million	1152	62.1	0.03	0.007
	Above 1.5 million	703	37.9		

* A significant level below 0.05 is considered.

MATERIALS AND METHODS

This study is a retrospective cross-sectional analytical descriptive study. The study included a survey of 1855 cases of diabetes patients admitted to hospitals in Shoushtar, Behbahan, and Abadan, which was conducted by eight investigators. Patients who were diagnosed with diabetes and referred to treatment centers in the mentioned cities during 2015 to 2017 were included in the study. This research is a result of the Behbahan University of Medical Sciences research project by code IR.BHN.REC.1397.9557. After obtaining the necessary permissions and financial support from the university, the patients were informed by written informed consent and their files were used for this study.

The data needed for the study were extracted from medical records of the hospitals of the mentioned cities by examining patients' files between 2015 and 2017. The criteria for entering the study included all diabetic patients in each age group and sex with the medical diagnosis of the disease, of cases that had medical diagnosis other than the disease, and files that were incompletely filled, were not used and were excluded. In order to study the files and collect data, a written Letter of Introduction was received by the Vice-Chancellor of Education and Research of the medical universities of the mentioned city. And then, the records of patients referring to health centers in the archives department were used, that the required information was collected through a researcher checklist from the records. The data in this study included demographic, laboratory and clinical information such as gender, age, marital status, ethnicity, occupation, economic status, level of education, having or not having a history of diabetes, cardiovascular and Alzheimer's disease, and family history of diabetes. Data were then entered into SPSS software version 17. Data were analyzed by descriptive statistics including enumerated tables, mean, standard deviation and variance, and analytical tests including Chi-square and Chi-square Pearson and at the significant level of $P < 0.05$.

RESULTS

The study included 1855 individuals with diabetes with an average age of 57.00 ± 46.23 years. of these, 1122 (60.4%) were female and the rest

were male. In terms of the economic situation, 1152 people (62.1%) had a poor financial status and the rest had a good economic situation. In terms of job status, the highest percentage was related to free employment with 653 (35.2%). In terms of ethnicity, the highest percentages were Lor people with 1233 people (66.4%), Shoushtari people with 422 (22.7%) and 200 (10.7%) Arabs, respectively. There was a significant relationship between the level of education with history of diabetes ($p = 0.001$). Also, there was a significant relationship between jobs with those with Alzheimer's disease (0.003). Table 1 shows the demographic information of these individuals.

In this study, there was a significant relationship between marital status and those with Alzheimer's disease ($p = 0.005$). However, there was no significant relation between diabetes history and this status ($p = 0.08$), (Figure 1).

In this study, 258 (13.9%) of those with diabetes also had Alzheimer's disease. Also, 658 patients (35.4%) had diabetes history, 452 (24.3%) had family history of diabetes, 326 (17.5%) patients had cardiovascular disease. There was a significant relationship between diabetes and those with Alzheimer's disease ($p = 0.006$). But there was no significant relationship between diabetes and those with a history of cardiovascular disease ($p = 0.09$), (Figure 2).

In this study, there was a significant statistical relationship between economic status and those with Alzheimer's disease ($p = 0.007$). However, there was no significant relation between diabetes history and this status ($p = 0.03$), (Figure 3).

DISCUSSION

Diabetes is associated with many complications, which in many cases is not reversible (7). One of these complications of diabetes is the development of Alzheimer's disease (8). Alzheimer's disease is a chronic progressive and debilitating brain disorder that has a profound effect on memory, intelligence and self-care (8-10). So far, few studies have been conducted to investigate the risk of Alzheimer's disease in diabetic patients in Khuzestan province. Therefore, the aim of this study

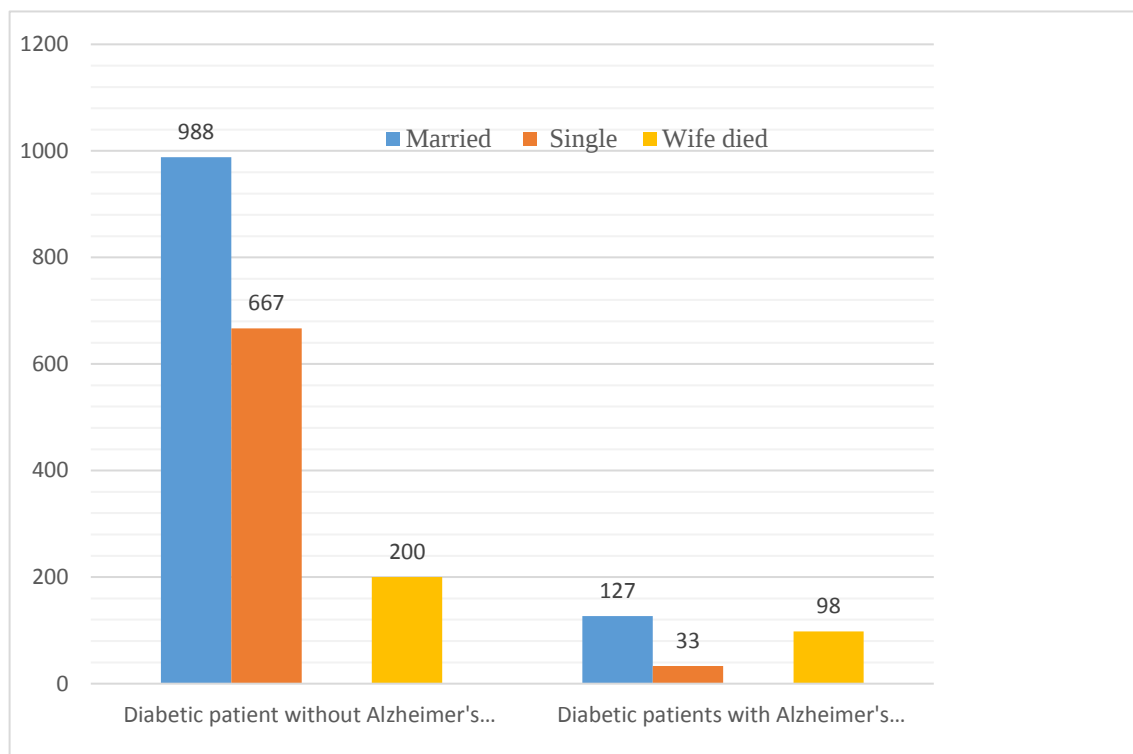


Figure 1 Frequency comparison of Marital status variables in Diabetic patients without Alzheimer's and diabetics who had Alzheimer's

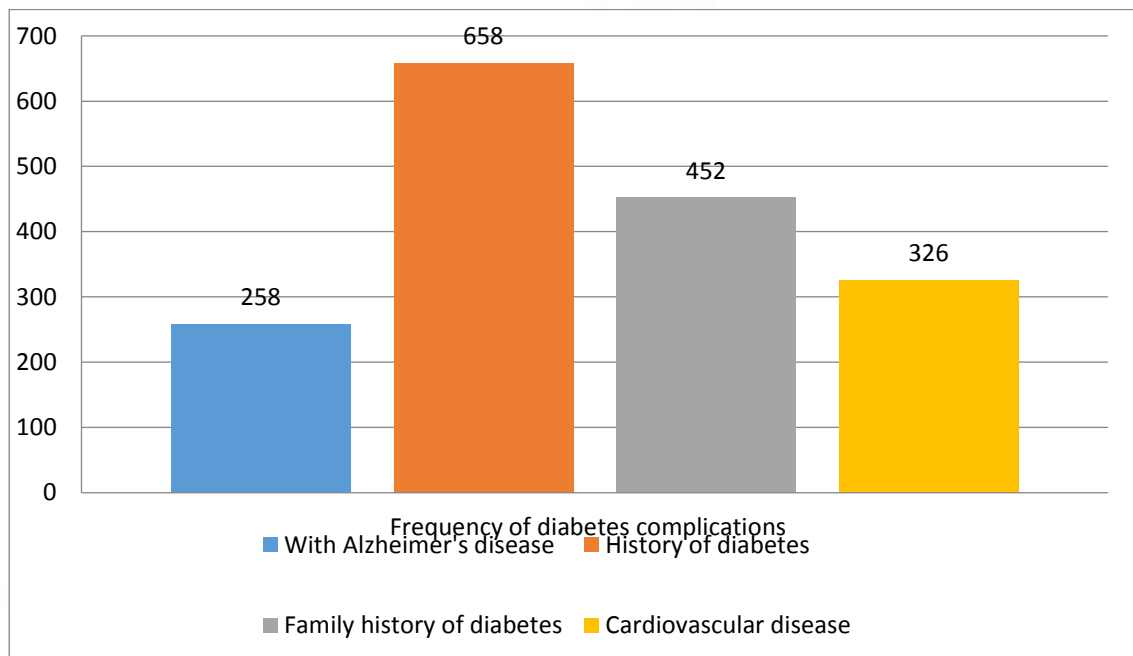


Figure 2 The frequency of complications of diabetes in diabetic patients (With Alzheimer's disease, history of diabetes, family history of diabetes, frequency of cardiovascular disease)

was to determine the predictive role of diabetes in Alzheimer's disease in three cities of Khuzestan province during 2015-2017.

In this study, the mean age of patients was over 57 years old. In the study by Raisifar et al. (8), the age of Alzheimer's patients who also had diabetes in all persons over 60 years old, this is in line with this study.

In one study, the prevalence of Alzheimer's disease was calculated. Of those over 65, 10.3% had Alzheimer's disease. 18.7% of people aged 75-84 and 47.2 % of those over 85 years old (14). Age is the greatest risk factor for Alzheimer's disease and the prevalence of this

disease increases with age. Many epigenetic changes occur with natural aging. These changes are seen in Alzheimer's disease, although these changes may occur in younger patients in patients with Alzheimer's disease, it can be confused with premature aging. The main cause of this disease is the destruction of neurons in the brain Which results in the formation of aging plates that ultimately lead to the death of neurons (15).

In this study 17.5% of diabetic patients had cardiovascular disease. While in the study of Madmoli et al., The prevalence of heart problems

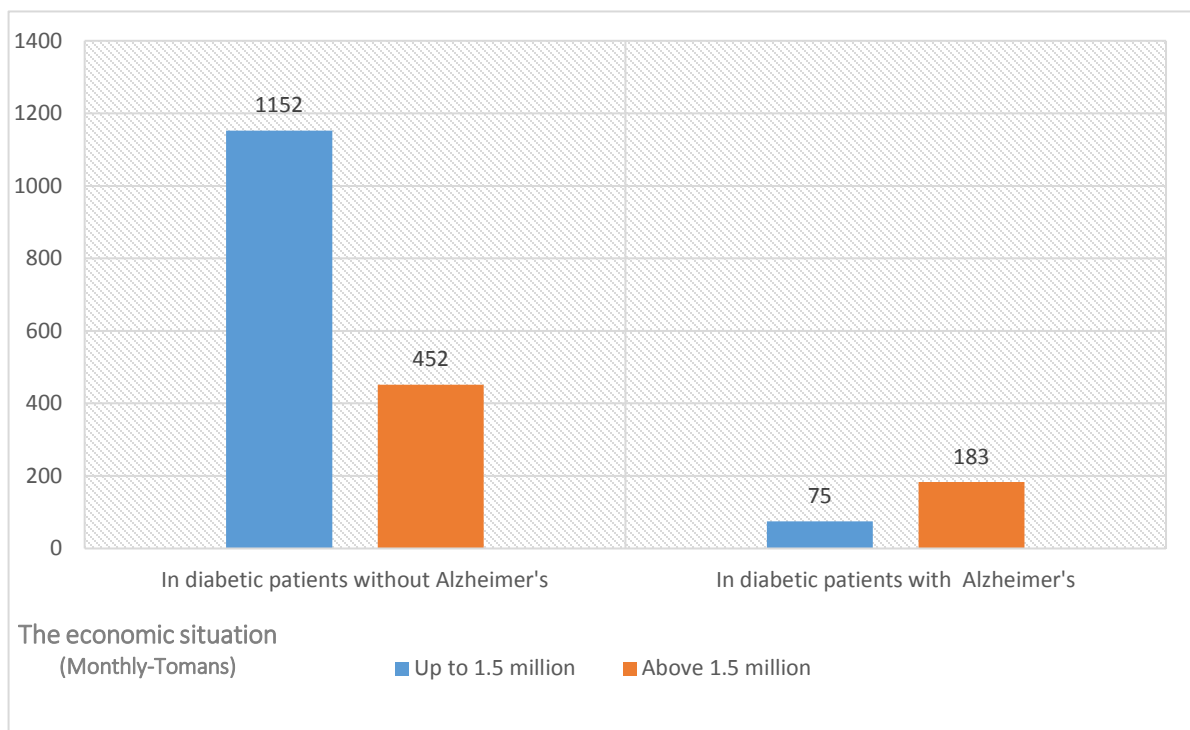


Figure 3 Frequency comparison of economic status variables in diabetic patients without and with Alzheimer's.

in diabetic patients was 39.7% and it was not favorable with this study, and this inconsistency can be due to different nutritional styles, low aerobic exercise, lack of Mediterranean diet, etc. (3). Diabetes has always been a risk factor for cardiovascular disease. For example, a study was conducted to investigate four major cardiovascular risk factors (hypertension, diabetes, cigarette and dyslipidemia) and more than 2,500 coronary patients were studied. Most of them had at least one of four risk factors (16). Also another study showed that 6.84% of women and 6.80% of men had at least one of the four major cardiovascular risk factors (hypertension, diabetes, cigarette and dyslipidemia) (17).

In this study, 13.9% of those with diabetes also had Alzheimer's disease. Also, there was a significant statistical relationship between diabetes and those with Alzheimer's disease. The results of the study by Madmoli et al. (8) showed that there is no statistically significant relationship between Alzheimer's disease and diabetes. But there was a significant relationship between insulin consumption and Alzheimer's disease that was not consistent with this study. The reason for this inconsistency can be due to differences in lifestyle in the two studies, dietary differences, and so on.

A study of some studies has shown that chronic consumption of high-fat diets and diabetes is one of the factors that reduce cognitive function and a type of dementia. In a study using magnetic resonance imaging, diabetic patients showed decreased levels of hippocampus and decreased cognitive speed compared with older adults (18).

The results of the study showed that animals undergoing induction of type 2 diabetes mellitus showed memory deficiency in comparison with non-diabetic SAMP8 mice. This memory deficit was observed using the Morris Water Maze. The authors of this article also showed that these animals were contained beta-amyloid proteins in the brain and hyperphosphorylated Tau proteins in the hippocampus which indicates similar changes to Alzheimer's disease (19).

In one study, 81 percent of Alzheimer's cases had Type II diabetes or IFG (Impaired Fasting Glucose) (20). This study also reveals the link between diabetes and Alzheimer's disease.

Epidemiological studies suggest convincing evidence for a meaningful relationship between type 2 diabetes and dementia. It also shows that Type 2 diabetes is a major cause of Alzheimer's disease (21-23). However, these findings are not controversy, and in a longitudinal survey. The researchers found that although borderline diabetes increases the risk of diabetes, dementia or Alzheimer's, the risk effects were independent rather than linked (24). This means that insulin resistance, the ability to respond to stimulation of insulin, varies in different organs (25, 26).

CONCLUSION

In this study, there was a significant relationship between diabetes and those with Alzheimer's disease. Therefore, this study showed the risk of Alzheimer's disease in diabetic patients in the three counties. Therefore, follow-up is needed to prevent diabetes. And measures to change lifestyles, such as the use of aerobic exercise, a healthy diet should be done. Also, regular referral to the Doctor should be done in these patients. One of the factors that increase the risk of diabetes is insulin resistance. We can be resistant to insulin for years without knowing this. This condition usually does not cause significant symptoms, So, it's important that your doctor regularly checks for your blood glucose. The American Diabetes Association (ADA) estimates that up to 50% of people with insulin resistance and pre-diabetes will develop type 2 diabetes, if lifestyle changes do not create, therefore, the need for more changes in the lifestyle of individuals, especially the elderly. It is also necessary to conduct more epidemiological and clinical investigations in order to investigate the relationship between these two diseases in a wider and larger volume.

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Diabetes, Risk Factor, Alzheimer's Disease, The Predictive role

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Conflict of interest

There are no conflicts of interest in this study.

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