Prevalence and Risk Factors of Alzheimer's Disease in Elderly People, Kerman, Iran: A House Based Survey

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ABSTRACT

Background: Population aging is occurring in almost every country in the world, resulting in reduced mortality, reduced fertility, and increased life expectancy. With an increase in the elderly population, chronic diseases related to aging, including Alzheimer's disease will also increase, which is a big problem for the health in society. Since early diagnosis can help a more effective treatment, this study was conducted to determine the prevalence of Alzheimer's disease and its risk factors in people aged 50 and above in Kerman, Iran.

Methods: For sampling, a one-step random cluster method was used across 11 districts of Kerman for one year and a ten-item questionnaire provided by Alzheimer's World Association and MMSE was employed for data collection.

Results: A total of 4,191 people were surveyed, of which 1,213 were 50 years of age or older. 1111 people had disorder at least one question in the MMSE ten-item questionnaire. 26 of these people were diagnosed with Alzheimer's disease after further investigation.

Conclusion: The prevalence of Alzheimer's disease in Kerman was similar to that in the rest of the world. Many of the cases were over 80 years old and had serious illnesses. If they had been diagnosed in the early stages of the disease, their disease could be managed at a lower cost and more effectively.

Keywords: MMSE, Neurology, Persian medicine, Traditional medicine

Introduction

Population aging is occurring in almost all countries worldwide (1) and is one of the greatest achievements of humanity due to reduced mortality and, most importantly, reduced fertility and extended life expectancy (2). On the other hand, with the increase in the population of the elderly, chronic diseases related to aging have also increased around the world (3). Alzheimer's disease (AD), which is the leading cause of dementia (4, 5) and the most common and important degenerative disease of the brain (6, 7), shows itself with reduced memory and cognitive impairment (4, 5). AD, as a chronic disorder associated with aging, has caused disability in the elderly population (8). Dementia is about 6-7% prevalent among people over 60 years of age (9), and the global prevalence of AD is about 47 million (10), which is expected to grow significantly even in high-income countries (11). For example, by the middle of the present century, the number of Americans aged 65 and older with AD-induced dementia may reach 13.8 million (12). The prevalence of AD doubles every 5 years after the age of 65, such that 40 to 50 percent of the people over the age of 85 are suffering from AD (13, 14). Some studies have shown that AD is more common in women, rather than in men (15). Currently, most of the world's elderly population live in developing countries. Forecasts show that the elderly are still increasing in the less developed regions of the world (16- 18). In Iran, people over the age of 65, who accounted for 5.2 percent of the population in 2000, will reach 21.7 percent in 2050, according to the United Nations. Therefore, Iran will become one of the countries at a serious risk of AD (19). Scientifically, the mechanisms of these changes have not been known yet, but they appear to be influenced by the environment and genetics (4, 5). Many risk factors, including aging, insulin resistance, vascular factors, lipoprotein E4 genotype, obesity, dyslipidemia, hypertension, and inflammatory markers, contribute to AD (20-23), but the most important cause of the disease is old age (24). Pathologically, the disease is characterized by the appearance of a large number of extracellular senile plaques, vascular amyloid deposits, and neurofibrillary tangles. The disease begins silently, or more often with memory loss and forgetfulness (6), in the form of a mild cognitive impairment (MCI), that is expected with age and does not interfere with a person's daily activities (25), as the first signs of AD, and with its progress leading to restlessness, anxiety, depression, obsessive-compulsive disorder, judgmental disorder, paranoid mood disorders, sleep disturbances, and anorexia nervosa and even awareness of time and place is impaired, and the patient's behavior, speaking, and writing is gradually impaired. Signs of the final stages then appear, including aphasia, urinary and fecal incontinence, inactivity, and falling into an unpleasant plant life, and the eventual death from infection or other factors (6). Therefore, due to the effect that this disease has on interpersonal and social relationships, it is a major problem for the health of society (26). Furthermore, the associated memory impairment indirectly causes many economic and psychological problems for other family members and the community recognizes that early detection will be very helpful in improving treatment outcomes (27). Unfortunately, despite the epidemiological importance of AD, its exact prevalence is not known in Kerman, nor in many parts of Iran. Given that definitive treatment is not available in this disease, detection of the disease in the early stages and providing health care and necessary training to prevent the progression of the disease and, hence, the occurrence of severe and irreversible complications, are necessary to reduce the pertaining economic and social burden. Therefore, the aim of this study was to determine the prevalence of AD, as well as its risk factors in the residents of Kerman, Iran, aged 50 and above, in an attempt to use the obtained information to avoid being afflicted with the disease and to prevent its progression from mild to severe, and provide useful training in this area for the necessary health planning.

Materials and Methods

This descriptive-analytical cross-sectional study was conducted from August 2018 to August 2019 in Kerman, Iran. For sampling, a one-step random cluster method was used. Randomly, 11 districts of Kerman, Iran, and in each region three main clusters were considered and approximately 30 to 35 families were selected by screening in each cluster. All members of a family was counted by a primary census, followed by the selection of people aged 50 and above (28), who did not have other neurological diseases, such as stroke, epilepsy, multiple sclerosis, hydrocephalus, Parkinson's, and physical illnesses, such as lung disease, chronic obstruction associated with hypoxia,

insulin-dependent diabetes, metastatic brain cancer, and known psychiatric illnesses under psychiatric treatment (29). Individuals who had the physical or mental ability to answer questions and agreed to participate in the study entered the second stage (30). Data collection tools in this study were a demographic questionnaire and a self-made questionnaire for risk factors of memory impairment including age (28, 31), sex (32), high blood pressure (33), diabetes (33, 34), hyperlipidemia (24, 33), smoking (35, 36) and family history (37). A ten-item questionnaire consisting of 10 warning signs to check for memory impairment, as well as the MMSE (Mini Mental State Examination) questionnaire were the additional tools. The ten-item questionnaire was provided by Alzheimer's World Association. MMSE is the most widely used tool for measuring cognitive function around the world and is primarily used to identify cognitive impairment and assess the severity of dementia (29, 38). It has been translated and standardized in different languages, including Persian (39). This questionnaire includes 30 questions .Each question has one score. A total score of above 24 is normal for literate people and a total score of above 19 is normal for illiterate people. For scores below 24, neurological counseling is considered (40). The advantages of this test are that the test time is short, the test tool is portable, the test method can be trained in a short period of time, and it evaluates various cognitive functions. People with impaired MMSE in this study were examined by a neurologist for further evaluation and, if AD was confirmed, they underwent common AD treatment. Because prevention is more important than treatment, and nutrition plays an important role in preventing and exacerbating AD (41), making its treatment easier and less costly, useful nutritional measures (42) by a Persian medicine specialist were taught to the patients and their families to improve their lifestyles. Figure 1 shows the process of the study.
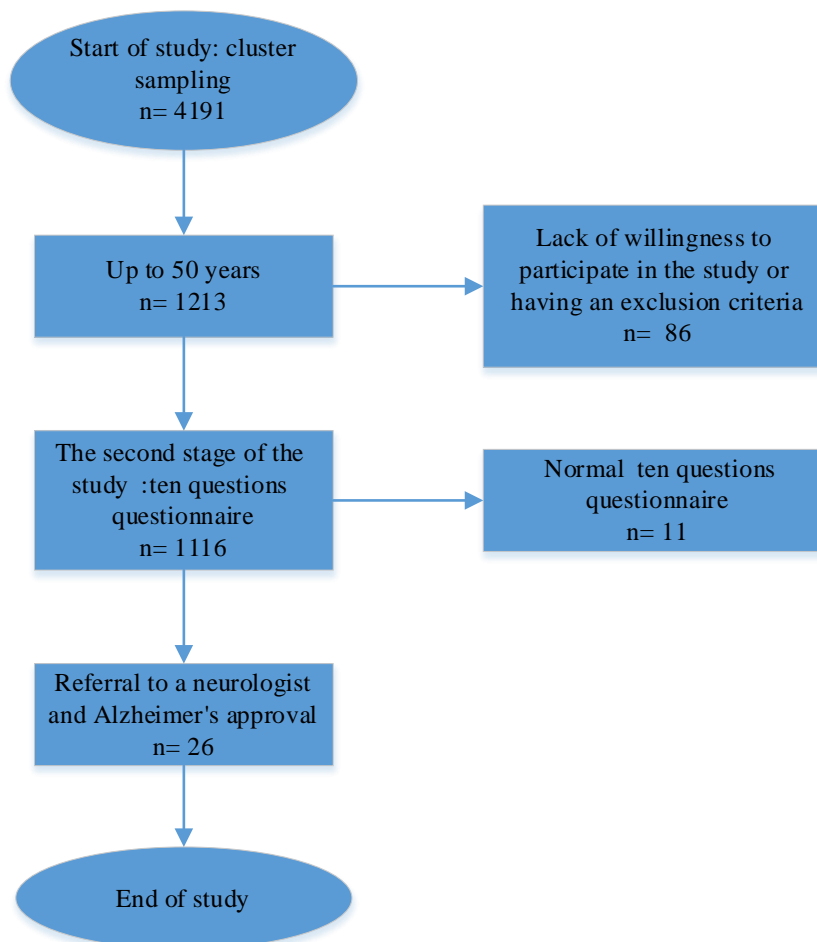

Figure 1. Flowchart of the study process

Sample size assessment

The sample size was determined from a homogeneous and accessible society by a biological statistician and according to global epidemiological studies, and given the fact that 300 out of every 100,000 people suffer from AD (5). Therefore, at the end of the study, a total of 1116 eligible individuals aged 50 and above, were entered the study through house to house survey by trained experts.

Sample size formula

$$n = \frac{z^2 pq}{d^2}$$

Z: Reliability level: 95%: 1.96
P: The predicted ratio in the community
D: Desired accuracy or marginal error rate (between 0.01 to 0.1)
Q: 1-p

Statistical Analysis

The data were entered into SPSS22 after collection. Data descriptions were reported using frequency distribution and qualitative variables by percentage. Quantitative variables were described using the mean standard deviation. In one-way analysis of variance, Chi-square test was used to evaluate the demographic variables and baseline variables in the two groups.

Results

A total of 4191 people from Kerman, Iran were surveyed, of whom 1991 were men and 2,200 were women. Eventually, 1213 people aged 50 and above were tested by the ten-item questionnaire and 1116 of them had a disorder in one or more of the questions, and thus entered the second stage of the study. Due to the normality of the ten-item test or various other reasons, 97 subjects were excluded from the second stage of this study. For those who entered the second stage, an MMSE test was performed to confirm memory impairment. Subjects with impaired MMSE test were referred to a neurologist for a visit and other diagnostic procedures to rule out other causes of dementia. Eventually, 26 cases were diagnosed with AD. In the second phase of the study, 404 participants were men (36.2%) and 712 ones were women (63.8%). About 10 percent were illiterate and 90 percent were literate. Furthermore, about 0.9 percent were single and about 98.77 percent were married. Among the subjects 9.3% had diabetes, 12.27% had hypertension, and 9.8 percent had hyperlipidemia, 7.7 percent were smokers and approximately 4% had a family history of AD. Most of the participants in our study were between 51 and 60 years old with a frequency of 42.5%. Details of the study results are given in Tables 1 and 2.

Table1. The prevalence rate of Alzheimer′s disease in the studied population based on the age groups and sex

Age (year)	the whole papulation			Alzheimer′s disease patients (95% CI)*		
	Men	Women	Both sex	Men	Women	Both sex
≤50	1531(51.41 %)	1447 (48.58 %)	2978	-	-	-
51-60	175 (36/08 %)	310 (63.91 %)	485	0 (0.00%)	2 (0.04%)	2 (0.04%)
61-70	152 (39.37 %)	234 (60.62 %)	386	0 (0.00%)	0 (0.00%)	0 (0.00%)
71-80	72 (35.29 %)	132 (64.70 %)	204	0 (0.00%)	0 (0.00%)	0 (0.00%)
81-90	53 (45.29 %)	64 (54.70 %)	117	0 (0.00%)	16 (0.38%)	16 (0.38%)
>90	8 (38.09 %)	13 (61.90 %)	21	8 (0.19%)	0 (0.00%)	8 (0.19%)
Total	1991	2200	4191	8 (0.4%)	18 (0.8%)	26 (0.62%)

Data have been presented as number (percent)
* Confidence interval

Table 2. The relationship between Alzheimer′s Disease and the studied variables

Variables	Alzheimer′s Disease	Frequency n (%) Normal population	Total	P-value
Age				
51-60	2 (0.18%)	473 (42.38%)	475 (42.56%)	
61-70	0 (0.00%)	343 (30.73%)	343 (30.73%)	
71-80	0 (0.00%)	180 (16.12%)	180 (1.61%)	0.000
81-90	16 (1.43%)	81 (7.25%)	97 (8.69%)	
>90	8 (0.71%)	13 (1.16%)	21 (1.88%)	
Sex				
Male	8 (0.71%)	396 (35.48%)	404 (36.20%)	0.360
Female	18 (1.61%)	694 (62.18%)	712 (63.80%)	
Marital status				
Single	0 (0.00%)	10 (0.90%)	10 (0.90%)	0.624
Married	26 (2.33%)	1080 (96.77%)	1106 (99.10%)	
Educational level				
Illiterate	4 (0.35%)	110 (9.85%)	114 (10.21%)	
Elementary	17 (1.52%)	218 (19.53%)	235 (21.05%)	
Middle school	1 (0.09%)	163 (14.60%)	164 (14.69%)	0.000
High school	4 (0.35%)	334 (29.92%)	338 (30.28%)	
Academic	0 (0.00%)	265 (23.74%)	265 (23/74%)	
Family history				
Yes	2 (0.18%)	42(3.76%)	44 (3.94%)	0.000
No	24 (2.15%)	1048 (93.90%)	1072 (96.05%)	
Diabetes mellitus				
Yes	4 (0.35%)	100 (8.96%)	104 (9.31%)	0.920
No	22 (1.97%)	990 (88.70%)	1012 (90.68%)	
Hypertension				
Yes	5 (0.44%)	132 (11.82%)	137 (12.27%)	0.877
No	21 (1.88%)	850 (76.16%)	979 (87.72%)	
Hyperlipidemia				
Yes	7 (0.62%)	103 (9.22%)	110 (9.85%)	0.000
No	19 (1.70%)	987 (88.44%)	1006 (90.14)	
Cigarette smoking				
Yes	0 (0.00%)	86 (7.70%)	86 (7.70%)	0.325
No	26 (2.33%)	1004 (89.96%)	1030 (92.29%)	

Discussion

In this study, 4191 people were examined, of whom 52.5% were women and 47.5% were men. The higher population of women is a common finding as in other parts of the world. In the present study, 0.62 percent of the subjects had AD which is almost identical to the worldwide prevalence of AD (0.6 percent) and the United Nations estimate (10). Also, in our study, the prevalence of AD in women was higher than men (0.8% in women and less than 0.4% in men). This finding could be due to the fact that the population of elderly women is larger than that of men due to the longer lifespan of women compared to men, as well as the greater vulnerability of men compared to women in the study area (43). However, other studies have shown that both the incidence and prevalence of AD in women are almost twice as high as those in men (10, 44). Table 1 shows the ascending course of AD with increasing age. In other studies, aging has been shown to be a major cause of AD (45, 46). The prevalence of AD increases significantly with age, especially after the age of 65 that there is approximately a 15-fold increase in the prevalence of dementia, which manifests itself mainly in the form of AD between the ages of 60 and 85 (45). Since AD is so severely associated with aging, it is predicted that this progressive disorder will pose major challenges to public health and elderly care systems in all countries across the world (46). Population growth has major social and economic consequences. Aging support ratios

(number of adults per working age per capita in the population), i.e. the rate of activity in the adult population, is currently low in developed regions and in some developing countries, and is expected to decline, which may deteriorate by the financial pressures on the support systems for the elderly in later decades. In a number of developing countries, poverty is high among the elderly, especially in countries with limited social security coverage. Also, because people live longer almost everywhere, the prevalence of non-communicable diseases and disabilities increases with age (47). In the United States, it is estimated that 18.1 billion hours are spent caring for patients with AD, valued at $ 232 billion; in addition, expenses caused by emotional distress and the negative consequences of mental health on the family members should not be overlooked (48). Most studies on the prevalence of dementia, AD, and the associated risk factors have been conducted in developed countries, while more than 66% of people at risk for AD live in low- and middle-income countries, and only 10% of studies are dedicated to this population. Iran should not be an exception. Failure to make an initial diagnosis can lead to the loss of valuable opportunities to improve the quality of life of millions of people with dementia. In addition, early treatment helps the patients' families and caregivers to access supportive and counseling services. This will reduce the financial, social, psychological, and physical costs of the disease. The benefits of early detection include slowing cognitive development, maintaining better functioning, reducing mortality, improving challenging patient behaviors, and increasing opportunities for social participation such as recreation, education, and employment (49). In our study, the prevalence of AD varied for different ages and the highest prevalence was observed in the subjects over 80 years of age. In another study, the prevalence of AD was 5% in people aged 65 to 85, 20% to 40% in people over the age of 85, and 50% in older ages (50). In another similar study, the prevalence of AD in people over 60 was 2.3% (51). The most important risk factor for Alzheimer's disease is aging (51, 52). In our study, the difference in the prevalence of AD between men and women was not significant, but a study conducted by Laws, Keith R *et al.* In 2018 in the UK showed that women are at a more significant risk of AD and the disease progresses

more in women compared to men (52, 53). There was no significant association between AD and diabetes. In EL Abner *et al.* study (2016), diabetes increased the risk of developing cerebrovascular diseases, but did not affect AD (54). Due to the different neuropathology of AD, another study has shown that cerebrovascular diseases are a risk factor for AD (53). Long-term studies are needed to clarify the relationship between AD and vascular health (55). There was no significant relationship between AD and hypertension in our study. But much of the scientific evidence suggests a link between vascular diseases and cognitive impairment and dementia, including AD (56). In the present study, there was a significant association between AD and education levels, such that the lower the level of education, the higher the prevalence of AD. There was no significant relationship between AD and smoking. However, there was a significant association between AD and hyperlipidemia and a family history of AD. Haihong Xue *et al.* (2017) found that older age, low levels of education, smoking, and hyperlipidemia increased the risk of cognitive impairments, including AD (53). Also, most of the people with AD in our study had a positive family history, which is also mentioned in other studies as one of the risk factors for AD (57). In this study, most people over the age of 50 were married, so the present study observed no significant relationship between AD and marital status.

Conclusion

The findings of this study showed that the prevalence of AD in Kerman, Iran is similar to its prevalence worldwide. In the present study, most cases with AD were at an advanced age and at a severe stage of the disease who could be managed at a lower cost and the progression of their disease could be prevented, if they had been diagnosed at early ages.

Acknowledgement

Conflict of Interest

There is no conflict of interest to be declared.

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