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# Public knowledge about Alzheimer disease in Mecca Region, Kingdom of Saudi Arabia: a cross-sectional study

Faisal Salem Alhumaidi<sup>1\*</sup> , Muhammad Irfanullah Siddiqui<sup>2</sup>, Abdulaziz Fahad Altowairqi<sup>1</sup>, Hattan Hassan Alshawkani<sup>1</sup>, Bashar Omar Babkour<sup>1</sup> and Fahad Khalid Alaugla<sup>1</sup>

## Abstract

**Background:** Raising the general population knowledge of Alzheimer's disease is crucial for optimizing care and ultimately enhancing the quality of life of people diagnosed and their caregivers.

**Aim:** To assess knowledge among the general population in Makkah Region about symptoms, diagnosis, causes, course, life impact, care giving, and management of Alzheimer disease.

**Material and methods:** A descriptive cross-sectional study was conducted during July to August 2018 in three main cities of Makkah Region, i.e., Makkah, Jeddah, and Taif, Saudi Arabia. Two to three mosques and/or malls were selected randomly from a list of all mosques and malls in each city, and then every fifth subject was selected using a systematic random technique, entering the mall or getting out from the mosques. Both genders, aged 18 years or more and able to understand Arabic were included. Valid and reliable Alzheimer's Disease Knowledge Scale (ADKS) was used to assess knowledge about the diseases, in addition to socio-demographic characteristics of the participants.

**Results:** The study included 862 adult participants. Their age ranged between 18 and 65 years with a mean  $\pm$  standard deviation (SD) of  $31.2 \pm 10.3$  years. History of having a relative with Alzheimer's disease was mentioned by 20.8% of the participants. Overall, the percentage of total Alzheimer's disease knowledge score ranged between 26.7 and 100% with a mean of 58.5%, median of 60%, mode of 56.7%, and standard deviation of  $\pm 11.5\%$ . There was a significant positive correlation between participant's age and their knowledge regarding Alzheimer's disease (Spearman's correlation coefficient " $r$ " = 0.099,  $p$  = 0.004). The highest known subscale of Alzheimer's disease was assessment (mean percentage was 62.21%), followed by treatment (62.09), care giving (61.83%) and course of the disease (60.99%) whereas the lowest known subscale was symptoms (53.25%). Participants who reported a history of having a relative with Alzheimer's disease were more knowledgeable regarding symptoms than those who did not had such history (mean ranks were 470.48 and 421.28, respectively),  $p$  = 0.014.

**Conclusion:** Knowledge of the general population in Makkah Region is deficient, particularly regarding symptoms, risk factors and life impacts. Therefore, health education campaigns are required for general public in this regards.

**Keywords:** Alzheimer's disease, Knowledge, Risk factors, Alzheimer's Disease Knowledge Scale, Saudi Arabia

\* Correspondence: [faisal1546-2013@hotmail.com](mailto:faisal1546-2013@hotmail.com)

<sup>1</sup>Umm Al-Qura University College of Medicine, Mecca, Saudi Arabia  
Full list of author information is available at the end of the article

## Introduction

Alzheimer's disease (AD) is an irreversible progressive brain disease that gradually and slowly destroys memory and rational thinking processes and skills and eventually it affects the ability to perform the simplest tasks. Usually, the majority of the inflicted cases start to develop Alzheimer's signs and symptoms after the age of 60. Nearly 3% of men and women ages 65–74 and almost half of those aged 85 and above usually have the disease with an average age at diagnosis of about 80 years. AD is the most underlying cause of dementia among older people that is characterized by the loss of cognitive functioning, thinking, remembering, reasoning, and behavioral abilities, to the degree that it interferes with a person's daily life and basic activities [1]. According to the DSM3, the person of AD "must have the criteria for major or mild neurocognitive disorder in addition to insidious onset and gradual progression of impairment in one or more cognitive domains (for major neurocognitive disorder, at least two domains must be impaired)" [2].

The Saudi Alzheimer's Disease Association reported that Alzheimer's disease accounts for 50 to 80% of dementia cases worldwide and the greatest known risk factor is increasing age of 65 and older. There are no official statistics on the prevalence of Alzheimer's disease in the Saudi Arabia, but experts estimate that there are at least 50 thousand patients in the Kingdom; most of them are women and there are chances of getting the disease to double each 5 years [3]. Studies in Arab countries revealed a prevalence ranging from 1.1 to 2.3% among people aged 50 years and older and from 13.5 to 18.5% among those aged 80 years and above [4]. The prevalence in the USA was 1.6% among people in the age group 65–74 years and 19% in the age group 75–84 years and reached up to 42% among those aged 85 years old and above [5].

Patients with Alzheimer's disease are characteristically exhibit and show symptoms of impaired memory and decision-making abilities, as well as other problems with their behavior and verbal abilities [6, 7].

As these caregivers witness the person with Alzheimer disease "die twice," first in mind and then a few years later in body, they make day-to-day and often ethically charged decisions for the patient as they themselves experience notable morbidity, especially depression [8]. Other problems they may face include fall down and losses of dignity and respect, as well as abuse, neglect, and exploitation [9].

Matters of daily living become challenging and difficult when Alzheimer's disease influences the patients their families and caregivers. During the progress of the disease, the caregivers, in addition to their own personal business and needs, are charged with more responsibilities, duties including seeking, dealing with healthcare

providers, negotiating medications, monitoring patient's behavior, and attending to the daily needs and requirements of the patient [9, 10].

Raising public knowledge of dementia is crucial for optimizing care and ultimately enhancing the quality of life of people diagnosed and their caregivers [11]. Increasing the knowledge levels of the general population will also help to tackle the stigma of dementia and open up a better-informed debate about the needs of those affected.

The first step toward improving dementia knowledge of population is to assess their current level of dementia knowledge using a reliable tool that will identify knowledge gaps. Additionally as the problem is considerable in our country as a result of aging induced by improvement of care, although there is no epidemiologic evidence, it could have socioeconomic drawbacks and hence tracing community knowledge about the disease will help in prevention and treatment, so in this study, knowledge was measured among the population in Mecca Region about symptoms, diagnosis, causes, course, life impact, care giving, and management of Alzheimer disease.

## Population and methods

It is a descriptive cross-sectional study conducted during July to August 2018 in three main cities of Makkah Region, i.e., Makkah, Jeddah, and Taif, Saudi Arabia. Two mosques and one mall (because the authority prohibited us from including people from the other mall) were selected randomly from a list of the biggest in Makkah city, whereas two mosque and three malls were selected from Jeddah city and two mosques and two malls from Taif city and then every fifth subject was selected using a systematic random technique, entering the mall or getting out from the mosques. Both genders, aged 18 years or more and able to understand Arabic were included. Those aged over 65 years were excluded.

The data collection took about 2 months after getting the approval from the ethical committee of Umm Al Qura University. The purpose of the study was explained briefly and those who agreed and met the study criteria were invited to answer the question. One hundred and forty two persons refused to participate, mostly because they were busy and had no time. Those who refused were replaced immediately by the next one who agreed to participate. Valid and reliable Alzheimer's Disease Knowledge Scale (ADKS) was used to assess knowledge about the diseases [9], in addition to socio-demographic characteristics of the participants. The ADKS is the only tool that can be used to assess knowledge about Alzheimer disease in general population; however, it includes some relatively easy items for those with some knowledge on the disease. It has an acceptable reliability and validity and reliability values [12].

The total sample size was calculated using epi info software version 3.01. Based on frequency of knowledge of Alzheimer’s disease and as there was no reliable data, 50% prevalence was utilized and design effect of two to calculate sample size, the confidence interval was set at 95%, and level of significance at 5%. Hence, the calculated sample size was 768. We added 77 more anticipating a non-response rate of 10%. Hence, a total sample size estimated was 845.

Surveys are completely anonymous and confidential. No names or any identifying information is required. In addition, the surveys were not distributed before getting the ethical approval from Umm Al-Qura University IRB. The participation in this study was voluntary, the collected information were kept in sealed envelopes by the participants before returning it to the investigators.

**Statistical analysis**

Data entry and statistical analysis were performed utilizing the Statistical Package for Social Sciences (SPSS) software, version 25. Descriptive statistics was done using frequency and percentages for categorical variables and mean and standard deviation for continuous variables. Since the total of subscales knowledge scores were abnormally distributed as evidenced by significant Shapiro-Wilk test, they were described in the form of median, inter-quartile range, and mean ranks. Non-parametric statistical tests were used in comparisons. Mann-Whitney was applied to test for difference between two different groups and Kruskal-Wallis was applied to test for the difference between more than two groups. Statistical significance was determined at level of  $p < 0.05$ .

**Results**

The study included 862 adult participants. Their age ranged between 18 and 65 years with a mean  $\pm$  standard

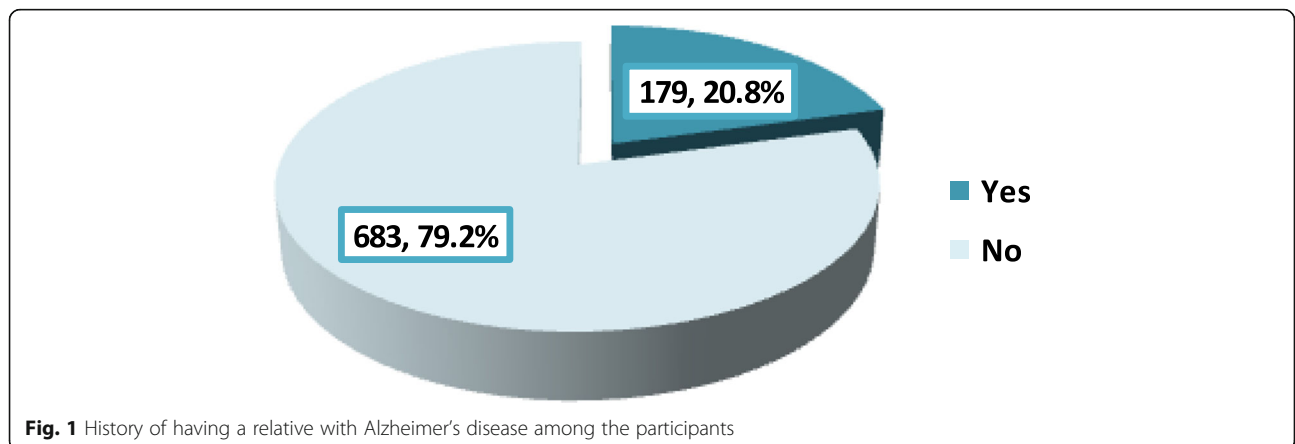
**Table 1** Personal characteristics of the participants (n = 862)

	Frequency	Percentage
<b>Gender</b>		
Male	383	44.4
Female	479	55.6
<b>Nationality</b>		
Saudi	743	86.2
Non-Saudi	119	13.8
<b>Years of education</b>		
≤ 9	63	7.3
10–12	240	27.8
13–16	486	56.4
> 16	73	8.5
<b>City</b>		
Makkah	249	28.9
Jeddah	305	35.4
Taif	308	35.7

deviation (SD) of  $31.2 \pm 10.3$  years. Table 1 summarizes the remaining demographic characteristics of the participants. More than half of them (55.6%) were females and had between 13 and 16 years of education (56.4%). Majority (86.2%) were Saudis. Less than one third were recruited from Makkah as we are prohibited from including one another mall while 71% were from Jeddah and Taif.

History of having a relative with Alzheimer’s disease was mentioned by 20.8% of the participants as demonstrated in Fig. 1.

Table 2 shows that majority of the participants could recognize correctly that eventually, a person with Alzheimer’s disease will need 24 h supervision (83.3%), people with Alzheimer’s disease are particularly prone to



**Fig. 1** History of having a relative with Alzheimer’s disease among the participants

**Table 2** Response of the participants to Alzheimer's disease knowledge statements

	Right answer	
	No.	%
People with Alzheimer's disease are particularly prone to depression. (True)	691	80.2
It has been scientifically proven that mental exercise can prevent a person from getting Alzheimer's disease. (False)	558	64.7
After symptoms of Alzheimer's disease appear, the average life expectancy is 6 to 12 years. (True)	365	42.3
When a person with Alzheimer's disease becomes agitated, a medical examination might reveal other health problems that caused the agitation. (True)	610	70.8
People with Alzheimer's disease do best with simple, instructions given one step at a time. (True)	637	73.9
When people with Alzheimer's disease begin to have difficulty taking care of themselves, caregivers should take over right away. (False)	540	62.6
If a person with Alzheimer's disease becomes alert and agitated at night, a good strategy is to try to make sure that the person gets plenty of physical activity during the day. (True)	629	73.0
In rare cases, people have recovered from Alzheimer's disease. (False)	428	49.7
People whose Alzheimer's disease is not yet severe can benefit from psychotherapy for depression and anxiety. (True)	649	75.3
If trouble with memory and confused thinking appears suddenly, it is likely due to Alzheimer's disease. (False)	377	43.7
Most people with Alzheimer's disease live in nursing homes. (False)	352	40.8
Poor nutrition can make the symptoms of Alzheimer's disease worse. (True)	633	73.4
People in their 30s can have Alzheimer's disease. (True)	490	56.8
A person with Alzheimer's disease becomes increasingly likely to fall down as the disease gets worse. (True)	592	68.7
When people with Alzheimer's disease repeat the same question or story several times, it is helpful to remind them that they are repeating themselves. (False)	402	46.6
Once people have Alzheimer's disease, they are no longer capable of making informed decisions about their own care. (False)	457	53.0
Eventually, a person with Alzheimer's disease will need 24-h supervision. (True)	718	83.3
Having high cholesterol may increase a person's risk of developing Alzheimer's disease. (True)	372	43.2
Tremor or shaking of the hands or arms is a common symptom in people with Alzheimer's disease. (False)	418	48.5
Symptoms of severe depression can be mistaken for symptoms of Alzheimer's disease. (True)	473	54.9
Alzheimer's disease is one type of dementia. (True)	685	79.5
Trouble handling money or paying bills is a common early symptom of Alzheimer's disease. (True)	482	55.9
One symptom that can occur with Alzheimer's disease is believing that other people are stealing one's things. (True)	528	61.3
When a person has Alzheimer's disease, using reminder notes is a crutch that can contribute to decline. (False)	405	47.0
Prescription drugs that prevent Alzheimer's disease are available. (False)	475	55.1
Having high blood pressure may increase a person's risk of developing Alzheimer's disease. (True)	405	47.0
Genes can only partially account for the development of Alzheimer's disease. (True)	506	58.7
It is safe for people with Alzheimer's disease to drive, as long as they have a companion in the car at all times. (False)	384	44.5
Alzheimer's disease cannot be cured. (True)	454	52.7
Most people with Alzheimer's disease remember recent events better than things that happened in the past. (False)	408	47.3

depression (80.2%), Alzheimer's disease is one type of dementia (79.5%), people whose Alzheimer's disease is not yet severe can benefit from psychotherapy for depression and anxiety (73.5%), and people with Alzheimer's disease do best with simple, instructions giving one step at a time (73.9%). On the other hand, only 44.5% of them knew that it is not safe for people with Alzheimer's disease to drive, as long as they have a companion in the car at all times, 43.2% could recognize that having high cholesterol may increase a person's risk of

developing Alzheimer's disease, having high cholesterol may increase a person's risk of developing Alzheimer's disease (43.2%), after symptoms of Alzheimer's disease appear, the average life expectancy is 6 to 12 years (42.3%), and most people with Alzheimer's disease do not live in nursing homes (40.8%).

Overall, the percentage of total Alzheimer's disease knowledge score ranged between 26.7 and 100% with a mean of 58.5%, median of 60%, mode of 56.7%, and standard deviation of  $\pm 11.5\%$ . It was abnormally

distributed as evident by significant Shapiro-Wilk test (0.990,  $p < 0.001$ ; Fig. 2).

From Table 3, it is shown that none of the studied factors (gender, nationality, years of education, city, and having a relative with Alzheimer’s disease) was significantly associated with the knowledge level regarding Alzheimer’s disease. However, there was some border line association observed between knowledge level and relative with Alzheimer disease, though it did not reach to significant level.

From Fig. 3, it is realized that there was a significant positive correlation between participant’s age and their knowledge regarding Alzheimer’s disease (Spearman’s correlation coefficient “ $r$ ” = 0.099,  $p = 0.004$ ).

From Fig. 4, it is obvious that, the highest known subscale of Alzheimer’s disease was assessment (mean percentage was 62.21%), followed by treatment (62.09), care giving (61.83%), and course of the disease (60.99%), whereas the lowest known subscale was symptoms (53.25%).

As demonstrated from Table 4. There was no gender difference regarding knowledge of different aspects of Alzheimer’s disease (life impact, risk factors, symptoms, treatment, assessment, care giving, and course of the disease).

As realized from Table 5, there was no nationality difference regarding knowledge of different aspects of Alzheimer’s disease (life impact, risk factors, symptoms, treatment, assessment, care giving, and course of the disease).

As seen in Table 6, participants who had more than 16 years of education expressed the highest level of knowledge regarding course of the disease (mean rank was 452.55) whereas participants with 9 years of education or less expressed the lowest level of knowledge (mean rank was 387.97),  $p = 0.035$ . There was no difference regarding knowledge of other aspects of Alzheimer’s disease (life impact, risk factors, symptoms, treatment, assessment, and care giving) according to participant’s years of education.

Participants from Taif were more knowledgeable regarding life impact and treatment compared to those from Jeddah and Makkah, whereas participants from Jeddah were more knowledgeable regarding risk factors, while those from Makkah were more knowledgeable regarding caregiving. There was no difference between participants from the three cities regarding symptoms, assessment, and course of the disease (Table 7)

As evident from Table 8, participants who reported a history of having a relative with Alzheimer’s disease were

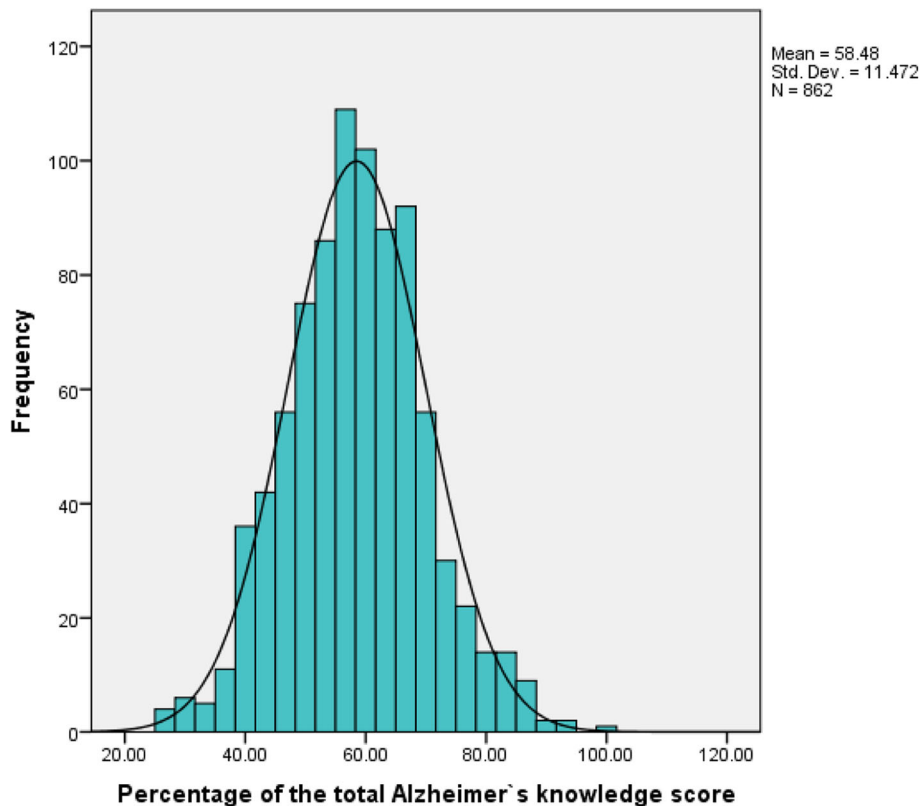


Fig. 2 Distribution of the percentage of the total Alzheimer’s knowledge score among the participants

**Table 3** Factors associated with percentage of the total Alzheimer's knowledge score among the participants

	Percentage of the total Alzheimer's knowledge score			<i>p</i> value
	Median	IQR	Mean rank	
<b>Gender</b>				
Male	56.67	50–66.67	429.14	0.803*
Female	60	50–66.67	433.39	
<b>Nationality</b>				
Saudi	60	50–66.67	433.23	0.609*
Non-Saudi	56.67	50–66.67	420.69	
<b>Educational level</b>				
Below high school	60	53.33–66.67	461.64	0.582**
High school	56.67	50–66.6750–	425.43	
University	56.67	66.6753.33–	426.91	
Postgraduate	60	66.67	456.03	
<b>City</b>				
Makkah	60	51.67–66.67	458.43	0.096**
Jeddah	56.67	50–66.67	428.10	
Taif	56.67	50–63.33	413.09	
<b>Having a relative with Alzheimer's disease</b>				
Yes	60	53.33–66.67	423.73	0.072*
No	56.67	50–66.67	461.14	

\*Mann-Whitney test

\*\*Kruskal-Wallis test

more knowledgeable regarding symptoms than those who did not have such history (mean ranks were 470.48 and 421.28, respectively),  $p = 0.014$ . There was no significant difference between both groups regarding other subscales.

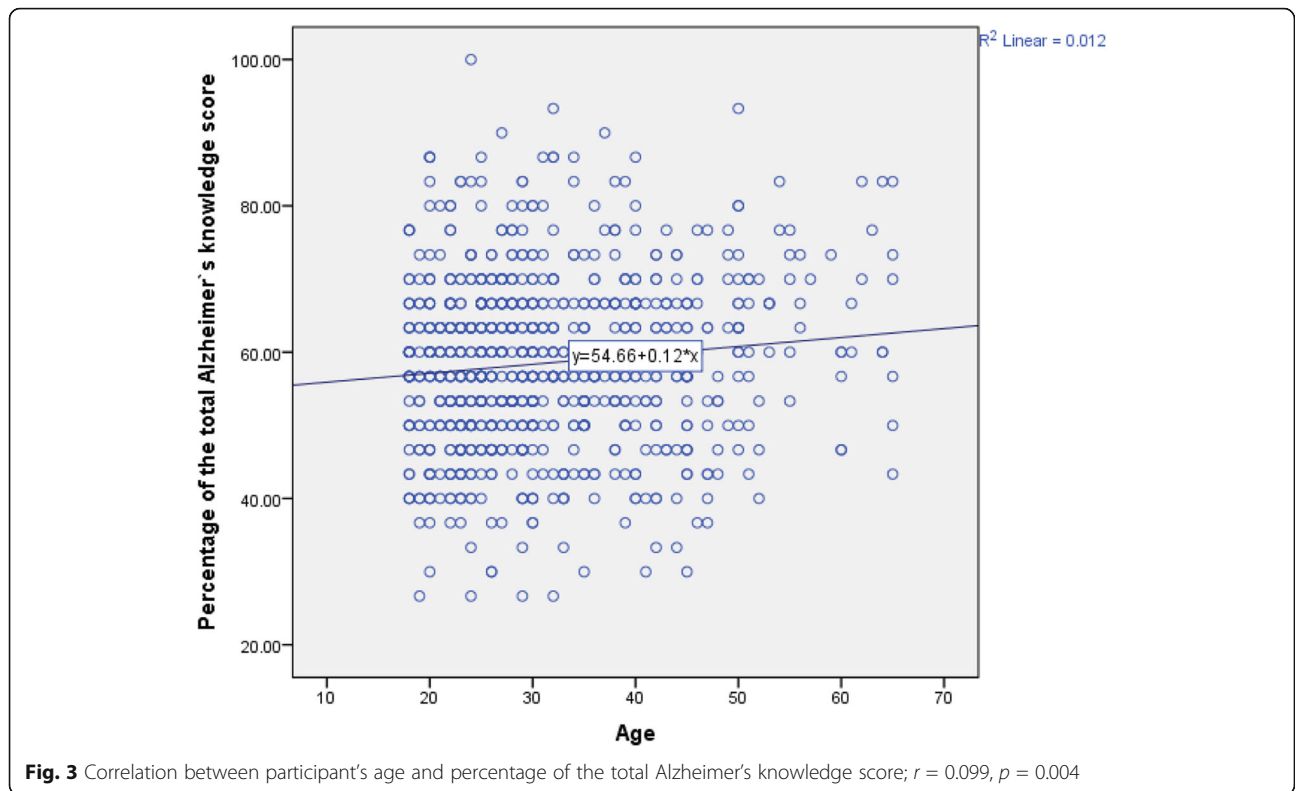
## Discussion

Although changes of some lifestyles could impact positively the human health, the general population appears to be unaware of this fact and, consequently, does not adhere to these health habits that could reduce the risk of developing Alzheimer's disease [13]. This study was conducted with primary aim to explore the knowledge level about symptoms, diagnosis, causes, course, life impact, caregiving, and management of Alzheimer's disease among general population in three main cities of Western Saudi Arabia.

The present study revealed that the overall percentage of total Alzheimer's disease knowledge score ranged between 26.7 and 100% with a mean of 58.5%, median of 60%, mode of 56.7% which indicate moderate level of knowledge. Quite similar findings were observed among general population in Brazil [14]. However, expectedly higher figures were reported in studies carried out among pharmacists in Malaysia [15], healthcare professionals in Australia [16], and psychologists in Norway

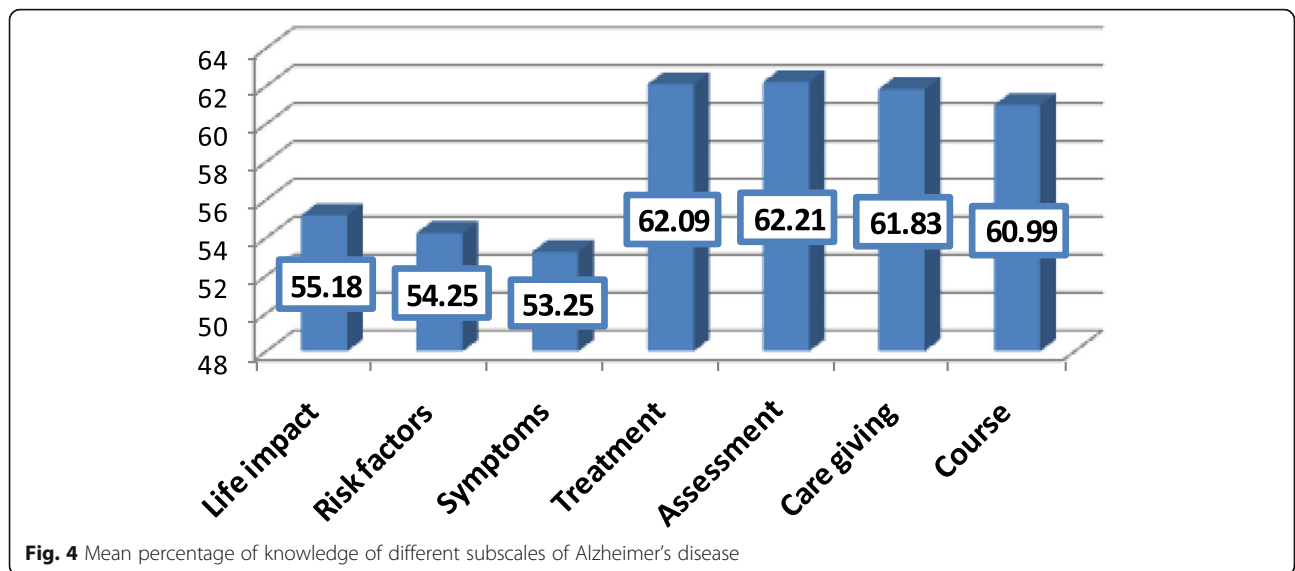
[17]. These results could be attributed to the fact that general population usually lack open access to high quality information, contrary to those working in medical field. Cahill et al. carried out systematic review included 40 studies from different developed and developing nations that evaluated the knowledge about Alzheimer's disease in the population and concluded that about half of these studies revealed a limited knowledge about Alzheimer's disease in the general population with a common concept that AD is part of aging [18].

In the current study, gender, nationality, years of education, city, and having a relative with Alzheimer's disease were not significantly associated with the knowledge level regarding Alzheimer's disease as a total. However, taking the subscale of knowledge into consideration, participants with higher years of education were more knowledgeable regarding course of the disease and this is quite expected. Also, it was expected to find participants who had relatives with Alzheimer's disease more knowledgeable about symptoms of the disease as they are dealing with such patients. Regarding participants' age, contrary to what has been reported in a previous systematic review [18], older participants were more knowledgeable. This could be explained by limiting the inclusion in the present study to those aged 65 years or below.



The highest known subscale of Alzheimer's disease in the present survey was assessment, followed by treatment, care giving, and course of the disease, whereas the lowest known subscale was symptoms. Different findings were observed in other studies. In China [19], defect knowledge was reported regarding life impact, symptoms, and care giving. Among older Chinese Americans, the lowest knowledge was

observed regarding risk factors and symptoms [20]. In Malaysia, symptoms, course of the disease and life impacts were the lowest known items [15]. Comparison between these studies and the present one is not practical despite using the same study tool, due to difference in socio-demographic characteristics of the participants in various studies, including age, educational level, and occupation.



**Table 4** Knowledge of different aspects of Alzheimer’s disease according to participant’s gender

	Gender	
	Male	Female
<b>Life impact (%)</b>		
Median	66.67	66.67
IQR	33.33–66.67	33.33–66.67
Mean rank	435.09	428.63
<i>p</i> value	0.687	
<b>Risk factors (%)</b>		
Median	50	50
IQR	33.33–66.67	33.33–66.67
Mean rank	433.58	429.84
<i>p</i> value	0.822	
<b>Symptoms (%)</b>		
Median	50	50
IQR	25–75	25–75
Mean rank	420.18	440.55
<i>p</i> value	0.214	
<b>Treatment (%)</b>		
Median	75	75
IQR	50–75	50–75
Mean rank	426.26	435.69
<i>p</i> value	0.563	
<b>Assessment (%)</b>		
Median	75	50
IQR	50–75	50–75
Mean rank	444.55	421.06
<i>p</i> value	0.149	
<b>Care giving (%)</b>		
Median	60	60
IQR	40–80	40–80
Mean rank	436.12	427.80
<i>p</i> value	0.614	
<b>Course of the disease (%)</b>		
Median	50	50
IQR	50–75	50–75
Mean rank	416.45	443.53
<i>p</i> value	0.094	

Mann-Whitney test

**Table 5** Knowledge of different aspects of Alzheimer’s disease according to participant’s nationality

	Nationality	
	Saudi	Non-Saudi
<b>Life impact (%)</b>		
Median	66.67	66.67
IQR	33.33–66.67	33.33–66.67
Mean rank	429.51	443.95
<i>p</i> value	0.532	
<b>Risk factors (%)</b>		
Median	50	50
IQR	33.33–66.67	33.33–66.77
Mean rank	429.17	446.06
<i>p</i> value	0.482	
<b>Symptoms (%)</b>		
Median	50	50
IQR	25–75	25–75
Mean rank	431.93	428.80
<i>p</i> value	0.894	
<b>Treatment (%)</b>		
Median	75	75
IQR	50–75	50–75
Mean rank	426.57	462.26
<i>p</i> value	0.129	
<b>Assessment (%)</b>		
Median	75	50
IQR	50–75	50–75
Mean rank	436.77	398.63
<i>p</i> value	0.104	
<b>Care giving (%)</b>		
Median	60	60
IQR	40–80	40–80
Mean rank	432.96	422.39
<i>p</i> value	0.656	
<b>Course of the disease (%)</b>		
Median	50	50
IQR	50–75	50–75
Mean rank	436.08	402.89
<i>p</i> value	0.155	

Mann-Whitney test

The finding that participants from Taif city were more knowledgeable regarding life impact and treatment compared to those from Jeddah and Makkah cities, whereas participants from Jeddah city were more knowledgeable regarding risk factors, while those from Makkah city were more knowledgeable regarding caregiving, cannot

be explained easily; however, religious culture in Makkah could explain the higher knowledge regarding caregiving. However, further in-depth analysis of the characteristics of population in different cities as well as the components of the educational programs regarding AD implemented in these cities is warranted.



**Table 6** Knowledge of different aspects of Alzheimer’s disease according to participant’s years of education

	Years of education			
	≤ 9	10–12	13–16	> 16e
<b>Life impact (%)</b>				
Median	66.67	66.67	66.67	66.67
IQR	33.33–66.67	33.33–66.67	33.33–66.67	33.33–66.67
Mean rank	445.61	448.87	422.39	422.89
<i>p</i> value	0.496			
<b>Risk factors (%)</b>				
Median	66.67	50	50	50
IQR	33.33–66.67	33.33–66.67	33.33–66.67	33.33–66.67
Mean rank	452.92	424.08	433.37	424.95
<i>p</i> value	0.851			
<b>Symptoms (%)</b>				
Median	50	50	50	50
IQR	25–75	25–75	25–75	50–75
Mean rank	440.47	429.56	428.17	452.34
<i>p</i> value	0.861			
<b>Treatment (%)</b>				
Median	75	75	50	75
IQR	50–75	50–75	50–75	50–75
Mean rank	446.06	436.62	422.23	463.78
<i>p</i> value	0.488			
<b>Assessment (%)</b>				
Median	75	75	50	50
IQR	50–75	50–75	50–75	50–75
Mean rank	55.70	448.28	425.19	397.48
<i>p</i> value	0.296			
<b>Care giving (%)</b>				
Median	60	60	60	60
IQR	40–80	40–80	40–80	40–80
Mean rank	472.66	431.84	424.23	443.22
<i>p</i> value	0.482			
<b>Course of the disease (%)</b>				
Median	50	50	75	75
IQR	50–75	50–75	50–75	50–75
Mean rank	387.97	403.01	448.05	452.55
<i>p</i> value	0.035			

Kruskal-Wallis test

**Table 7** Knowledge of different aspects of Alzheimer’s disease according to participant’s city

	City		
	Makkah	Jeddah	Taif
<b>Life impact (%)</b>			
Median	33.33	66.67	66.67
IQR	33.33–66.67	33.33–66.67	33.33–66.67
Mean rank	390	430.41	466.13
<i>p</i> value	0.001		
<b>Risk factors (%)</b>			
Median	50	50	50
IQR	41.67–66.67	41.67–66.67	33.33–66.67
Mean rank	445.46	457.30	394.66
<i>p</i> value	0.003		
<b>Symptoms (%)</b>			
Median	50	50	50
IQR	50–75	25–75	25–75
Mean rank	446.90	421.14	429.31
<i>p</i> value	0.442		
<b>Treatment (%)</b>			
Median	50	50	75
IQR	50–75	50–75	50–75
Mean rank	409.95	418.39	461.90
<i>p</i> value	0.018		
<b>Assessment (%)</b>			
Median	75	75	75
IQR	50–75	50–75	50–75
Mean rank	435.92	427.07	432.32
<i>p</i> value	0.906		
<b>Care giving (%)</b>			
Median	80	60	60
IQR	60–80	40–80	40–80
Mean rank	508.97	427.18	373.15
<i>p</i> value	< 0.001		
<b>Course of the disease (%)</b>			
Median	50	50	75
IQR	50–75	50–75	50–75
Mean rank	436.44	412.88	445.95
<i>p</i> value	0.206		

Kruskal-Wallis test

Although this study has a public health importance as being the first of its kind in our area in exploring knowledge of the general population about Alzheimer’s disease, it has some important limitations that should be mentioned. Its cross-sectional design confirms only association and not causality between

dependent and independent variables. Limited studies have been conducted among general population; therefore, comparison with other studies is not practical as most of them were carried out among medical professionals.

**Table 8** Knowledge of different aspects of Alzheimer's disease according to participant's history of having relative with Alzheimer's disease

	Having relative with Alzheimer disease	
	Yes	No
<b>Life impact (%)</b>		
Median	66.67	66.67
IQR	33.33–66.67	33.33–66.67
Mean rank	425.91	452.84
<i>p</i> value	0.171	
<b>Risk factors (%)</b>		
Median	50	50
IQR	33.33–66.67	50–66.67
Mean rank	426.23	451.61
<i>p</i> value	0.214	
<b>Symptoms (%)</b>		
Median	50	50
IQR	50–75	25–75
Mean rank	470.48	421.28
<i>p</i> value	0.014	
<b>Treatment (%)</b>		
Median	75	75
IQR	50–75	50–75
Mean rank	427.80	445.60
<i>p</i> value	0.373	
<b>Assessment (%)</b>		
Median	75	75
IQR	50–75	50–75
Mean rank	428.81	441.76
<i>p</i> value	0.516	
<b>Care giving (%)</b>		
Median	60	60
IQR	40–80	40–80
Mean rank	432.34	428.28
<i>p</i> value	0.841	
<b>Course of the disease (%)</b>		
Median	50	75
IQR	50–75	50–75
Mean rank	426.66	449.95
<i>p</i> value	0.240	

Mann-Whitney test

## Conclusion

In conclusion, knowledge of the general population in Makkah Region is deficient, particularly regarding symptoms, risk factors, and life impacts. Therefore, health education campaigns are required for the general public in this regard with participation of healthcare professionals.

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## Authors' contributions

Study conception and design: All authors. Acquisition of data: All authors. Analysis and interpretation of data: Dr. Muhammad Irfanullah Siddiqui and Dr. Faisal Salem Alhumaidi. Drafting of manuscript: All authors. Critical revision and final approval: All authors. All authors read and approved the final manuscript.

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## Availability of data and materials

Data are available upon request. Please contact the corresponding author.

## Ethics approval and consent to participate

Written consent was taken from all participants after explaining the details, benefits, and risks to them. The study was approved by the Ethics Committee of Faculty of Medicine, Umm Al-Qura University—Makkah (No. HAPO-02-K-012-2018-06-269) on 2 June 2018.

## Consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

## Author details

<sup>1</sup>Umm Al-Qura University College of Medicine, Mecca, Saudi Arabia.

<sup>2</sup>Department of Community Medicine, Faculty of Medicine, Umm Al-Qura University, Mecca, Saudi Arabia.

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