



## Research Article

# Factors associated with dementia among elderly people living in Algiers

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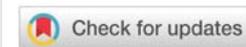
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## Abstract

**Background:** The demographic aging of the Algerian population increases the risk of some age-related pathologies, including dementia. It is one of the most significant public health problems. The prevalence of dementia and risk factors has not been fully investigated in Algeria. This study aims to improve the knowledge of dementia in Algiers by determining its risk factors, allowing to enrich its epidemiology and social aspects.

**Methods:** A cross-sectional, door-to-door study in the Department of Sidi M'Hamed in Algiers "Algeria", conducted in general population, was carried out between June 2012 and August 2014. The clinical diagnosis of dementia was made according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria. Possible or probable cases of Alzheimer's Disease (AD), Mixed Dementia (MD), Vascular Dementia (VD), Frontotemporal Dementia (FTD), Parkinson's Dementia (PD), and other dementias were identified using standard criteria.

Sociodemographic characteristics, lifestyle and the pathological history were recorded.

**Results:** 3896 subjects aged 60 years and over participated in the study. Among them, 192 had dementia. Factors strongly associated with dementia in the department of Sidi M'Hamed were advanced age, living alone, widowhood, low cultural level, family history of dementia, high blood pressure and stroke ( $p < 10^{-6}$ ).

**Conclusion:** Greater age, low social raise, low level of education and vascular risk factors (stroke and high blood pressure) increase the risk of suffering from dementia. Other more extensive studies should be conducted, both in rural and urban areas of Algeria, in order to consider comprehensive management solutions and prevention approaches adapted to our context.

## Introduction

At world level, the population is aging due to the increase in life expectancy and the decrease of fertility [1]. This increase in age contributes to the growing emergence of some pathologies associated with age, including dementia [1].

Dementia is a real public health problem. The latest estimates from the 2019 World Alzheimer Report put the number of people with dementia over 50 million worldwide.

This number is expected to almost double every 20 years, reaching 131.5 million in 2050 [2].

Dementia is often evoked in the presence of memory, cognitive, or behavioral disorders. It is characterized by a progressive and irreversible deterioration of cognitive functions, with an impact on the social, professional and daily activities of the patient.

Alzheimer's Disease (AD) is the most prevalent cause of



dementia. It represents 70% of dementia cases diagnosed worldwide [3].

Several factors such as aging, environment and genetics interact to cause dementia.

Worldwide, dementia is one of the leading causes of disability and dependence in the elderly. It has serious physical, psychological, social and economic consequences for patients, caregivers, families and society.

Epidemiological data on dementia in Africa are scarce, especially in Algeria.

During a thesis work, the prevalence of dementia in subjects aged 60 years and over was estimated at 5.28% in Algiers “Department of Sidi M’Hamed” in 2017 [4]. The number of people aged 60 years and over with dementia was close to 189,182 patients. Among them, 71.87% had Alzheimer’s disease, which corresponds to 135.965 cases of AD. The remaining cases were divided into 26.603 cases of mixed dementia (14.06%) and 9853 cases of vascular dementia (5.21%).

This study was launched to identify the factors associated with dementia and Alzheimer’s disease in Algiers “Department of Sidi M’Hamed”, in subjects aged 60 years and over and thus contributes to a better knowledge of the epidemiology of dementia in Algeria.

## Populations and methods

We report an analytical and descriptive cross-sectional, door-to-door study, carried out from June 2012 to August 2014, in subjects aged 60 years or more, residing in urban areas, in the department of Sidi M’Hamed of Algiers. This study was conducted to determine the prevalence of dementia in this city and to identify the main risk factors for dementia.

The minimum sample size was calculated based on a known average prevalence of dementia in the world, estimated at 4.7% in subjects aged 60 years and over, in the 2009 World Alzheimer’s Report [5]. Assuming a prevalence  $p^0=0.05$ , a degree of precision  $i=0.007$  and a 1st species risk  $\alpha =5\%$ , the calculations give a minimum size  $n= 3896$ . The sample design was provided by the National Statistics Office.

Ethically, participation in the survey was voluntary once the objectives of the study had been presented to the respondent. For each subject investigated, written and informed consent was signed. In cases where the respondent was unable to express his/her wishes, consent was obtained from the spouse or a family member living in the same household.

The implementation phase of the study was conducted in three phases, comprising:

- A screening phase: Duration 1.5 months.
- A clinical diagnosis phase: 18 months.
- A paraclinical investigation phase: 7 months.

During the screening phase, we used Catherine Thomas-Anterion’s Cognitive Complaints Questionnaire [6], which is a tool for searching for complaints that might suggest Alzheimer’s disease. It is a questionnaire targeted at clinical research into the initial difficulties of Alzheimer’s disease, which focuses not only on memory but also on two cognitive complaints that are very frequent at the beginning of the disease: spatial orientation and word loss (anomia). The CCQ is intended to help identify a complaint, differentiate a suspicious complaint from a mild one.

An overall score  $\geq 3$  on the questionnaire, particularly for the first 10 questions, raises the suspicion of a cognitive disorder or even dementia and prompts clinical, neuropsychological and paraclinical investigations.

All subjects with a CCQ score  $\geq 3$  proceeded to the diagnostic phase. A meticulous neurological examination was carried out for each patient, as well as a neuropsychological evaluation, taking into account the level of education and paraclinical assessment.

The neuropsychological tests performed for subjects with  $CL < 3$  are:

- The MMSE “Mini Mental State Exam” for a global cognitive assessment. An MMSE score  $< 22$  is considered pathological according to the 2003 GRECO norms as well as those of Farrag A in 1998 [7]. The 2 points for the reading and writing items of the MMSE were excluded in subjects with low education and/or illiteracy, and the total score was calculated on 28 instead of 30 points; therefore, the reference threshold for a subject with suspected dementia was 21 instead of 23 points [7].
- The Nine Pictures Test (TNI-93) for an assessment of episodic memory. A delayed recall score  $< 8$  is pathological.
- The DMS 48 (delayed matching-to-sample) for an evaluation of visual recognition memory.
- The Digit Span Task for an evaluation of working memory.
- The FAB (Frontal Assessment Battery) for an assessment of executive functions. Due to the low level of instruction, only the following BREF items were assessed: Programming ability, Interference sensitivity and inhibitory control.
- Reflexive praxis.
- The ISAACS SET Test for an assessment of categorical verbal fluency.

The neuropsychological tests performed for subjects with  $CL \geq 3$  are:

- MMSE for a global cognitive assessment. According to the 2003 Greco norms, the cut-off is set at 23 for subjects with primary school certificates and 26 for subjects with high school or Baccalaureate levels.

- Dubois' 5-word test for an evaluation of episodic memory. This test is scored out of 10. It is considered pathological if the score is less than or equal to 8.
- The DMS 48 for an evaluation of visual recognition memory.
- The Digit Span Task for an evaluation of the working memory
- The FAB for an evaluation of executive functions. Scored out of 18, the score is pathological if it is less than or equal to 14.
- The clock test for an evaluation of executive and visual-spatial functions. The maximum total score is 7. Overall, a score below 4 is pathological.
- The Trail Making Test A (TMT A) and B (TMT B) for an evaluation of executive functions, mainly mental flexibility.
- Reflexive praxis.
- Categorical and lexical verbal fluency test to evaluate semantic memory and/or executive functions.

Both groups of patients were evaluated for autonomy using the IADL (Instrumental Activities of Daily Living) scale. An evaluation of psycho-behavioral disorders by the NPI "Neuropsychiatric Inventory" was also carried out in both groups.

This study identified 192 cases of dementia with an estimated prevalence of 5,28 % in subjects aged 60 years and over.

After estimating the prevalence of dementia we divided our cohort into 2 groups:

The first group included 192 subjects who met the criteria of dementia according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM V), including:

-146 cases (76.04%) of degenerative dementia, classified as Alzheimer's Disease (AD) 138 cases (94.52%), Fronto-Temporal dementia 4 cases (2.74%) and Parkinson's disease dementia 4 cases (2.74%).

19 cases (9.9%) of acquired dementia, classified as Vascular dementia 10 cases (52,63%), Dementia due to subdural hematoma 3cases (15,79%), Dementia due to an intracranial tumor 3 cases (15,79%), Dementia by Hypothyroidism 2 cases (10,53%), Dementia due to Hashimoto's thyroiditis 1 case (5,26%).

27 cases (14.06%) of mixed dementia (Alzheimer's disease and cerebrovascular disease).

The second group included 3704 subjects without dementia, presenting either with normal cognitive aging or without cognitive deficits.

In each group we assessed for each subject:

1. His sociodemographic characteristics:
  - Age ( $\geq 80$  years /  $< 80$  years).
  - Sex (F / M).
  - Marital status (single, married, divorced, widowed).
  - Lifestyle (alone, with family).
  - Family history of dementia.
  - Professional activity (No profession, Civil servant, Craftsman, Farmer/breeder, worker, Liberal profession).
  - Cultural level, with the help of the BARBIZET scale, allowing to distinguish subjects with a low Cultural Level (CL) (Illiterate or self-taught:  $<CL 3$ ) and those with a medium or high cultural level (having at least the primary school certificate  $\geq CL 3$ ).
2. His lifestyle
  - Regular consumption of fish.
  - Regular practice of physical activity.
  - Leisure activities.
3. His pathological history
  - Cardiovascular history (hypertension, diabetes, heart disease, dyslipidemia, stroke).
  - Alcohol consumption.
  - Smoking.
  - Depression.
  - Hormonal treatment with estrogens.
  - History of head trauma.
  - General anesthesia.

The statistical analysis took 6 months. Data entry was carried out in Excel. Statistical analysis of the data was performed on Epi info 7.2.0.1. The chi-square test was used to illustrate relationships or comparisons in the nominal data. A P value of less than 0.05 was considered significant. Comparisons were made between subjects with dementia and healthy subjects.

Multivariate analysis (logistic regression) was used to investigate associations between dementia and various medical, sociodemographic and psychosocial factors.

## Results

Sociodemographic factors associated with dementia were age over 80 years, widowhood, living alone, low cultural level, no work activity, and family history of dementia ( $p < 0.00001$ ) (Table 1).



Regarding pathological history, cardiovascular history (hypertension, diabetes, heart disease and stroke) ( $p < 0.00001$ ), as well as history of head trauma ( $p < 0.00001$ ) were closely associated with dementia (Tables 2-4).

### Discussion

The search for modifiable risk factors was a major issue in our dementia epidemiological study.

#### Unmodifiable risk factors

Concerning the Unmodifiable risk factors, we did not find in our study a significant link between gender and dementia ( $p = 0.379$ ) (Table 1). These results are in agreement with those of El Tallawy in 2012 [8] and Farrag in 1998 [7], who reported a similar frequency of dementia and AD between men and women.

**Table 1:** Relationship between Socio-Demographic Characteristics and Dementia.

Parameters	Dementia				Total	p-value
	Yes		No			
	n	%	n	%		
Age (Years)						
60-79	77	40.10	2937	79.29	3014	<0.00001
≥ 80	115	59.90	767	20.71	882	
Sex						0.379
Male	75	39.06	1331	35.93	1406	
Female	117	60.94	2373	64.07	2490	
Marital status:						<0.00001
Single	1	0.52	7	0.19	8	
Married	91	47.40	3077	83.07	3168	
Widowed	98	51.04	613	16.55	711	
Divorced	2	1.04	7	0.19	9	
Lifestyle:						<0.00001
Lives alone	5	2.60	4	0.11	9	
Lives with family	187	97.40	3700	99.89	3887	
Cultural Level (CL):						<0.00001
Low CL: CL<3	174	90.63	2344	63.28	2518	
Medium or high CL: CL ≥ 3	18	9.37	1360	36.72	1378	
Occupation:						<0.00001
No profession	107	55.73	1402	37.85	1509	
Civil servant	40	20.83	1309	35.34	1349	
Craftsman	15	7.81	118	3.19	133	
Farmer/breeder	7	3.65	12	0.32	19	
worker	21	10.94	833	22.49	854	
Liberal profession	2	1.04	30	0.81	32	
Family history of dementia:						<0.00001
Yes	44	22.92	129	3.48	173	
No	148	77.08	3575	96.51	3723	

**Table 2:** Relationship between Healthy Living and Dementia.

Parameters	Dementia				Total	p-value
	Yes		No			
	n	%	n	%		
Regular consumption of fish:						0.613
Ye	41	21.35	849	22.92	890	
No	151	78.65	2855	77.08	3006	
Physical activity:						0.0555
Yes	22	11.46	619	16.71	641	
No	170	88.54	3085	83.29	3255	
Leisures:						0.139
Yes	17	8.85	461	12.45	478	
No	175	91.14	3243	87.55	3418	

**Table 3:** Relationship between Cardiovascular History and Dementia.

Cardiovascular history	Total	Dementia				p-value
		Yes		No		
		n	%	n	%	
High blood pressure:						<0.00001
Yes	1255	137	71.35	1118	30.18	
No	2641	55	28.65	2586	69.82	
Diabetes:						<0.00001
Yes	668	70	36.46	598	16.14	
No	3228	122	63.54	3106	83.86	
Heart disease:						<0.00001
Yes	640	64	33.33	576	15.55	
No	3256	128	66.67	3128	84.45	
Dyslipidemia:						0.063
Yes	1458	84	43.75	1374	37.70	
No	2438	108	56.25	2330	62.90	
Stroke:						<0.00001
Yes	133	29	15.10	104	2.81	
No	3763	163	84.90	3600	97.19	

**Table 4:** Link between Various Pathological Histories and Dementia.

Pathological history	Total	Dementia				p-value
		Yes		no		
		n	%	n	%	
Alcohol:						0.134
Yes	68	6	3.13	62	1.67	
No	3828	186	96.87	3642	98.32	
Smoking:						0.753
Yes	257	16	8.33	241	6.51	
No	3639	176	91.67	3463	93.49	
Depression:						0.346
Yes	101	7	3.65	94	2.54	
No	3795	185	96.35	3610	97.46	
Hormonal treatment:						0.604
Yes	35	1	0.85	34	1.43	
No	2455	116	99.15	2339	98.57	
Head trauma:						0.0048
Yes	42	6	3.13	36	0.97	
No	3854	186	95.87	3668	99.03	
General anesthesia within one year:						0.0771
Yes	48	5	2.60	43	1.16	
No	3848	187	97.40	3661	98.84	

In the literature, several authors report a higher prevalence of dementia in women, regardless of the source population [9], whereas studies reporting identical prevalence in both genders are rarer [10]. This over-representation of women could be explained on the one hand, by biological, hormonal (estrogen deficiency in the post-menopausal period) or genetic differences, or sociocultural differences such as a low level of education. On the other hand, by their longer life expectancy. This finding is well-known in the literature [11].

In agreement with the scientific literature, our study showed that age is a strong discriminating factor. 60% of the subjects with dementia were aged 80 years and more, while 20.71% did not have dementia ( $p < 10^{-6}$ ) (Table 1). Age was the only established risk factor in all populations studied, and also in low- and middle-income countries [12]. This significant increase in the prevalence of dementia with age could be explained in addition to biological factors, by the risk of the appearance of cardiovascular diseases, known risk factors for dementia [13], as shown by the high frequency of blood pressure (71.35%) observed in subjects with dementia. Another

explanation would be some situations that the elderly are confronted with: widowhood, malnutrition, change of financial status that can cause stress and withdrawal.

In our study population, 22.92% of the subjects with dementia had a family history of dementia. This rate is significantly higher than the rate found in subjects without dementia (3.28%) ( $p < 0.00001$ ) (Table 1). The Odds Ratio (OR) of dementia in case of a family history of dementia was 8.2 (95% CI: 5.64 - 12.04). Our results are in line with several studies, mainly cross-sectional, which have reported that having a first-degree relative with dementia increases the risk of developing AD by 2 to 4 times [14].

### Modifiable risk factors

**Cultural level and professional activity:** Regarding cultural level, several studies agree that a high level of education (eight or more years of schooling) is a protective factor against Alzheimer's disease because it could increase the synaptic network associated with learning [15]. Other studies have shown that the intensity of intellectual activities is reduced in subjects with Alzheimer's disease [16].

A low level of education (less than 8 years of schooling) is, therefore, a risk factor for this disease. This is, moreover, what our results tend to confirm insofar as 174 subjects suffering from dementia are illiterate (Table 1).

In subjects with a low or medium level of education, the probability ratio (OR) of dementia was estimated at 5.6 (95% CI: 3.44 - 9.16).

According to some authors, the low level of education reduces the phenomenon of neuronal plasticity which would protect against dementia [17]. However, subjects with a high level of education have a greater capacity for cerebral reserve which would allow them to better resist the disease, cope with it and delay the diagnosis [18].

Concerning the link between occupation and dementia, we found a significantly higher rate of subjects who had never worked (55.73%) among the dementia cases than among the subjects without dementia (37.85%) ( $p < 0.00001$ ) (Table 1). The Odds Ratio (OR) of dementia in never-working subjects was estimated to be 2.1 (95% CI: 1.54 - 2.77). Subjects with manual activity have more dementia than those with administrative activity, however, this relationship is not significant ( $p = 0.108$ ).

The relationship between dementia, AD and type of occupation is controversial. Some authors have reported that manual workers have an increased risk of AD [19], others have refuted this [20]. One review reported evidence for a protective effect of high job control and work complexity, relating to people and data against cognitive decline and dementia [21].

The Paquid study showed that the risk of AD would not be related to a particular occupation, but rather would be influenced by cognitive skills during childhood and adolescence and that, however, the risk of dementia with parkinsonism would be increased in female farmers [22].

Among the subjects with dementia we observed a significantly high rate of widowhood (51.04%) compared to that observed among the subjects without dementia (16.55%). Nonetheless, among the subjects without dementia, the rate of married subjects was significantly higher (83.07%) than among the subjects with dementia (47.40%) (Table 1). Our results agree with what has been reported in the literature, that social isolation and loneliness are associated with an increased risk of late-onset dementia [23]. Single subjects or those living alone have a double risk of developing dementia compared to those living in couples [24]. The Fine study [25] showed that men who lost their partners were not married and lived alone had twice the risk of cognitive decline.

### Vascular risk factors

In the present study, a history of High Blood Pressure (HBP) was significantly more common in dementia. It was found in 71.35% of patients with dementia ( $n=137$ ) (Table 3). The Odds Ratio (OR) of dementia in case of a history of hypertension was estimated at 5.76 (95% CI: 4.18-7.94). The existence of a relationship between HBP and neuropathological lesions of Alzheimer's disease (cerebral atrophy, senile plaques and Neurofibrillary Degeneration or (NFD) has been described with a prospective approach in the Honolulu-Asia Aging Study (HAAS) cohort [26].

This study showed that an increase in systolic blood pressure (SBP  $\geq 160$  mmHg) in midlife is associated with lower brain weight and more senile plaques in the neocortex and hippocampus. It also showed that increased Diastolic Blood Pressure (DBP  $\geq 95$  mmHg) is associated with more NFD in the hippocampus. These results are in agreement with much of the literature showing an association between elevated blood pressure and incident dementia or decline in cognitive function [27].

Concerning diabetes mellitus, it was found at a significantly higher rate in patients with dementia (36.46%) compared to those without dementia (16.40%) ( $p < 0.00001$ ) (Table 3). The association of diabetes with dementia regardless of etiology has been proven by several well-conducted meta-analyses and prospective studies over the last decade [28].

In our study, a history of stroke was significantly more frequent in dementia. It was observed in 15.10% of patients with dementia and in 2.81% of those without dementia ( $p < 0.00001$ ) (Table 3). The relative risk of dementia in case of a history of stroke was estimated at 5.03. This is consistent with the literature, which reports that stroke increases the risk of dementia by a factor of 2 to 5, making it one of the major risk factors for dementia [29].

Heart disease was also significantly more frequent in dementia, observed in 33.33% of patients with dementia compared to 15.55% of those without dementia ( $p < 0.00001$ ) (Table 3). The Odds Ratio (OR) of dementia with heart disease was estimated to be =2.72 (95% CI: 1.99-3.72). The association between dementia and heart disease has been studied by several teams, who have found a positive association between



atrial fibrillation and Alzheimer's disease [30], others that heart failure was not only associated with dementia but also with Alzheimer's disease [31].

To explain the association of these different heart diseases with Alzheimer's disease, various hypotheses have been raised, among which the most important is chronic cerebral hypoperfusion.

In our study population, 43.75% of subjects with dementia had hypercholesterolemia, whereas it was observed in 37.07% of subjects without dementia, although this difference was not significant ( $p=0.063$ ) (Table 3). In our study, the absence of an association between cholesterol and dementia could be due to the fact that dyslipidemia was investigated at a late age and not in midlife.

Indeed, studies on cholesterol levels and dementia are very contradictory [32]. While epidemiological studies report an association between high cholesterol levels in midlife and an increased risk of dementia, this association disappears when participants reach a later age. Some studies have even reported an elevated risk of dementia in those with low cholesterol levels [33].

### Lifestyle and dementia

We did not find an association between leisure time and dementia, nor between fish consumption and dementia. On the other hand, we found a borderline significant association between dementia and physical activity ( $p=0.0555$ ). Subjects with dementia and regular physical activity were estimated at 11.46%, and those with regular physical activity without dementia at 16.71% (Table 2).

Recent longitudinal studies carried out on subjects aged 65 years and over, in the general population, have reported an inverse association between regular and sustained physical activity and the occurrence of cognitive decline or dementia [34-36], in particular Alzheimer's type [36-38]. Diversity and frequency appear to be important. The study by Rovio, et al. [39] showed that leisure-time physical activity performed at least twice a week during adult life was associated with a reduced risk of dementia and AD.

### Other factors

History of head injury was found to be a risk factor for dementia in our study population. It was found in 3.13% of patients with dementia and 0.97% of patients without dementia ( $p=0.0048$ ) (Table 4). The odds ratio (OR) of dementia in case of a history of head injury was estimated to be 3.29 (95% CI: 1.37 - 7.91). Indeed, several studies have shown an increased risk of AD after head trauma, and more so in men, which could be increased by the presence of the ApoE 4 allele [40,41].

No other variable was associated with dementia (alcohol, smoking, depression, hormone replacement therapy by estrogen) in the present study. The lack of association between dementia and alcohol in our study is probably related to our socio-cultural attitude towards alcohol consumption.

We did not find a link between depression and dementia (Table 4). The association between depressive disorders and dementia is much discussed in the world literature [39] but is still controversial. Are depressive symptoms real risk factors for dementia, are they an early symptom of neurodegeneration or a response to early cognitive deficits?

### Conclusion

This epidemiological study is part of a public health study because, for dementias associated with aging, our approach should be above all a preventive one. Indeed, the knowledge of several risk factors should favor such an approach which will potentially have a huge impact on the social and health level. Age, lifestyle (living alone), family history of dementia, low cultural level, vascular risk factors (high blood pressure, diabetes, heart disease and stroke), are the most important risk factors for dementia in the Sidi M'Hamed department of Algiers. Risk factors, at least cardiovascular, should be investigated in depth.

The epidemiological data from this study, therefore, constitute a basis for planning primary prevention activities and should encourage the public authorities to consider dementia as a public health priority. However, the need for further studies in other regions of Algeria is obvious.

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