

# The Relationship Between Oral Health and Cognitive Status of the Elderly

Zohre Taraghi,<sup>1</sup> Laleh Fanni-Saberi,<sup>2</sup> Jamshid Yazdani-Charati,<sup>3</sup> and Leila Meskini<sup>4,\*</sup>

<sup>1</sup>Assistant Professor, Head of Geriatric Nursing Department, Mazandaran University of Medical Sciences, Sari, Iran

<sup>2</sup>Faculty Member, Department of Community Health Nursing, Mazandaran University of Medical Sciences, Sari, Iran

<sup>3</sup>Associate Professor, Department of Statistics, Mazandaran University of Medical Sciences, Sari, Iran

<sup>4</sup>MSC Student of Geriatric Nursing, Student Research Committee, Mazandaran University of Medical Sciences, Sari, Iran

\*Corresponding author: Leila Meskini, MSC Student of Geriatric Nursing, Student Research Committee, Mazandaran University of Medical Sciences, Sari, Iran. E-mail: mes136259@yahoo.com

Received 2017 February 18; Revised 2017 April 08; Accepted 2017 May 02.

## Abstract

**Background:** Oral health has a major role in the health as well as quality of life of older adults.

**Objectives:** The present study was conducted with the aim to determine the relationship between oral health and cognitive status of the elderly.

**Methods:** In this descriptive, correlation, cross sectional study, 206 older individuals were selected according to a stratified random sampling method from health centers in Ghaemshahr, Iran between May and October 2016. Data collection tools included cognitive state test (COST), geriatric oral health assessment index (GOHAI), geriatric depression scale, as well as a socio-demographic questionnaire. Dental history and risk factors for cardiovascular diseases were also recorded. Data were analyzed using a logistic regression test.

**Results:** The mean age was  $67.71 \pm 7.28$  years. Out of all participants, 53% (111 individuals) were women, 81.6% (168 individuals) were married, 50.5% (104 individuals) were overweight, 19.4% (40 individuals) had hypertension, and 30.1% (62 individuals) had concomitant hyper-lipidemia, diabetes, and hypertension. No significant relationship was found between age and oral health; however, the relationship between age and cognitive score was significant ( $P = 0.002$ ). Tooth loss was the most predictive of the cognitive state. People that lost 5 - 7 teeth were 4.16 times more at risk for cognitive decline. The cognitive score of those with no weight gain was 2.6 times better than those with weight gain. The cognitive state improved by 1.77 times with a higher education level. The cognitive state of participants who better observed oral health was 1.14 times better. Generally, predictive power of the model was 57.2%.

**Conclusions:** Development of interventions to improve older adults' oral health seems to be essential.

**Keywords:** Oral Health, Older People, Cognitive State

## 1. Background

Despite reports from developed countries regarding reduced tooth loss in adults, edentulousness as well as wearing dentures is still considered a major geriatric problem (1). Nearly 25% of people over 60 years of age are edentulous and those who are not edentulous have lost 50% of their teeth (2). In Iran, 60.6% of the elderly suffer from oral as well as dental problems and 32.2% wear dentures (3).

About 35% of older individuals show different degrees of cognitive problems (4). The results from some recent studies indicate a mild to moderate relationship between oral health as well as cognitive disorders (5). The reaction of the immune system to oral and dental bacteria seems resulted in the death of nerve cells or attenuation of memory (6, 7). According to some studies, reduced number of teeth is associated with increased incidence of cognitive decline (5, 8). These researchers recommended further studies in this field. In a study, no relationship was ob-

served between oral hygiene and cognitive decline in geriatrics (7). Although some studies were conducted to assess oral health in the elderly, in our country, currently, there is insufficient evidence to develop recommendations for strategies to improve cognitive status among the elderly.

## 2. Methods

### 2.1. Sample Collection

In this descriptive, correlation, cross sectional study, 206 older individuals were selected from governmental as well as referral health centers in Ghaemshahr, Iran by a stratified random sampling method between May and October 2016. After the official stages as well as obtaining permission from the research ethics committee of Mazandaran University of Medical Sciences, names as well as addresses of health centers in Ghaemshahr were prepared. Furthermore, 5 out of 12 centers that were located in the

north, south, east, and west of the town were randomly selected and the ratio of the older individuals in each center to the total number of older individuals was found. In each center, samples were selected randomly using the round-between function in Excel. Unqualified older individuals were replaced with others. While explaining the objectives as well as method of the study, the researcher identified eligible older individuals and after obtaining their informed consent, assured them of the confidentiality of data. This study ethically complies with the declaration of Helsinki. Questionnaires were completed verbally, face-to-face, and individually. Necessary training regarding oral and dental hygiene as well as care was given. Sample size was found according to the Park study (5) as follows:

$$n = \frac{\left(z_{\frac{\alpha}{2}} + z_{\beta}\right)^2 \sigma^2}{d^2} \quad (1)$$

$$= 196$$

$$\sigma^2 = 2.25; \alpha = 0.05; \beta = 0.2; d = 0.3$$

Taking into account possible withdrawals, 206 older individuals were recruited. The study inclusion criterion was 60 years old and above. The exclusion criteria included no history of hypothyroidism, stroke, or dementia (5) based on patient's record and unwilling to take part.

## 2.2. Measurement

Cognitive status was assessed using cognitive state test (COST) developed by Babacan-Yildiz (2012) and validated in Iran by Lotfi (2014) (9, 10), with reported Cronbach's alpha of 0.82. This questionnaire contains 19 items in such dimensions as orientation (4 points), registration (3 points), attention (5 points), recall memory (3 points), abstraction and judgment (2 points), verbal category fluency (1 point), retrograde memory (3 points), language (5 points), agnosia (1 point), apraxia (2 points), and visuospatial functions (1 point), making a maximum score of 30 points. Higher scores indicate a better cognitive state. Sensitivity and specificity at the cut-off point of 25.5 were found 94% and 86%, respectively.

Oral health was assessed using the geriatric oral health assessment index (GOHAI) developed by Atchison (1990) and Rezaei et al. found its validity and reliability, with reported Cronbach's alpha of 0.74. This questionnaire contains 12 items in physical, psychological, and social dimensions with scoring based on 5-point Likert scale: always (1), often (2), sometimes (3), rarely (4), and never (5). Questions 3, 5, and 7 are scored in reverse. Minimum score is 12 points and maximum 60 points, and higher scores show a better status of oral health (11).

Depression symptoms were assessed using geriatric depression scale (Yesavage et al., 1983), whose validity and

reliability in Iran were found by Malakouti (2006), with a cut-off point of 6, sensitivity of 0.9, and specificity of 0.83 (12). The sociodemographic questionnaire included age, gender, and education level, cardiovascular risk factors of hypertension, diabetes, hyperlipidemia, smoking, and overweight (13), as well as dental history of number of lost teeth, frequency of brushing, use of dental floss, use of toothpaste, and last visit to dentist (11).

## 2.3. Statistical Analysis

Data were analyzed using descriptive (absolute and relative frequency distribution tables, mean and standard deviation) and inferential (correlation coefficient, logistic regression) statistical tests. Normality of continuous variables was assessed by kolmogorov-smirnov test. Fisher's exact test and logistic regression were used to compare cognitive status scores with oral health variables, depression, weight gain, education, and tooth loss. Values  $P < 0.05$  were considered significant.

## 3. Results

Of all participants, 53% (111 individuals) were women, 81.6% (168 individuals) were married, 50.5% (104 individuals) were overweight, 19.4% (40 individuals) had hypertension, and 30.1% (62 individuals) had concomitant hyperlipidemia, diabetes and hypertension. Information regarding quantitative variables was shown in Table 1.

**Table 1.** Mean Age, Oral Health State, Cognitive State, and Depression Symptoms in Participating Older People in 2016

Variable	Mean $\pm$ SD
Age	67.71 $\pm$ 7.28
Oral health score	39.14 $\pm$ 5.66
Cognitive state score	25.07 $\pm$ 4.13
Depression symptoms score	22.89 $\pm$ 1.74

There was a significant relationship between cognitive state and education ( $P = 0.001$ ). Out of the 206 samples, 48.5% (100 individuals) had cognitive scores of  $\leq 25.5$ , of whom 66.7% (42 individuals) were illiterate, and 51.5% (106 individuals) had cognitive scores of  $> 25.5$ , of whom 33.3% (21 individuals) were illiterates.

Cognitive decline (scores  $\leq 25$ ) was higher in women (49.5%) compared to men (47.4%), however, there was no significant difference between the 2 groups ( $P = 0.781$ ).

Spearman's correlation coefficient showed no significant relationship between age and oral health or between age and BMI, however the relationships between age and cognitive score ( $P < 0.001$ ) as well as age and depression

symptoms were significant ( $P = 0.028$ ). Moreover, the relationships between oral health and cognitive score ( $P < 0.001$ ), oral health and depression symptoms ( $P < 0.001$ ), as well as cognitive score and BMI ( $P = 0.004$ ) were significant.

The present study results showed a significant relationship between cognitive state and frequency of brushing ( $P < 0.001$ ), use of toothpaste ( $P < 0.001$ ), use of dental floss ( $P < 0.001$ ), and last visit to dentist in older people ( $P < 0.001$ ), such that those who less frequently brushed their teeth had lower cognitive scores compared to those that more frequently brushed their teeth; those who used toothpaste had better cognitive state compared to those that did not; those who used dental floss had better cognitive status compared to those that did not; and those with more than 3 years since their last visit to dentist had poorer cognitive state compared to those with less than 1 year since their last visit.

Cognitive status was most predicted by tooth loss. People that lost 5 - 7 teeth were 4.16 times more at risk of cognitive decline. The cognitive score of those with no weight gain was 2.6 times better than those with weight gain. The cognitive state improved by 1.77 times with higher education level. The cognitive state of participants who better observed oral hygiene was 1.14 times better. Generally, predictive power of the model was 57.2% (Table 2).

#### 4. Discussion

The present study results showed that cognitive state improves by 1.77 times with a high education level. In a similar study conducted to assess the relationship between oral hygiene and cognitive decline in elderly Chinese individuals, a significant relationship was found between education level and cognitive disorder, thus people with a lower education had greater cognitive disorders (8). A systematic review conducted on factors affecting older individuals cognitive state showed contradictory data relating to 14 studies conducted on 43201 people over 1 to 11 years follow-up (13).

The results of this study showed the cognitive score of those with no weight gain was 2.6 times better than those with weight gain. In a similar study conducted to assess the relationship between oral hygiene and cognitive function, a significant relationship was found between BMI and cognitive state (14). A systematic review conducted on factors affecting older people's cognitive state showed contradictory data relating to 3 studies conducted on 8475 people over 4 to 8 years follow-up (13).

The present study results showed that the cognitive state was most predicted by tooth loss. Individuals that lost 5 - 7 teeth were 4.16 times more at risk of cognitive

decline and cognitive state of participants that better observed oral hygiene was 1.14 times better. Generally, predictive power of the model was 57.2%. This finding is consistent with the study done by Rai et al. (2010) in North India (15); Stewart et al. study (2013) in London (14); Park et al. study (2012) in Korea (5); and the Luo et al. study (2015) in China (8). However, the study done by Arrive et al., in France (2012), showed no relationship between oral hygiene and cognitive decline in older people (7), which may have been due to the difference in participants' mean age, their socioeconomic status, and study design.

It seems that both rate and speed of tooth loss are higher in old age. The results obtained in a study conducted by Hajiebrahimi et al. (2009) showed that cognitive state is significantly related to use of toothpaste, use of dental floss, brushing, and last visit to dentist (16). In a cross-sectional study conducted in Japan to assess cognitive state and oral hygiene, a significant relationship was observed between brushing and cognitive state, but frequency of brushing was not cited (17). In another study conducted to assess the relationship between edentulousness and quality of life in older individuals in Isfahan city, those that brushed irregularly or had more than 5 years since their last visit to the dentist had poorer quality of life (18).

#### 4.1. Limitations

A number of limitations affected the present study. First, this is a cross sectional study and the correlations can not imply causation relationships between parameters. Secondly, the nutritional status of participants was not assessed.

#### 4.2. Conclusion

It seems that oral health not only prevents gingival diseases and dental caries, but it also provides an effective strategy for preventing cognitive disorders. Considering the prevalence of oral problems in older individuals and its importance in their general health, hygiene training can provide the best and easiest way for maintaining public health. Proper planning for the public through the media can also be beneficial. The usual care measures taken to prevent cognitive disorders are not sufficient. Further studies on the effect of oral health on the cognitive state, taking into account the role of other protective measures are recommended.

#### Acknowledgments

The present article is an extract from geriatric nursing MSc thesis with ethical code: IR.Mazums.REC.95-2236.

**Table 2.** The Relationship Between Oral Health and Cognitive State in Older People According to Regression Analysis (Other Variables Controlled)

Variable	Sig	Exp (B)	95% Confidence Interval for Exp (B)	
			Low limit	High limit
Depression score	0.09	0.54	0.26	1.10
Oral health score	0.000	1.14	1.06	1.22
Education	0.004	1.77	1.20	2.60
Weight gain	0.006	2.60	1.32	5.12
1 - 3 teeth lost	1	0	0	0
3 - 5 teeth lost	0.12	2.61	0.77	8.81
5 - 7 teeth lost	0.007	4.16	1.46	11.85
7 and more teeth lost	0.05	2.43	0.98	5.54

We wish to express our thanks to the Research Deputy of Mazandaran University of Medical Sciences, Director of Ghaemshahr health center, physicians, families, as well as other colleagues, participating older individuals, and all those that helped in this project.

#### Footnote

**Conflicts of Interests:** None

#### References

1. Pallegedara C, Ekanayake L. Tooth loss, the wearing of dentures and associated factors in Sri Lankan older individuals. *Gerodontology*. 2005;22(4):193-9. doi: [10.1111/j.1741-2358.2005.00079.x](https://doi.org/10.1111/j.1741-2358.2005.00079.x). [PubMed: [16329226](https://pubmed.ncbi.nlm.nih.gov/16329226/)].
2. Allen PF. Assessment of oral health related quality of life. *Health Qual Life Outcomes*. 2003;1:40. doi: [10.1186/1477-7525-1-40](https://doi.org/10.1186/1477-7525-1-40). [PubMed: [14514355](https://pubmed.ncbi.nlm.nih.gov/14514355/)].
3. Motlagh MA, Yazdani SH, Taheri Tanjani P. Elderly health profile in Islamic republic of Iran. ;2014.
4. Nejati V. Assessing the health status of elderly people in the province of Qom (2007) [In Persian]. *J Qazvin Univ Med Sci*. 2009;13(1):67-72.
5. Park H, Suk SH, Cheong JS, Lee HS, Chang H, Do SY, et al. Tooth loss may predict poor cognitive function in community-dwelling adults without dementia or stroke: the PRESENT project. *J Korean Med Sci*. 2013;28(10):1518-21. doi: [10.3346/jkms.2013.28.10.1518](https://doi.org/10.3346/jkms.2013.28.10.1518). [PubMed: [24133359](https://pubmed.ncbi.nlm.nih.gov/24133359/)].
6. Kocaelli H, Yaltirik M, Yargic LI, Ozbas H. Alzheimer's disease and dental management. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2002;93(5):521-4. doi: [10.1067/moe.2002.123538](https://doi.org/10.1067/moe.2002.123538). [PubMed: [12075198](https://pubmed.ncbi.nlm.nih.gov/12075198/)].
7. Arrive E, Letenneur L, Matharan F, Laporte C, Helmer C, Barberger-Gateau P, et al. Oral health condition of French elderly and risk of dementia: a longitudinal cohort study. *Community Dent Oral Epidemiol*. 2012;40(3):230-8. doi: [10.1111/j.1600-0528.2011.00650.x](https://doi.org/10.1111/j.1600-0528.2011.00650.x). [PubMed: [22059867](https://pubmed.ncbi.nlm.nih.gov/22059867/)].
8. Luo J, Wu B, Zhao Q, Guo Q, Meng H, Yu L, et al. Association between tooth loss and cognitive function among 3063 Chinese older adults: a community-based study. *PLoS One*. 2015;10(3):e0120986. doi: [10.1371/journal.pone.0120986](https://doi.org/10.1371/journal.pone.0120986). [PubMed: [25803052](https://pubmed.ncbi.nlm.nih.gov/25803052/)].
9. Lotfi MS, Tagharrobi Z, Sharifi K, Abolhasani J. Psychometric Evaluation of the Cognitive State Test (COST) in a Sample of Iranian Elderly People. *Iran Red Crescent Med J*. 2016;18(5):e23786. doi: [10.5812/ircmj.23786](https://doi.org/10.5812/ircmj.23786). [PubMed: [27478627](https://pubmed.ncbi.nlm.nih.gov/27478627/)].
10. Babacan-Yildiz G, Isik AT, Ur E, Aydemir E, Ertas C, Cebi M, et al. COST: Cognitive State Test, a brief screening battery for Alzheimer disease in illiterate and literate patients. *Int Psychogeriatr*. 2013;25(3):403-12. doi: [10.1017/S104160121001780](https://doi.org/10.1017/S104160121001780). [PubMed: [23137551](https://pubmed.ncbi.nlm.nih.gov/23137551/)].
11. Rezaei M, Rashedi V, Khedmati Morasae E. A Persian version of Geriatric Oral Health Assessment Index. *Gerodontology*. 2016;33(3):335-41. doi: [10.1111/ger.12161](https://doi.org/10.1111/ger.12161). [PubMed: [25319235](https://pubmed.ncbi.nlm.nih.gov/25319235/)].
12. Malakouti K, Fathollahi P, Salavati M, Kahani S. Validation of geriatric depression scale (GDS 15) in Iran [In Persian]. *Pejouhesh*. 2006;30(4):361-9.
13. Plassman BL, Williams JJ, Burke JR, Holsinger T, Benjamin S. Systematic review: factors associated with risk for and possible prevention of cognitive decline in later life. *Ann Intern Med*. 2010;153(3):182-93. doi: [10.7326/0003-4819-153-3-201008030-00258](https://doi.org/10.7326/0003-4819-153-3-201008030-00258). [PubMed: [20547887](https://pubmed.ncbi.nlm.nih.gov/20547887/)].
14. Stewart R, Weyant RJ, Garcia ME, Harris T, Launer LJ, Satterfield S, et al. Adverse oral health and cognitive decline: the health, aging and body composition study. *J Am Geriatr Soc*. 2013;61(2):177-84. doi: [10.1111/jgs.12094](https://doi.org/10.1111/jgs.12094). [PubMed: [23405916](https://pubmed.ncbi.nlm.nih.gov/23405916/)].
15. Rai B, Kaur J, Anand SC. Possible relationship between periodontitis and dementia in a North Indian old age population: a pilot study. *Gerodontology*. 2012;29(2):e200-5. doi: [10.1111/j.1741-2358.2010.00441.x](https://doi.org/10.1111/j.1741-2358.2010.00441.x). [PubMed: [21083740](https://pubmed.ncbi.nlm.nih.gov/21083740/)].
16. Hajiebrahimi MH, Charkazi A, Rastgarimehr B, Homayonpour A, Hajiebrahimi Z, Mansourian M. Oral health situation in elder people in gorgan city [In Persian]. *J Diabetes Metab*. 2009;13(6):505-12.
17. Saito Y, Sugawara N, Yasui-Furukori N, Takahashi I, Nakaji S, Kimura H. Cognitive function and number of teeth in a community-dwelling population in Japan. *Ann Gen Psychiatry*. 2013;12(1):20. doi: [10.1186/1744-859X-12-20](https://doi.org/10.1186/1744-859X-12-20). [PubMed: [23800274](https://pubmed.ncbi.nlm.nih.gov/23800274/)].
18. Khadem P. Relationship dental and denture use and quality of life of older people Esfahan [In Persian]. *J Esfahan Dentist Univ*. 2009;5(3):148-54.