# Oral health and nutritional assessment among older adults -An explorative study

## Dr. Devika A B

Ex- Intern Manipal College of Dental Sciences Mangalore, Manipal Academy of Higher Education, Manipal

## Dr. Ramya Shenoy

Professor and Head Department of Public Health Dentistry Manipal College of Dental Sciences Mangalore, Manipal Academy of Higher Education, Manipal

## Dr. Avinash B R

Senior Lecturer Department of Public Health Dentistry, Manipal College of Dental Sciences Mangalore, Manipal Academy of Higher Education, Manipal

## Dr. Praveen Jodalli

Associate Professor Department of Public Health Dentistry, Manipal College of Dental Sciences, Mangalore, Affiliated to Manipal Academy of Higher Education (MAHE), Manipal, India

## Dr. Dharnappa Poojary

Professor Department of Oral and Maxillofacial Surgery Manipal College of Dental Sciences Mangalore Affiliated to Manipal Academy of Higher Education (MAHE), Manipal, India

## Dr. Violet D'Souza

Assistant Professor, Department of Dental Clinical Sciences Faculty of Dentistry, Dalhousie University

Corresonding Author: **Dr. Ramya Shenoy**

**Abstract:**

**Background**:Due to overall development of health care delivery system life expectancy of the population is getting better. India have predicted that the number of older adults is expected to grow to 173 million by 2026. Aging involves many physiological and psychological changes. Often, these may be related to their nutritional intake, oral manifestations of the systemic illness and their treatment, lack of oral care and limited access to dental care services. Studies have shown an association between a reduced number of teeth with the caloric intake.**Objective:**This study aimed to assess uses Oral Hygeine Index- Simplified, Russel's periodontal Index and DMFT Index to evaluate oral status. Mini Nutritional Assesment scale is used to evaluate the general nutrition status of the study population.**Methods:**This cross-sectional analytical study was conducted among older adults living in the Mangalore city.The older adults having 60 years of age, community-dwelling and living in nursing homes, able to perform activities of daily living independently were selected.In this study a total of 66 participants were included out of which 30 older adults were from old age home and 36 were community dwelling.The oral status evaluation included Simplified Oral Hygiene Index (OHI-S), Russel Periodontal Index (PlI), and DMFT index.The nutritional status was assessed using the Mini Nutritional Assessment(MNA) scale**. Results:**The mean BMI of study participants were 25.92 ± 3.90. The MNA assessment showed 38 participants [57.6%] score fell within the normal limits, and only 4 participants [6.1%] were malnourished. Correlation with the mean number of missing teeth,no significant association between the two (r = 0.112, $p$ = 0.403) for the community dwelling participants were observed.

**Keywords:** Dental Plaque Index, DMF Index, Frail Elderly, Mini Nutritional Assessment, Oral Health, Oral Hygeine Index.

## Background

People worldwide are living longer. Today most people can expect to live into their sixties and beyond. Every country in the world is experiencing growth in both the size and the proportion of older persons in the population [1]. According to the population census of India 2011,there are nearly 104 million older adults in India. The United Nations Population Fund and Help Age India have predicted that the number of older adults is expected to grow to 173 million by 2026[2].

Aging involves many physiological and psychological changes leading to increasedmorbiditythere bynegatively affecting physical and cognitive functioning. Impaired physical or cognitive functions affect the oral hygiene practices and thus increase their risk for oral diseases [3].Often, these may be related to their nutritional intake, oral manifestations of the systemic illness and their treatment, lack of oral care and limited access to dental care services.Tooth loss impairs chewing function, and dietary intake and may lead to nutrioanl deficiencies. Studies have shown an association between a reduced number of teeth with the caloric intake[4,5].

Nutrition and oral health have an inter-dependable relation on each other, especially among older adults. A well-balanced diet is the key to oral health and a body that is strong and free from disease because nutrients available systemically will impact overall development, growth and maintenance of tooth structure, connective tissue, alveolar bone and oral mucosa. A nutritional assessment is an in-depth evaluation of both objective and subjective data related to an individual's food and nutrient intake, lifestyle and medical history [6]. Nutritional status of an individual can be determined by clinical, dietary and physical assessment. The Mini Nutritional Assessment Scale is one of the widely used scales[7].

A limited number of studieshave assessed the oral health status and nutritional assessment in older adults residing in India[8].The comparison of the nutritional assessment of older adults living in community-dwelling and old age homes is being done since the characteristics in terms of their levels of care and lifestyles differ. The community dwelling older adults live in a private residence and are independent to choose their diet. The older adults who reside in old age homes are not provided with nutritious food, with their diet restricted to rice and fewer vegetables, meat, milk, and fruits. The old age homes which are commonly called "Poor Homes"are shelters for waifs and the orphans, the old and disabled and all those who have no one to take care of them. The older persons living in old age homes have limited access to dental care compared to older adults in community dwelling. So the present study was carried out to assess the oral health and nutritional status among older adults in community dwelling and old age homes of South Karnataka, India.

## Methodology

This cross-sectional analytical study was conducted among older adults living in the Mangalore city. Ethical clearance to conduct the study was taken from the Institutional Ethics Committee. The older adults having 60 years of age, community-dwelling and living in  nursing homes, able to perform activities of daily living independently were seleted . They had no history of dementia, depression, or any other kind of mental disorders, spoke either English or Kannada (the regional language), and wasphysically and cognitively able to participate in the study. All participants were required to provide written informed consent prior to their participation in the study.

## Data collection

In this study a total of 66 participants were included out of which  30 older adults were from old age home and 36 were community dwelling.Permission to conduct the study among old age home participants was obtained from the Director of the old age home.For the communting dwelling participants snowball sampling  techinique was used. The Confidentiality of the participants was maintained throughout the study.

Two investigators were calibrated for the oral examination prior to the data collection, which involved completing the Simplified Oral Hygiene Index (OHI-S), Plaque Index (PI), and DMFT index[9,10,11] for ten people for both inter- examiners agreement.The kappa value was found to be 0.86. Once this was completed, the consented participants' oral status was evaluated by the two examiners and their demographicsinformation andoral hygiene behaviours were collected using a structured questionnaire.Additionally,the reason for participants'dental visitswas documented.

### Oral status evaluation

The oral status evaluation included Simplified Oral Hygiene Index (OHI-S),Russel Periodontal Index (PlI), and DMFT index[9,10,11].The OHI-S is a simple and sensitive method to assess oral hygiene and has two components,namely 1) Simplified Debris Index(DI-S) and 2) the Simplified Calculus Index(CI-S). The DI-S precede oral examination and scoring. Natural teeth with full-crown restorations and surfaces reduced in height by caries or trauma were not scored[9].Russell's periodontal index was a composite index as it records both reversible and irreversible changes of the periodontium.All the teeth present were examined[10].The DMFT was used to determine the prevalence of coronal caries in twenty eight permanent teeth[11].Those who were in need of urgent or emergency dental care were referred to the dental college immediately.

### Nutritional status

The nutritional status was assessed using the Mini Nutritional Assessment(MNA) scale [7].These investigators were trainedby a nutritionist for assessing the nutritional status of the participants using the MNA scale, which included measuring of height,weight,BMI,food and water intake,mobility, mode of feeding, mid-arm, and calf circumference using a calibrated digital weight scale and a stadiometer and the body mass index was calculated.The BMI was categorized as underweight (18.5); normal weight (18.5 - 24.9); overweight (25-29.9); and obese (30 or greater ).The mid-arm circumference was the circumference of the left upper arm that was measured at the midpoint between the tips of the shoulder and elbow. The mid-calf circumference was measured with the participant sitting on a chair with the leg folded to 90 degrees while the tape positioned circumscribing the widest point without tightening the skin.

### Data Analyses

Data have been analyzed using SPSS 26.0 software, which included descriptive statistics for describing the sample characteristics.Total mean scores and standard deviations (SD) werecalculated for all measured outcomes, such as MNA, malnutrition, PI, DMFT, OHI-S, and then subgroup analyses were performed for old age home residents and community-dwelling participants. All analyses were performed using the statistical significance level at $p \leq 0.05$.

### Results

A total of 66 older adults participated in the study.Of them, 30 were from old age home (OAH) and 36 were community Dwelling(CD). The mean agewas $70.27 \pm 6.95$; and 81.8% were females. The mean BMI of study participants were$25.92 \pm 3.90$ (Table 1).Toothbrushing was the preferred mode of oral hygiene practice for all but one participant [98.5%]; OAH=29(96.7%) CD=36(100%). A majority of participants(63.6%) brushed once daily, 75.8% changed their toothbrush once in two months (Table 3). About 87.9% previously visited a dentist within the last year.Two main reasons for the visit were to receive restoration(17.24%) andcompletedenture (17.24%).Only one person visited the dentist fora routine dental check-up.[Table 1]

### Oral health status

The mean (SD) OHI-S scorewas1.94 $\pm$1.23, suggesting fair oral hygiene. The mean PI was 2.69 $\pm$ 1.95,which means established destructive periodontal disease, and 42% (n=28) had no periodontitis measured by using PI. We did not observe significant differences in OHI-S (p=0.765) and PI scores (p=0.503) between community-dwelling and old age home participants.

The mean DMFT score was 16.76 ± 8.12, and it was comparable between the old age residents and community-dwelling participants. However, the mean number of decayed (p= 0.005)and mean the number of filled teeth  (p=0.039)varied between the two groups. In the DMFT, missing component scored highest with a  mean (SD) value  of 12.93±8.12(Table 2)

**Nutritional condition**
The MNA assessment showed that 50 participants (75.8%) did not show any decrease in food intake for the past threemonths, and 36 participants (54.5%) were unaware of their weight changes for the past threemonths. About 90.9% (n=60) were able to move out of bed but did not prefer going out, and 54.5%(n=36) did not feel any psychological stress.There were mild neurological problems in 93.9% (n=62) of the participants. A vast majority84.8%(n=56) had a BMI greater than 23but within the normal range.Compared with the community-dwelling participants, fewer old age home  participants had BMI greater than 23, though this difference was not significantly different.
The distribution of score between OAH and CD was statistically significant, revealing older adults in old age homes were at risk of malnutrition.  Table 7 indicates a mean malnutrition score of 23.03± 5.57, which was suggestive of risk of malnutrition in the entire population, but the participants from the community had a mean score of 26.02 ± 2.41, which suggests of normal nutritional status.
Malnutrition analysis was carried based on the nutritional assessment scale. We observed that 38 participants [57.6%] had scored that fell within the normal limits, and only 4 participants [6.1%] were malnourished.When the mean malnutrition score was correlated with the  mean number of missing teeth,we found no significant association between the two (r = 0.112, $p$=0.403) for the community dwelling participants.

**Discussion**

This cross-sectional study was conducted with 66 older adults.The mean BMI of  older adults in old age home falls in to the category of overweight[Table 1].A similar  trend was also shown by Ziebolz et al.(2) where 87 nursing home residents were examined.Also there were 52% subjects at the risk of malnutrition and none of them were evaluated as malnourished. In current study, 56.7% were at risk of malnutrition and 13.3% were suffering from malnutrition[Table 8]. The mean DMFT score for their study was 26.4±3.1 which was not in accordance with our mean score  as the mean age was 84.1 ± 8.6  for them which did not match with our mean age of 70.27 ±6.95 .

In comparing the current study with Lauro  H et al.[12] in which  33 elderly people from the Group for the Elderly Interdisciplinary Geriatrics and Gerontology Program, at Fluminense Federal University, Niteroi, RJ, Brazil were assed , there was  a similar trend in  mean age [  71.7±5.35] and Body Mass Index [ 28.8±4.80] with the  current study . Also mean DMFT  was given as 20.19±7.97 with major score being acquired by the missing component [19.65±8.75] simulating our study .

 In a retrospective study by El Toum S Cassia A Bouchi N et al.[13] among  the patients attending Lebanese School of Dentistry ;were 178 patients aged between 10 -92 years with a mean  age of 40.1±17.7,showed a similar trend in the reason to visit dentist with  pain  being scored the most frequent reason  and regular check-up scoring the lowest.

The results from the Fifth German Oral Health Survey showed ,the older adults aged from 65-74  years had a   high DMFT score with missing component contributing the most [14,15].The findings from the present study was in accordance with it.

The results from the oral health survey [16]of people participated in the British National Diet and Nutrition Survey with the participants aged on or above 65 were they divided the population in to two groups –Free living sample and Institutional sample. The authors concluded that the relation between the number of tooth and the BMI score was not linear. In the current study, we have considered correlation between  the number of missing  tooth and the  malnutrition score and a  statistically significant  relation was found in the residents of old age home.

**Strength and limitations**

This is one among the very few studies in this region that have considered comparing the oral health and nutrition status among older adults in the region. Due to the very small sample size, a correct representation of population was not possible. Since the access to the medical report of the participants were not there, the medical and drug history was not complete. The accuracy of weight and height measurements would have compromised as some of the participants had difficulty in standing straight. For the oral examination, majority of the participants were not very keen to the process which might have affected the accuracy. Apart from oral heath, the general health of the subjects were not considered which could have impacted the accuracy of the results .

**Conclusions**

- The main reason for the older persons living OAH to visit dentist was extraction, whereas CD older person visited for the restorative purposes.
- Older adults from CD had better oral hygiene status, low PI score, a smaller number of decayed and missing teeth and a greater number of filled teeth compared to older adults living in OAH.
- Majority of older persons from OAH were at risk of malnutrition and few were malnourished.
- There was no statistically significant correlation between number of missing tooth to malnutrition score with both the groups

**Listofabbreviations:**

PI= Plaque index

PlI= Russels periodontal Index

OHI-S= Oral Hygeine Index simplified

DMFT Index= Decayed Missing Filled Teeth Index

MNA= Mini Nutritional Assessment

CD= Community Dwelling

OAH= Old age Home

**Consent for Publication:**

Informed comsent was taken from all the participants and ethical clearance was obtained from Instituitional research committee, MCODS, Mamgalore.

**Standard of Publication:**

Follows STROBE guidelines

**Availability of Data and Materials:**

On request, data can be shared for the interesred researchers.

# References

1. Ziebolz D, Werner C, Schmalz G, et al. Oral Health and nutritional status in nursing home residents — results of an explorative cross-sectional pilot study. BMC Geriatr. 2017:1-8.
2. Müller F, Nitschke I. Oral health, dental state and nutrition in older adults. Z Gerontol Geriatr. 2005;38:334–41 [in German].
3. Hildebrandt GH, Dominguez BL, Schork MA, Loesche WJ. Functional units, chewing, swallowing, and food avoidance among the older adults. J Prosthet Dent. 1997;77:588–95.
4. Guigoz Y. The Mini-Nutritional Assessment (MNA®) Review of the Literature - What does it tell us? J Nutr Health Aging 2006; 10:466-487
5. Greene JC, Vermillion JR. The oral hygiene index: a method for classifying oral hygiene status. The Journal of the American Dental Association. 1960 Aug ;61(2):172-9.
6. Russell AL. A system of classification and scoring for prevalence surveys of periodontal disease. Journal of Dental Research. 1956 Jun;35(3):350-9.
7. Klein H, Palmer CE, Knutson JW. Studies on dental caries: I.Dental status and dental needs of elementary school children. Public Health Reports (1896-1970). 1938 May 13:751-65.
8. Lauro H, Junior R, Scelza MFZ, et al. Relation between oral health and nutritional condition in the older adults. Journal of Applied Oral Science.2012;20(1):38-44
9. El Toum S, Cassia A, Bouchi N, Kassab I. Prevalence and Distribution of Oral Mucosal Lesions by Sex and Age Categories: A Retrospective Study of Patients Attending Lebanese School of Dentistry. Int J Dent. 2018;2018.
10. Jordan, R. A. & Micheelis, W. (2015) Krankheitsund Versorgungspr€avalenzen bei €Alteren Senioeren mit Pflegebedarf, in Jordan and Micheelis. K€oln: F€unfte Deutsche Mundgesundheitsstudie, IDZ.
11. López R, Smith PC, Göstemeyer G, Schwendicke F. Ageing, dental caries and periodontal diseases. J Clin Periodontol. 2017;44:S145-S152.
12. Marcenes W, Steele JG, Sheiham A, Walls AW.The relationship between dental status, food selestion,nutrient intake, nutritional status , and body mass index in older people .Cad Saude Publica 2003;19:809-16
13. Razak AP et al. Geriatric Oral Health: A Review Article.Journal of International Oral Health 2014;6(6):110-116.
14. Mujica V, Rivera H, Carrero M. Prevalence of oral lesions in older adults Med Oral Patol Oral Cir Bucal. 2008;13(5):270-274. www.medicinaoral.com.
15. Olívia Galvão Lucena Ferreira; Silvana Carneiro Maciel; Antonia Oliveira Silva; Walberto Silva dos Santos; Maria Adelaide Silva P. Moreira. Active aging from the perspective of aged individuals who are functionally independent. Rev. esc. enferm. USP vol.44 no.4 São Paulo Dec. 2010
16. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice :Developing the Short-Form Mini Nutritional Assessment (MNA-SF). J. Geront. 2001; 56A: M366-377.
17. Tomioka K, Okamoto N, Kurumatani N, Hosoi H. Association of Psychosocial Conditions , Oral Health , and Dietary Variety with Intellectual Activity in Older Community-Dwelling Japanese Adults. 2015:1-15.
18. Stow R, Ives N, Smith C, Rick C, Rushton A. A cluster randomised feasibility trial evaluating nutritional interventions in the treatment of malnutrition in care home adult residents. Trials. 2015:1-21.
19. Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment Short-Form (MNA®-SF): A practical tool for identification of nutritional status. J Nutr Health Aging 2009; 13:782-788.
20. Saunders MJ, Stattmiller SP, Kirk KM. Oral health issues in the nutrition of institutionalized elders. J Nutr Elder. 2007;26:39–58.

21. Vanobbergen JN, De Visschere LM. Factors contributing to the variation in oral hygiene practices and facilities in long-term care institutions for the elderly. Community Dent Health. 2005;22:260–5.

22. Lopez-Jornet P, Saura-Perez M, Llevat-Espinosa N. Effect of oral health dental state and risk of malnutrition in elderly people. Geriatr Gerontol Int. 2013;13:43–9.

23. www.everydayhealth.com.(Accessed on Dec 23,2018)

| Table 1. The general characteristics of the sample | | | | |
|---|---|---|---|---|
| | **TOTAL** | **OAH** | **CD** | **ANALYSIS** |
| **Age** | 70.27 ± 6.95 | 72.07±8.30 | 68.78±5.24 | |
| **Sex** | | | | |
| Male | 12(18.2%) | 5(16.7%) | 7(19.4%) | |
| Female | 54(81.8%) | 25(83.3%) | 29(80.6%) | |
| **Body Mass Index** | 25.92 (3.90) | 26.80±4.69 | 25.19 ±2.99 | |
| **Oral hygiene practice** | | | | |
| Toothbrush | 65[98.5%] | 29[96.7%] | 29(96.7%) | |
| Others | 1[1.5%] | 1[3.3%] | | |
| **Brushing frequency** | | | | |
| Once a day | 42[63.6] | 25[83.3%] | 17[47.2%] | |
| Twice a day | 22[33.3%] | 4[13.3%] | 18[50%] | Chi-square=9.97; Df=2; p value=0.007 |
| More than twice a day | 2(3)) | 1[3.3%] | 1[2.8%] | |
| **Frequency of changing toothbrush** | | | | |
| Once in 2 months | 50[75.8%] | | | |
| Once in 3 months | 13[19.7%] | 5[16.7%] | 8[22.2%] | Chi-square=2.33; Df=2; p value=0.311 |
| Once a year | 3[4.5%] | 1[3.3%] | 4[5.6%] | |
| **Dental visit in the past year** | | | | |
| Visited | 58 | 24[80%] | 34[94.4%] | Chi-square=3.205; Df=1; p value=0.073 |
| Not visited | 8 | 6[20%] | 2[5.6%] | |
| **Reasons for dental visits** | | | | |
| Check up | 1[1.72%] | 1[1.72%] | | |
| Pain | 4[6.89%] | 4[6.89%] | | |
| Oral hygiene care | 6[10.34%] | 2[3.44%] | 4[6.89%] | |
| Tooth extraction | 9[15.51%] | 7[12.06%] | 2[3.44%] | |
| Restoration | 10[17.24%] | 1[1.72%] | 9[15.51%] | |

| | | | | |
|---|---|---|---|---|
| Root canal treatment | 2(3.44) | | 2[3.44%] | |
| Crown | 2(3.44) | 1[1.72%] | 1[1.72%] | |
| Removable partial dentures | 2(3.44) | 1[1.72%] | 1[1.72%] | |
| Complete dentures | 10(17.24) | 2[3.44%] | 8[13.79%] | |

| Table 2. The oral health status of the participants | | | | |
|---|---|---|---|---|
| | **Mean (SD)** | **Nursing home residents** | **Community dwelling** | ***p* value** |
| **OHI-S** | 1.94 (1.23) | 1.87 (1.65) | 1.98 (0.95) | 0.765 |
| **PI** | 2.69 (1.95) | 2.92 (2.11) | 2.55 (1.86) | 0.503 |
| **DMFT** | 16.76 (8.12) | 16.22 (10.04) | 17.11 (6.71) | 0.685 |
| **Decayed** | 1.72 (2.10) | 2.65 (2.69) | 1.11 (1.32) | 0.005 |
| **Missing** | 12.93 (8.12) | 12.74 (9.93) | 13.06 (6.8) | 0.886 |
| **Filled** | 1.90 (3.21) | 0.83 (1.85) | 2.60 (3.72) | 0.039 |

| Table 3. Outcomes measured using MNA | | | |
|---|---|---|---|
| | **All participants** | **NH residents** | **Community dwelling** |
| **Food intake decline in the past three months** | | | |
| Severe decrease | 4(6.1) | 4(13.3) | |
| Moderate decrease | 12(18.2) | 8(26.7) | 4(11.1) |
| No decrease | 50(75.8) | 18.(60) | 32(88.9) |
| | | | |
| **Weight loss in the 3 months** | | | |
| >3 | 2(3) | 2(6.7) | |
| 1 to 3 | 16(24.2) | 13(43.3) | 3(8.3) |
| No | 12(18.2) | 3(10) | 9(25) |
| | | | |
| **Mobility** | | | |
| Bedridden or chair bound | 6(9.1) | 6(20) | |
| Not bedridden, but not able to go out | 60(90.9) | 24(80) | 36(100) |
| Abel to go out | | | |
| | | | |
| **Psychological stress or acute disease** | | | |
| Yes | 30(45.5) | 13(43.3) | 17(47.2) |
| No | 36(54.5) | 17(56.7) | 19(52.8) |
| | | | |
| **Neurological problem** | | | |
| No | 4(6.1) | 4(13.3) | |
| Mild | 62(93.9) | 26(86.7) | 36(100) |
| Severe dementia or depression | | | |
| | | | |
| **BMI** | | | |
| < 19 | 2(3) | 2(6.7) | |
| 19-21 | 2(3) | 2(6.7) | |
| 21-23 | 6(9.1) | 3(10) | 3(8.3) |
| >23 | 56(84.8) | 23(76.7) | 33(91.7) |

**Table4: MNA screening,assessment and malnutrition scoreof older adults participate in this survey**

|  | TOTAL | OAH | CD | F value ; df; p value |
|---|---|---|---|---|
| MNA Screening point | 1.52± 0.66 | 1.73 ±0.78 | 1.33 ±0.47 | 2.54; 64; 0.019 |
| Assessment score | 11.83± 3.10 | 9.53± 3.06 | 13.75 ± 1.33 | 7.45; 64; 0.000 |
| Malnutrition score | 23.03± 5.57 | 19.43 ± 6.17 | 26.02 ± 2.41 | 5.89; 64; 0.000 |

Abbreviations :OAH Old Age Home ,CD Community Dwelling MNA Mini Nutritional Assessment

**Table 5: Malnutrition Analysis based on MNA scale of older adults participated in this survey**

|  |  | TOTAL | OAH | CD | Chi-square; df; p value |
|---|---|---|---|---|---|
| Normal |  | 38[57.6%] | 9[30%] | 29[80.6%] | 18.29; |
| At risk |  | 24[36.4%] | 17[56.7%] | 7{19.4%] | 2; |
| Malnourished |  | 4[6.1%] | 4[13.3%] |  | 0.003 |

Abbreviations : OAH Old Age Home CD Community Dwelling