

# Synergistic Relationship of Oral Health Status and Functional Ability on Nutritional Status Among Elderly in Delhi

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## ABSTRACT

**Background:** Malnutrition is becoming an alarming phenomenon among the elderly and is oftentimes underdiagnosed. Poor oral health status and functional inability have been suggested to negatively impact the intake of food, eventually leading to malnutrition. **Objective:** To assess the association of oral health status and functional ability on nutritional status among the elderly in Delhi. **Methodology:** A community-based cross-sectional study of 100 subjects between 60-75 years of age was conducted during 2020-2021 in the West Zone of Delhi, India. Subjects were enrolled using purposive sampling. Information on the socio-demographic profile was collected. Nutritional status was assessed by measuring anthropometric indicators and Body Mass Index (BMI) was calculated and categorized into undernutrition (BMI less than 18.5 Kg/m<sup>2</sup>), normal (18.5-24.9 kg/m<sup>2</sup>), and overnutrition (BMI  $\geq$  25 kg/m<sup>2</sup>). A questionnaire was developed to examine the oral health status. Functional ability was assessed using the Katz index for Activities of Daily Living (ADL) and the Lawton & Brody scale for Instrumental Activities of Daily Living (IADL). **Results:** In the total population (n=100), the prevalence of malnutrition was found to be 42% (24%- undernutrition, 18%- overnutrition). On demographic parameters, financial dependency (p=0.03), monthly income (p=0.04), and SES (p=0.04) were found to be statistically significant among BMI categories of elderly subjects. The prevalence of complete edentulism was 8% and it was significantly associated (p=0.04) with low BMI. Changes in the frequency and quantity of food intake were significantly associated (p=0.03) with 22% of undernourished subjects. Overnourished elderly subjects had a dependency on performing ADL (p=0.03) however, IADL dependency was found not statistically significant among the elderly (p=0.05). **Conclusion:** Oral health and functional ability are found to be associated with the nutritional status however, various demographic factors such as financial dependency, SES, and monthly income also play a crucial role in determining the nutritional status. Thus, the holistic capacity building plays an important role in achieving optimal nutritional status and supporting healthy ageing.

**Keywords:** Malnutrition, Oral health status, Functional ability, Elderly, Nutritional status

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## INTRODUCTION

Aging is a global phenomenon that has a significant impact on population pyramids. [1] Demographic transitions include increase in life expectancy, declining fertility and mortality rates are key factors that result in an increase in the proportion of population aged 60 years and above. [2] Malnutrition is becoming an alarming phenomenon among elderly and is oftentimes under diagnosed.

Poor dental health status as defined by loss of natural teeth leads to loss of chewing ability, mastication, taste perception, and swallowing. [3] It has been reported that poor oral health negatively impacts the overall dietary intake of food and selection of foods. [4] Nutritious foods that are hard in texture,

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difficult to chew and digest are not consumed and this causes deficiency of micronutrients and poor nutritional status among the elderly population.<sup>[5]</sup> Furthermore, poor oral health status and functional inability have been suggested to negatively impact the intake of food which eventually leads to malnutrition. Malnutrition is associated with deteriorating functional status, weakening of the immune system, increased risk of infections, poor wound healing, and sarcopenia.<sup>[2]</sup> A thorough literature review showed a paucity of scientific evidence on studies in India on the association of nutritional status with oral health status and functional abilities among elderly population. Hence, this study was undertaken to fill the gap in the existing knowledge.

## METHODOLOGY

A community-based cross-sectional study was conducted during 2020-2021 in Delhi, India. Delhi has 11 district which sub categorized into 1,616 colonies.<sup>[6]</sup> A total of 100 elderly population aged 60 years and above were selected using purposive sampling methodology. The subjects belong to Middle Income Group (MIG) belonging to D and E grades of land assessment in West Zone of Delhi. Using random sampling methodology, 5 colonies were chosen for the study. The data collection was done house-to-house visit. An informed written consent was obtained from each subject after explaining the objectives and procedure of data collection for the study. The study was approved by the ethical committee of the Department of Home Science, University of Delhi.

### Sample Size

Assuming the prevalence of malnutrition among elderly in Delhi as 20% (Double burden of malnutrition among elderly population of Delhi)<sup>[7]</sup> the desired sample size was obtained using the formula:

$$n = \left[ \frac{Z_{crit}^2 * p * q}{d^2} \right] / D$$

where,

$Z_{crit}^2$  is the confidence co-efficient corresponds to 95% confidence level, relative precision was taken as  $\pm 10$ , design effect of 1.5, and 20% non-response was 96. After considering dropout rate, sample size of 100 elderly subjects was calculated in the study.

The data was collected on the following parameters:

**i) Socio-demographic profile:** An oral questionnaire was administered to obtain identification data and socio-demographic profile such as age, gender, educational qualification, present occupation, family monthly income, financial dependency and living arrangement

of the subjects. Socioeconomic status (SES) was calculated using Kuppaswamy classification (2018).<sup>[8]</sup>

**ii) Oral health status:** Questionnaire was used to collect information on complete loss of teeth, missing teeth, use of dentures, problems related to mouth/teeth, loss of appetite due to change in eating habits through physical examination. Subjects were requested to open the oral cavity for inspection. Complete examination of teeth was undertaken. The edentulous status was assessed when there were no teeth in each of the upper and lower jaws by palpation method. Complete loss of teeth in each of the upper and lower jaws was considered as completely edentulous state.<sup>[10]</sup> In case of complete edentulism, subjects were asked about use of dentures and reason(s) were sought on the non usage of dentures. Subjects were questioned about problems related to mouth/teeth in oral cavity which could affect their oral health status. Data on change in frequency and quantity of food intake due to oral problems was also gathered.

**iii) Activities of daily living (ADL):** Katz index of independence in ADL was used to screen basic functional activities of elderly.<sup>[9]</sup> The scoring system consists of 0-6 points, which categorizes subjects as following: score 6= completely independent; score 4-5= low dependency; score 3-4= medium dependency, and score 1-2=high dependency.<sup>[11]</sup>

**iv) Instrumental activities of daily living (IADL):** Lawton- Brody instrument was used to assess IADL<sup>[12]</sup>. In female, the scoring of IADL scale ranged as following: 0-2= low functionality, 3-5= medium functionality, 6-8=high functionality. In male, the scoring of IADL scale was: 0-1= low functionality, 2-3= medium functionality, 4-5= high functionality.<sup>[11]</sup>

**v) Anthropometric indicators:** The anthropometric indicators such as weight, height, were measured using standard procedures. All these readings were also taken in duplicates. The Body Mass Index (BMI) was computed from measurements taken using the formula: BMI (kg/m<sup>2</sup>) = weight (kg)/height (m<sup>2</sup>). BMI (kg/m<sup>2</sup>) was classified as <18.5 (underweight), 18.5-24.9 (normal), 25-29.9 (overweight) and  $\geq 30$  (obese) as per World Health Organization, 2004.<sup>[13]</sup>

## RESULTS

A total of 100 elderly subjects were enrolled in the study. The socio-demographic profile variables are given in Table 1. The mean age of elderly men was  $65.8 \pm 3.1$  years and women  $63.8 \pm 2.6$  years. Majority of women (63.8%) were found to

<b>Table 1: Socio-demographic Profile of the Elderly Subjects (n=100)</b>		
<b>Socio-demographic variables</b>	<b>Men (n=53)</b>	<b>Women(n=47)</b>
<b>Age</b>		
60-<65	20 (37.7)	32 (68.1)
65-<70	26 (49.1)	14 (29.7)
≤70	7 (13.2)	1 (2.1)
<b>Religion</b>		
Hindu	24 (45.2)	29 (61.7)
Muslim	10 (18.8)	4 (8.5)
Sikh	12 (22.6)	6 (12.7)
Christian	7 (13.2)	4 (8.5)
Others	0	4 (8.5)
<b>Marital Status</b>		
Married	44 (83.1)	38 (80.8)
Widowed	8 (15.1)	8 (17.1)
Divorced/Separated	1 (1.8)	1 (2.1)
Never Married		
<b>Occupation</b>		
Unemployed	4 (7.5)	21 (44.6)
Unskilled	8 (15.1)	7 (14.8)
Skilled	16 (30.1)	3 (6.3)
Clerical	18 (33.9)	14 (29.7)
Professionals	7 (13.2)	2 (4.2)
<b>Education</b>		
Illiterate	0	0
Primary School	4 (7.5)	7 (14.8)
Middle School	3 (5.6)	10 (21.2)
High School	10 (18.8)	15 (31.9)
Intermediate or Diploma	14 (26.4)	6 (12.7)
Graduate	11 (20.7)	6 (12.7)
Profession or Honours	11 (20.7)	3 (6.3)
<b>Financially Status</b>		
Dependent	27 (51)	30 (63.8)
Independent	26 (49)	17 (36.2)

<b>Table 1 (Cont.)</b>		
<b>Socio-demographic variables</b>	<b>Men (n=53)</b>	<b>Women(n=47)</b>
<b>Monthly Income (Rs.)</b>		
6,327-18,949	1 (1.8)	7 (14.8)
18,953-31,589	12 (22.6)	10 (21.2)
31,591-47,262	11 (20.7)	14 (29.7)
47,266-63,178	16 (30.1)	10 (21.2)
63,182-1,26,356	11 (20.7)	4 (8.5)
>1,26,360	2 (3.7)	2 (4.2)
<b>Living Arrangement</b>		
With Spouse and Married Children	18 (33.9)	11 (23.4)
With Spouse and Unmarried Children	8 (15.1)	5 (10.6)
With Spouse, Married and Unmarried Children	12 (22.6)	11 (23.4)
With Married Children Only	12 (22.6)	10 (21.2)
Any Other Combination (Specify)	3 (5.6)	10 (21.2)
<b>Type of Family</b>		
Nuclear	3 (5.6)	5 (10.6)
Joint	23 (43.3)	20 (42.5)
Extended	27 (50.9)	22 (46.8)
<b>Kuppuswamy Scale Socioeconomic Class</b>		
Upper	7 (13.2)	3 (6.3)
Upper Middle	25 (47.1)	12 (25.5)
Lower Middle	11 (20.7)	5 (10.6)
Upper Lower	10 (18.8)	27 (57.4)
Lower	0	0
<b>Note:</b> Figures in parenthesis denote percentages		

be financially dependent and 57.4% belonged to the upper lower SES class.

It was found that the prevalence of complete edentulism was 8% among elderly subjects. Usage of dentures was found in only 2%. The reasons reported for not using denture were discomfort, pain in mouth and ulcers. The problems related to mouth/teeth were reported among 85% of elderly subjects. [Table 2]

On demographic parameters financial dependency ( $p=0.03$ ), monthly income ( $p=0.04$ ) and SES ( $p=0.04$ ) were found to statistically significant among underweight category of BMI of elderly subjects. [Table 3]

The prevalence of malnutrition was 42% (under nutrition-24%, over nutrition-18%) as per BMI was calculated. The prevalence of underweight was higher among subjects who were completely edentulous and had missing teeth ( $p=0.04$ ). [Table 4]

The majorities of subjects (55.6%) were moderately dependent on support for ADL and were significantly associated with elderly who were overweight with BMI more than 25 Kg/m<sup>2</sup>. According to IADL score range, 30% of the men and 37% of the women had dependency for performing IADL however, no statistical significance was found with BMI categories ( $p=0.05$ ). [Table 5]

<b>Table 2: Oral health and functional inability of elderly subjects</b>			
<b>Gender</b>	<b>Men(n=53)</b>	<b>Women(n=47)</b>	<b>Total(n=100)</b>
<b>Oral health status</b>			
Completely edentulous	5 (62.5)	3 (37.5)	8
Missing teeth	48 (52.2)	44 (47.8)	92
Problems related to mouth/teeth	44 (53)	39 (47)	83
Change in frequency and quantity of food intake	44 (51.8)	41 (48.2)	85
<b>Functional inability</b>			
ADL dependency	19 (61.3)	12 (38.7)	31
IADL dependency	30 (56.6)	37 (78.7)	*
<b>Note:</b> Figures in parenthesis denote percentages*Total percentage cannot be calculated because of different IADL score range for males and females.			

<b>Table 3: Association of BMI with Demographic profile of elderly subjects (n=100)</b>				
<b>Variables</b>	<b>BMI</b>			<b>p</b>
	<b>Underweight (&lt;18.5) n=24</b>	<b>Normal (18.5-24.9) n=58</b>	<b>Overweight (≥25) n=18</b>	
<b>Gender</b>				
Men	10 (41.7)	34 (58.6)	9 (50)	0.36
Women	14 (58.3)	24 (41.4)	9 (50)	
<b>Age</b>				
60- <65	12 (50)	32 (55.2)	8 (44.4)	0.40
65- <70	8 (33.3)	23 (39.7)	9 (50)	
≥70	4 (16.7)	3 (5.2)	1 (5.6)	
<b>Financial Dependency</b>				
Dependent	15 (62.5)	33 (56.9)	9 (50)	0.03†
Independent	9 (37.5)	25 (43.1)	9 (50)	
<b>Education</b>				
Primary School	3 (12.5)	6 (10.3)	2 (11.1)	0.58
Middle School	2 (8.3)	7 (12.1)	4 (22.2)	
High School	7 (29.2)	15 (25.9)	3 (16.7)	
Intermediate	7 (29.2)	10 (17.2)	3 (16.7)	
Graduation	5 (29.2)	9 (17.2)	3 (16.7)	
Professional	0	11 (19)	3 (16.7)	
<b>Monthly Income (Rs.)</b>				
6,327-18,949	4 (16.7)	2 (3.4)	2 (11.1)	0.04†
18,953-31,589	3 (12.5)	15 (25.9)	4 (22.2)	

<b>Table 3 (Cont.)</b>				
<b>Variables</b>	<b>BMI</b>			<b>p</b>
	<b>Underweight (&lt;18.5) n=24</b>	<b>Normal (18.5-24.9) n=58</b>	<b>Overweight (≥25) n=18</b>	
31,591-47,262	7 (29.2)	14 (24.1)	4 (22.2)	
47,266-63,178	6 (25)	15 (25.9)	5 (27.8)	
63,182-1,26,356	3 (12.5)	9 (15.5)	3 (16.7)	
>1,26,360	1 (4.2)	3 (5.2)	0	
<b>Living Arrangement</b>				
With Spouse and Married Children	10 (41.7)	12 (20.7)	7 (38.9)	
With Spouse and Unmarried Children	5 (20.8)	4 (6.9)	4 (22.2)	
With Spouse, Married and Unmarried Children	1 (4.2)	16 (27.6)	6 (33.3)	
With Married Children Only	4 (16.7)	17 (29.3)	1 (5.6)	
Any Other Combination (Specify)	4 (16.7)	9 (15.5)	0	
<b>Kuppuswamy Scale Socioeconomic Class</b>				
Upper	1 (4.2)	9 (15.5)	0	<b>0.04†</b>
Upper Middle	11 (45.8)	18 (31)	8 (44.4)	
Lower Middle	1 (4.2)	13 (22.4)	2 (11.1)	
Upper Lower	11 (45.8)	18 (31)	8 (44.4)	
Lower	0	0	0	
Figures in parenthesis denote percentages; †Significant at p<0.05.				

<b>Table 4: Association with BMI with Oral Health Status (n=100)</b>				
<b>Oral Health Status</b>	<b>BMI</b>			<b>p</b>
	<b>Underweight (&lt;18.5) n=24</b>	<b>Normal (18.5-24.9) n=58</b>	<b>Overweight (≥25) n=18</b>	
Completely Edentulous (n=8)	3 (12.5)	5 (9.4)	0	<b>0.04†</b>
Missing teeth (n=92)	21 (87.5)	53 (91.6)	18 (19.6)	
Problems in Mouth and /or Teeth (n=83)	22 (26.5)	45 (54.2)	16 (19.3)	0.23
Change in frequency and quantity of food Intake due to oral problems (n=85)	19 (22.4)	50 (58.8)	16 (18.8)	<b>0.03†</b>
<b>Note:</b> Figures in parenthesis denote percentages; †Significant at p<0.05				

**Table 5: Association with BMI with Functional Ability Status (n=100)**

Activities of Daily Living (ADL)	BMI			p
	Underweight (<18.5) n=24	Normal (18.5-24.9) n=58	Overweight (≥25) n=18	
Independent	19 (79.2)	42 (72.4)	8 (44.4)	<b>0.03†</b>
Dependent	5 (20.8)	16 (27.6)	10 (55.6)	
<b>Instrumental Activities of Daily Living (IADL)</b>				
<b>For Men</b>				0.05
Dependent	5 (50)	17 (50)	8 (88.9)	
Independent	5 (50)	17 (50)	1 (11.1)	
<b>For Women</b>				
Dependent	10 (71.4)	18 (75)	9 (100)	
Independent	4 (28.6)	6 (25)	0	
<b>Note:</b> Figures in parenthesis denote percentages†Significant at p<0.05				

## DISCUSSION

The Covid-19 epidemic has altered the global health, socioeconomic, educational, and cultural landscape in unforeseen ways. The existing age related changes of elderly worsen because of Covid-19. The present study documented the prevalence of malnutrition as 42%. Similar result in Assam showed 53% of malnutrition among elderly. [14] The completely edentulous state was found in 8% of elderly subject. A National Oral Health Survey conducted in 2002–2003 reported that 29.3% of the Indian elderly population had complete edentulism. [15] Earlier studies have reported prevalence of complete edentulism in the range of 15%–55% among elderly subjects. [16, 17, 18, 19, 20]

The study found that subjects with poor oral health status as defined by complete edentulism had significantly low BMI and poor nutritional status. In concordance to the present study, previous studies have reported similar association between poor oral health and involuntary weight loss, [21] underweight, and poor nutritional status among elderly subjects. [3, 22] The study found that restorative treatment for oral problems was not sought by 65% of the elderly subjects. As the study subjects were from middle income group as also observed from SES (table 1), high cost of dental treatment may not be the possible reason, however low awareness regarding oral health hygiene or knowledge about importance of good oral health with age could be one of the reasons. This assumption can be supported from a recent study. [23] The subjects who had missing teeth had significantly high prevalence of under nutrition. Change in the frequency and quantity of food intake due to oral health problems

leads to low BMI. Ease in chewing and swallowing by use of dentures or appropriate treatment at dental healthcare services may probably improve the total quantity of food consumed by the subjects. Previous studies have also documented similar results. [3, 24] The present study assessed the functional ability, both ADL and IADL among elderly subjects. Statistically, ADL was found to be associated with high BMI. The IADL was not significant with BMI however, both men and women with high BMI had low functional ability to perform IADLs. The study on 221 rural elderly in Kalaburagi district of Karnataka found ADL difficulties (p=0.04). Similar results were reported in recent international studies. [25, 26]

## CONCLUSION

The present study found that poor oral health status and functional inability among elderly subjects resulted in poor nutritional status. This study highlights the need to create awareness among elderly by healthcare professional, dentists and physiotherapists on the importance of maintaining good oral health. Physical activity interventions should be included in elderly health programs that help them to improve functional ability and maintain body weight.

## RECOMMENDATION

Creating awareness and implementation of intervention programs will prove to be an effective measure in improving the nutritional status of the elderly and achieve healthy ageing.

## RELEVANCE OF THE STUDY

Preventive education regarding oral health, nutritious diet, adoption of healthy lifestyle behaviors, importance of physical

activity to attain functional ability, periodic regular screening of the elderly population should be incorporated in the health care facilities to promote healthy ageing and better nutritional status.

## AUTHORS CONTRIBUTION

PK: Design, acquisition of data and interpretation of data, manuscript preparation and editing. MS: Conception, manuscript review and final approval of the version to be published.

### SP:

Statistical analysis.

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