Evaluation of Relationship between Nutritional Status and Oral Health Related Quality of Life in Complete Denture Wearers

Abstract

Introduction: The prevalence of malnutrition increases with old age, especially in developing countries like India, and it is the most common cause of morbidity and mortality, because of many factors out of which dentate status is one. Aim and Objective: The aim of this study is to evaluate and determine the effect of nutritional status and dietary intake on the oral health-related quality of life (OHRQOL) of elderly edentulous complete denture-wearing patients and to know whether elderly complete denture wearers have a higher risk of malnutrition. Materials and Methods: A cross-sectional study was conducted among 200 elderly denture-wearing patients above 60 years of age from Nagpur, Maharashtra. Mini-Nutritional Assessment (MNA) questionnaire was used to assess nutritional status, and Geriatric Oral Health Assessment Index (GOHAI) questionnaire was used to determine the OHRQOL of these patients. Descriptive statistics were used to analyze data using SPSS version 21 (SPSS Inc., Chicago, IL, USA). Results: Among the assessed participants, nearly 95% of them had total scores of GOHAI between 12 and 57 which require “needed dental care.” As per MNA, 10.5% had adequate nutrition, 70% were at risk of malnutrition, and remaining 19.5% of participants were malnourished. There was a significant correlation between GOHAI and MNA scores. Conclusion: Low nutritional status was associated with the poor OHRQOL among the elderly. A strong association was found between mean GOHAI and MNA scores and thereby nutritional status and OHRQOL. The use of conventional dentures increases the risk of malnutrition in the elderly due to inability to eat and chew food properly. Dietary analysis and counseling should be strictly incorporated into geriatric treatment planning during prosthetic rehabilitation.

Keywords: Complete dentures, dietary counseling, edentulous, elderly, General Oral Health Assessment Index, Mini-Nutritional Assessment

Introduction

In almost every country, the proportion of people aged over 60 years is growing faster than any other age group, as a result of both longer life expectancy and declining fertility rates.[1] India has around 100 million elderly at present, and the number is expected to increase to 323 million, constituting 20% of the total population, by 2050.[2] Many of the older adults face special health challenges such as degenerative, physical, mental, and cognitive diseases and are at constant risk of noncommunicable cerebral and cardiovascular diseases and communicable diseases.[3,6] Edentulousness is another major challenge faced by the elderly population. Edentulous patients commonly choose cooked or processed foods rather than fresh foods.[3] Some may eliminate entire food groups; have fewer vegetables, less carotene and fiber and more cholesterol, saturated fat and calories.[5-7] Extensive tooth loss reduces chewing performance and affects food choice, leading to malnourishment. Conventional complete dentures are the most commonly used rehabilitation procedure for edentulous patients; however, dentures affect chewing ability as it requires more strokes and time to chew food.[8] Decreased chewing performance, impact on taste, and food selection with difficulty in swallowing as it becomes poorly coordinated, results in choking, low diet quality and poor overall general health.[9] Malnutrition in the elderly because of poor food choices and intake of key nutrients, causing various nutritional problems have an evident impact on their general health and quality of life.[10] The oral cavity is closely related to nutrition because it is the entrance to the digestive system; hence it is common for elderly patients to have poor nutrition and a lower quality of life.
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tract. There are relatively very few studies on oral health and nutritional status. Therefore, an attempt was made to assess the relationship between nutritional status and oral health-related quality of life (OHRQOL) among elderly of Nagpur, the second capital of Maharashtra with an estimated population of 4.6 lakhs and a literacy rate of 88.87%,[10,11] with a potential representation of the Central India region as the district has a very large cultural and socioeconomic diversity as well as patient inflow from a large part of central India, most of the people belonging to middle socioeconomic status. A need was, therefore, felt to evaluate and determine the effect of nutritional status and dietary intake on the oral health-related quality of life (OHRQOL) of elderly edentulous complete denture-wearing patients and to know whether elderly complete denture wearers have a higher risk of malnutrition. The objective was to assess the need to include dietary and nutritional counseling during prosthodontic rehabilitation of elderly edentulous patients. The hypotheses to be tested were that the nutritional status and geriatric oral health do not affect the quality of life of elderly patients.

Materials and Methods

Inclusion criteria were the participants more than 60 years old and did not have any medical conditions contraindicating the oral examination. Exclusion criteria included patients with malabsorption and digestive disorders. A pilot study was conducted among 30 individuals, and sample size was derived at probability of 90% and error of 5%. The final sample size was calculated to 200. Variables assessed were demographic variables, OHRQOL, and nutritional status of the elderly. Ethical approval was obtained from the Institutional Ethics Committee before the start of the study.

Nutritional status assessment

The nutritional assessment will be done using a Mini-Nutritional Assessment questionnaire (MNA, Nestle Nutrition Institute) translated into the local language by the interviewer. Among the tools used to screen malnutrition risk in elderly participants, the MNA[12] is widely used for its reliability in detecting malnutrition risk situations and interception and follow-up throughout treatment. The MNA tests composed of simple measurements and brief questions that can be completed in <10 min: anthropometric measurements (weight, height, and weight loss), global assessment (six questions related to lifestyle, medications, and mobility), dietary questionnaire (eight questions related to number of meals, food and fluid intake, and autonomy of feeding), and subjective assessment (self-perception of health and nutrition). An MNA score >24 identifies participants with good nutritional status. Scores between 17 and 23.5 identify participants at risk of malnutrition. An MNA score <17 reveals protein-energy malnutrition.

Oral health-related quality of life assessment

Numerous instruments have been developed to evaluate the oral health aspect of quality of life, including the oral health impact profile, oral impacts on daily performance, and general oral health assessment index. These tools explore the functional, social, and psychological impacts of oral disorders. The Geriatric Oral Health Assessment Index (GOHAI) is a 12-item assessment questionnaire originally developed by Atchison and Dolan for measuring the quality of life in elderly population.[13] It measures patient-reported oral functional problems together with the psychosocial impacts associated with oral disease. GOHAI has been shown to be sensitive to the provision of dental care, more appropriate when considering functional and psychosocial impacts and better able to detect change within a case than any other study tool used for the purpose. GOHAI comprises 12 items grouped into three fields: (1) the functional field (eating, speaking, and swallowing), (2) the psychosocial field (concerns, relational discomfort, and appearance), and (3) pain or discomfort field (drugs, gingival sensitivity, and discomfort when chewing certain foods). The method used in this study will be the cumulative method (GOHAI-Add), which consists in adding the scores obtained for each of the 12 GOHAI questions. Each question is given a score between 1 and 5. The maximum score is 60 (20 = functional field; 25 = psychosocial field; and 15 = pain or discomfort field). According to Atchison and Dolan, a score ranging between 57 and 60 is considered as high and corresponds.

Figure 1: Diet and nutritional counseling management in edentulous patients
to a satisfactory OHRQOL. A score ranging between 51 and 56 is regarded as average, and a score of 50 or less is considered as a low score, reflecting a poor OHRQOL. In this study, a validated GOHAI questionnaire (Hindi version) by Deshmukh and Radke was used.

The recorded data were transferred to the computer in MS Excel Worksheet. The data were subjected to statistical analysis by SPSS version 21 (SPSS Inc., Chicago, IL, USA). Descriptive and inferential statistics were used to analyze the data. \( P \) value was set at <0.05.

**Results**

A total of 200 institutionalized elderly were included in the study, of which 55% were males and 45% were females. The majority of study participants (46%) were between the age group of 65 and 70 years. Only 75 (37.5%) of participants had completed secondary education. The majority of 154 (77%) participants were unskilled, and 46 (23%) of participants were in skilled occupation [Table 1]. About 85.0% of participants sometimes had difficulty in eating food because of the problems with dentures. Approximately, 80.0% of participants had trouble biting or chewing any kind of food such as firm meat or apples, 95.0% of participants were able to swallow comfortably, and 85.5% of participants never had problems in speaking. Nearly, 90% of them had total scores of GOHAI between 12 and 57 which require “needed dental care” [Table 2]. As per MNA, 10.5% had adequate nutrition, 70% were at risk of malnutrition, and remaining 19.5% of participants were malnourished [Tables 3 and 4]. Pearson correlation results showed that there was a significant correlation between GOHAI and MNA scores \( (P < 0.001, r = 0.36) \).

According to the data derived, the quality of life was also found to be directly proportional to the nutritional status as patients with better nutritional status depicted better quality of life and *vice versa*. It was also seen that female patients were at a higher risk of malnutrition as compared to male patients and also had lower scores for quality of life.

**Discussion**

Appropriate and adequate nutrition of elderly people is of great importance for their general and oral health. Diet plays an important role in preventing disease in the elderly. It has been shown that general health and quality of diet are determined by social support, socioeconomic status, culture, and oral health. A multitude of physical, social, psychological, and biological factors contribute to a person’s nutritional health status. Almost all these factors are particularly pertinent among older adults. Factors such as poverty, social isolation, poorer mental health, loneliness, and losses of different kinds can affect general health and oral health of the person. Older adults are more likely to experience events such as bereavements or physical disability that affect emotional well-being and can result in nutritional health. Previous studies showed that impaired dental status can cause dietary limitations through chewing difficulty, resulting in impaired nutritional status. Masticatory efficiency is affected by the presence of teeth, the number of functional teeth, and the use of prostheses, which influence the choice of food. Tooth loss in elderly people has been related to changes in food intake and nutritional deficiency. Diet and dentition are of great importance, due to the significant role of diet in the etiology of common systemic diseases, such as bowel cancer and coronary heart disease, especially in the elderly. As preparing the food for digestion is one of the main functions of dentition, a fundamental research is required for the scientific exploration of the association between dental status and food intake, nutrition, and mastication, especially for the elderly population.

In this study of elderly population, the elderly with a poor perception of their oral health state had a lower MNA score. In fact, more than 60% of the individuals classified by MNA results as malnourished required dental care according to their GOHAI. OHRQOL tools for the elderly that take account of the functional, social, and psychological repercussions of their oral health are valuable. The MNA results were significantly associated with GOHAI. A high prevalence of the different mastication-related problems were detected (limits on types or amounts of food, difficulties with biting or chewing food, discomfort when swallowing or eating, and feeling uncomfortable eating in front of people) which is supportive of reports by other authors. Daly *et al.* evaluated 49 individuals aged 25–74 years and showed that poor diet and inappropriate food choice were related to the reduced number of teeth. They recommended that dietary advice was needed for older adults to be aware of the importance of a healthy diet. Bailey *et al.* assessed 210 individuals aged 65 years or more and found that an inadequate intake of

![Table 1: Distribution of participants according to the demographic variables variable total subjects=200 n (%)](image)

| Age (years) | n (%) |
|------------|-------|
| 60-65      | 47 (23.5) |
| 65-70      | 92 (46.0) |
| 71 and above | 61 (30.5) |

| Gender | n (%) |
|--------|-------|
| Male   | 110 (55.0) |
| Female | 90 (45.0) |

| Education | n (%) |
|-----------|-------|
| Primary education | 52 (26.0) |
| Secondary education | 75 (37.5) |
| Higher education | 47 (23.5) |
| Graduate | 26 (13.0) |

| Occupation | n (%) |
|------------|-------|
| Skilled | 46 (23.0) |
| Unskilled | 154 (77.0) |
nutrients was related to oral health problems. They came to the conclusion that oral status should be considered as one of the significant components of overall health. Saliva acts as a lubricant in the masticatory process and oral dryness has an important role in food choice and oral manipulation of food, which is even greater than the role of masticatory efficiency. The three main causes of xerostomia in elderly individuals include dehydration, salivary gland deterioration, and neural transmissions interfering with salivary secretion. As salivary secretion is provoked by a normal masticatory function, decreased masticatory function may lead to salivary gland atrophy and therefore decreased synthesis and secretion of saliva. Sheiham et al. reported that a restriction in food because of mastication difficulties only very occasionally produced a deficit in key nutrients (except Vitamin C) detectable by biochemical analysis that could cause a clinical nutritional disease. Hence, these results should always be interpreted in terms of malnutrition risk rather than actual malnutrition. Besides the large number of reported mastication-related problems in this elderly population, the present results show the strong association of an OHRQOL measure with malnutrition in individuals with oral health concerns, although the actual diagnosis of malnutrition requires a more complex study of the patient. Daly et al. found a significant relationship between low body weight and the number of remaining teeth using the MNA. El Osta et al. evaluated OHRQOL using the GOHAI and MNA. The mean GOHAI was 52.1 ± 7.2, with 70.7% of the sample needing oral health care, and the mean MNA score was 24.0 ± 3.31; 3.5% of the elderly were malnourished; 31.5% were at risk of malnutrition; 65.0% were considered adequately nourished. Similar findings were recorded in our study. Geriatric denture population is particularly vulnerable to compromised nutritional health. This paper provides an overview regarding the risk factors associated with malnutrition in the geriatric population, noted as the most important factor considering inability to eat and chew food properly. Since dental prosthetic rehabilitation requires a series of appointment, dietary analysis and counseling can be easily incorporated into geriatric treatment planning which has been presented in a systematic step-wise procedure in Figure 1. The clinician must be aware of beneficial effects of prosthetic treatment and must encourage counteractive dietary guidance. Hence, under individual case scenario, dental and nutritional need may vary and it must be tailored along with dietician to meet the patient’s specific needs. The result of the present study is in accordance with the study done by Patel et al. in the Satara district which also proved the significant relation between nutritional status and OHRQOL. However, due to the nature of the study, the causal relation between the quality of life and nutritional status cannot be assessed. Similar, larger sample-sized multicentric studies may be required for further in-depth studies on the relationship between quality of life and nutritional status. These tools, designed to detect the outcomes of oral—facial disorders, in general, may also serve to identify individuals at risk of malnutrition caused by oral problems. More such surveys

| Table 2: Distribution of participants according to GOHAI scores questionnaire |
|-------------------------------------------------|
| Always (%) | Often (%) | Sometimes (%) | Seldom (%) | Never (%) |
|------------|-----------|---------------|------------|-----------|
| How often did you limit the kinds or amounts of food you eat because of the problems with your teeth or dentures? | 8 (4.0) | 1 (0.5) | 170 (85.0) | 1 (0.5) | 20 (10.0) |
| How often did you have trouble biting or chewing any kinds or food such as firm meat or apples? | 9 (4.5) | 0 (0.0) | 160 (80.0) | 10 (5.0) | 21 (10.5) |
| How often were you able to swallow comfortably? | 180 (90.0) | 4 (2.0) | 2 (1.0) | 4 (2.0) | 10 (5.0) |
| How often have your teeth or dentures prevented you from speaking the way you wanted? | 7 (3.5) | 2 (1.0) | 11 (5.5) | 9 (4.5) | 171 (85.5) |
| How often were you able to eat anything feeling discomfort? | 5 (2.5) | 0 (0.0) | 184 (92.0) | 2 (1.0) | 9 (4.5) |
| How often did you limit contacts with people because of the condition of your teeth or denture? | 3 (1.5) | 0 (0.0) | 8 (4.0) | 11 (5.5) | 178 (89.0) |
| How often were you pleased or happy with the looks of your teeth and gums, or dentures? | 187 (93.5) | 2 (1.0) | 3 (1.5) | 0 (0.0) | 8 (4.0) |
| How often did you use medication to relieve pain or discomfort from around your mouth? | 2 (1.0) | 3 (1.5) | 180 (90.0) | 9 (4.5) | 6 (3.0) |
| How often were you worried or concerned about the problems with your teeth, gums or dentures? | 5 (2.5) | 6 (3.0) | 91 (45.5) | 14 (7.0) | 84 (42.0) |
| How often did you feel nervous or self-conscious because of problems with your teeth, gums or dentures? | 2 (1.0) | 1 (0.5) | 40 (20.0) | 21 (10.5) | 136 (68.0) |
| How often did you feel uncomfortable eating in front of people because problems with your teeth or dentures? | 5 (2.5) | 6 (3.0) | 156 (78.0) | 1 (0.5) | 32 (16.0) |
| How often were your teeth or gums sensitive to hot, cold or sweets? | 12 (6.0) | 119 (59.5) | 60 (30.0) | 1 (0.5) | 8 (4.0) |

*P<0.05 is significant. GOHAI=Geriatric oral health assessment index
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Need oral care
(Gohai<57) 160 (37.9±2.4) 30 125 9
Do not need oral care
(Gohai>57) 40 (61.2±3.1) 9 15 12
Total - n (mean±SD) 200 (14.98±1.59) 39 (27.1±1.34) 140 (19.17±0.99) 21

MNA=Mini nutritional assessment, GOHAI=Geriatric oral health assessment index, SD=Standard deviation

Table 3: Distribution of participants according to the MNA index questionnaire

| Response options                                      | Response n (%) |
|--------------------------------------------------------|----------------|
| Has food intake declined over the past 3 months due to loss of appetite digestive problem chewing or swallowing difficulties? | Severe decrease in food intake 2 (1.0) Moderate decrease in food intake 46 (23.0) No decrease in food intake 152 (76.0) |
| Weight loss during last 3 months?*                     | Weight loss >3 kg 2 (1.0) Does not know 58 (29.0) Weight loss between 1 and 3 kg 4 (2.0) No weight loss 136 (68.0) |
| Mobility?                                              | Bed or chair bound 0 (0.0) Able to get out of bed 3 (1.5) Goes out 197 (98.5) |
| Has suffered psychological stress or acute disease in past 3 months? | Yes 24 (12.0) No 176 (88.0) |
| Neuropsychological problems?*                          | Severe depression 2 (1.0) Mild dementia 24 (12.0) No psychological problems 174 (87.0) |
| How many full meals does patient eat daily?             | 1 meal 0 (0.0) 2 meals 55 (27.5) 3 meals or more 145 (72.5) |
| Consumes 2 or more serving of fruit or vegetables/day?*| No 19 (9.5) Yes 181 (90.5) |
| How much fluid (water, juice, tea, milk, coffee, etc.,) is consumed per day? | <3 cups 84 (42.0) 3-5 cups 111 (55.5) 5 cups 5 (2.5) |
| Mode of feeding?                                       | Unable to eat without assistance 0 (0.0) Self-fed with some difficulties 26 (13.0) Self-fed without any problems 174 (87.0) |
| In comparison with other people of the same age, how does the patient consider his/her health status? | Not as good 4 (2.0) Does not know 138 (69.0) As good 48 (24.0) Better 10 (5.0) |

*P<0.05 is significant. MNA=Mini nutritional assessment

Table 4: Distribution of participants according to the various GOHAI and MNA categories GOHAI

| Response options                                      | Response n (%) |
|--------------------------------------------------------|----------------|
| Has food intake declined over the past 3 months due to loss of appetite digestive problem chewing or swallowing difficulties? | Severe decrease in food intake 2 (1.0) Moderate decrease in food intake 46 (23.0) No decrease in food intake 152 (76.0) |
| Weight loss during last 3 months?*                     | Weight loss >3 kg 2 (1.0) Does not know 58 (29.0) Weight loss between 1 and 3 kg 4 (2.0) No weight loss 136 (68.0) |
| Mobility?                                              | Bed or chair bound 0 (0.0) Able to get out of bed 3 (1.5) Goes out 197 (98.5) |
| Has suffered psychological stress or acute disease in past 3 months? | Yes 24 (12.0) No 176 (88.0) |
| Neuropsychological problems?*                          | Severe depression 2 (1.0) Mild dementia 24 (12.0) No psychological problems 174 (87.0) |
| How many full meals does patient eat daily?             | 1 meal 0 (0.0) 2 meals 55 (27.5) 3 meals or more 145 (72.5) |
| Consumes 2 or more serving of fruit or vegetables/day?*| No 19 (9.5) Yes 181 (90.5) |
| How much fluid (water, juice, tea, milk, coffee, etc.,) is consumed per day? | <3 cups 84 (42.0) 3-5 cups 111 (55.5) 5 cups 5 (2.5) |
| Mode of feeding?                                       | Unable to eat without assistance 0 (0.0) Self-fed with some difficulties 26 (13.0) Self-fed without any problems 174 (87.0) |
| In comparison with other people of the same age, how does the patient consider his/her health status? | Not as good 4 (2.0) Does not know 138 (69.0) As good 48 (24.0) Better 10 (5.0) |

*P<0.05 is significant. MNA=Mini nutritional assessment

Table 3: Distribution of participants according to the various GOHAI and MNA categories GOHAI

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Conflicts of interest
There are no conflicts of interest.

References
1. Irudaya RS. The National Policy for Older Persons: Critical Issues in Implementation BKPAI Working Paper No. 5. New Delhi, US: United Nations Population Fund (UNFPA); 2011.

need to be carried out in other large cities of the country to build comprehensive database for future policy decisions on OHRQOL and nutritional status.

Conclusion
The results of the present study showed that nutritional status was significantly associated with OHRQOL, and the strong association was found between mean GOHAI and MNA scores and nutrition status and OHRQOL. Geriatric denture population is particularly vulnerable to compromised nutritional health. As dental prosthetic rehabilitation requires a series of appointment, dietary analysis and counseling can be easily incorporated into geriatric treatment planning.
2. Jeyaseelan M, Prabu G. Family and marginalisation of elders. Indian J Appl Res 2014;4:601-3.
3. Sammieng P, Ueno M, Shinada K, Zaitsu T, Wright FA, Kawaguchi Y, et al. Oral health status and chewing ability is related to mini-nutritional assessment results in an older adult population in Thailand. J Nutr Gerontol Geriatr 2011;30:291-304.
4. Dauchet L, Amouyel P, Hereberg S, Dallongeville J. Fruit and vegetable consumption and risk of coronary heart disease: A meta-analysis of cohort studies. J Nutr 2006;136:2588-93.
5. He FJ, Nowson CA, MacGregor GA. Fruit and vegetable consumption and stroke: Meta-analysis of cohort studies. Lancet 2006;367:320-6.
6. Hildebrandt GH, Dominguez BL, Schork MA, Loesche WJ. Functional units, chewing, swallowing, and food avoidance among the elderly. J Prosthet Dent 1997;77:588-95.
7. Sheilam A, Steele J. Does the condition of the mouth and teeth affect the ability to eat certain foods, nutrient and dietary intake and nutritional status amongst older people? Public Health Nutr 2001;4:797-803.
8. Gil-Montoya JA, Subirá C, Ramón JM, González-Moles MA. Oral health-related quality of life and nutritional status. J Public Health Dent 2008;68:88-93.
9. Atchison KA. The general oral health assessment index – The geriatric oral health assessment index. In: Slade GD, editor. Measuring Oral Health and Quality of Life. Chapel Hill: University of North Carolina, Dental Ecology; 1997.
10. Census of India 2011: Data from 2011 Census Including Cities Villages and Towns. Census Commission of India. Press Information Bureau, Government of India; 2011.
11. WHO. Basic Oral Health Survey, Basic Methods. 4th ed. New Delhi: AITBS Publishers and Distributors; 1998.
12. Patel P, Shivakumar KM, Patil S, Suresh KV, Kadasetti V. Association of oral health-related quality of life and nutritional status among elderly population of Satara district, Western Maharashtra, India. J Indian Assoc Public Health Dent 2015;13:269-73.
13. Atchison KA, Dolan TA. Development of the geriatric oral health assessment index. J Dent Educ 1990;54:680-7.
14. Deshmukh SP, Radke UM. Translation and validation of the Hindi version of the geriatric oral health assessment index. Gerodontology 2012;29:e1052-8.
15. de Andrade FB, de França Caldas A Jr., Kitoko PM. Relationship between oral health, nutrient intake and nutritional status in a sample of Brazilian elderly people. Gerodontology 2009;26:40-5.
16. Daly RM, Elsner RJ, Allen PF, Burke FM. Associations between self-reported dental status and diet. J Oral Rehabil 2003;30:964-70.
17. Lamy M, Mojon P, Kalykakis G, Legrand R, Butz-Jorgensen E. Oral status and nutrition in the institutionalized elderly. J Dent 1999;27:443-8.
18. Sheiham A, Steele JG, Marcenes W, Lowe C, Finch S, Bates CJ, et al. The relationship among dental status, nutrient intake, and nutritional status in older people. J Dent Res 2001;80:408-13.
19. Chauncey HH, Muench ME, Kapur KK, Wayler AH. The effect of the loss of teeth on diet and nutrition. Int Dent J 1984;34:98-104.
20. Hollister MC, Weintraub JA. The association of oral status with systemic health, quality of life, and economic productivity. J Dent Educ 1993;57:901-12.
21. Papas AS, Palmer CA, Rounds MC, Herman J, McGandy RB, Hartz SC, et al. Longitudinal relationships between nutrition and oral health. Ann N Y Acad Sci 1989;561:124-42.
22. Wayler AH, Muench ME, Kapur KK, Chauncey HH. Masticatory performance and food acceptability in persons with removable partial dentures, full dentures and intact natural dentition. J Gerontol 1984;39:284-9.
23. Touger-Decker R, Schaeffer M, Flinton R, Steinberg L. The impact of tooth loss and dentures on dietary habits and nutrition risk status. J Dent Res 1996;75:190.
24. Liedberg B, Stoltze K, Norlén P, Owall B. ‘Inadequate’ dietary habits and mastication in elderly men. Gerodontology 2007;24:41-6.
25. Bailey RL, Ledikwe JH, Smiciklas-Wright H, Mitchell DC, Jensen GL. Persistent oral health problems associated with comorbidity and impaired diet quality in older adults. J Am Diet Assoc 2004;104:1273-6.
26. Allen PF. Association between diet, social resources and oral health related quality of life in edentulous patients. J Oral Rehabil 2005;32:623-8.
27. Joshipura KJ, Willett WC, Douglass CW. The impact of edentulosity on food and nutrient intake. J Am Dent Assoc 1996;127:459-67.
28. Geissler CA, Bates JF. The nutritional effects of tooth loss. Am J Clin Nutr 1984;39:478-89.
29. Ernest SL. Dietary intake, food preferences, stimulated salivary flow rate, and masticatory ability in older adults with complete dentitions. Spec Care Dentist 1993;13:102-6.
30. Adibi P, Kesh teli AH, Esmailizadeh A, Afshar H, Roohafza H, Bagherian-Sararoudi H, et al. The study on the epidemiology of psychological, alimentary health and nutrition (SEPAHAN): Overview of methodology. J Res Med Sci 2012;17:211-6.
31. El Osta N, Hennequin M, Tubert-Jeannin S, Abboud Naaman NB, El Osta L, Geahchan N, et al. The pertinence of oral health indicators in nutritional studies in the elderly. Clin Nutr 2014;33:316-21.
32. Rathee M, Singla S, Bhoria M, Kundu R. Role of nutrition assessment and dietary counseling in geriatric denture population – An overview. J Oral Health Res 2015;6:2-4.