A Systematic Review on Impact of Edentulism on Nutritional Status of Elderly Adults as Compared to Dentulous Adults

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Abstract

Background: Age related changes in oral structures and nutritional deficiencies cause difficulties in wearing complete dentures amongst elderly adults
Objective: To identify the impact of edentulism on nutritional status of elderly adults.
Methodology: To conduct the present study, information of existing literature are collected from textbooks, printed journals, and electronic databases such as pubmed, scopus, and science direct.
Result: Prevalence of malnutrition rises with an increase in age. Edentulous subjects more likely to report trouble in chewing their food as compared to dentulous subjects. Edentulous subjects had significantly lower intake of calories, protein, carbohydrate, fibres, vitamins A, C,B1, and B6. Intake of calcium and protein was lower in women with dentures than in dentate women. Compromised oral functional status was associated with lower serum albumin levels and lower BMI in functionally dependent elderly people.
Conclusion: There is good quality evidence that edentulism is associated with poor diet and compromised nutrition. Although the majority of the studies cited here have not established a cause and effect relationship, results from Sheiham and others. However, more longitudinal studies on this topic are required to further understand the potential role of nutrition in the prevention of age related changes and reduce the failure of complete denture treatment in elderly adults.
Keywords: Aging, Complete Denture, Elderly adults, Nutritional Assessment, Nutrition.

1 INTRODUCTION

Aging begins at conception, but from a practical viewpoint, aging begins at birth.
Thereafter, two phases of aging must be considered—the chronologic age and the physiologic age; the first denoting the passage of time, the second, the resultant effect of the passage of time on the functional elements of the body. The rate of aging varies in individuals, and an applicant for social security at the age of 65 years may have mental alertness approximating the age of 50, but a masticating mechanism approximating the age of 75 years. (1)

The normal age-related changes of the masticatory apparatus are attrition of the teeth, loss of elasticity and surface texture of the mucosa, reduction in the bulk and control of the masticatory muscles, arthritis in the temporomandibular joints, a moderate reduction of taste perception and resting salivary flow rate, and a certain loss of periodontal attachment. (2, 3)

Epidemiologic studies have shown that older people today tend to have few remaining functional teeth and that their general dental health is usually poor. (4)

The oral problems of particular importance are a high prevalence of root surface caries and poor oral hygiene. However, older individuals often can adapt to or compensate for such physiologic changes. For example, an age-related reduction in the unstimulated salivary flow rate due to structural changes in the salivary glands is not necessarily associated with a similar reduction of the stimulated salivary flow rates; in fact, the latter may increase with age. (5)

Nutrition is the process of providing proper food elements for the maintenance of health and growth. Nutrition includes digestion, absorption, assimilation, and the actual use of nutrients by the cells of the body. Diet is related to the variety and amount of food that is eaten. A proper diet must be followed for an individual to be well-nourished. (6)

Even after wearing well-made dentures, edentulous people have difficulty in chewing foods that are hard or tough in texture (7–11). Furthermore, there is ample evidence that they modify their diets and that even the foods they are eating aren’t always easy to chew. (12, 13) This situation leads to the question of whether edentulous patients have adequate nutrient intake to maintain general good health. Thus the objective of the present study was to synthesize evidence on the impact of edentulism on the nutritional status of elderly adults as compared to dentulous individuals.

2 | METHOD

To conduct the present study, information on existing literature is collected from textbooks, printed journals, and electronic databases. General information was collected from google. Information in the electronic databases is collected from HON certified websites such as PubMed, Scopus, Science direct. The highest level of evidence in the form of meta-analyses of systematic reviews was collected from the Cochrane library by indexing mechanism with sets of queries. The literature search was carried out by using the following search terms: Aging, Complete Denture, Elderly adults, Nutritional Assessment, Nutrition.

The research question formulated for the study was: Do edentulous oral status and denture therapy impact nutritional status as compared to the dentulous oral status of elderly adults? The collected articles of good quality are organized with the research question and objectives of this study. The articles are tabulated for comparison of data for scholarly critical appraisal.

3 | RESULTS

The review procedure is described in Figure 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement was followed to assess the quality of the included articles. (14, 15) As shown in the Figure 1, a total of 353 studies were identified: After the removal of duplicates, 243 were considered potentially relevant and were screened for pertinent content. This was
a scientific review that didn’t require the ethics approval of an ethics panel. Because of the heterogeneity of the study designs, a narrative synthesis approach, instead of a meta-analysis, was utilized to look at the results. Different estimators of effect size (ES) were calculated consistent with the info to be compared. Cohen’s d values were reported as indicators of effect size (ES) for comparing the mean values. We interpreted the importance of the ES using the benchmarks for “small ES” (d = 0.2), "medium ES" (d = 0.5), and "large ES" (d = 0.8) as defined by Cohen. (16) The ES of the difference between two proportions was estimated consistent with the arcsine transformation by Cohen, and a Cohen’s h value was obtained. We interpreted the importance of those ES using the benchmarks for “small ES” (h = 0.2), “medium ES” (h = 0.5) and “large ES” (h = 0.8). Finally, odds ratios were converted into ES using a method proposed by Hasselblad & Hedges. (17)

Prevalence of malnutrition rises with an increase in age. Edentulous subjects more likely to report trouble in chewing their food as compared to dentulous subjects. Edentulous subjects had significantly lower intake of calories, protein, carbohydrate, fibers, vitamins A,C,B1,B6 and folates. intake of calcium and protein was lower in women with dentures than in dentate women. Compromised oral functional status was associated with lower serum albumin levels and lower BMI in functionally dependent elderly people.

There is good evidence that edentulism is associated with poor diet and compromised nutrition. Although the bulk of the studies cited here haven’t established a cause and- effect relationship, results from Sheiham and others (18), Allen and McMillan (25) and our group do suggest that tooth loss may cause the dietary change. As a result, those with edentulism may be at elevated risk for several chronic illnesses such as cancer, diabetes, hypertension, and heart disease.

Oral rehabilitation with simple mandibular implant overdentures appears to offer a solution to the lack of intake of healthy, hard-to-chew foods by people wearing conventional dentures. Additional studies must be carried out to support these recent findings. (26)

4 | DISCUSSION

Research to advance the treatment of edentulism must also continue. Conventional dentures have long been the quality treatment for edentulism. However, even with new conventional dentures, which improve simple chewing, dietary intake often remains unchanged. (27) Numerous studies over the past 2 decades have shown that implant-retained overdentures significantly improve ease of chewing (28–32), and investigators are now measuring the effect of implant therapy on nutrition. Sebring and others (33) and Sandström and Lindquist (34) both conducted investigations to work out whether patients with implant-retained overdentures and traditional dentures changed their eating patterns. They found no significant alterations in dietary intake for either group and Sebring et al. further noted no increase within the consumption of nutrients among the implant group. Those studies suggest that, even with improvements in their ability to chew, people don’t change their diets. However, Allen and McMillan (25) reported that subjects who received mandibular implant overdentures did alter their food choices, as compared to patients who received conventional dentures. What this prospective study suggests is that appropriate oral rehabilitation can overcome the poor dietary habits of individuals wearing conventional dentures. As-yet-unpublished data from a randomized clinical test, including blood studies and anthropometric tests, tend to support the hypothesis that nutrition improves in subjects wearing mandibular 2-implant overdentures. Further research to check the truth effect of implant therapy on the nutritional state is a priority. Unfortunately, none of these studies measured physiological variables.

Milne et al. (35) examined trials to evaluate interventions designed to improve the nutritional status of older people and their clinical outcomes; extra protein ad energy sources were provided, usually as commercial sip-feeds. Most studies were randomized or quasi-randomized controlled trials of oral protein and energy supplementation in older people and were included in the review except groups recovering from cancer treatment or in critical care. Sixty-two trials were included (n = 10 187), of which
only 38 involved undernourished older people or frail dependent older people. In 2015, this review was updated by WHO and a further 29 trials were included within the evidence synthesis.

Baldwin et al. (36) published a Cochrane review that examined the evidence that dietary advice in adults with disease-related malnutrition improves survival, weight, and anthropometry; estimated the dimensions of any additional effect of oral nutritional supplement (ONS) combined with dietary advice and compared the consequences of dietary advice with those of ONS administration. Forty-five studies (n = 3186) met the inclusion criteria. Dietary advice was compared with: no advice (n = 1053); ONS (n = 332); dietary advice and ONS (n = 731). Dietary advice plus ONS was compared with no additional intervention (n = 1070). Four studies from this review targeted older people and were included in the WHO review.

Munk et al. (37) undertook a systematic review and meta-analysis to evaluate the evidence for an effect of individualized dietary counselling on physical function, readmissions, mortality, nutritional status, nutritional intake, and quality of life in nutritionally at-risk older patients following discharge from hospital. Four randomized controlled trials (n = 729) were included. Overall, the evidence was of moderate quality. Dietitians provided counseling in all studies. Three studies from this review were included in the evidence synthesis by WHO.

There is adequate, moderate-quality evidence to suggest that oral nutritional supplement (ONS) with or without dietary advice improves the nutritional status of undernourished older people. Four trials examined the benefit of ONS for undernourished older people in community settings. Data on weight gain reported as an outcome was pooled in the meta-analysis. Overall, the pooled treatment effect was in favour of the ONS group (mean difference 3.17 [2.12 to 4.21], P < 0.01). Also, 14 trials from hospital or long-term care settings that examined the benefit of ONS reported significant reductions in mortality and increased weight gain in the intervention groups compared with usual care or placebo. (38)

There is adequate, low-quality evidence to suggest that ONS with or without dietary advice may improve the nutritional status of older people at risk of undernutrition. Fifteen trials that investigated the benefit of ONS in a hospital or long-term care settings reported significant improvements in body weight. A further seven trials showed a significant improvement in handgrip strength. However, trials from community settings showed no benefit of ONS for older people at risk of undernutrition in either improving body weight or reducing mortality. Outcomes related to functional status were reported in many trials. Improvements in activities of daily living were assessed in 12 studies; however, the results in only three trials achieved statistical significance. Health-related quality of life was measured in 17 studies. (38)

**SAMPLE DIETS FOR EDENTULOUS PATIENTS (39–41)**

Denture patients may only be one-fourth as efficient in chewing food as persons who possess natural teeth. Although the sequence of eating food is incising, then chewing, and eventually swallowing, it’s much easier for denture patients to find out eating procedures within the opposite order, namely, swallowing, chewing, and incising. Logically, then, foods of the right consistency must be chosen so that these functions can be learned during this order. For the primary day, the patient with new dentures should select liquid foods that require only swallowing. Foods should be selected from the four food groups.

- **Milk group:** Fluid milk could also be taken in any form.
- **Meat group:** Tender meat, like finely chopped beef, ground liver, tender chicken, or fish during a white sauce.
- **Vegetable-fruit group:** These foods could also be used as juices.
- **Bread-cereal group:** Thin gruels could also be cooked in either milk or water.

The diet for the second and third day should include foods that need a minimum of chewing.

- **Milk group:** Fluid milk could also be taken, as within the diet.
- **Meat group:** Tender meat, like finely chopped beef, ground liver, tender chicken, or fish during a white sauce.
Vegetable-fruit group: additionally, fruit and vegetables (skins and seeds must be removed), like asparagus tips, cooked carrots, green beans, potato, chopped spinach or other greens, winter squash, applesauce, peaches, pears, and apricots, could also be used. Dried peas could also be utilized in a strained thick soup.

Bread-cereal group: Cooked cereals, like Cream of Wheat, milk toast and softened bread, boiled rice, spaghetti, macaroni, or noodles may bread used. The diet for the fourth and subsequent days are often expanded.

Milk group: Cheddar type cheeses also as fluid milk and pot cheese are often added.

Meat group: Steak, chops, roast, fish, eggs altogether forms, and cooked legumes could also be eaten.

Vegetable-fruit group: All cooked and raw fruits except those which require an incision, like apples and corn on the cob, could also be eaten.

Bread-cereal group: All bread and cereals except those with hard crusts that require an incision, like sandwiches, crusty bread, and hard rolls, could also be included.

After several weeks, solid food requiring incision could also be allowed additionally to the foods within the initial diet plan. the power of patients to manage foods like sandwiches, raw apples, corn on the cob, and raw celery is a private variable. Theoretically, if all mechanical, biologic, and psychological obstacles involved within the wearing of complete dentures are overcome, the patient should be ready to masticate foods of all textures, even those requiring prehension and division.

5 | CONCLUSION

This systematic review analyses recent evidence that nutrition and aging are related to complete denture treatment in older adults. However, an easy conclusion about the efficacy of nutrition and aging on the success of complete denture treatment can’t be established due mainly to the cross-sectional design of many of the included studies. In summary, more prospective cohort studies in older adults are needed to further understand the potential role of nutrition within the prevention of aging-related changes and reduce the failure of complete denture treatment in elderly adults.

REFERENCES


EDENTULISM AND NUTRITIONAL STATUS


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FIGURE 1: Flow diagram of study selection

- Records identified through database searching (n=353)
  - Pubmed=142
  - Scopus=211

  - Duplicates removed (n=110)

  - Records after duplicates removal that were screened for retrieval (n=243)

  - Records excluded based on the title and abstract (n=188)
    1. Setting (n=31): Persons younger than 65 or with a mean age<65 yrs old (n=13), patients with specific diseases (n=8), or the sample did not include elderly adults (n=11)
    2. Study objective (n=88): not designed to study the relationship between nutritional status and aging in edentulous patients (n=63), nutrition and/or aging in edentulous patients was not a primary outcome (n=20), or there was not sufficient information included to interpret the data (n=3)
    3. Type of study (n=71): reviews (n=27), letters and editorials (n=2), abstracts (n=3), books or book chapters (n=8), Conference abstracts or papers (n=6), descriptive studies (n=3), studies based on the description of a protocol (n=5), studies based on the perspective of the author (n=4), comments on an article (n=3), and guidelines (n=10)

- Full text articles assessed for eligibility (n=55)

- Full text articles excluded based on the application of inclusion criteria (total n=48)
  1. Setting (n=19): Persons younger than 65 or within a mean age <65 years old (n=8), patients on specific diet (n=1), unclear criteria of aging in edentulous patients (n=9), or the sample did not include aging in edentulous patients (n=1)
  2. Study objective (n=29): not designed to study the relationship between nutritional status and aging in edentulous patients (n=17), nutrition and/or aging in edentulous patients was not a primary outcome (n=8), or examining an intervention program (n=4)

- Studies included in the manuscripts (n=7)
## EDENTULISM AND NUTRITIONAL STATUS

### TABLE 1: Summary of important articles regarding the connection between edentulism and nutrient intake

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study design</th>
<th>Study sample</th>
<th>Primary classification</th>
<th>Primary Outcome</th>
<th>Key results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheiham and others (18) (2001)</td>
<td>Cross-sectional</td>
<td>755 elderly adults, some living in the community and others living in institutions</td>
<td>Dentition status</td>
<td>Nutrient intake measured by food diary, blood sample and urine sample</td>
<td>After adjustment for age, socioeconomic factors and sex, edentulous subjects has significantly lower intake of numerous nutrients.</td>
</tr>
<tr>
<td>Joshipura and others (19) (1996)</td>
<td>Prospective, cross-sectional</td>
<td>49,501 male health care professionals</td>
<td>Dentition status</td>
<td>Dietary intake</td>
<td>Pronounced differences in intake of hard to chew foods between dentate and edentulous subjects; amount of processed food eaten increased with degree of edentulism.</td>
</tr>
<tr>
<td>Krall and others (20) (1998)</td>
<td>Cross-sectional</td>
<td>638 middle aged and elderly man</td>
<td>Dentition status</td>
<td>Intake of various nutrients</td>
<td>Progressive impairment of dentition status was related to decreasing intake of calories, protein, carbohydrate, fibre and numerous vitamins and minerals; dentition status and nutrient intake were related to masticatory function.</td>
</tr>
<tr>
<td>Papas and others (22) (1998)</td>
<td>Cross-sectional</td>
<td>691 subjects for one portion and a subset of 181 for a second portion</td>
<td>Dentition status</td>
<td>Nutrient intake</td>
<td>Significantly lower intake of vitamin A, C and B6, folates, protein and calories in man with dentures than in dentate man. Intake of calcium and protein was lower in women with dentures than in dentate women.</td>
</tr>
<tr>
<td>Greksa and others (23) (1995)</td>
<td>Cross-sectional</td>
<td>34 edentulous and 38 dentate subjects</td>
<td>Dentition status</td>
<td>Nutrient intake determined by 24-h dietary recall</td>
<td>Edentulous subjects more likely to report trouble in chewing their food, diet of dentate subjects tended to be better, as indicated by lower consumption of fat and cholesterol and higher consumption of protein, vitamins and minerals.</td>
</tr>
<tr>
<td>Mojon and others (24) (1999)</td>
<td>Cross-sectional</td>
<td>324 older adults living in institutions</td>
<td>Compromised oral functional status defined by the presence of specific health disorders</td>
<td>Nutritional status as measured by serum albumin level and body mass index</td>
<td>Compromised oral functional status was associated with lower serum albumin levels and lower BMI in functionally dependent elderly people.</td>
</tr>
</tbody>
</table>