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Review Article

Association between food intake and oral health in elderly: SEPAHAN systematic review no. 8

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ABSTRACT

Dental status may influence food intake. The aim of this review was to summarize the earlier investigations on the association between food intake and dental status. We searched the electronic databases of PubMed and the Cochrane library for articles published until 30 February, 2012. To reach the related published articles, Medical Subject Heading (MeSH) terms of 'oral health,' 'masticatory performance,' 'dental status,' and 'eating' or 'food intake' were used. We included all research articles in the English language that (1) had used the random sampling method, and (2) had investigated the association between dental status and nutrient intake in elderly, non-denture wearer individuals, with no systemic illness. The findings of the seven original research articles had a great variation. Four of them supported a strong association between dietary intake and dental status and three of them found that there was no association between these variables. Most investigations found a significant relationship between the oral health status and nutrient intake; however, longitudinal studies were required for a better understanding of the diet-oral health relations.

Key Words: Dental status, dietary intake, eating, food intake, masticatory performance, oral health

INTRODUCTION

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.[1-5] It has been shown that general health and quality of diet are determined by social support,[6-8] socioeconomic status, culture,[9,10] and oral health.[11,12] Recent studies have indicated a significant association between dental status and nutrient intakes.[11,12] Dental impairment is associated with reduced intake of vitamins, calcium, dietary fiber, and protein.[12,13] An adequate amount of saliva is necessary for the proper masticatory function and swallowing. Saliva plays an important role in the chewing process by binding the food fragments together so that they can be swallowed without the risk of respiratory aspiration.[14] It seems that limited dietary intakes are related to food choice, rather than the direct mechanical effects of imperfect chewing in individuals with impaired oral function.[15]

Previous studies showed that impaired dental status can cause dietary limitations through chewing difficulty, resulting in impaired nutritional status.[15-17] 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.[12,18,19] Tooth loss in elderly people has been related to changes in food intake and nutritional deficiency.[16,20-24] 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

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elderly.[14,20,25] 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. The purpose of this systematic review is to summarize the earlier investigations on the association between food intake and oral-dental status in elderly people.

MATERIALS AND METHODS

Search strategy

We used the electronic databases of PubMed and the Cochrane library for the articles published until 30 February, 2012. To reach the related published articles, Medical Subject Heading (MeSH) terms of 'oral health,' 'masticatory performance,' 'dental status,' 'eating,' and 'food intake' were used. The reference lists of the published articles were also searched for the relevant publications. The detailed flow diagram of the search process is demonstrated in [Figure 1].

Inclusion criteria

We included all research articles in the English language that (1) had used the random sampling method; and (2) investigated the association between dental status and nutrient intake in non-denture wearing, elderly individuals, with no systemic illness. When there were multiple publications from the same population, only data from the most recent report were included.

Critical appraisal and selection of studies

The electronic search in the PubMed database yielded 258 articles using MeSH terms 'oral health' and 'eating', 221 articles using 'dietary intake' and 'dental status' as the keywords, and 287 articles using 'masticatory performance' and 'food intake' as the keywords. The initial screening by titles identified 82 relevant studies. Within these 82 relevant articles, 28 articles were selected after reviewing the abstracts. Full texts of all the citations were reviewed and checked for the eligibility criteria, to be included in the final analysis. Finally, seven original research articles were selected to be included in this systematic review.

Data extraction

The selected and included citations were reviewed and the major findings were extracted. The extracted data were first author's last name, year of publication, place of study, study design, sample size, and demographic characteristics of the study population [Table 1].

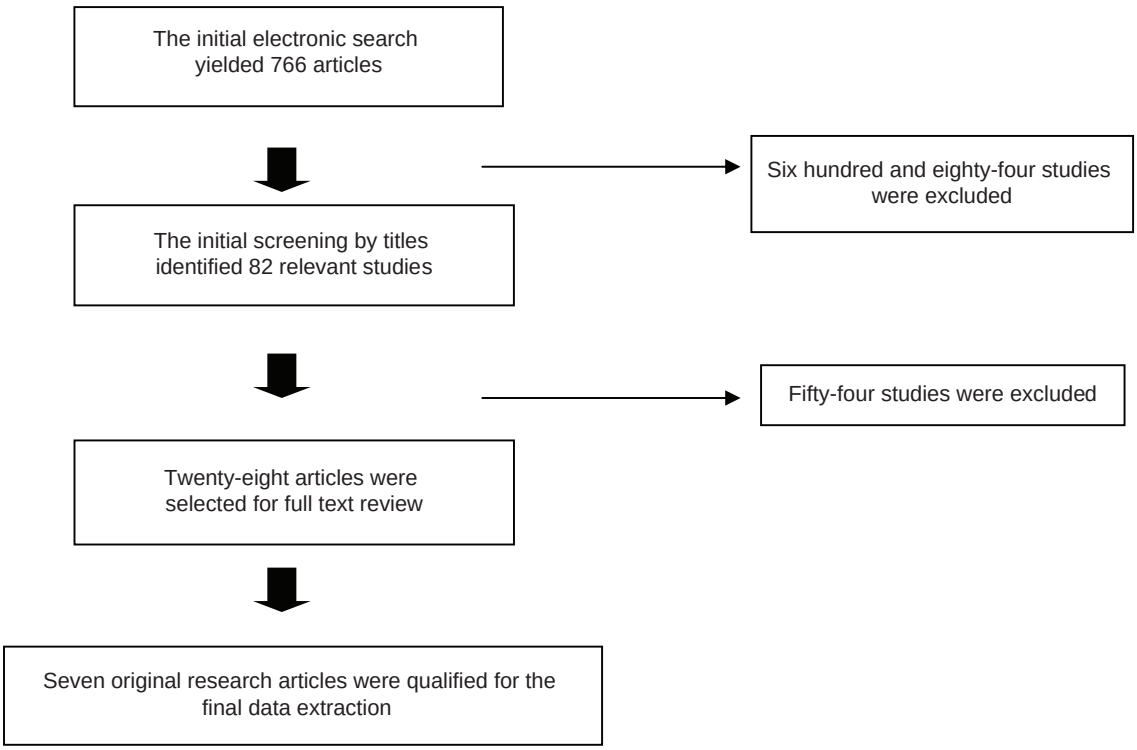

Figure 1: Diagram of the systematic review and searches for association between food intake and oral health in the elderly

Table 1: Summary of the original research articles studied

Authors	Year	Place of study	Sample size	Age	Study design	Results
Osterberg, T. *et al*.[26]	2002	Sweden	160	80	Cross-sectional	Dental status and masticatory ability had a minor influence on dietary selection and intake
Liedberg, B. *et al*.[27]	2007	Sweden	481	67–68	Cohort	Inadequate dietary habits were independent of teeth and denture status
de Andrade, F. B. *et al*.[28]	2011	Brazil	887	70	Cross-sectional	Association between oral health and inadequate intake of important nutrients was observed
Marcenes, Wagner *et al*.[12]	2003	Great Britain	N/A	≥65	Cross-sectional	Preservation of healthy functional dentition plays an important role in having an appropriate nutritional status
Daly, R. M. *et al*.[29]	2003	Ireland	49	25–74	Cross-sectional	Association between impaired food choice and reduced number of teeth and aging was observed
Bailey, R. L. *et al*.[30]	2004	Pennsylva nia	210	≥65	Cross-sectional	Impaired food intake was associated with constant oral health problems
de Andrade, F. B. *et al*.[11]	2009	Brazil	887	≥60	Cross-sectional	Nutrient intake was associated with oral health status by means of clinical measures

RESULTS

Out of the 28 articles that were selected for full text review, we found seven eligible articles for the current review. All these articles had been published in the past eleven years, from 2001 to 2011. For the original research articles, we have summarized the main results, sample size, location, and study design in [Table 1]. There was a great variation between the findings of the studies. Three studies had reported had reported no significant association between food intake and oral health, four others reported a significant relationship. As each article had focused on one aspect of oral health, it would be suitable to look at their findings separately. Osterberg *et al*.[26] evaluated the relationship between self-assessed masticatory efficiency, bite force, and the energy and nutrient intake in 160 elderly individuals (mean age=80 years) and found that great variations in dental status might be associated with only a minor influence in dietary selection and intake. Marcenes *et al*.,[12] evaluated the findings of a national survey in Great Britain and found that a healthy functional dentition (defined as having more than twenty teeth in old age) has an essential role in acceptable nutritional status. Liedberg *et al*.,[27] assessed 481 individuals to explore the association between inadequate dietary habits, oral status, and masticatory function, and demonstrated that dietary habits were independent of dental status. de Andrade *et al*.,[11,28] investigated the relationship between food intake, dental status, and family cohesion among 887 elderly Brazilians, with a mean age of 70 years, and concluded that impaired oral health is related to insufficient intake of important nutrients in non-institutionalized elderly Brazilians. Daly *et al*.,[29] evaluated 49 individuals aged 25 to 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*.,[30] assessed 210 individuals aged 65 years or more and found that an inadequate intake of 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.

According to the findings of the selected articles, most investigations found a significant relationship between the oral health status and nutrient intake; however, longitudinal studies were required for a better understanding of the diet-oral health relations.

DISCUSSION

Through summarizing the earlier studies, we found a significant association between the dietary intake of elderly people and their oral health; however, some investigators had failed to find this relationship. Several studies had demonstrated that there was an association between destroyed dentition and malnutrition within the past ten years.[29,31-35] However, many of these studies had not considered the confounding role of the common risk factors of malnutrition in evaluating this association. Most of these studies had measured the nutritional status using inaccurate methods causing a bias in assessing the relationship between the dental and nutritional status.

A recent study[36] adjusted the common risk factors affecting nutritional status and found that poor dental

status was still related to malnutrition in elderly individuals and showed that decreased masticatory performance could increase the possibility of malnutrition; however, Mojon *et al*.[13] and Nordenram *et al*.,[37] concluded that only highly impaired dentition was related to malnutrition among the elderly population.

Liedberg *et al*.,[27] found no significant difference with respect to the number of teeth and inadequate nutrient intake, which was not in agreement with the finding of Marshal *et al*.,[38] stating that adequate intake of calcium and folate was observed only in individuals with adequate number of teeth. However, inaccurate tests used to measure oral status and nutrient adequacy could cause a bias in making a direct comparison of studies. de Andrade *et al*.,[28] showed that the number of posterior occluding pairs was the strongest predictor of a higher risk of malnutrition among three parameters of oral health. However, almost all studies using objective clinical variables, including the number of teeth, tooth distribution, number of occluding natural pairs, tooth condition or duration, and the number of chewing strokes before swallowing, concluded that there is a relationship between oral health status and food intake.[19,33,34,39-43] Conversely, Daly *et al*.,[29] found no association between these two variables in a small sample of the elderly, but the oral health status was not always consistent with the objective clinical data. A large number of cross-sectional and longitudinal studies done in Europe and the USA[19,22,44] supported this assumption that there was a significant association between the oral health and food intake, and this association was independent of the demographic factors such as age.[45] Inadequate intake of vitamins A, C, and B_6 could cause visual, immunological, and cardiovascular disorders.[46] Other studies had contributed to gastritis and peptic ulcers and to oral health problems, such as, impaired chewing or increased gastric acidity.[47] According to the literature there was an inverse relation between masticatory efficiency and cholesterol intake, which meant that masticatory deficiency was an indirect risk factor for cardiovascular disease, with serious outcomes.[48-50] However, further research is needed, to explore whether oral health problems are a cause or a result of these systemic diseases.

Saliva acts as a lubricant in the masticatory process[51] 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.[52] The three main causes of xerostomia in elderly individuals include: dehydration, salivary gland deterioration, and neural transmissions interfering with salivary secretion.[53,54] 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.[54] Even though there are numerous studies linking masticatory function and inadequate food intake, none of them established a causal relationship. Shinkai *et al*.,[55] have concluded that differences in masticatory variables between all dentition groups do not affect the diet pattern, which shows the ability to compensate the reduced masticatory function among patients with impaired dentition.

Furthermore, longitudinal-cohort studies considering the role of confounding variables such as coffee or tea drinking, smoking, aging, socioeconomic status, and psychological status affecting the nutritional status, with a larger sample size, are required to better investigate the profound interactions between dental status and dietary intake. It must be acknowledged that caries and periodontal disease, which are the main causes of tooth loss, are of high prevalence among elderly individuals and both are preventable. The majority of the public health policy's focus for preventive oral health care and dietary intake modifications should be given to the elderly population because of a high prevalence of tooth loss and nutrient deficiency within this population.

The public health promotion's efforts should be developed to make the elderly individuals aware of the essential role of functional dentition on food choice and masticatory performance.

Finally, it should be noted that this review provides the background knowledge for the oral health track of the 'Study on the Epidemiology of Psychological, Alimentary Health, and Nutrition' (SEPAHAN).[56]

CONCLUSION

The data of this study will estimate the impact of masticatory dysfunction and oral health on food intake and functional gastrointestinal disorders, and will be published later by the same study group.

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