

The Spectrum

A Peer-Reviewed Publication

Fall 2014

The Relationship Between Oral Health, Nutritional Status, and Food Intake in Older Adults

Tina White, MS, RD; Suzanne Neubauer, PhD, RD, CNSC



LEARNING OBJECTIVES

At the completion of this self-study article, the learner will be able to:

- Describe the relationship between Mini-Nutrition Assessment (MNA) scores and oral health.
- Describe the negative impact of poor oral health on nutritional status as it relates to an MNA score and BMI.
- Distinguish between the effects of food avoidance and food modification on nutritional status.
- Identify two oral-health interventions used to improve or maintain nutritional status.

Introduction

Mastication is the first step toward proper digestion and absorption of nutrients.¹ Maintaining an adequate number of healthy teeth is the best guarantee to support adequate chewing ability and preserve optimal nutritional status. A majority of adults over age 60 suffer from poor oral health, including tooth loss, denture-related issues, cavities, and periodontal disease.² A substantial number of older individuals cannot chew properly because they have few or no natural teeth; therefore, they select foods they can chew easily. Limited nutritional intakes may be related to food choices, as well as the mechanical effects of impaired chewing.³ As a result of an

impaired chewing ability and subsequent altered food choices, older individuals may be at risk of malnutrition.

The Academy's position is that oral health and nutrition have a multifaceted relationship. Nutrition can affect the integrity of the oral cavity as well as the progression of oral diseases. Moreover, poor oral health can impact functional ability to eat as well as nutritional status.⁴ The purpose of this literature review is to explore the association between oral health, nutritional status, and food intake. These possible associations could provide valuable information for implementing oral-health intervention programs that improve oral health, thus improving nutritional status both in the community and in institutions caring for older adults. [Appendix 1](#) summarizes the articles used in this literature review.

ORAL HEALTH AND NUTRITION STATUS

Oral Health and Malnutrition

Several studies examining the relationship between oral health and nutritional status utilized the Nestle® Nutrition Institute [Mini-Nutrition Assessment \(MNA®\)](#) tool to identify individuals 65 years of age and older who are malnourished or at risk for malnutrition. The questionnaire consists of 18 questions based on anthropometric measurements, general health status, a dietary questionnaire, and a subjective assessment (self-

perception) of health and nutrition. Each question is assigned a weighted number, and the maximum score is 30 points. A score of ≥ 24 indicates good nutritional status, 17–23.5 indicates a risk of malnutrition, and < 17 indicates malnutrition.⁵

continued on page 2

In this issue ...

The Relationship Between Oral Health, Nutritional Status, and Food Intake in Older Adults	1
Chair's Message	7
Call for Information: Conferences and Events	7
Need Award Money to Fund Your Research?	8
House of Delegates (HOD) Update: Moving the Profession Forward with Business and Management Skills	9
Healthy Aging DPG Member Benefits	9
Legislative Update: Stepping Up to the Table	10
Mark Your Calendar: Upcoming Conferences & Events	10
Author Opportunities	11
Soy and the Health of Older Individuals	12

Oral Health

continued from page 1

Lopez-Jornet et al.⁶ studied the relationship between oral health and the risk of malnutrition in 465 institutionalized and non-institutionalized adults aged ≥ 65 years to determine which group was at greater risk of malnutrition. Institutionalized participants had poorer oral health than non-institutionalized participants, and their risk of malnutrition was five times greater (OR=5.12, 95% CI 3.08–8.49). There were no differences in terms of malnutrition or risk of malnutrition between the participants with or without dentures, or between the dentate and edentulous participants. Because of the cross-sectional design of this study, the results cannot confirm a causal relationship between oral health and malnutrition.

Looking at institutionalized individuals alone, Soini et al.⁷ examined the association between oral status and nutritional status among individuals in either nursing homes ($n=2,036$, mean age 83 years) or long-term care wards ($n=1,052$, mean age 81). Nutritional status was significantly associated with oral status and with a number of oral-health problems. Those with mixed dentition or complete dentures had a significantly better nutritional status (MNA ≥ 23.5) than those totally edentulous without prosthesis (MNA ≤ 17). Malnutrition increased significantly and consistently with the increasing number of oral-health problems (including chewing problems, swallowing difficulties, pain in the mouth, and xerostomia) for individuals in both nursing homes and long-term care wards. Similarly, Dion et al.⁸ found that the risk of malnutrition increased significantly (OR 1.15, 95% CI 1.06–1.25) when chewing ability decreased by 10 points, which was equivalent to the loss of two mo-

lars, in 1,094 institutionalized individuals aged ≥ 60 years.

Also evaluating the relationship between oral health and nutrition status in institutionalized individuals, Lamy et al.⁹ investigated whether poor oral status contributed to the development of malnutrition in 120 adults, mean age 81 years. An oral examination and evaluation of chewing ability were performed, and participants were classified into three groups according to oral status: edentulous without dentures or with only one complete denture (poor oral-health status), edentulous with two complete dentures, or dentate with or without partial dentures. Subjects with a poor oral-health status had significantly lower MNA scores than did edentulous subjects with two complete dentures. Subjects with two complete dentures had similar MNA scores as dentate subjects with few remaining teeth (10.4 ± 7.8 teeth).

The aforementioned studies looked at the relationship between oral health and nutrition status in institutionalized elderly people; however, non-institutionalized individuals with poor oral health were also found to have a compromised nutrition status.^{10–12} Marchi et al.¹⁰ conducted a study to examine the association between oral health status and risk of malnutrition in 471 community-dwelling adults aged ≥ 61 years. Subjects who were malnourished or at risk for malnutrition had significantly fewer teeth than did well-nourished subjects. Interestingly, having one to eight natural teeth was protective against the risk of malnutrition (OR 0.53, 95% CI, 0.29–0.98) even after adjusting for self-rated gingival health, oral status, and gender, all of which were variables independently associated with the MNA.

Similarly, Samnieng et al.¹¹ found that the number of teeth present in malnourished individuals was significantly lower than in individuals with normal nutrition or those at risk of malnutrition in 612 community-dwelling individuals with a mean age of 67 years. Functional tooth units (FTUs) were defined as pairs of upper and lower opposing natural teeth and artificial teeth on fixed or removable prostheses, whereas the presence of cavities and teeth with extensive damage to the crown and tooth loss was regarded as non-functional. Individuals with 13.2 teeth, 10.3 FTUs, and only 1.1 decaying teeth had a normal nutritional status, while malnourished individuals had 8.7 teeth, 8.3 FTUs, and 1.6 decaying teeth. Malnourished individuals had fewer FTUs than did subjects with normal nutrition, and a lessened chewing ability than those who were at risk of malnourishment and those with normal nutrition ($p < 0.05$). They also had significantly more decaying teeth than those who were at risk of malnutrition and those with normal nutrition.

El Osta et al.¹² evaluated the associations between nutritional deficits and measures of oral health in 201 community-dwelling individuals aged ≥ 65 years. Individuals were categorized based on MNA nutritional status, which included individuals who were malnourished or at risk for malnutrition ($n=85$) and individuals with normal nutritional status ($n=116$). Compared with individuals with normal nutritional status, individuals at risk of malnutrition or who were malnourished had fewer than 21 residual teeth without dentures, or were edentulous without dentures. Additionally, the number of FTUs was significantly associated with nutrition; participants who had four FTUs or fewer were three times more likely to be malnour-

continued on page 3

Oral Health

continued from page 2

ished than participants with more than four FTUs.

Summary: With the exception of Lopez-Jornet et al.,⁶ these studies found a relationship between oral health and nutritional status in both non-institutionalized and institutionalized older individuals. Malnourished older persons were found to have significantly fewer teeth, significantly more decaying teeth, and fewer FTUs than individuals at risk or malnutrition or those with normal nutritional status according to the MNA. Institutionalized older adults were found to have poorer oral health and were at a significantly greater risk of malnutrition than non-institutionalized older adults. Additionally, malnutrition increased consistently with increasing number of oral-health problems.

Oral Health and Body Mass Index

While the MNA generates a score that reflects the nutritional status of older individuals, researchers have found that oral-health status is also associated with body mass index (BMI).¹³⁻¹⁷ BMI can be used as a screening tool to identify possible weight problems for adults. Institutionalized individuals are provided with food from their respective facilities; however, when oral-health care is not consistent, this can lead to fluctuations in food intake and subsequent shifts in BMI. Conversely, because community-dwelling individuals have more control over food selection and caloric intake, they may therefore experience increased BMIs irrespective of oral health.

Mojon et al.¹³ evaluated the relationship between oral-health status and nutritional deficiency among 324 institutionalized adults, mean age 85 years. The [Barthel index](#) was used to

categorize subjects as dependent or semi-dependent based on oral-health status and ability to perform activities of daily living, including self-feeding and self-grooming. When adjusted for age, the presence of a compromised oral function was more common in dependent subjects than in semi-dependent subjects, and BMI was significantly lower in subjects with a compromised oral functional status. This suggests that the ability to perform activities of daily living was protective against declines in oral health, and was thereby protective against adverse changes in BMI.

Looking at non-institutionalized individuals, Nascimento et al.¹⁴ evaluated whether poor oral status was associated with underweight or overweight regardless of confounding variables in 875 adults, mean age 72 years. Having 20 or more teeth in the mouth is associated with normal BMI values;¹⁵ thus, participants were categorized into the following groups: edentulous without dentures or wearing one complete denture, edentulous wearing complete dentures, <20 teeth without prosthesis, <20 teeth with prosthesis, ≥20 teeth without prosthesis, and ≥20 teeth with prosthesis. After adjusting for confounders, edentulous subjects wearing one or no dentures were three times more likely to be underweight (OR 3.94, 95% CI, 1.14–13.64) or two times more likely to be overweight/obese (OR 2.88, 95% CI, 1.12–7.40) compared with all other groups.

While the previous study found a relationship between BMI and either the number of teeth or the use of a prosthetic, Sahyoun et al.¹⁶ examined the relationship between total number of posterior FTUs and BMI in 5,958 non-institutionalized adults aged >50 years, participating in the National Health and Nutrition Examination

Survey (NHANES). Subjects were categorized into the following groups based on number of posterior pairs of teeth: zero posterior pairs, full dentures, one to four posterior pairs, and five to eight posterior pairs (reference group). Individuals with one to four posterior pairs of teeth had higher BMIs compared with the reference group ($p=0.009$), but no association was found between edentulous individuals or individuals wearing dentures and BMI.

Also evaluating non-institutionalized individuals, Ritchie et al.¹⁷ assessed the nutritional status of 49 adults aged ≥65 years to identify factors associated with poor nutritional status. Subjects were asked a series of questions to assess their oral health; self-reported difficulty in chewing and being bothered by one's teeth were significantly associated with a lower BMI after controlling for age, education level, functional status, and gender. This study suggests that individuals are aware of their oral-health issues, but are perhaps unable to solve the problem and are unaware of the effects on their nutritional status.

Summary: These studies suggest a link between oral health and BMI in both non-institutionalized and institutionalized older adults. Interestingly, self-reported oral-health problems were associated with lower BMIs, which indicates that simple measures such as incorporating soft foods can be taken to prevent declines in nutritional status regardless of living situation. Because cross-sectional studies cannot conclude cause-and-effect relationships, and because most of the above studies did not collect information on food intake, additional evaluation of the effects of oral health on nutritional status in relation to food intake is needed.

continued on page 4

Oral Health

continued from page 3

ORAL HEALTH AND FOOD INTAKE

The associations between oral health and nutritional status in the studies listed above suggest that elderly individuals who have impaired oral health may change their dietary habits; for example, they may avoid foods that are difficult to chew or modify the way foods are prepared or eaten. Modifications in food selection practices may result in high-calorie diets or in the elimination of calories, leading to weight changes regardless of living situation. The relationship between oral health and nutrition can be better understood by examining food intake.

Chewing Ability

Taking into consideration oral functional status and food intake, Ikebe et al.¹⁸ found that chewing ability was significantly associated with the number of teeth when examining 1,288 individuals ages 60 to 84 years. Looking at the long-term effects of impaired chewing ability, Lee et al.¹⁹ examined chewing ability in conjunction with food intake and energy status in 1,410 individuals aged ≥ 65 years with metabolic syndrome. By the end of the eight-year study, 368 subjects had died; there was a significantly higher age- and gender-adjusted hazard ratio (HR) for mortality in those who had reported unsatisfactory chewing ability at baseline. Additionally, after eight years, individuals with unsatisfactory chewing ability had significantly lower intakes of fruit and lean poultry compared with those who had satisfactory chewing ability.

Bailey et al.¹ observed the relationship between oral-health problems and diet quality in 147 adults, mean age 73 years, by examining the diet quality of individuals with self-reported persistent chewing, swallowing, and

mouth pain at baseline and after one year. Diet quality was assessed using the Healthy Eating Index (HEI),²⁰ which measures diet quality as it relates to the [*Dietary Guidelines for Americans*](#). After one year, individuals with persistent oral-health problems (n=22) had significantly lower HEI scores, including inadequate intake of essential micronutrients compared to baseline, whereas HEI scores for the group with no persistent oral-health problems (n=125) did not change from baseline.

Food Avoidance and Modification

To better understand the reasons for differences in diet quality, researchers have evaluated food avoidance and food-modification behaviors in relation to oral health.^{21–24} Hildebrandt et al.²¹ compared the number and types of functional tooth units with complaints about oral function and food-avoidance practices in a convenience sample of 602 adults, mean age 70 years. Chewing ability was assessed by the number of opposing natural or prosthetic FTUs; those who did not avoid a food texture were considered the control group. Individuals avoiding stringy foods had significantly fewer natural FTUs and more prosthetic FTUs compared with the control group, and individuals avoiding crunchy foods had significantly fewer natural FTUs and more non-functional FTUs compared with the control group. Additionally, individuals avoiding dry solid foods had significantly fewer total and natural FTUs and more non-functional FTUs. Similarly, Kossioni and Bellou²² found that the ability to chew solid food was significantly related to number of teeth, but did not look at FTUs specifically.

Likewise, Quandt et al.²³ found a significant negative association between the number of foods avoided and the

number of FTUs in 635 individuals, mean age 72 years. Self-rated oral health was also recorded, ranging from poor to excellent. Approximately 66% of those who reported “good to excellent” oral health avoided no foods, while only 33% of those with “fair or poor” oral health reported no food avoidance. Savoca et al.²⁴ used the same data to examine the relationship between self-reported food avoidance and food modification due to oral-health problems and dietary quality. Dietary quality was assessed by taking a food frequency questionnaire, and data were converted into HEI scores. Individuals avoiding three to 14 foods had lower HEI scores than those who avoided fewer foods (p=0.001). Modifying four to five foods was associated with HEI scores that were significantly higher than those associated with modifying zero to three foods across all food avoidance categories. An example of modifying a food would be peeling an apple, cutting it into slices or small pieces, or cooking it. Steaks, pork chops, or roasts can also be slow cooked with added moisture to soften them, or they can be cut into small pieces to enable easier mastication. Interestingly, participants who did not avoid foods, but modified four to five foods, had higher HEI scores compared with the group that avoided three to 14 foods and modified zero to three foods (p<0.001). These data suggest that individuals unable to modify their own food are more likely to avoid difficult-to-chew, nutrient-dense foods and instead may consume foods higher in calories and fat. For instance, individuals avoiding three to 14 foods consumed more saturated fat and energy and more added sugar than those avoiding fewer than three foods and those who modified four to five foods.

continued on page 5

Oral Health

continued from page 4

Summary: These studies suggest that persistent oral-health problems are associated with compensatory food behaviors. Dietary quality was compromised for older adults who shift their food choices toward foods that are soft and easy to chew and swallow, and away from those that are dry, crunchy, and stringy. Elderly individuals avoid a large number of foods due to oral-health problems, and individuals who avoid one food are more likely to avoid others, which may impact nutritional status. In contrast, modifying foods in response to oral-health problems was associated with better dietary quality, and may contribute to better nutritional status.

INTERVENTION PROGRAMS

Due to the numerous studies that found associations between oral health, nutritional status, and food intake, researchers have examined the impact of oral-health intervention programs on nutritional status in older individuals.²⁵⁻²⁷ In a prospective 60-day pilot study, Paturu et al.²⁵ analyzed the change in eating pattern and nutritional status of two groups of edentulous individuals: those fitted with complete dentures for the first time, and those who after wearing the same complete dentures for 5 to 10 years were fitted with new dentures. Individuals who wore dentures for the first time showed no difference in BMI after dental treatment compared to baseline; note that these individuals may have needed time to adjust to their new dentures. In contrast, BMIs of second-time denture wearers were significantly greater than before the intervention, and food-intake data revealed an improved intake of fruits, vegetables, and protein.

While not all intervention programs will improve nutrition status, they may

help prevent declines in nutritional status. For example, Sumi et al.²⁶ conducted a one-year longitudinal, controlled study finding that individuals who received oral care three times per week, including the use of a powerful electric toothbrush and an antibacterial agent, had no significant declines in body weight or BMI compared to baseline; the control group had significant declines in both measures. Similarly, Wostmann et al.²⁷ found that six months after dentures were restored or replaced in 47 older individuals, markers of nutritional status, including MNA scores, remained unchanged.

Further emphasizing the need for oral-healthcare intervention, Jung and Shin²⁸ found that half the 268 participants (mean age 72 years) taking part in a quality-of-life study related to oral health thought they were in need

of oral-healthcare services. Likewise, McGrath and Bede²⁹ found that disparities in quality of life related to oral health were seen among individuals who experienced tooth loss and did not seek oral-health care for dentures ($p < 0.001$), and Marino et al.³⁰ found that older adults whose self-reported quality of life was “average/bad” were more likely to be edentulous compared with those who self-reported a “good/excellent” quality of life (OR 1.5, 95% CI, 1.10–2.00). These studies suggest that older adults are aware of their oral-health status, yet their needs are not being met.

CONCLUSION AND IMPLICATIONS FOR PRACTICE

This review of the studies evaluating the relationship between oral health, nutritional status, and food intake

continued on page 6

For More Information

- Yoshida M, Suzuki R, Kikutani T. Nutrition and oral status in elderly people. *Jpn Dent Sci Rev.* 2014;50:9–14.
The systematic review conducted by Yoshida et al. found a general consensus among studies that tooth loss leads to reduced fruit and vegetable consumption, and that tooth loss could lead to nutritional disorders such as obesity and low body weight.
- Putten G, Baat C, Visschere L, Schols J. Poor oral health, a potential new geriatric syndrome. *Gerodontology.* 2014;31:17–24.
This article by Putten et al. examines the effect of aging and age-related diseases on oral-health status in non-institutionalized individuals, including the adverse effects of polypharmacy, frailty, disability, care dependency, and limited access to oral healthcare. The article also provides recommendations for improving oral-health status.
- Pretty IA, Ellwood RP, Lo ECM, et al. The Seattle Care Pathway for securing oral health in older patients. *Gerodontology.* 2014;31:77–87.
The Seattle Care Pathway is an evidence-based, standardized healthcare program designed to prevent oral-health issues in older adults. This article describes the development of the program and provides guidance for its application through various clinical scenarios.
- Healthy People. [Healthy People 2020 Summary of Objectives, Oral Health.](#) Healthy People website. Published 2013. Accessed May 3, 2014.
This website describes the efforts proposed to maintain oral health in adults, including providing access to preventative services, oral-health interventions, monitoring and surveillance systems, and modifications in the public health infrastructure.

Oral Health

continued from page 5

indicates that poor oral health is associated with modifications in food-selection behaviors, and subsequently with poor nutritional status in both institutionalized and non-institutionalized older adults. Based on the studies reviewed, institutionalized individuals with compromised oral functionality tend to have lower BMIs than their independent counterparts, suggesting that older adults with impaired ability to perform activities of daily living are at greater risk of declining nutritional status. Individuals who are at risk of malnutrition or who are malnourished tend to have fewer teeth and FTUs compared with individuals with normal nutritional status. When considering food-selection behaviors, individuals tend to avoid or modify foods due to poor oral health. These findings are important for institutionalized individuals who are unable to prepare foods; therefore, caretakers must be aware of the current oral-health status, food preferences, and appropriate food modifications required for each patient. Moreover, individuals living in the community who avoid foods may lose weight or consume soft, easy-to-chew foods that are less nutrient dense and higher in calories, which could lead to weight gain. Prevention programs focused on oral-health care and coordinated nutrition education may help maintain the nutritional status of older adults. One such program is the [Louisiana Smiles for Life Program](#),³¹ which focuses on independent older adults and includes lesson plans for nutrition, a handout promoting healthy food choices based on the food pyramid, denture care, and overall oral health and hygiene. Likewise, independent older adults may benefit from handouts with tips on healthy eating and oral health awareness. For example, the Aging Resources of Central Iowa's [handout](#) "Are You Having Trouble Swallowing?" provides tips

for healthy eating, food-modification strategies for addressing chewing and swallowing difficulties, and a self-administered dental checklist used to identify oral-health problems.

Dietetics practitioners should advocate for appropriate, affordable dental care for the older population to promote oral health and thus prevent declines in food intake. Preventative measures and simple dental procedures, either by a visiting dental hygienist or a trained nurse, are an important part of the routine care in institutions. Additionally, practitioners should monitor patients with compromised oral-health status using validated assessment tools such as BMI and MNA to assess changes in nutritional status. Community pilot programs focused on dietary education for the elderly inclusive of oral health and food-intake strategies should be explored. ■

CPE CREDIT



This article has been approved for one hour of CPE credit upon successful completion of a quiz. At the conclusion of each month, the quizzes are reviewed and those successfully scoring 80% will receive their CPE certificate via email.

This free CPE credit is available for all Healthy Aging DPG members until November 1, 2017.

Click [here](#) to take the quiz.



About the Authors

Tina White, MS, RD, received her bachelor's degree in May 2007 from the University of Vermont, Burlington, VT. She completed the Coordinated Program in Dietetics and received her master's degree from Framingham State University in May 2014. Tina is interested in nutrition throughout the life cycle; she is currently writing a literature review on the efficacy of cornstarch to treat glycogen storage disease (GSD). Tina plans to pursue a career in clinical nutrition.



Suzanne Neubauer, PhD, RD, CNSC, is Professor of Food and Nutrition and Director of the Coordinated Program in Dietetics at Framingham State University, Massachusetts. She teaches medical nutrition therapy and supervises students in their clinical-nutrition practicums. Suzanne especially enjoys working with students to submit their literature research for publication and/or poster presentations at local dietetic association meetings. Dr. Neubauer can be reached at sneubauer@framingham.edu.

References

[Click here](#) to see the references for this article.