

Review Article

A Review of the Literature on Nutrition, Dietary Habits, and Dental Hygiene in Elderly Individuals

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Abstract: Oral health, nutrition, and diet are intimately related. Malnutrition poses a difficult health risk to older persons since it is linked to physical deterioration that lowers their quality of life and daily activities. The purpose of this study is to present an evidence-based overview of the consequences of the relationship between older individuals' dental health and nutrition and food. One of the main goals of the World Health Organization's ageing initiatives is to promote healthy aging. The reciprocal association between nutrition and oral health was validated by the American Dental Association. Research indicates that oral health conditions such as dental caries, periodontal disorders, tooth wear, and even oral cancer are correlated with diet and nutrition. In elderly persons, dental caries and other oral illnesses are more likely to occur due to inadequate nutritional intake and poor eating habits. However, poor oral health disorders like periodontal disease can cause discomfort, infection, and tooth loss in older persons, which might have an impact on their dietary consumption. According to surveys, dietary imbalances or inadequacies impacting oral health were common among older persons, especially those living in underprivileged communities. Furthermore, evidence from recent research indicates a link between malnutrition and hospitalization, mortality, morbidity, and frailty. Maintaining adequate nutritional intake and lowering the risk of malnutrition in older persons requires both functioning dentition and good oral health. In order to enhance older individuals' nutritional and dental health conditions and promote healthy aging, it is crucial to integrate oral health into general health care services.

Keywords: dental hygiene, elderly individuals, dietary habits, nutrition

1. INTRODUCTION

The World Health Organization identified dental and nutritional health as the two most important factors in promoting healthy aging in older persons [1,2]. The World Health Organization's 2015 World Report on Ageing and Health stressed that maintaining an individual's functional ability to be and do what they value is just as important as being disease-free when it comes to healthy aging [3]. "Multifaceted and included the ability to communicate, smile, taste, smell, touch, chew, swallow, and convey an array of emotions through facial expressions with confidence and without pain, discomfort, and disease," according to the FDI World Dental Federation, is how oral health is defined [4]. The significance of dental health for dietary intake was recognized in this revised concept of oral health. Many chronic diseases can be prevented or slowed down in their progression by leading a healthy lifestyle and consuming enough nutrients [3]. For older persons to mature healthily, proper diet and dental hygiene are also crucial [3]. Physiological age

changes, long-term medical illnesses, and medication use all raise the likelihood of poor nutritional status and dental health status as one ages [5, 6]. A few socioeconomic determinants of health in older persons are shared by nutritional intake and dental health [7]. As they get older, older folks' cognitive and functional capacities deteriorate [8]. They might progressively lose their ability to cook, clean their teeth, and prepare meals [9]. In elderly persons, physiological aging causes atrophy of the salivary glands and taste buds [9, 10]. Taste buds can influence how food tastes, which can affect how people feel about food and reduce their appetite [11]. Older persons who experience hyposalivation may find it difficult to chew and swallow food, which may lead to a diet higher in soft foods and lower in fiber [11]. Salivation makes chewing and swallowing easier. Additionally, hyposalivation raises the risk of oral conditions such as periodontal disease and dental caries [11]. Chronic illnesses that affect older persons, like Parkinson's disease and arthritis, further impair their ability to take care of themselves, their diet, and their dental health [9]. They could require help paying for food or going to the dentist.

The drugs used to treat these illnesses not only interfere with the digestive system's ability to absorb nutrients, but they also raise the possibility of hyposalivation [11]. Social determinants of health, such as living alone, having little money, and having little health literacy, limit older individuals' access to, affordability of, and availability of dental and food supplies [1, 7]. Therefore, compared to other age groups, older persons are more likely to have poor dental and nutritional health. The reciprocal association between nutrition, food, and oral health was validated by the American Dental Association [12]. The risk of oral disorders, such as dental caries, periodontal diseases, tooth wear, and oral cancer, is influenced by nutritional intake and dietary patterns. Poor oral health issues can cause pain, infection, and tooth loss in older persons. These conditions include dental caries, periodontal disease, worn dentition, dry mouth, and ill-fitting dentures. These conditions can also impair dietary intake [13, 14]. The dietary deficiencies or imbalances that older persons are susceptible to can have an adverse effect on their oral and systemic health [14,15]. It can also cause an undesirable loss of muscle, which can contribute to a deterioration in functional status (ability to move and chew), independence, and immunological function [15].

Ensuring optimal nutrition and dental health in older individuals requires integrating oral health into general health care services [16]. To preserve oral and general health till the end of life, a multidisciplinary team should do a thorough geriatric evaluation and create a coordinated, integrated, and patient-based treatment plan for every older adult [16]. The purpose of this narrative review is to present an evidence-based overview of the relationship between older individuals' food, nutrition, and dental health as well as the implications for enhancing these conditions. The English-language publications, clinical studies, and reviews found in the PubMed and Google Scholar databases, as well as data on diet and nutrition and oral health in older adults from websites of international organizations like the World Health Organization, FDI World Dental Federation, and American Dental Association, up to May 2023, served as the basis for this review. The terms "diet," "nutrition," "nutrient," "nutritional intake," "malnutrition," "oral health," and "oral disease" were used in the search.

2. LITERATURE REVIEW

The term "diet" describes a person's consumption of food and liquids as well as the physiological and psychological aspects (frequency and mode of ingestion) of eating. The term "nutrition" describes the micronutrients—vitamins and minerals—and macronutrients—protein, carbs, and fat—that the body requires [12]. Oral health may be impacted by the consumption of specific macronutrient or

micronutrient combinations as well as dietary practices, such as frequency of consumption [17]. Elderly people's dental health is also linked to malnutrition, which the World Health Organization defines as "deficiencies or excesses in nutrient intake, imbalance of essential nutrients, or impair nutrient utilization" [18]. Dental caries is caused by the demineralization of dental hard tissues as a result of the bacteria in the biofilm (dental plaque) fermenting food carbohydrates, producing acidic byproducts [19]. Diet is one of the caries risk factors in older adults, with untreated dental caries affecting half of the global older adult population [20]. Unambiguous data demonstrates the critical role fermentable carbohydrates, such as sugars and starches, play in the development and progression of caries [17]. The kind, quantity, and frequency of carbohydrate consumption all affect the risk of caries [17]. Free sugars are "all monosaccharides and disaccharides added to foods and drinks by the manufacturer, cook, or consumer, as well as sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates," according to the World Health Organization, which acknowledged that free sugars are the critical components in the development of caries [21]. Of all the free sugars, sucrose needs special consideration since it can quickly turn into acid and produce a significant pH decrease [22]. Additionally, sucrose can be converted into intracellular storage compounds, extracellular glucans, and fructans, all of which promote the formation of biofilm at lower concentrations of buffering components including fluoride, phosphorus, and calcium [17, 22]. A diet that includes more than 10% of total caloric intake as free sugar raises the incidence of dental caries, according to moderate evidence [23]. As a result, the World Health Organization advises limiting free-sugar intake to less than 10% of total caloric intake and doing so throughout life [24].

As they get older, older people's ability to perceive salty, sweet, and umami flavors declines. They also tend to prefer stronger flavors and eat more sweet and salty meals, which can lead to an increase in sugar intake [25]. According to a study, elderly Japanese seniors who live in communities had higher rates of root surface caries when they consume sugar-filled beverages like tea or coffee [26]. Another important determinant in the development of caries is the frequency of sugar intake [27]. After consuming sugar, the pH can decline for longer than 30 minutes [27]. Consequently, regular consumption of sugar will result in a low pH of dental biofilm, raising the possibility of caries formation [27]. Due to reduced appetite brought on by age, systemic disorders, and medicine, older persons typically eat lesser portions during meals [11, 28]. However, they may develop snacking behaviors in between meals. Research has shown that over 84% of older persons in America snack, and that these older adults who snack are better able to obtain a sufficient daily nutritional intake [29]. These studies, however, did not take into account the potential negative consequences of frequent snacking on dental health.

Periodontal disease is an inflammation of the periodontium caused by dental plaque. In susceptible individuals, this inflammation is mediated by a sequence of host reactions that lead to tissue damage, which is shown as pocket development, gingival recession, and alveolar bone resorption [30, 31]. In old age, periodontal disease is common and cumulative, impacting around 60% of older adults worldwide [32]. A growing body of research suggests a connection between food and periodontal disease [17]. Periodontal disease development can be influenced by the immune-mediated inflammatory responses that are triggered or regulated by specific dietary patterns and nutrient intake [33]. While a diet high in fiber, fruits, vegetables, antioxidant micronutrients, polyunsaturated fatty acids, and calcium is anti-inflammatory and may lower the risk of periodontal disease, a diet high in carbohydrates and saturated fats is proinflammatory and may increase the risk of the condition [17,33]. In community-dwelling older persons, intake of fatty acids, vitamin C, vitamin E, beta-carotene, fiber, dairy calcium, fruits, and

vegetables was found to be inversely linked with the risk of periodontal disease [33]. It has been demonstrated that a larger consumption of n-3 polyunsaturated fatty acids and dietary antioxidants including vitamin C, vitamin E, and beta-carotene slows the advancement of periodontal disease and reduces the number of teeth in older Japanese adults that have clinical attachment loss [34, 35]. While dietary antioxidants lessen the level of oxidative stress and hence lessen inflammation in periodontal tissues, N-3 polyunsaturated fatty acids enhance pro-resolving lipid mediators and thereby modulate the destructive inflammatory response [34, 35]. Danes with advanced age had a lower incidence of periodontitis when they consumed more dairy products, particularly milk and fermented meals, which contain high levels of total calcium [36]. However, due to their small sample sizes, the majority of studies were rated as having low quality [33]. Though the data is still weak, recent studies have concentrated on the use of probiotics and fruit and vegetable extracts as supplementary intake to improve the clinical outcomes following periodontal therapy [17]. Tooth wear is more common as people age, reaching up to 17% by the age of 70 [9]. Attrition, abrasion, erosion, or any combination of these can result in tooth wear [9]. Diet has a significant impact on dental erosion [37]. Dental erosion is the gradual and irreversible loss of dental hard tissue brought on by an acid-solving chemical process that happens without the involvement of microorganisms, according to the American Dental Association [37]. Extrinsic acid production can result from consuming acidic foods and beverages, such as carbonated soft drinks and acidic fruit juice, or intrinsic acid production, which is frequently caused by stomach reflux [37]. Food and beverage pH has an impact on how erosive they can be on the teeth [38]. Food and beverages are deemed erosive to dentition if their pH is less than 4.0, as teeth deteriorate in the pH range of 2.0 to 4.0 [38]. According to a study that tested the pH of 379 widely used commercial beverages in the US, lemon juice had the lowest pH of 2.4 [38].

Studies have shown that regular drinking of natural fruit juice increased the incidence of tooth erosion at an odds ratio of 1.2 [39, 40]. A positive correlation has been documented in the literature between 100% fruit juice consumption and dental erosion. According to the Dietary Guidelines for Americans, fruits are essential for both attaining a healthy ageing in older persons and for maintaining a balanced dietary pattern [41]. Pomegranate, cherry, and beetroot juice are among the acidic fruit juices that have been reported to enhance a number of health issues, including blood pressure, low-density lipoprotein cholesterol, and cognitive performance in older persons [42, 43]. Although it was recommended that older persons consume more fruit and fruit juice as part of a healthy lifestyle, many were unaware of the damaging effects that these foods and drinks could have on their teeth [44]. According to a study, when it came to tooth wear progression, the timing of fruit intake was found to be critical. Fruit intake between meals had a considerably higher odds ratio (3.64) than fruit intake during meals [45]. It is possible to counsel senior citizens on appropriate fruit consumption practices in order to prevent tooth deterioration. For elderly persons who are susceptible to nutritional deficiencies, dietary supplements may be recommended. Chewable vitamin C (ascorbic acid) pills raised the incidence of dental erosion at an odds ratio of 1.16, higher than any other supplement [46]. However, there haven't been many research done on older persons to look into the connection between tooth wear and nutrition and food.

Alcohol intake is one of the main causes of oral cancer, which is the 13th most prevalent cancer globally [47]. Adults 65 years of age and older have a higher risk of oral cancer due to the disease's age-related increase [9,48]. Strong data indicates that drinking more alcohol significantly increases the risk of oral cancer [48]. When compared to not drinking alcohol at all, alcohol intake was linked to head and neck cancer at an odds ratio of two if three or more drinks were drunk daily [49]. Acetaldehyde, the main and

most harmful metabolite of alcohol, was thought to cause cancer by interfering with DNA synthesis and repair [48]. Studies have generally consistently shown that increased consumption of non-starchy vegetables decreased the incidence of oral cancer, despite the paucity of evidence linking food and nutrition to the disease [48]. The extensive spectrum of minerals and phytochemicals found in vegetables, including carotenoids, vitamin A, vitamin C, vitamin E, and flavonoids, were thought to have antitumorigenic properties; however, more research is required to determine their relationship and underlying mechanisms [48]. As the initial segment of the digestive system, the oral cavity is in charge of chewing, salivation, and swallowing food boluses so that they can be consumed nutritionally in the stomach [50]. Many common dental issues that affect older persons, including dental caries, periodontal disease, tooth wear, and oral cancer, can cause discomfort, infection, and tooth loss in addition to endangering the regular digestion process needed to absorb nutrients [9]. For the purpose of swallowing, bolus production, and taste perception, salivation is essential. Thus, nutrient intake may be impacted by hyposalivation, a frequent oral disease in the elderly [9]. Uncontrolled reduction in nutritional intake can result in nutritional deficit, which has been linked to older adult frailty, mortality, and morbidity [13]. Tooth wear, periodontal disease, and dental caries can all lead to dentine hypersensitivity or even pain, which restricts meal options, decreases chewing effectiveness, and makes it more difficult to consume nutrients [13]. Chewing difficulties linked to oral health were more common in home care older individuals in Finland who reported having toothaches (odds ratio = 10.3) [51]. Another study carried out in a German nursing home discovered that older persons who experienced pain when chewing avoided meals more [52]. According to a recent study, the incidence of nutritional deficiency in older adults living in the community was determined by pain during chewing, which could be caused by ill-fitting dentures, dental caries, or dentine hypersensitivity. The study also suggested that treating and diagnosing the underlying oral conditions could help prevent nutritional deficiency in older adults [13].

General health can be impacted by poor oral health [9]. Periodontal disease and periapical inflammation are examples of oral infections that can cause systemic, long-term low-grade inflammation. This might result in anorexia due to decreased food intake and altered metabolism due to increased muscle catabolism [53]. Anorexia, defined as the presence of decreased food intake or weak appetite, is caused by a prolonged low-grade inflammation that raises the levels of interleukin 1, interleukin 6, and tumor necrosis factor alpha in the blood. These factors delay stomach emptying and clamp down on small intestine motility [54]. One-fifth of older persons suffer from anorexia, a multifactorial disorder that is linked to nutritional inadequacy, frailty, morbidity, and mortality in this age group [27]. Muscle mass and strength decline as a result of increased muscle catabolism brought on by systemic inflammation [53]. This reduces the masticatory efficiency and mobility of frail older persons or those suffering from sarcopenia, a pathological condition that causes an accelerated and gradual loss of muscular mass and strength, ultimately leading to impaired function. As a result, the functional state of muscles is compromised [55]. A multidisciplinary intervention is required for improved care for older persons, as there is mounting evidence linking dental health, malnourishment, and sarcopenia in frail older adults [55]. Food particles are cut, torn, and ground by teeth into smaller bits, which are then combined with saliva to create a bolus that may be swallowed [56]. The literature also supports the conclusion that a minimum pair of occluding natural teeth is required to provide functional dentition, as stated by the World Health Organization, which states that the retention of at least 20 natural teeth without any prostheses should be maintained to ensure adequate function [57,58]. If left untreated, dental caries and periodontal disease can eventually result in tooth loss [9]. The frequency of tooth loss peaks at age 65 and is more common as people age [59]. In the United States, 13% of older persons 65 years of age or

older had full tooth loss in 2015–2018; the situation is probably worse in developing nations [60,61]. For older persons, mastication becomes more difficult due to the loss of their natural teeth. Chewing difficulty was more common in older persons without functional teeth (odds ratio: 4.7) [62].

Swallowing is also impacted by tooth loss. As the number of teeth reduces, the bolus size increases, and this also causes an increase in swallowing difficulty [63]. Harder foods including meats, fruits, and vegetables—which are the primary sources of proteins, fiber, minerals, and vitamins—tend to be avoided by older persons with significant tooth loss [64]. Severe tooth loss that leaves an older adult with edentulism, or no functional dentition, has an impact on nutritional intake and raises their risk of nutritional deficit by 21% [64]. A third of elderly adults suffer from the prevalent condition of hyposalivation [65]. Hyposalivation in older persons is influenced by age changes, long-term medical problems, and drugs [9]. Many older persons chose softer foods because hyposalivation can affect swallowing and change taste perception [11]. According to a cross-sectional study, older Japanese adults with hyposalivation consumed much less fish and vegetables than those without the condition, which resulted in a lower intake of folate, vitamin B6, vitamin E, and n-3 polyunsaturated fatty acids [66]. Hyposalivation has been shown to decrease the comfort of wearing removable dentures during chewing in older persons by reducing denture retention [13]. Older persons who experienced pain when chewing due to ill-fitting dentures were at risk for nutritional deficiencies [13]. Nonetheless, there is still little proof linking hyposalivation to malnourishment [13]. Poor dental health, including pain, illness, or tooth loss, can generally lower an older adult's intake of nutrients and, if left unchecked, result in a nutritional deficiency with insufficient intake of macronutrients, minerals, and vitamins. While micronutrients (vitamins and minerals) are crucial for controlling immunological function, macronutrients (proteins, carbs, and fiber) are necessary for preserving muscle mass and strength [67]. A diet deficient in macronutrients raises the risk of sarcopenia and frailty as well as the unhealthful loss of muscle mass [67]. In older adults, a micronutrient shortage may worsen immunological response, raise the risk of infection, and prolong the time it takes to recover from illness [67].

Oral health and nutrition are linked to diet. Poor dental health and dietary deficiencies are risks for older persons. In order to improve older individuals' nutritional and oral health condition, the World Health Organization and the FDI World Dental Federation concurred that oral health care integration with general health care services is essential [16]. In order to create a patient-centered, coordinated, and integrated treatment plan that will enhance the oral and general health of older adults, a multidisciplinary team composed of oral and medical professionals should work together to perform a thorough geriatric assessment that includes the oral, nutritional, and medical status of older adults [69]. Advocates for this integration include academics, public health experts, worldwide professional organizations, policy leaders, and individual health care providers [16]. Policymakers should support the provision of resources, financial assistance, and interdisciplinary clinical settings to enable the integration of oral health care into general health care services for older individuals [16]. It is crucial for worldwide professional organizations to offer education or workshops to increase the awareness and improve the knowledge and abilities of health care professionals on this topic, as the majority of them are unaware of the connection between diet, nutrition, and oral health [70]. Public health professionals should provide community services to inform the public about the advantages of eating a healthy diet for oral health, the negative effects of malnutrition on oral and systemic health, and how to get a healthy and sufficient diet. This should begin with evaluating the nutrition facts label on food packages and emphasizing the significance of adopting healthy eating habits. Scholars ought to offer greater proof for this kind of integration. The majority of

research on the relationship between nutrition, food, and dental health comes from small sample size cross-sectional studies. The majority of the studies were carried out in a select few nations, including the US, Japan, and several European nations. A greater understanding of the relationship between nutrition and food and dental health in older persons should be attained by the conduct of more long-term studies from other nations, with bigger sample sizes [13]. To give further data regarding the clinical uses of nutritional therapies, clinical trials including intervention arms should be carried out to examine the efficacy of different nutritional interventions in improving oral health outcomes in older persons. Nutritionists who advise older persons on diet should take into account the possible effects on dental health. Frequency of snacking as well as the cariogenic properties and acidity of food and beverages should all be taken into account. As cariostatics, milk and dairy products, tea, and high-fiber foods may be offered as alternatives to sugary snacks or as a way to cut back on sugar intake during meals when necessary [71]. Increased consumption of polyunsaturated fatty acids, which are abundant in salmon, nuts, fibers, and vegetables, is recommended for older persons. In order to lower the risk of dental erosion, older persons should eat fruit or fruit juice with their meals rather than afterward. All older persons should have regular dietary analyses performed by oral health care specialists, who should also offer dietary recommendations to enhance dental health. If they observe that the elderly person may be at danger of a nutritional deficiency or imbalance, they should also be informed on the most recent evidence-based dietary guidelines and make appropriate arrangements for a referral to a nutritionist. Since prevention is always preferable than treatment, older persons should get and benefit from preventative care throughout their lives to ensure they have functioning dentition and good dental health [7]. Fluoridated toothpaste is an easy, affordable, and practical way to prevent dental cavities in older persons. Fluoride has been shown to prevent dental cavities [72]. In order to enhance the nutritional condition of older persons who have experienced severe tooth loss, prosthodontic rehabilitation may be a viable option for rebuilding a functioning dentition [68]. A growing body of research indicates that receiving prosthodontic therapy along with individualized dietary counseling may enhance people's nutritional status even further [73].

3. CONCLUSION

Oral health and nutrition are linked to diet. Oral health is improved by appropriate diet and eating habits, and a functional, healthy dentition facilitates nutritional intake. In order to raise awareness among the general population and dental and medical professionals, nutritional education is essential. All older persons can receive coordinated and integrated therapy to maintain their oral and general health throughout their lives if oral health is integrated into general health care services.

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