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EXAMINING THE NEXUS OF FOOD INSECURITY AND ORAL HEALTH

By
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A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College.

Oxford, MS

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ABSTRACT

EXAMINING THE NEXUS OF FOOD INSECURITY AND ORAL HEALTH

This research paper delves into the relationship between oral health and nutrition status among individuals with food insecurity. As both oral health and nutritional well-being play pivotal roles in overall health, understanding their interplay in the context of food insecurity becomes important. This study investigated how inadequate access to food resources, a characteristic of food insecurity, can impact oral health, leading to a spectrum of dental issues. The study explores the impact of compromised oral health on dietary habits, potentially resulting in nutritional deficiencies or malnutrition. By examining the potential pathways through which these factors influence each other, the study seeks to contribute valuable insights to the broader understanding of health disparities and vulnerabilities faced by food-insecure individuals. All participants were asked anonymously to complete a voluntary questionnaire to assess their nutritional status, nutritional habits, food insecurity level, and oral health history. All participants were 18 years of age or older. During a meeting at a local food pantry, paper copies of the survey were distributed to any patrons (n=20) who wished to participate. The survey took approximately five minutes to complete. After completing the survey, participants received a toiletry bag with oral hygiene items and a pamphlet with dental information.

A total of 20 food pantry patrons completed the survey. Results indicated that a large percentage of food-insecure individuals engage in behaviors that are known to impact both nutritional and oral health (84%). Furthermore, most participants did not adhere to the recommended frequency for dental visits, with only 40% having visited the dentist in the past six months. Lastly, a considerable number of individuals reported that their eating habits and food

intake had been influenced by oral pain or issues (30%). In conclusion, the survey findings underscore the need for comprehensive interventions addressing both nutritional and oral health disparities among food-insecure populations, emphasizing the importance of accessible dental care and education to promote overall well-being.

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INTRODUCTION

As medicine and healthcare constantly evolve, the relationship between nutrition and oral health has been noted as a complex and interrelated topic, recognizing how treating oral health and nutritional problems is important in improving health and quality of life. Inadequate nutrition, a result of food insecurity, can affect oral health and cause the onset of numerous dental issues (Jauhiainen et al., 2020). On the other hand, compromised oral health can negatively affect food intake, often leading to nutritional deficiencies or malnutrition (Pflipsen & Zenchenko, 2017). The relationship between oral health and nutrition can result in an increased risk of developing various diseases, such as periodontal disease, which can be further exacerbated by food insecurity. Despite the multidimensional and complex relationship between nutrition and oral health, this research topic has only been explored in the past few years. As a result, this is not included in dental school curricula, which can result in conflicting dietary messages in healthcare settings. Even though there is an overall association between poor oral health and an inadequate diet, research on this topic is minimal, underscoring the need for further study.

The aim of this study was to determine the impact of food insecurity on oral health in food pantry patrons. Depending on the results of this study, the most common barriers that contribute to the lack of oral health care in the food-insecure population will be acknowledged for future improvements in dentistry.

REVIEW OF LITERATURE

The relationship between nutrition and oral health

Poor oral health because of inadequate nutrition can worsen pre-existing health conditions and make someone more prone to disease. Dental caries are multifactorial and may result from unhealthy diets and unfavorable intrapersonal, environmental, and social factors (Sachdev et al., 2021). Jauhiainen et al. (2020) studied adults aged 30-49, specifically looking at their periodontal conditions and their daily diet. They found that diet plays a role in maintaining periodontal health and is one factor that affects the inflammatory response in a way that leads to the development and progression of periodontal disease. Through the 11-year follow-up period of their study, they found that a poor-quality diet is associated with periodontal pocket formation. Expanding on this idea, Bapat et al. (2016) argued that poor nutrition affects the entire immune system and increases susceptibility to disorders. They also found that people with less competent immune systems have been shown to have an increased risk for oral diseases, which in turn could compromise overall health. If nutrients are missing from a person's diet, it becomes difficult for their oral tissues to resist infection, causing tooth loss or periodontal diseases.

Although not the only determinant, food insecurity can significantly contribute to a decline in nutritional status and the occurrence of malnutrition. Food insecurity is a state characterized by restricted or uncertain access to sufficient food. It has become a prominent global public health concern, extending beyond developing nations to include developed countries like the United States. Currently, about 50 million Americans are food insecure (Sun et al., 2020). Additionally, food insecurity has been recently associated with a multitude of adverse health outcomes. These health risks include but are not limited to obesity, diabetes mellitus, hypertension, hyperlipidemia, and cardiovascular disease. In their study, Sun et al. (2020)

classified food security into four different groups. High food security was when zero food-insecure conditions were reported; marginal food security was if there were 1 or 2 affirmative responses; low food security if there were 3 to 5 affirmative responses; and very low food security if there were 6 to 10 affirmative responses. A comparable categorical framework was employed in this study to classify food insecurity risk.

Common behavioral habits of food-insecure individuals

Food insecurity arises due to inconsistent availability of affordable and nutritious food. Additionally, it can serve as a persistent stressor, irrespective of economic status (Leung et al., 2014). As a social determinant of health, food insecurity exhibits intricate connections with various social and economic elements, both at the individual and macro levels, shaping health and health-related behaviors. Frequent smoking, increased intake of alcoholic and sugar-sweetened beverages, and consumption of more highly palatable foods are all coping mechanisms associated with food insecurity. Most of these activities have many negative health consequences and can lead to overall poorer health, contributing to continued food insecurity as these behaviors progress. Some of these associations have notable implications for both oral health and nutrition absorption, particularly smoking, alcohol consumption, and sugar-sweetened beverage intake.

Smoking Habits

Smoking in all capacities – cigarettes, vapes, or cigars – is a significant public health concern in the United States. In fact, tobacco incurs economic expenses exceeding \$300 billion annually in the United States and contributes to a litany of medical morbidities as the leading

cause of preventable death (Bergmans et al., 2019). Kim and Tsoh (2016) studied the smoking status of young adults aged 18–30 years who were considered socioeconomically disadvantaged as measured by education and poverty. This study asserted that smoking contributes to socioeconomic inequities in disease and mortality. Therefore, socioeconomically disadvantaged adults with food insecurity are considered a high-risk group with respect to cigarette smoking.

Bergmans et al. (2019) randomly selected adults to examine whether food insecurity was associated with cigarette smoking and heavy alcohol use in their study. According to them, food insecure individuals are 5.5 times more likely to be smokers than their food secure counterparts. Further supporting this association, Armour et al. (2008) proved that the prevalence of cigarette smoking in the United States is higher among adults living below the poverty level than among those living at or above the poverty level. Their study quantified the association between food insecurity and smoking among low-income families. It has been theorized that this relationship between food insecurity and cigarette consumption is due to nicotine's appetite-suppressant effects (Kim & Tsoh, 2016). This decrease in appetite is associated with decreased food intake, which may be the intended result for low socioeconomic smokers during times of significant food scarcity (Bergmans et al., 2019). However, nicotine, the addictive psychoactive substance in tobacco, can quickly turn this appetite suppression strategy into a daily addiction. Therefore, cigarette purchases may deplete financial resources that would otherwise be used to purchase food, thus exacerbating food insecurity. Efforts to reduce tobacco-related health disparities should address various factors affecting socioeconomic conditions, including experiences of food insecurity (Kim & Tsoh, 2016).

Alcohol Intake

Heavy and excessive alcohol use is also economically costly and implicated in greater morbidity and mortality among U.S. adults (Bergmans et al., 2019). However, heavy alcohol consumption may be a strategy used by individuals who are food insecure to cope with the unique psychological strain of not having reliable access to food, and the stigma associated with social assistance dependence. Nagata et al. (2021) studied adults aged 24-32 and found that food insecurity risk was associated with moderate and severe alcohol use disorder. They also concluded that food insecurity risk was most strongly associated with higher odds of persistent consumption of alcohol despite experiencing emotional or physical health issues. Reitzel et al. (2020) investigated the association between alcohol use and food insecurity among homeless men and women. They determined there is a bidirectional association between alcohol use and food insecurity. Results indicated that heavy drinking and probable alcohol dependence were each associated with increased odds of food insecurity. Bergmans et al. (2019) also investigated the association between heavy alcohol use and food insecurity, in addition to smoking. This study found that heavy alcohol consumption was positively correlated with food insecurity among men, but not among women.

Additionally, heavy alcohol use can induce a vicious cycle which can be a detriment to socioeconomic status (Reitzel et al., 2020). This study found that heavy alcohol use is linked with financial stress and unemployment, which are related to the risk of being food insecure. Higher total alcohol consumption is also associated with unemployment, which can lead to loss of income; thus, further increasing the risk of food insecurity. Alcohol can also be a financial burden and deplete material resources, decreasing the ability to obtain adequate amounts of nutritious food regularly. Nagata et al. (2021) also noted the concept that problematic alcohol use is likely to use up limited financial resources and lower the probability of maintaining

employment. Alcohol use disorders generally decrease time for income generation due to the duration dedicated to consuming alcohol, experiencing intoxication, and recuperating. Thus, heavy alcohol consumption can elevate the risk of food insecurity.

Sugar-Sweetened Beverage Consumption

Sugar-sweetened beverages (SSB) are drinks that contain added sugar, including but not limited to non-diet soft drinks, flavored juice drinks, sports drinks, sweetened tea, coffee drinks, and energy drinks. The consumption of these beverages has been linked to increased risks of type 2 diabetes, metabolic syndrome, and cardiovascular disease in all age groups (Leung et al., 2014). Sugar-sweetened beverage consumption is also associated with an increased risk of diabetes and other obesity-related diseases (Davy et al., 2015). Leung et al. (2014) conducted a comprehensive analysis of how household food security was associated with the intake of foods, nutrients, and overall dietary quality in lower-income adults aged 20 to 65. In their study, they found that food insecurity was also associated with more sugar-sweetened beverage consumption. They noted that very low food security was associated with 12% more sugar-sweetened beverage intake. This was rationalized by determining that food-insecure adults may consume more highly palatable foods as a coping mechanism, leading to poorer diet quality and increased risks of chronic disease over time.

There are two reasons researchers have hypothesized that food insecurity is associated with lower dietary quality. Firstly, nutrient-dense foods like fruits and vegetables are costly and can be less available in low socioeconomic areas with food swamps or deserts. Secondly, processed foods are less expensive and highly accessible; they can provide excessive energy in the form of added fats, sugar, or salt. These components have the potential to make these

processed items addictive. However, there are other factors that affect SSB consumption in different populations and demographics. Davy et al. (2015) examined the associations between sugar-sweetened beverages and water intake in residents of a medically underserved, rural area. They found that higher risk of heavy SSB consumption occurs among low-socioeconomic status populations and subgroups at greatest risk of obesity and diabetes. Those with lower health literacy and education levels are also more frequent SSB consumers. Finally, they concluded that higher rates of SSB consumption have been reported among males and young adults.

Despite being more susceptible to consume sugar-sweetened beverages, food insecure individuals also tend to consume more than the recommended serving, 1 serving or less a day. Leung et al. (2014) reported that the mean intake of sugar-sweetened food among food insecure adults was 2.7 to 2.8 servings per day. They also concluded that 10% of adults consume at least six servings per day. The remarkably elevated levels of consumption warrant distinct consideration due to their significant implications for health and policy.

The effects of behavioral choices on nutritional status and oral health

The above-mentioned habits – smoking, alcohol intake, and SSB consumption – are dual risks for both nutrition and oral health status. Additionally, the availability of proper nutrients is critical for the growth, development, maintenance, and repair of healthy dentition and oral tissues (Pflipsen & Zenchenko, 2017). Alcohol consumption and smoking can be linked to periodontal disease regardless of oral hygiene status, in contrast to studies proposing that chronic consumption of alcohol and tobacco leads to oral disease because of self-neglect. Other risk markers for negative oral health outcomes include age, low income, low education level, smoking, and alcohol abuse (Tezal et al., 2001). Sugar-sweetened beverages (SSBs) are leading

sources of added sugars in the American diet, and frequent consumption is associated with an onslaught of medical complications. However, tooth decay and cavities are serious but often less marketed consequences of overconsumption of SSB. Therefore, the limitation and ideal cessation of these multifaceted unhealthy behaviors should be considered to better both nutritional and oral health.

Smoking Habits

All tobacco products interface with the oral cavity during use, which increases the risk of oral disease no matter the form of tobacco. Pfilpsen and Zenchenko (2017) studied tobacco's impact on oral health. In their study, they deduced many oral manifestations that occur due to tobacco use. These manifestations impact both dentition and the oral mucosa and range from cosmetic to cancerous. Examples of these conditions include staining, such as smoker's melanosis, acute necrotizing ulcerative gingivitis (trench mouth), nicotinic stomatitis (smoker's palate), and leukoplakia. Periodontitis, also known as inflammation of the gums, is more prevalent in smokers. Finally, smoking is one of the principal risk factors for oral cancer development due to the presence of dozens of known carcinogens. Therefore, tobacco use can predispose any site of the oral cavity to cancerous growth, including the lips, gingiva, alveolar ridges, buccal mucosa, floor of the mouth, tongue, and hard palate.

Aside from oral health manifestations, smoking can also greatly influence nutrition habits and status. Raatz et al. (2017) studied 184 participants, both smokers and nonsmokers, between the ages of 18 and 70 years old. They investigated energy intake and key nutrient levels in smokers, reflected by dietary reference intakes (DRIs) and kilocalories. The DRIs consist of science-based standards that are stratified by age and sex. These standards are utilized to assess

the sufficiency of nutrient intake or to plan menus for groups or individuals in the U.S. and Canada. Each DRI represents the average daily recommended nutrient intake for individuals over a specified period. Previous studies have shown that smokers are leaner and that the nutrient quality of smokers' diets is substantially reduced compared to nonsmokers. According to their results, energy intake and nutrient consumption were lower in the smoking group. Because of tobacco, smokers may have increased needs for specific nutrients due to the metabolic damage created by smoking. For example, the DRI for vitamin C is increased by 35 mg/d for smokers to compensate for the oxidative stress induced by smoking, which results in increased turnover of vitamin C. Therefore, it is even more crucial for this population to try to meet the DRI for several specific nutrients. Similarly, Dallongeville et al. (1998) investigated smokers' nutritional habits, finding that most smokers have lower intakes of vitamins C, E, and β -carotene than nonsmokers. This study also suggests that smokers have unhealthy patterns of nutrient intake compared with nonsmokers. They proved that not only are quantities of food affected by frequent smoking but also the quality of food choices. Smokers declared significantly higher intakes of total fat, saturated fat, cholesterol, and alcohol and lower intakes of polyunsaturated fat and fiber than nonsmokers.

Finally, smokers are quantified by frequency to evaluate risks by consumption. In their study, Pulvers et al. (2014) classified a smoker scale in adult daily and nondaily smokers. By their scale, light daily smokers consume ten or fewer cigarettes per day and moderate to heavy daily smokers consume more than ten cigarettes per day. This scale was used in the survey provided to participants to determine their nutritional risk from smoking.

Alcohol Intake

Alcohol can have radical consequences on both oral health and nutrition status when used in excess. In 2016, Peycheva and Boteva analyzed the effect of alcohol on oral health. They determined that high alcohol consumption has a deep impact on oral health. Consequences of this habit include non-carious destructions of teeth like dental erosion. This is due to the high concentration of organic and inorganic acids as well as the habit of keeping the alcoholic drink in the mouth for prolonged periods, which can cause chronic inflammations of the soft tissues in the mouth. People with high alcohol consumption also have a high incidence of decayed, missing, and filled (DMF) teeth, as well as chronic periodontal inflammations. Periodontal tissue surrounds teeth and includes soft tissue like gums. The cross-sectional study performed by Tezal et al. (2001) focused on periodontal disease specifically in 1,371 alcoholics ages 25 to 74. Their results suggest that alcohol may affect soft and hard tissues of the periodontium differently. Different areas have different levels of effect, with the gums being the most affected by alcohol intake. Tezal et al. (2001) also highlight that the lifestyles and hygiene patterns of chronic alcoholics may impact oral health. Chronic alcoholics may neglect themselves as they are preoccupied with their addiction and may have poor dental hygiene. Poor dental hygiene can diminish the integrity of teeth and cause them to be more susceptible to damage by alcohol.

In the above-mentioned study, Pfilpsen and Zenchenko (2017) also investigated alcohol's negative effect on oral health. Their study elaborated on how alcohol independently increases the risk of cancer in the oral cavity by generating reactive oxygen species (ROS). These molecules, in turn, can damage DNA and proteins through oxidation. Additionally, Pfilpsen and Zenchenko (2017) noted the association between alcohol and malnutrition, stating it as a widely recognized factor contributing to malnutrition through various mechanisms. Alcohol provides 7 kilocalories per gram and decreases appetite, discouraging caloric intake from food sources, and

consequently decreases nutrient intake, especially of proteins and B vitamins. There are also associated symptoms and conditions with high alcohol intake such as nausea, emesis, anorexia, pancreatitis, and gastritis that can further contribute to reduced food intake. Finally, alcohol causes mucosal erosions and loss of epithelial villi in the stomach and parts of the small intestine. This change in anatomy results in a decrease in absorptive capability. Following this thinking, Butts et al. (2023) noted that chronic dosages of ethanol, a main component of alcohol, have been shown to affect the intestinal mucosa by reducing villus height, which can lead to villus blunting. Alcohol can also affect the composition of the microbiota and cause bacterial overgrowth in the intestine. In their study, Butts et al. (2023) compiled a comprehensive review to study the influence of alcohol consumption on intestinal nutrient absorption. They furthered the idea that chronic alcohol use has been attributed to the development of malnutrition. Because ethanol inhibits the absorption of vital nutrients, alcohol consumption affects the absorption of micronutrients, including water-soluble vitamins, such as vitamins B1, B2, B6, B9, B12, and C. Additionally, the absorption of fat-soluble vitamins is affected, including vitamins A, D, E, and K and minerals, including calcium, zinc, iron, magnesium, and selenium. All of these risks and consequences of alcohol are dependent on chronic or extreme abuse. The net result of alcohol's effect on oral disease or other diseases may depend on dose, frequency, timing, and pattern of exposure (Tezal et al., 2001).

When used in moderation, alcohol can be minimally beneficial to overall health. The Dietary Guidelines for Americans for 2020-2025 recommend that adults of legal drinking age limit their alcoholic intake to 2 drinks or less in a day for men and 1 drink or less in a day for women. They define binge drinking as “5 or more drinks for the typical adult male or 4 or more

drinks for the typical adult female in about 2 hours.” Thus, these values were used to make the upper and lower scales of alcohol consumption in the survey for this research project.

Sugar-Sweetened Beverage Consumption

Sugar is known to be a fermentable carbohydrate and can be cariogenic through its fermentation by oral bacteria producing acid, which can dissolve the tooth enamel (Kim et al., 2017). Valenzuela et al. (2021) conducted a meta-analysis on the effect of sugar-sweetened beverages on oral health, including 38 cross-sectional studies. Sugar-sweetened beverages (SSB) are significant risk factors for negative oral health outcomes. Due to their high sugar content and acidity, SSBs contribute to the onset of dental caries and tooth erosion. Consequently, they play a role in developing dental caries and tooth erosion. The frequency of consumption also influences the severity of the outcome. Increased SSB consumption was associated with an increased risk of dental caries and erosion. Valenzuela et al. (2021) compared low, moderate, and high consumption of SSB and their effect on oral health. There was a significantly higher risk of caries and erosion when comparing moderate to low consumption. Additionally, the risk of caries and erosion increased when comparing high to moderate consumption. Thus, a dose-response gradient and high certainty of evidence were observed for caries. In 2017, Mishra and Mishra warned about the general and oral health hazards sugar-sweetened beverages can cause. They provided clear evidence demonstrating a correlation between the quantity of products containing sugars and the prevalence of dental caries and erosion. Additionally, carbonation can increase the hazards of sugar-sweetened beverages. Carbonated drinks have a pH of 2 to 3. This level of acidity can cause deterioration of tooth structure through erosion. Thus, it should be

known that increased consumption of sugar-sweetened beverages ultimately renders the general population into medical and dental complications.

Additionally, sugar-sweetened beverages can greatly affect nutritional status and healthy dietary patterns. Sugar-sweetened beverages are the leading sources of added sugars in the American diet (CDC, 2022). Frequent consumption of sugar-sweetened beverages is associated with a multitude of health implications. Conditions that can be caused or worsened by SSB consumption include weight gain, obesity, type 2 diabetes, heart disease, kidney disease, non-alcoholic liver disease, tooth decay and cavities, and gout. Therefore, limiting or eliminating SSB consumption can help individuals increase their health in many facets.

In a study by Kim et al. (2017), tooth loss was positively associated with SSB intake frequency. They reported that the odds of losing 1-5 teeth were higher among adults who drank more than one sugar-sweetened beverage a day. They further categorized SSB consumption rates into three groups: more than zero but less than one SSB per day, one to two SSB per day, and more than two SSBs per day. This scale was also used for the More Than A Meal survey. Finally, Kim et al. (2017) proved that the loss of one or more permanent teeth due to dental caries or periodontal disease was positively associated with the frequency of SSB intake after adjustment for socio-demographic characteristics and several risk factors.

Food insecurity/ low socioeconomic status increases nutritional risk

Food insecurity can increase nutritional risk, causing oral health to diminish. Sachdev et al. (2021) note that low-income individuals often lack knowledge of nutrition and oral hygiene practices. They studied 220 low-income women aged 18 to 50 years with a yearly family income of <250% of the Federal Poverty Level. Additionally, a lack of nutrition knowledge has been

suggested to play a role in the increased consumption of unhealthy foods in those with low socioeconomic status. Without adequate dental knowledge, low socioeconomic individuals may be unable to reduce the consumption of foods related to an increased risk of caries development. Sachdev et al. (2021) also found that economic disparities exist, with an elevated incidence of untreated dental cavities in socioeconomically disadvantaged racial/ethnic communities. They determined that lack of nutrition education, self-efficacy, positive eating behaviors, and social support are factors that act as barriers to the consumption of healthy foods and, in turn, promote caries in low-income individuals.

Furthermore, Bapat et al. (2016) argued that if nutrients are missing from a diet, it becomes difficult for oral tissues to resist infection, which may lead to tooth loss or periodontal diseases. They also concluded that eating a variety of well-balanced diets will improve dental health, and increased fiber and vitamin intake will reduce the risk of other diseases. Lower availability of food venues with healthy choices within poor neighborhoods is a major barrier to healthy eating. Thus, public health interventions to reduce dental caries should involve strategies to increase the availability and accessibility of healthy foods in low-income neighborhoods. Jauhiainen et al. (2020) found that smoking, visiting the dentist irregularly, and having a lower level of education were more common among those who had low dietary scores. Additionally, they found that both periodontitis and nutrition are related to socio-behavioral aspects.

METHODS

Purpose of study

The purpose of this study was to determine how food insecurity can affect oral health negatively. The survey was developed to collect information from the patrons of More Than A Meal in Oxford, Mississippi, concerning their demographics, nutritional habits, food insecurity level, oral health, and oral hygiene.

Participants

The sample population for this study included 20 food assistance program patrons ages 18 and older recruited from a food assistance program in North Mississippi. This location was chosen because the patrons were more likely to be food insecure and not have access to nutritious food or consistent dental care. The survey was administered in person during a time when patrons could come and eat a meal at the facility that day. All patrons were approached about participating in the survey and those that volunteered to, completed the survey.

Procedure

Institutional Review Board approval was obtained before the study began. The study was considered exempt #24x-084. Before the meal began, the researcher explained the study and the conditions to participate. If willing and over the age of 18, patrons were provided a paper survey. Participants were told to “fill out the survey to the best of your ability with answers as close to the truth as possible.” During the survey, the researcher walked around the room and ensured all participants could read and understand the survey. As participants finished, surveys were collected, and the researcher handed out toiletry bags with an informational flier with accessible

and economical ways to improve oral and nutritional health as well as dental hygiene supplies. This was done to increase their overall education in these topics and provide hygiene products to encourage dental hygiene after this investigation. The provision of toiletry bags to participants was made possible by the generosity of the Sally McDonnell Barksdale Honors College, which provided financial support for this project.

Data Analysis

After the data was collected, surveys with more than three unanswered questions were deleted. The data was entered into Microsoft Excel. Because the surveys were completed by hand, all data entry was checked multiple times to ensure accuracy. For the nutrition history aspect of the survey, items were coded on a scale of low to none (0), moderate (1), and high nutritional risk (2). The scale was then summed to get the total nutrition risk score, ranging from zero to eight. Lower scores represent no engagement in nutritional behaviors known to risk both oral and nutritional health, and higher scores show maximum engagement in these behaviors. Items in the food insecurity section were scored on a scale of (0)= never, (1)= sometimes, and (2)= often. Sample items include “Do you eat fewer than two meals a day?” and “Do you have adequate nutrition and access to healthy food.” In this instance, a higher total score of these food security questions means a higher food insecurity risk, with zero being the lowest possible score and six being the highest.

The data was then exported into Excel to be transported into Statistical Package for Social Sciences (SPSS) version 29.0. Descriptive statistics tests were performed to find central tendency and variability including frequencies and percentages. For statistical analysis, the investigator intended to use correlation analysis to assess the relationships between nutritional

habits, food security status, and oral health. However, due to insufficient variability in observed values, correlation analysis was not conducted.

RESULTS

There was a total of 20 respondents. Most participants were female (n= 17, 85%) with three male participants (n= 3, 15%). Most participants were of African American racial group (n= 17, 94.4%).

There were four questions regarding nutritional habits that can affect both oral health and overall nutrition status. For sugar-sweetened beverage intake (SSB), 60% of participants reported that they consumed above the recommended serving size. Five participants (25%) reported consuming double or more of the recommended serving size of SSB. Regarding water consumption, only five participants (25%) consumed the recommended daily water intake of seven or more cups, whereas two participants (10%) reported drinking less than one cup daily. None of the participants reported above the recommended alcohol intake of one or less per day for women or two or less per day for men. In respect to smoking, 80% of participants reported total avoidance of smoking. Three participants (15%) were categorized as light daily smokers, and one participant was considered a moderate to heavy daily smoker. When considering all these habits together, 84% of participants were at low to moderate nutritional risk.

Three questions determined the degree of food insecurity among participants. Of all the participants, 80% responded they “sometimes” consumed fewer than two meals a day, 15% responded “never,” and one participant selected “often.” When describing their household food security level, 25% of participants answered that they sometimes do not have enough to eat. To assess the overall risk of food insecurity, a total score was calculated by adding the answers of the three questions. Only 10% of the participants reported no signs of food insecurity, whereas 75% were marginally food secure, 15% of the participants had low food security, and none were classified as having very low food security.

Two open-ended questions were asked to the participants about their oral health. The questions were based on their answers to specific multiple-choice questions. When asked about their last visit to the dentist, 40% of participants said they visited less than six months ago, 25% said they visited less than two years ago, 10% said they visited less than five years ago, 20% said they visited more than five years ago, and 5% said they had never been to the dentist. In total, 60% of the participants reported not following the recommended frequency of visiting the dentist twice a year. Participants were asked about their dental care history and reasons for not visiting the dentist if they hadn't been to one in less than five years, over five years, or never. The primary obstacle hindering their access to dental care was identified. The most common reason reported by participants was the cost of dental care. Out of the small group that reported infrequent dentist visits, 50% cited "cost" or "income" as their biggest barrier to obtaining oral health care. 25% said they did not go to the dentist because they had "false teeth" or "no teeth." Additionally, 12.5% reported that transportation was their issue, mentioning "car." Finally, the remaining 12.5% said they did not have the "time" to visit the dentist.

During the survey, participants were asked whether their teeth had ever prevented them from eating. Out of the 20 participants, 14 (70%) answered no, whereas six (30%) answered yes. The six participants who reported difficulties with eating due to their teeth were further asked to describe their experiences. They were asked to specify if the issue was majorly caused by pain, lack of teeth, or any other problem. Out of the six participants, four mentioned lack of teeth and/or dentures as the main problem. Among these four responses, one participant reported that their poor-quality dentures hindered them from eating regularly. The other two participants mentioned that tooth pain was the reason behind their difficulty in eating. In general, the major

barriers to dental care include lack of time, transportation, high cost, and disregard due to missing teeth.

Table 1: Participant Characteristics of Food Pantry Patrons

Characteristic	n	%
Gender (n=20)		
Female	17	85
Male	3	15
Ethnicity (n=18)		
African American	17	94.4
White	1	5.6
Nutrition Risk ^a (n=19)		
None	3	15.8
At Risk	16	84.2
Food Security Level ^b (n=20)		
High	2	10
Marginal	15	75
Low	3	15
Very Low	0	0
Dental health care frequency (n=20)		
Less than 6 months	8	40
Less than 2 years	5	25
Less than 5 years	2	10
More than 5 years	4	20
Never	1	5
Presence of oral pain (n=20)		
Yes	6	30
No	14	70

Note. ^a Nutrition risk was calculated based on participants engagement and frequency in habits like alcohol intake, smoking frequency, and sugar-sweetened beverage consumption. ^b Food security level was determined by combining scores from the three food security questions, using a minimum score of zero to represent high food security and a maximum possible score of six to represent very low food security.

DISCUSSION

This study indicated that a majority of food-insecure pantry patrons exhibit behaviors affecting both nutritional and oral health statuses. It was also found that many participants experienced multiple barriers when attempting to access dental care, including but not limited to financial burden, lack of transportation, fear of the dentist, and lack of remaining natural teeth. As expected, a large portion of participants (90%) reported low to marginal levels of food security. This was expected due to the survey distribution location being a food assistance program. None of the participants were identified as experiencing an extreme level of food insecurity, which can be attributed to the fact that they all voluntarily visited the food pantry, indicating their willingness to improve their level of food security.

The study found that 84% of the participants were classified as having low to moderate nutritional risk based on their responses to four nutritional behavior questions. These questions asked participants about the frequency of their consumption of cigarettes, alcohol, sugar-sweetened beverages, and water. The study revealed a significant number of food-insecure participants who engaged in one of the four studied nutritional risk behaviors, indicating a correlation between food insecurity and these behaviors. However, the frequency of each behavior was not as expected. Unlike Nagata et al. (2021) reporting that food insecurity is associated with moderate to severe alcohol use disorder, no participants in this study reported alcohol intake beyond the Dietary Guidelines for Americans for 2020-2025 recommendations. For sugar-sweetened beverages, only eight participants (40%) reported consuming the recommended serving size per day. Out of the 60% of participants who reported consuming above the recommended serving size, five participants (25%) reported that they consume more than two servings of SSB per day. This is in line with the study by Leung et al. (2014) which

reported that the mean intake of sugar-sweetened food among food-insecure adults was 2.7 to 2.8 servings per day. Finally, reported consumption of smoking was below what was expected. Only four participants said that they consistently smoke, with three being light daily smokers and one being a moderate to heavy daily smoker. However, all research articles that investigate the association between food insecurity and smoking compare the reported frequency of smoking against food secure and food insecure populations. Because this study did not investigate the frequency of these behaviors in a food secure population, associations between the two based on the frequency of cigarette consumption cannot be made.

Finally, 60% of participants reported not going to the dentist as often as recommended by healthcare professionals. This percentage is comparable to other research data. For example, Wiener et al. (2018) linked unmet dental needs with food insecurity, with 47% of participants lacking oral healthcare. From their study, they determined that food insecure individuals are 58% more likely to have an unmet dental need than their food secure counterparts. Additionally, of the barriers to dental care reported in this study, many were known issues in the dental community. Lieneck et al. (2023) investigated the facilitators and barriers to oral healthcare for women and children with low socioeconomic status. They found that the most extensive barriers to accessing oral healthcare include financial constraints, transportation issues, language barriers, education, food insecurity, and a lack of awareness about the importance of oral health. Among these potential concerns, many were mentioned and documented in the surveys of this research project. Those mentioned by the participants from More Than A Meal include cost, transportation, time, and absence of teeth. Despite being well-documented in research, these factors that reduce access to oral healthcare have received little commitment to be addressed.

Limitations of this study should be addressed. Due to a small sample size, there was not enough data to analyze for statistical significance. This was also affected by a large percentage of homogenous data. The uniformity in responses could be caused by similar lifestyle habits in this population, or participants could have copied what neighbors next to them said if they were unsure or felt pressured. The survey also did not ask about their opinions of their nutritional habits or if they thought these items affected their nutritional and oral health. Finally, there could have been a language or education barrier that caused some participants to respond incorrectly or others at the event not to be able to participate at all.

Further research is needed to completely understand the role that food insecurity plays in maintaining and obtaining oral health care. Further research is needed to thoroughly understand the role that food insecurity plays in maintaining and obtaining oral health care. Future research should investigate whether education on nutrition and oral care directly affects the incidence of caries, periodontal disease, and pocket formation. The specific impact of behaviors known to degrade oral health like alcohol abuse, frequent smoking, high stress levels, and excess sugar consumption, should also be taken into consideration when evaluating how food security levels and diet impact dental health. Additionally, the proclivity to engage and the comprehension of consequences of these behaviors should be studied. Moreover, age groups should be compared to see if certain age groups are more prone to dental disease, indicating the outcome of the accumulation of improper oral care. Comparing age groups would also allow for insight into how different dental recommendations have impacted care over the years. Examples of this include fluorination of water and new suggestions for the frequency of flossing, brushing, and dental checkups.

Additionally, both the fields of dentistry and dietetics should incorporate ongoing education and curriculum pertaining to each other's areas of expertise. As proper nutrition status and behaviors significantly affect oral health, similarly, oral pain or tooth loss can influence nutritional intake. Moreover, long-term systemic health changes alongside maintaining proper nutrition and oral care should be investigated. This could include overall health and well-being and the prevention and treatment of various conditions.

IMPLICATIONS

The present study has several implications for dentists, registered dietitians, and public health professionals. Not only does nutrition status significantly influence oral health, but oral health status also affects food intake. Moreover, untreated oral health issues can result in a decline in overall systemic health, exacerbating existing conditions or triggering new ones. All patients should be taught about the relationship between nutrition and oral health and educated on the effect it can have on their lives. Food-insecure or low-socioeconomic-status individuals should also be educated on this topic and made aware of any resources that can alleviate the barriers to obtaining dental care. Finally, dental practitioners should be knowledgeable about common barriers to dental care and actively work to lessen these barriers. Insurance companies and healthcare policymakers should also assist in this area, learning that untreated dental issues can lead to more complex medical issues, which can radically increase healthcare costs.

REFERENCES

- Armour, B. S., Pitts, M. M., & Lee, C. W. (2008). Cigarette smoking and food insecurity among low-income families in the United States, 2001. *American Journal of Health promotion, 22*(6), 386-390.
- Bapat, S., Asawa, K., Bhat, N., Tak, M., Gupta, V. V., Chaturvedi, P., Daryani, H., & Shinde, K. (2016). Assessment of dental nutrition knowledge among nutrition/dietetics students. *Journal of Clinical and Diagnostic Research: JCDR, 10*(11), ZC37.
- Bergmans, R. S., Coughlin, L., Wilson, T., & Malecki, K. (2019). Cross-sectional associations of food insecurity with smoking cigarettes and heavy alcohol use in a population-based sample of adults. *Drug and Alcohol Dependence, 205*, 107646.
- Butts, M., Sundaram, V. L., Murughiyan, U., Borthakur, A., & Singh, S. (2023). The influence of alcohol consumption on intestinal nutrient absorption: A comprehensive review. *Nutrients, 15*(7), 1571. <https://doi.org/10.3390/nu15071571>
- Centers for Disease Control and Prevention. (2022, April 11). Get the facts: Sugar-sweetened beverages and consumption. Centers for Disease Control and Prevention. <https://www.cdc.gov/nutrition/data-statistics/sugar-sweetened-beverages-intake.html#:~:text=Frequently%20drinking%20sugar%2Dsweetened%20beverages,gout%2C%20a%20type%20of%20arthritis>
- Dallongeville, J., Marécaux, N., Fruchart, J., & Amouyel, P. (1998). Cigarette Smoking Is Associated with Unhealthy Patterns of Nutrient Intake: A Meta-analysis. *The Journal of Nutrition, 128*(9), 1450-1457. <https://doi.org/10.1093/jn/128.9.1450>
- Davy, B. M., Zoellner, J. M., Waters, C. N., Bailey, A. N., & Hill, J. L. (2015). Associations among chronic disease status, participation in federal nutrition programs, food insecurity,

- and sugar-sweetened beverage and water intake among residents of a health-disparate region. *Journal of Nutrition Education and Behavior*, 47(3), 196-205.
- Definitions of Food Security. USDA ERS - Definitions of Food Security. (2023).
<https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/definitions-of-food-security/>
- Dietary Guidelines for Americans, 2020-2025. (2020). U.S. Department of Agriculture and U.S. Department of Health and Human Services. 9th Edition.
- Jauhiainen, L. M., Ylöstalo, P. V., Knuutila, M., Männistö, S., Kanerva, N., & Suominen, A. L. (2020). Poor diet predicts periodontal disease development in 11-year follow-up study. *Community Dentistry and Oral Epidemiology*, 48(2), 143-151.
- Kim, J. E., & Tsoh, J. Y. (2016). Peer reviewed: cigarette smoking among socioeconomically disadvantaged young adults in association with food insecurity and other factors. *Preventing Chronic Disease*, 13.
- Kim, S., Park, S., & Lin, M. (2017). Permanent tooth loss and sugar-sweetened beverage intake in US young adults. *Journal of Public Health Dentistry*, 77(2), 148-154.
- Leung, C. W., Epel, E. S., Ritchie, L. D., Crawford, P. B., & Laraia, B. A. (2014). Food insecurity is inversely associated with diet quality of lower-income adults. *Journal of the Academy of Nutrition and Dietetics*, 114(12), 1943-1953.
- Lieneck, C., Connelly, E., Ireland, D., Jefferson, A., Jones, J., & Breidel, N. (2023). Facilitators and Barriers to Oral Healthcare for Women and Children with Low Socioeconomic Status in the United States: A Narrative Review. *Healthcare (Basel, Switzerland)*, 11(16), 2248. <https://doi.org/10.3390/healthcare11162248>

- Mishra, M., & Mishra, S. (2011). Sugar-sweetened beverages: General and oral health hazards in children and adolescents. *International Journal of Clinical Pediatric Dentistry*, 4(2), 119–123. <https://doi.org/10.5005/jp-journals-10005-1094>
- Nagata, J. M., Whittle, H. J., Ganson, K. T., Tabler, J., Hahn, J. A., & Weiser, S. D. (2021). Food insecurity risk and alcohol use disorder in US young adults: Findings from the National Longitudinal Study of Adolescent to Adult Health. *The American Journal on Addictions*, 30(6), 601-608.
- Peycheva, K., & Boteva, E. (2016). Effect of alcohol to Oral Health. *Acta Medica Bulgarica*, 43(1), 71–77. <https://doi.org/10.1515/amb-2016-0009>
- Pflipsen, M., & Zenchenko, Y. (2017). Nutrition for oral health and oral manifestations of poor nutrition and unhealthy habits. *Gen Dent*, 65(6), 36-43.
- Pulvers, K., Scheuermann, T. S., Romero, D. R., Basora, B., Luo, X., & Ahluwalia, J. S. (2014). Classifying a smoker scale in adult daily and nondaily smokers. *Journal of the Society for Research on Nicotine and Tobacco*, 16(5), 591–599. <https://doi.org/10.1093/ntr/ntt187>
- Raatz, S. K., Jahns, L., Johnson, L. K., Scheett, A., Carriquiry, A., Lemieux, A., ... & al'Absi, M. (2017). Smokers report lower intake of key nutrients than nonsmokers, yet both fall short of meeting recommended intakes. *Nutrition Research*, 45, 30-37.
- Reitzel, L. R., Chinamuthevi, S., Daundasekara, S. S., Hernandez, D. C., Chen, T. A., Harkara, Y., ... & Businelle, M. S. (2020). Association of problematic alcohol use and food insecurity among homeless men and women. *International Journal of Environmental Research and Public Health*, 17(10), 3631.

- Sachdev, P. K., Freeland-Graves, J., Ranjit, N., & Babaei, M. (2021). Role of dental nutrition knowledge and socioecological factors in dental caries in low-income women. *Health Education & Behavior*, 10901981211004149.
- Sun, Y., Liu, B., Rong, S., Du, Y., Xu, G., Snetselaar, L. G., ... & Bao, W. (2020). Food insecurity is associated with cardiovascular and all-cause mortality among adults in the United States. *Journal of the American Heart Association*, 9(19), e014629.
- Tezal, M., Grossi, S. G., Ho, A. W., & Genco, R. J. (2001). The effect of alcohol consumption on periodontal disease. *Journal of Periodontology*, 72(2), 183–189.
<https://doi.org/10.1902/jop.2001.72.2.183>
- Valenzuela, M. J., Waterhouse, B., Aggarwal, V. R., Bloor, K., & Doran, T. (2021). Effect of sugar-sweetened beverages on oral health: a systematic review and meta-analysis. *European Journal of Public Health*, 31(1), 122-129.
- Wiener, R. C., Sambamoorthi, U., Shen, C., Alwhaibi, M., & Findley, P. (2018). Food Security and Unmet Dental Care Needs in Adults in the United States. *Journal of Dental Hygiene*, 92(3), 14–22.