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THE RELATIONSHIP BETWEEN DENTAL HEALTH AND NUTRITION RISK
FACTORS IN HOME BOUND SENIOR CITIZENS

By

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A Thesis

Submitted in Partial Fulfillment of the
Requirements for the Degree of
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ABSTRACT

Ahmed, Aiysha. MS. The University of Memphis. December/2011. The relationship between dental health and nutrition risk factors in home bound senior citizens. Major Professor: Carol O. Mitchell, PhD.

Objective: To determine if there is a correlation between dental health and nutrition status among homebound senior citizens who participate in the MIFA (Metropolitan Interfaith Association) meals on wheels program.

Design: Qualified participants were given questionnaires at their residence or over the phone. The interviews were administered by trained MIFA volunteers.

Subjects: Fifty MIFA participants were chosen through random selection.

Results: The correlation between dental health and malnutrition risk factors was non-significant ($p=0.098$).

Conclusions: Programs to help raise awareness within dental offices and dental associations regarding this correlation would benefit the rising issues with elderly malnutrition significantly.

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CHAPTER 1

REVIEW OF LITERATURE

Introduction

As the aging population continuously increases year after year, an increasing number of older adults are signing up for government funded programs like “Meals on Wheels.” These programs attempt to focus on fulfilling seniors’ dietary requirements by making sure they provide program participants with a well balanced, nutritionally complete meal. One program in particular, called MIFA meals, provides fresh fruit and two vegetable servings with every meal sent out. In general, older individuals that consume a diet high in fiber, low in saturated fat, and have a lower total energy intake are at a reduced risk of mortality compared to those individuals who consume a greater amount of high-fat dairy foods, fried foods, sweets and desserts (1). A major barrier to consuming a higher quantity of fruits and vegetables may be poor dental health and/or inadequate dentition.

Most literature available on the topic of oral health and nutrition in the elderly population conveys the message that as age progresses past 60 years, there is an increased likelihood for risk of malnutrition. A major problem with this population is that metabolism declines and physical activity decreases. As a result, elderly individuals are recommended to consume low calorie foods instead of high calorie foods (i.e. junk food, sweets, and snack foods). Low calorie foods which should be consumed frequently include fruits, vegetables and whole wheat

grain products. However, adequate oral health is needed for consumption of these foods, especially if they are eaten in their raw form. Several articles regarding the topic of oral health, state that elderly individuals frequently encounter numerous oral health problems including missing teeth, mastication difficulties and gingivitis. If homebound elderly individuals are not being provided with adequate oral health care through dental services, they could potentially be at risk for severe malnutrition and vitamin deficiencies (2).

Meal Delivery Programs

Many homebound seniors are able to benefit considerably from programs such as “Meals on Wheels” and various other social programs. These programs have the potential to markedly improve nutrition status of their participants by providing at least one healthy meal a day to seniors who need assistance with preparing meals, shopping and self-care help (3-5). In order to qualify for meal delivery programs, certain criteria must be met. Screening tools are used to evaluate whether or not seniors are eligible for the program based on demonstration of their financial and physical need for meal delivery services (6).

Asides from nutrition, screening tools also assess number of medications consumed, medical conditions and overall health status (7,8). These factors are important for determining the eligibility of seniors within meal programs. Seniors who score high on these screening tools and who are at high risk for malnutrition will be able to participate in these programs. Furthermore, they may also qualify for more than one program, meaning a senior could be simultaneously receiving

meals from the “Meals on Wheels” program and receive food stamps. Individuals who may be denied participation in such programs could include seniors who either live with others that can help them prepare meals and support them financially, as well as seniors who may have sufficient physical capabilities to prepare meals for themselves and complete all activities of daily living independently. By providing meals to seniors who are at higher risk for malnutrition, it is anticipated that the nutrition related quality of life issues of those seniors will be improved (9). Several studies have concluded that participation in meal programs for seniors can significantly improve the quality of life and nutritional status of elderly individuals, especially if they have no form of formal and/or informal assistance with activities of daily living (10,11).

Although these programs can have a large influence on the risk of malnutrition and mortality in the aging population, the type of diet consumed by these individuals on a daily basis is an important factor in determining risk factors as well. MIFA meals generally provides two vegetables and a fresh fruit with every meal sent out in order to provide a well-balanced healthy meal to its participants. Studies have also shown that older individuals who consume a diet high in fiber and low in saturated fat generally have a much lower risk of mortality than those who consume a diet containing high fat dairy products, sweets, desserts and fried foods (1). Additionally, consumption of a higher plant based diet is known to reduce multiple chronic diseases as well as reduce the risk of developing Alzheimer’s disease, heart disease and stroke (12).

Roadblocks to a Nutritionally Balanced Diet

Although promoting healthy eating to seniors is desirable, there are many reasons why seniors may not be able to consume the recommended healthy diet consisting of vegetables, fruit, whole grains and low fat dairy products. Several of these factors can include low income status, inability to complete activities of daily living and poor dental health. Other factors such as residential neighborhood, race of the individual and socioeconomic status can have a major influence on the accessibility of fruits and vegetables (13-16). Unfortunately, neighborhoods which don't have access to produce have an increased abundance of fast food restaurants (16). In addition, seniors who struggle to get to the grocery store might prefer to purchase canned fruits and vegetables (which have a lower nutritional value) as an alternative to fresh fruits and vegetables due to their extended shelf life (14). It makes sense for an individual to purchase foods which can last them a long period if they don't have the energy to walk around in a store or have a limited income.

Additional studies have compared nutritional status of seniors receiving one meal vs. two meals a day through meal programs. The main goal of increasing free meals to two meals a day is to improve not only nutrition status, but also the quality of life amongst the frail, elderly homebound population (11). Improving quality of life in this population could include any number of small and large changes. Examples include making food more visually appealing so that seniors look forward to eating their meals and reducing the burdens of seniors' financial constraints in procuring food on a daily basis (17). Limitations of seniors

receiving only one meal a day leaves them responsible for consuming a sufficient diet covering 2/3's of their RDIs (Recommended Dietary Intake) for all micronutrients and macronutrients (18). Unfortunately most of these seniors do not have adequate support or help to prepare the rest of their meals. Therefore, these consequences can result in an insufficient diet without any improvements in nutrition status. In addition, many seniors suffer from conditions like depression and they do not look forward to starting their day off with a sufficient breakfast meal (19).

One particular study concerning this population ultimately demonstrated the long term benefits of receiving both a breakfast and lunch meal. Since the meal program provided a breakfast meal to one group, the seniors who received both meals were able to consume an additional 300 calories, 14 grams of protein, 36 grams of carbohydrates, 12 grams of fat and 4 grams of fiber (11). They also received an additional amount of vitamins and minerals (i.e. potassium and iron) compared to the control group which only received the lunch meal. This is considerable because the seniors who did not receive a breakfast meal may just be skipping the meal and/or eating junk food in place of a wholesome, nutritious breakfast. Furthermore, this study was able to conclude that seniors who had both meals delivered to them had a significantly greater quality of life as well as increased food intake and nutrition satisfaction (11). Lower incidences of depressive symptoms were also observed when seniors were provided with two meals a day (20). The service of two meals a day is especially important for seniors who are too frail to prepare their own meals and cannot complete

activities of daily living. In other words, if they are struggling to get up and walk to the kitchen to cut a piece of fruit, this means they will be significantly limited in preparing a wholesome nutritious meal for themselves. Overall, the group consisting of seniors being provided with two meals a day (breakfast & lunch), had significantly more beneficial outcomes than seniors being solely provided with one meal (11). The consumption of two meals a day demonstrated reduction in shopping anxiety and food insecurity. Altogether, these outcomes greatly influence the ability of homebound seniors to procure food and consume sufficient nutrients to reduce the risk of malnutrition.

Social Factors and Nutrition in the Elderly Population

The social aspect of food consumption is yet another key factor that plays into seniors' nutritional quality of life. One study regarding this topic concluded that the incorporation of social-psychological components in meal programs for seniors also has a major impact on food satisfaction and food consumption (17). In this particular study it was observed that seniors who participated in congregate meal programs tended to have a significantly higher quality of life and health status compared to seniors who received home-delivered meals (17). This makes sense because seniors who interact with others in a social setting most likely don't feel as isolated and lonely while eating meals. Eating in a group setting gives seniors a chance to interact with their peers and motivates them to look forward to eating with friends. On the other hand, eating alone after receiving a home-delivered meal may make homebound seniors feel bored and

uninterested in their food. This situation might continue to place homebound seniors at risk of malnutrition, if they feel unhappy about eating their meals alone (21). Therefore, it is important to assess seniors adequately based on the need for whether they qualify to receive free meals at a congregate site or receive meals delivered to their home.

Aging and Risk of Malnutrition

It is well documented that seniors are regarded as a high risk population for malnutrition and a multiple number of health risks (22). Regardless, of whether they receive meals from food delivery programs and/or receive formal assistance, this population remains at risk for higher hospital admission and readmission rates, mortality, nutritional deficiencies, anemia, and reduced cognitive functioning (23). Several causes of malnutrition in this population could be attributed to changes in the digestive system due to declines in appetite, thirst and a diminished sense of taste and smell. Unfortunately this leads to increased gastrointestinal complications including impaired gastric motility, constipation, dysphagia, bacterial overgrowth in the intestine and reduced gastric acid secretions (24). Overall the primary message from all these complications is that the most major risk within this population is weight loss due to anorexia contributing to a decrease in energy intake overtime (25). In other words, much of the weight loss includes skeletal muscle loss instead of fat loss. One study estimated 29% body fat in a 79 year old man compared to only 15% body fat in a 20 year old man both weighing 80 kg (25).

Weight loss in the elderly can be defined within the following categories: wasting, cachexia and sarcopenia (26). The particular term for loss of muscle mass is called wasting and results in decreased functioning of the immune system causing release of pro-inflammatory cytokines and negative nitrogen balance (25). As a result serum albumin decreases due to an increase in acute phase proteins. On the other hand, the term used for a decrease in skeletal muscle is called sarcopenia. This is usually caused by reduced physical activity and neuronal losses from the spinal cord (27). Sarcopenia also results in breakdown of muscle and increased levels of acute phase proteins and pro-inflammatory cytokines (26). Both sarcopenia and wasting can lead to increased fatigue and tiredness also resulting in reduced abilities to perform activities of daily living. If a particular senior does not have enough energy to do light housework, it will be very difficult for them to combine ingredients together and prepare nutritious meals for themselves.

Another significant component to aging is that many seniors are required to take medications which can decrease their appetite or reduce their sense of taste and smell (25). An added complication of medications is that they often compete for the same pathways used in absorption of certain nutrients resulting in deficiencies, regardless of vitamin and mineral intake (25). One study indicated that individuals suffering from congestive heart failure were at increased risk for thiamin deficiency (28). This was mainly due to use of diuretics for treatment of the disease. Patients using diuretics to treat the disease had incidences of large

urinary losses of thiamin secondary to inhibition of sodium and chloride reabsorption (28).

Unfortunately, complications of drug and nutrient interactions and declines in appetite and hunger in the elderly contribute to undesirable weight loss, cachexia and sarcopenia. Physical findings that support nutrient and caloric deficiencies can be identified by performing a physical exam of the skin, hair, nails, eyes, mouth, neck, abdomen and extremities (25). For example, the skin may reveal an obvious zinc deficiency if an individual has dry scaly skin (25). Biochemical markers can also confirm nutrient deficiencies and provide insight on malnutrition risks. Significant markers include albumin, prealbumin, transferrin and total serum cholesterol (25).

Elderly Complications and Nutrition Status

If seniors are suffering from major medical illnesses and/or have psychological and social disabilities, their risk for malnutrition greatly increases. Many medical complications and diseases which have a direct influence on nutrition status include respiratory diseases, gastrointestinal complications, endocrine disorders, neurological disorders, infections, alcoholism and poor dentition (25). Psychological disabilities causing nutrition related problems may include depression, anxiety, Alzheimer's disease and dementia (25). Although it's not clearly obvious how these disabilities affect nutrition status, a consequence of depression may result in loss of interest of food and consuming a poor diet. Social issues may include poverty and isolation (25). Poverty in general reduces

consumption of food if seniors cannot afford to eat three wholesome meals a day. Also if seniors are spending all their money on medications, housing bills, and other non-food related items, this leaves very little money for obtaining a sufficient food supply.

Furthermore, it is recommended that seniors have an intake of 1.5 grams protein/kg body weight in order to prevent the loss of muscle mass and skeletal muscle (29). However, if they cannot afford to consume enough food items and/or if they are not physically and cognitively able to prepare their own meals, then this goal of consuming 1.5 grams protein/kg body weight is extremely unrealistic. In the real world, seniors probably consume much less than the recommended amount. Additionally, if they are suffering from vitamin deficiencies, skeletal muscle loss may be greater.

Oral and Dental Health

Even before the risks of malnutrition start to show up through obvious physical markers such as muscle wasting and overall weight loss, it is highly important to examine oral and dental health. For example, if a dietitian wants to increase calories or increase food intake of whole foods (i.e. non-supplemental foods like ensure and boost) in the diet, it will be very difficult for that person to follow the specified meal plan if they are having dental complications. Dental complications may include tooth loss, reduced salivary flow, decreased masticatory functions and periodontal disease (30). Elderly people often do not have all teeth present, and it could be an arduous task for them if a dietitian

includes raw vegetables, raw fruits, chewy meats and whole wheat grains in their diet plan. In other words, even if they can afford to purchase these foods and are physically able to prepare their own meals, they may not be able to chew their meal sufficiently. Again, this would put them at a very high risk for developing malnutrition. One study in particular found that nutritional deficits had a high correlation with individuals having serious oral conditions (30). This study concluded that due to a decreased amount of posterior occlusal pairs of teeth, a decline in fruit and vegetable intake was noted (31). Instead more packaged and prepared foods such as cereal, candies, and junk food were consumed causing even more dental complications such as periodontal disease (32). Ultimately, dietitians should be responsible for asking questions concerning the dental health of elderly individuals before providing a thorough nutrition consult or diet plan. If an elderly individual is only consuming soft textured foods or junk food, the dietitian should ask pertinent questions regarding the client's dental health. Perhaps they would like to have a varied diet consisting of fruits and vegetables, but they simply may not be able to tolerate such a diet due to any number of oral complications and dentition problems.

Dentition and Vitamin Intake

In general it is also found that elderly individuals suffering from mastication problems have lower nutrient intakes of β -carotene, vitamin C, folate and dietary fiber (1,33). Key foods containing a significant amount of these nutrients typically include carrots, oranges, strawberries, raw spinach and broccoli. By nature,

these foods tend to be crunchy and it takes sufficient chewing ability to break down these foods in order for it to be processed and consumed by the gastrointestinal tract. However, if a sufficient amount of teeth are not available to support the breakdown of these foods, the individual has very limited means of consuming natural forms of these specific vitamins and minerals through whole foods. Improper fitting dentures can also result in similar consequences, having an effect on daily intake of protein, thiamin, riboflavin, vitamin D, calcium, iron, magnesium and phosphorous (34).

Most studies regarding aging and nutrition highlight the importance of increasing macronutrient and micronutrient deficiencies. In addition, studies have similar findings that a combination of factors from malabsorption of nutrients to periodontal disease can cause these deficiencies. Social and psychological factors may also exacerbate these complications, however, it is well established amongst studies that the elderly population are at a notably high risk of developing nutrition related health problems. Oral health and nutrition are of particular concern because dental health can have a great impact on nutrition status of the homebound elderly population. Without adequate oral health, dietary changes cannot take place even if individuals are willing to improve their dietary habits.

This study examined if complications in the dental health of homebound seniors influenced food intake. Dental health is a serious issue in the elderly population because it is the gateway to optimal nutrition status as well as an overall healthy lifestyle. The cycle of optimal nutrition begins at the site of the oral

tissues and from there can positively or negatively affect all other systems and organs like the skin, skeletal muscle, gastrointestinal system and cardiovascular system. Dental health should not be overlooked and should be assessed regardless of a senior's social status. The purpose of this project was to determine if homebound seniors who participate on "Meals on Wheels" programs will likely have a positive correlation between poor dental health and nutrition risk.

CHAPTER II

METHODS

Research Design

This was a quantitative survey designed to answer questions regarding the dental health of elderly homebound participants (independent variable), receiving meals on wheels and their nutrition risks (dependent variable). Both questionnaires were administered at home, at a congregate meal site or over the phone by trained MIFA volunteers.

The first questionnaire was used to assess participants' risk of malnutrition. This questionnaire also included questions on how many fruits and vegetables are consumed on a daily basis and whether or not the client was physically able to shop or cook (see appendix). The second questionnaire was used to assess overall dental health of participants within the program (see appendix). This questionnaire was self developed and was not used before to assess clients on the MIFA meals on wheels program. It included pertinent questions regarding dental health and asked whether clients currently had dental insurance or if they had seen their dentist within the past year.

Participants

Since the target population of this study included homebound senior citizens, participant recruitment was conducted through clients enrolled in the Metropolitan Interfaith Association (MIFA) meals on wheels program. This

particular program is a non-profit meal delivery program for seniors in need of at home meal delivery. All home delivered meals were provided to participants, Monday through Friday, between the hours of 10am and 12pm. All seniors enrolled in the program had been qualified to participate if they had a certain functional score indicating a need for home delivered meals.

The clients used for this study receive one meal a day through MIFA meals. Participants were ineligible for the study if they were under 60 years of age. Participants who were bed ridden were excluded because they were not capable of performing any activities of daily living and therefore would have a much higher malnutrition risk compared to seniors who were able to be active at least to some extent. Additionally seniors who had severe dementia and were not capable of answering questions or understanding the content of the questionnaire were excluded.

Measures

Trained MIFA volunteers who worked at congregate meal sites and those who transported home delivery meals conducted the interviews. They marked a score next to the specified item on the questionnaire based on the participant's response. At the end of both questionnaires they calculated the total scores.

Nutrition Status

Nutrition status was assessed by use of a questionnaire developed by the Tennessee state dietitian, Valerie Keen, specifically known as the "Nutrition

Counseling Mini Assessment.” The main purpose of this assessment was to assess the nutrition status of clients at risk for malnutrition due to a variety of reasons including inability to perform activities of daily living, financial difficulties, and inability to move around and transfer (i.e. get in/out of bed/chair). The overall scoring used for the assessment was total number of yes responses. A score of 0-2 (yes responses) indicates a “good” nutritional score, a score of 3-5 (yes responses) indicates a “moderate” nutritional score and a score of 6 or more (yes responses) indicates a “poor” nutritional score. The dental health variable was considered the independent variable since the goal was to see if this was affected by nutrition status.

Dental Health

Dental health questions evaluated whether or not fruit and vegetable intake declined as a result of dental problems. In order to assess dental health we assigned a number to the items on a questionnaire, which asked the following questions including “when was your last dental appointment?,” “do you have dentures?,” and if so “do they fit well?” These were important questions to ask since many seniors participating on the MIFA meals program are on Medicare/Medicaid which does not cover dental health insurance. This can be a major problem for seniors in need of dentures or a replacement of dentures due to improper fitting. In addition, the number and amount of teeth tend to decrease with age and therefore missing teeth may cause problems with chewing raw and crunchy foods which typically tend to be the most nutritious foods. For example,

seniors may have trouble chewing foods like broccoli, apples and spinach which are all rich in vitamin C and fiber.

Fruits and Vegetable Intake

Fruit and vegetable intake was another dependent variable used to observe how many fruits and vegetables were consumed on a daily basis amongst all seniors who participated in the study. Although many reasons for decreased consumption could be due to financial difficulty in obtaining a sufficient quantity of fruits and vegetables, for the most part we wanted to observe the direct relationship of dental health on this intake. Using “DETERMINE your health checklist,” published by the American Academy of Physicians, we were able to obtain pertinent information including how many fruits and vegetables were consumed on a daily basis and whether the client was capable of shopping and cooking. Although MIFA meals provided one serving of fruit and two servings of vegetables with the one meal delivered, it was important to find out if seniors could shop or obtain foods from other sources in order to fill the recommended amount of 5 servings of fruits and vegetables per day. For example, if a senior could not drive or shop and had no access to fruits and vegetables, it would be very difficult for them to fulfill the additional nutrition requirements.

Respective Measurement

Two questionnaires were used in order to obtain data regarding dental health of these homebound seniors. The first questionnaire was already in use by

MIFA meals, called the “Nutritional Counseling Mini Assessment.” Key questions included “how many servings of fruits and/or vegetables are included in your diet,” as well as “how difficult is chewing/swallowing when consuming food?” The questionnaire posed the following questions in which the client was responsible for answering Yes or No (see appendix 1).

The second questionnaire pertained to dental health among the elderly clients. It included items asking questions like “when was your last dental visit?,” “do you have dentures?” and “if so do they fit properly?” We scored this similarly to the first questionnaire used by MIFA. Scores again were assessed by the number of “yes” answers and a score of 0-2 indicated a low risk dental health score, 3-5 indicated a moderate risk dental health score and a score of 6 or more indicated a high risk dental health score (see appendix 1). Again, all yes answers were given a score of one and yes answers were tallied at the end accordingly.

Procedures

The questionnaires were administered by calling participants over the phone and/or visiting them at their homes. Volunteers helping in the MIFA meals program were taught how to read the questions and work with the participants in helping them understand the material in order to obtain accurate results.

Although the questions were mostly subjective, volunteers were trained in asking the questions correctly and guiding participants in helping them understand the content of the questions asked. For example when using the first questionnaire to ask how many fruits and/or vegetables are consumed a day, the interviewer

described the serving of one fruit as “1/2 a banana” or “1/2 cup of canned fruit” in order for the participants to understand how much they consumed per a day.

In addition to the questionnaires, supplemental equipment used for this study included a list of fruits and vegetables, and menus from MIFA meals (including specific items provided in the meals on a monthly basis). All these items helped participants recall information on their fruit and vegetable consumption and helped them get a better idea of what fruits and vegetables they included in their overall intake. For example, many participants did not realize a potato is considered a vegetable, or that onions used on sandwiches, hotdogs, and hamburgers could also be included in the overall count.

Statistical Analysis Plan

In order to test the relationship between dental health and nutrition status, a contingency table was used. Data was arranged in a three way matrix and a chi-square test was performed in order to observe whether or not the p-value was significant. We used the alpha level of .05 to note if the correlation was significant or not. A statistics analysis program, R, was used in order to create the contingency table and calculate the p-value (35).

CHAPTER III

RESULTS

Characteristics of the Sample

The two main variables used for assessing correlations included dentition status and nutrition status. The data has been arranged in a three-way matrix (or a contingency table). Table 1, showing the three rows, represents the nutrition risk classifications of the sample population and the three columns represent the dentition risk classifications. All participants were classified according to both variables and were placed in their appropriate groups.

Nutrition Risk Score Groups	Dental Risk Score Groups			Total
	Low Risk Dental Score	Moderate Risk Dental Score	High Dental Risk Score	
Low Risk for malnutrition	8	5	1	14
Moderate Risk for malnutrition	9	10	4	23
High Risk for malnutrition	1	8	4	13
Total	18	23	9	50

Table 2 represents the observed and expected frequencies of the data, as well as the contribution to the x-squared statistic represented by the equation:

$$\frac{(\text{Observed frequency} - \text{Expected frequency})^2}{\text{Expected frequency}} = \text{Contribution to } x^2 \text{ statistic}$$

This equation is important because together all the values added up equal the chi-squared value. The higher the chi-squared value, the greater the difference between the observed and expected values. As shown by this table, the x-squared contributing statistic for the relationship between moderate risk malnutrition scores and each category of dental risk scores is relatively low, compared to the x-squared contributing statistic for the high risk malnutrition score and the low risk dental score. In addition the low risk malnutrition score and its relationship with the low risk dental health score is also high, meaning the observed and expected values have a notable difference.

Table 2. Calculation of X^2 for a 3 x 3 Contingency Table showing frequency of dental risk scores with malnutrition risk scores in the sample population of elderly MIFA meals on wheels clients

Category		Observed	Expected	Contribution to x-squared*	Standard Residual
Low Risk Malnutrition Score	Low Risk for dental health	8	5.04	1.7384	1.318
	Moderate Risk for dental health	5	6.44	0.322	-0.567
	High Risk for dental health	1	2.52	0.9168	-0.958
Moderate Risk Malnutrition Score	Low Risk for dental health	9	8.28	0.0626	0.25
	Moderate Risk for dental health	10	10.58	0.0318	-0.178
	High Risk for dental health	4	4.14	0.0047	-0.069
High Risk Malnutrition Score	Low Risk for dental health	1	4.68	2.8937	-1.701
	Moderate Risk for dental health	8	5.98	0.6823	0.826
	High Risk for dental health	4	2.34	1.1776	1.085

*Column was calculated using the following equation: $(\text{observed frequency} - \text{expected frequency})^2 / \text{expected frequency} = \text{contribution to } x^2 \text{ statistic}$

**All values in the "contribution to x-squared" column were added and a chi square value of 7.83 and p-value of 0.098 was calculated.

Ultimately the computed p-value of 0.098 tells us that there is no significant association between the dental risk scores and malnutrition risk scores. In order for the p-value to be significant it would have to be less than the critical value of 0.05. Therefore, the null hypothesis is not rejected.

CHAPTER IV

DISCUSSION

This study found that there are many factors which influence malnutrition and poor dental status in home-bound elderly meals on wheels participants. Factors for malnutrition include, previous and current illnesses, consumption of less than 3 meals a day, consumption of less than 5 fruits and vegetables a day, alcohol intake, financial status and significant weight change. In terms of dental health, factors include difficulty in chewing raw fruits and vegetables, denture use, oral health problems and frequency of dentist visits. Previously, studies have found that there are many factors which influence nutrition status, however, its correlation with dental health in the elderly has not been studied as extensively. Further studies which look at the various dental diseases, oral hygiene and oral health problems may provide further insight on specific dentition related nutrition problems in the elderly.

Overall, this study found no significant correlation between the participants' nutrition status and dental health status. However, it is important to note that there were 50 total participants in the study, and if the study had been performed on a larger population size, the p-value may have supported the positive correlation between dental health and nutrition status. Therefore, it is recommended that further studies be performed with a larger population size in the future.

Looking closer at the relationships between individual cells such as the correlation between “moderate risk malnutrition score and moderate risk dental score,” and also “moderate risk malnutrition score and high risk dental score,” it was found that the observed values were very close to that of the expected values. On the other hand, there were noted to be a few outliers which were observed to have a great difference between the observed and expected values. These include the negative correlation between “high risk for malnutrition and low risk for dental health” as well as the correlation between “low risk for malnutrition and low risk for dental health.” The negative correlation between “high risk for malnutrition and low risk for dental health” supports our hypothesis that poor dental health has an impact on malnutrition in the elderly. Reason being, an individual who has optimal dental health would most likely not suffer from malnutrition, which is why the observed and expected values don’t match up. Again, further studies should look into these relationships on a larger, generalized population scale.

Additional limitations of this study include limiting our population to homebound elderly individuals only receiving meals on wheels. Further studies should include elderly individuals from additional home health programs and services, as well as elderly who reside in independent and assisted living homes. In addition, this study only included participants residing in the Memphis, Tennessee area. A broader scale study should include participants from various parts of the nation including suburban and rural towns as well. Information not available in this study included social history, type of illness(s) participants’ may

be suffering from, past medical history and dietary recalls. These factors would be beneficial for further studies in the future.

Although the results of this study were not significant to reject the null hypothesis, there are some indications within our contingency table which support previous research studies. Elderly individuals are at an increased risk of malnutrition, hospitalization and health complications (25). From this study, it can be determined that most elderly individuals who have at least a moderate risk or a high risk dental health also have a moderate risk for malnutrition. This suggests that elderly individuals who don't have access to adequate dental care are at a disadvantage because they are at a higher risk for developing nutrition related deficiencies.

In previous studies it has been noted that several conditions related to malnutrition including sarcopenia and cachexia can occur as a result of decreased appetite and inadequate nutritional intake (25). The purpose of this study was to determine whether poor dentition status was a contributing factor to malnutrition in the elderly. Although these results were not significant future research could be beneficial in showing how inadequate dentition affects nutrition status. A simple solution such as better fitting dentures or one dentist visit may be highly effective in treating malnutrition in the elderly.

Conclusion

Although there was no significant association between adequate dental care and nutrition status, it would be beneficial for further studies to research this

relationship. Several elderly individuals are suffering from malnutrition due to unavailability of dental insurance as well as unresolved dental complications. There are several programs which help deliver meals to low income elderly individuals, however, there is very minimal support available in terms of dental care for the elderly. It would be very useful to raise awareness of this in elderly support groups, senior centers and dentist offices, in order to promote dental care for the elderly, regardless of income status. Funding for these programs remains an issue, however, further research into this correlation would be greatly beneficial in developing approaches to help resolve dental related malnutrition in the elderly.

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APPENDIX A
NUTRITION AND DENTAL HEALTH RISK SURVEY

Nutrition Risk Indicators*	Yes	No
Illness or condition that makes the consumer change the kind and/or amt of food		
Eats fewer than 2 meals per day		
Eats fewer than 5 fruits or vegetables (1/2 cup each) every day		
Eats fewer than 2 servings of dairy products (such as milk, yogurt, and cheese)		
Drinks more than 3 or more beers, liquor or wine almost everyday		
Has tooth/mouth pain/chewing problems		
Not enough money to buy adequate food		
Eats alone most of the time		
Takes 3 or more different medications or over the counter		
Unintentional weight gain / loss of 10 # in the past 6 months		
Physically able to shop, cook, and/or feed myself		

*Adapted from DETERMINE Your Health Checklist (19)

Dental Health Questions	Yes	No
Has it been more than a year since you've visited the dentist?		
Is it difficult to chew raw fruits and vegetables?		
Is dental insurance too expensive to pay for?		
Is it difficult to chew tough meats?		
Do you have dentures?		
If you have dentures are they too tight or too loose?		
Does it hurt to chew on specific foods?		
Do you consume mostly a soft diet?		
Do you have any oral health problems such as gum disease or gingivitis?		
If you have dentures, do you avoid wearing them?		

Low Risk Score: 0-2

Moderate Risk Score: 3-5

High Risk Score: 6 or more

Total Risk: