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The Relationship between Dental Health and Nutrition Risk Factors in Home Bound Senior Citizens

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

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ABSTRACT

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As the elderly population continues to increase, there is an increased need for government funded meal programs. The elderly population is at high risk for malnutrition due to multiple risk factors. The purpose of this study was to determine if any correlation exists between dental health and nutrition risk factors for homebound seniors, who participate in Meals on Wheels programs. Fifty clients from MIFA Meals on Wheels participated by answering dental and nutrition questionnaires. A Pearson bivariate correlation test was used to assess for a correlation between dental and nutrition health. T-tests were used to assess for difference between males and females on dental and nutrition status. No significant difference was found ($p = 0.066$). Results indicate that data is trending toward significance. The findings could be used to increase awareness of poor dentition and nutrition in homebound senior citizens and the need for dental and nutritional support.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Adequate nutrition intake is important for elderly individuals in order for them to maintain good health. With the ever-increasing number of older adults signing up for government funded nutrition programs such as Meals on Wheels, it is thought that the health of the general population may be deteriorating.[1] These government programs attempt to focus on meeting seniors' dietary requirements by ensuring that the program participants are provided with a well-balanced and nutritionally adequate meal. One program specifically, Metropolitan Inter-Faith Association (MIFA) Meals on Wheels located in Memphis, TN, provides elderly individuals with one meal each day that meets the minimum of 1/3 of the daily-recommended nutrient requirements.[2] Meals are monitored for total calories, protein, fiber, total fat percentage, calcium, vitamin C, vitamin A, vitamin B_{12}, vitamin B_6 and sodium.

It is thought that elderly individuals who consume a diet rich in fiber, low in saturated fat and low in total energy intake are at reduced risk for mortality compared to individuals with a greater intake of high-fat dairy foods, fried foods, sweets and desserts.[3] There are several barriers that may interfere with an elderly person receiving optimal nutrition, such as the inability to consume a higher quantity of fruits and vegetables, which may be due to poor dental health and/or inadequate dentition. As a result of these health and nutrition risks, it is recommended that elderly individuals consume low-calorie foods in place of high-calorie foods (i.e., junk foods, sweets and snack foods). Lower-calorie foods, which should be consumed frequently, include fruits, vegetables and whole-wheat grain products.[1] Poor dental health and/or inadequate dentition may be a

major barrier to consuming a higher intake of fruits and vegetables, especially in the raw form. Several articles report that elderly individuals commonly deal with numerous health problems and specifically oral health including missing teeth, mastication difficulties and gingivitis.[4, 5] If homebound elderly individuals are not receiving adequate oral health care, they could potentially be at risk for severe malnutrition and vitamin deficiencies.[2] Another barrier to consider in this field of research is the social setting in which the individuals participate. The social setting may also contribute largely to dietary intake, specifically if the individual is eating alone or with a group.

An overview of literature that focused on oral health and nutrition in the elderly population conveyed the message that as age progresses beyond sixty years, there is an increased likelihood for a risk of malnutrition.[2] Older adults have been found to have micronutrient deficiencies consisting of 33-55% of their Dietary Reference Intakes.[3] One study working with a new Meals on Wheels program found that only 11% of the screened participants were well nourished.[2] With an increase in age, a major setback is the decline in metabolism as well as physical activity.[1] Decreased physical activity, a decline in metabolism and the increased risk for the development of malnutrition, make the goal of providing adequate nutrition critical for elderly individuals.

The purpose of this project is to determine if any correlation exists between dental health and nutrition risk for homebound seniors, who participate in Meals on Wheels programs. The conclusions will provide current data that can be used by providers to enhance elderly nutrition programs.

CHAPTER II

REVIEW OF LITERATURE

Elderly Complications and Nutrition Status

Nutrition and physical activity are strongly linked to overall health status and the prevention of chronic diseases that are commonly seen in the elderly.[1] Unfortunately, elderly who suffer from major medical illnesses and/or have psychological and social disabilities are at an increased risk for malnutrition.[6] Many medical illnesses have a direct influence on a person's nutrition status including respiratory diseases, gastrointestinal complications, endocrine disorders, neurological disorders, infections, alcoholism and poor dentition.[6] Social and psychological factors may also exacerbate these complications; however, it is well established amongst research studies that the elderly population are at a notably higher risk of developing nutrition related health problems.[4] A few psychological disabilities include depression, anxiety and Alzheimer's disease and these may lead to nutrition related problems concerning personal food preferences, availability of food sources, and dietary habits. [4, 5, 6] Although the effects of illnesses and disabilities on nutrition status have not been fully elucidated at this time, consequences of depression are thought to result in a loss of interest in food as well as poor nutrient intake.[5] Social issues that may arise include poverty and isolation which is often the case for many elderly who lose their spouse late in life.[6] Poverty in general reduces consumption of food if seniors cannot afford to eat three wholesome meals a day. Moreover, if seniors are spending a majority of their money on medications, housing bills, and other non-food related items, this will result in little monetary support for obtaining a sufficient food supply.[7]

Seniors that cannot afford to purchase enough food or if they are not physically or cognitively able to prepare their own meals, may not be able to reach nutrition goals. While it is recommended that seniors obtain an intake of 1.5 grams of protein/kg body weight in order to prevent the loss of muscle mass and skeletal muscle, the goal often becomes unattainable when these financial and physical barriers are present.[8] In general, seniors often consume much less than the recommended protein intake.[8] Furthermore, if they are suffering from vitamin deficiencies, skeletal muscle loss may be greater.

Meal Delivery Programs

Many homebound seniors benefit considerably from programs such as Meals on Wheels, as well as, various other social programs. Meals on Wheels is one program that has the potential to markedly improve nutrition status of their participants by providing a minimum of one healthy meal a day (1/3 of their total nutritional needs) to seniors who need assistance with preparing meals, shopping and performing personal daily activities.[7, 9, 10] Screening tools are used to determine if the individual meets the set criteria to be eligible for the meal delivery program. In order to receive meal delivered services, eligibility is based on demonstration of financial and physical needs.[11]

Aside from nutrition, screening tools also assess the number of medications consumed, medical conditions and overall health status.[12, 13] Visvanathan recommended the use of several screening tools to assess nutrition: the DETERMINE Your Nutrition Health Checklist and the Mini Nutritional Assessment (MNA).[13] Seniors with a high score and who are at high risk for malnutrition will be encouraged to participate in these programs. Furthermore, they may also qualify for more than one program. For example, a senior could be simultaneously receiving meals from the Meals on Wheels program

while receiving food stamps. Individuals may also be denied participation in such programs. Instances in which denial occurs may include seniors who live with another individual(s) who helps prepare meals and support them financially, as well as, seniors who have sufficient physical capabilities to prepare meals for themselves and can independently complete all activities of daily living. By providing meals to seniors who are at a high risk for malnutrition, it is anticipated that their quality of life, specifically nutritional status, would improve.[14] Several studies have shown participation in meal programs for seniors significantly improves the quality of life and nutritional status of elderly individuals, especially if they have no form of assistance with their activities of daily living.[15, 16]

Since these programs 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. MIFA Meals on Wheels adheres to the U.S. Department of Agriculture (USDA) guidelines by generally providing a serving of meat, bread, a drink, two vegetables and fruit with every meal sent out in order to provide a well-balanced healthy meal to its participants. Studies have 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.[3] 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.[17]

Roadblocks to a Nutritionally Balanced Diet

Although promoting healthy eating to seniors is desirable, there are a few factors contributing to why the seniors may not be consuming the recommended healthy diet consisting of vegetables, fruit, whole grains and low-fat dairy products. Several of these factors include low-income status, inability to complete activities of daily living and poor dental health.[15] Factors such as residential neighborhood, race and socioeconomic status also have a major influence on the accessibility of fruits and vegetables.[18, 19, 20, 21] Unfortunately neighborhoods that do not have access to produce, often have an increased abundance of fast food restaurants; therefore, likely lending to an increased consumption of high-fat foods.[21] Additionally, seniors who find getting to a grocery store a challenge, may prefer to purchase canned fruits and vegetables as an alternative to fresh fruits and vegetables due to their extended shelf life.[19] If the individual lacks energy to travel to and about the grocery store and/or has a limited income, then purchasing extended shelf stable foods may be a good alternative. However, often times these canned foods are higher in sodium and fat content when compared to the fresh foods.

Additional studies have compared nutritional status of seniors receiving one meal verses two meals a day through meal programs. The main goal behind increasing one meal to two meals a day is to improve not only nutrition status, but also the quality of life in the frail, elderly homebound population.[16] Improving quality of life for the elderly may include any number of small or large changes. These changes may consist of improving the visual appeal of food as well as reducing financial burdens of seniors, specifically the burden of obtaining food on a daily basis.[22] Since the seniors participating in MIFA Meals on Wheels are only receiving one meal per day, there is a

concern regarding participants ability to prepare and achieve a sufficient diet to reach the remainder of their Recommended Dietary Intake (RDI) for all micronutrients and macronutrients.[23] Unfortunately, most of these seniors lack adequate support or help to prepare the rest of their meals, resulting in a decreased nutrition status.

A study by Gollub and Weddle, concerning the elderly population ultimately demonstrated the long term benefits of receiving both a breakfast and lunch meal. During the study, the meal program provided a breakfast meal to one group in addition to the lunch meal. 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.[16] The breakfast and lunch group also received an additional amount of vitamins and minerals (i.e., potassium and iron) compared to the control group who only received the lunch meal. These results are important since the seniors who did not receive a breakfast meal may be skipping the meal and/or eating foods that are higher in calorie and fat in place of a wholesome, nutritious breakfast. This study concluded that seniors who had both meals delivered to them had an improved quality of life as well as increased food intake and nutrition satisfaction.[16] Lower incidences of lethargy and poor eating, both linked to depression, were also observed when seniors were provided with two meals a day.[16] Moreover, the consumption of two meals a day demonstrated reduction in shopping anxiety and food insecurity. These outcomes greatly influence the ability of homebound seniors to adequately obtain 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 another key factor that affects a senior's nutritional quality of life. One study focusing on quality of life concluded that the incorporation of social-psychological components in meal programs for seniors also has a major impact on food satisfaction and food consumption.[25] In this 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.[25] This research concluded that seniors who interact with others in a social setting most likely do not feel as isolated and lonely while eating meals. Eating in a group setting gives seniors a chance to interact with their friends on a regular basis. However, eating alone after receiving a home-delivered meal may lead to the homebound senior becoming bored and uninterested in the food. If they feel unhappy about eating their meals alone, it may cause decreased food intake therefore placing homebound seniors at higher risk for malnutrition.[25] Another study supported the same conclusion that demonstrated that social factors played a positive role in optimal nutrition status in elderly homebound people.[26] Many studies have shown a number of psychosocial factors that affect the decreased dietary consumption in homebound individuals: stress, poor appetite, poor vision, low income, low level of education, skipping breakfast and multi-morbidity.[5] Therefore, it is encouraged that seniors attend congregate sites who are physically able, in order for them to receive a nutritious meal with social benefits rather than staying at home and eating by him/herself.

Aging and Risk of Malnutrition

Seniors are regarded as a high-risk population for malnutrition as well as multiple other health risks.[27] Malnutrition is a concern among elderly people, specifically with an increase in age-related physical decline that leads to frailty.[26] Malnutrition results from functional or clinical changes that could be due to an excess or imbalance of energy and or protein.[6] There are multiple co-morbidities associated with malnutrition; these include but are not limited to functional status, impaired muscle function, decreased bone mass, immune dysfunction, anemia, reduced cognitive function, poor wound healing, delayed surgery recovery, higher hospital admission and readmission rates and mortality.[6, 28] Several causes of malnutrition may be attributed to changes in the digestive system due to a decline 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.[29] The overall conclusion from research was that gastrointestinal complications pose a major risk within this population. This results in weight loss from anorexia that develops from a decrease in energy intake overtime.[6] Much of the weight loss includes skeletal muscle loss instead of fat loss. One study supported previous malnutrition research by estimating that a 79 year old man had 29% body fat compared to 15% body fat in a 20 year old man, both of who were weighing 80 kg.[6]

Weight loss in the elderly can be defined within the following categories: wasting, cachexia and sarcopenia.[30] Wasting is the term used for loss of muscle mass and results in decreasing function of the immune system causing the release of pro-inflammatory cytokines and negative nitrogen balance.[6] As a result serum albumin decreases due to an

increase in acute phase proteins. In contrast, sarcopenia is a decrease in skeletal muscle. This is usually caused by reduced physical activity and neuronal losses from the spinal cord.[31] Sarcopenia also results in breakdown of muscle and increased levels of acute phase proteins and pro-inflammatory cytokines.[30] Both sarcopenia and wasting can lead to increased fatigue and tiredness also resulting in reduced abilities to perform activities of daily living. If seniors do not have adequate energy to complete light housework, it could lead to increased difficulty in preparing a nutritious meal for themselves.

Medications, which are required by many seniors, may cause a decrease in appetite or a reduced sense of taste and/or smell.[6] Medications often compete for the same pathological pathways in the body that are used in absorption of certain nutrients. This may cause nutrient deficiencies regardless of overall vitamin and mineral intake.[6] In the study by Brady, Rock and Horneffer, they reported that individuals suffering from congestive heart failure were at increased risk for thiamin deficiency.[32] This was mainly due to the use of diuretics for treatment of the disease. The patients using diuretics had incidences of large urinary losses of thiamin secondary to inhibition of sodium and chloride reabsorption.[32] This is one example of the negative side effects that medications take on nutrient absorption. Unfortunately, complications of drug and nutrient interactions as well as a decline 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 a physical exam of skin, hair, nails, eyes, mouth, neck, abdomen and extremities.[6] For example, the skin may appear dry and scaly if a person has a zinc deficiency.[6] Biochemical markers are also able to confirm nutrient deficiencies and provide insight on

one's risk for malnutrition. Significant biochemical markers include albumin, prealbumin, transferrin and total serum cholesterol.[6]

Oral and Dental Health

Poor dentition, specifically tooth loss, is the final outcome of a multitude of factors that include lifestyle, disease-related factors, oral hygiene and professional dental care.[33] Two prime causes of tooth loss are periodontitis, which is the inflammation and infection of ligaments and bones that support the teeth, and dental carries that further lead to dental extraction.[33] Certain foods lend to increased acidity and development of bacteria causing tooth decay. Highly acidic foods that lend to the increased acidity include sports drinks, carbonated drinks, fruit juices and citrus fruits.[34] In the study by Zahara, et al., they did not find an acute response of tooth decay when trialing acidic foods, fruit juices, sport drinks and carbonated drinks, but rather found decay from a long term increased consumption of these high acidic beverages.[34] It is critical to examine oral and dental health before the risks of malnutrition appear through obvious physical markers such as muscle wasting and overall weight loss.

Dental caries also influence the onset of illness.[35] One study, reported that dietary intake is a major prevention factor of dental caries, specifically fluorine.[35] If a dietitian promotes an increase of food intake of whole foods rather than supplemental foods (i.e. supplemental foods such as Ensure and Boost) in the diet, it may become difficult for that person to follow the specified meal plan if they are having dental complications. One study by Mesas, et al. found that nutritional deficits had a high correlation with individuals having serious oral conditions.[36] This study concluded that due to a decreased amount of posterior occlusal pairs of teeth, a decline in fruit and vegetable

intake was noted.[38] Instead more packaged and prepared foods such as cereal, candies, and junk food were consumed causing increased dental complications such as periodontal disease.[39] Dental complications may include tooth loss, reduced salivary flow, decreased masticatory functions and periodontal disease.[36] Another study showed that users of dentures have decreased capability of chewing compared to a person who has at least twenty teeth in the dental arch.[4] Elderly individuals have missing teeth and it may become an arduous task for him/her if a dietitian provides a dietary plan that includes raw vegetables, raw fruits, tough meats and whole-wheat grains. Even if the seniors can afford to purchase these foods and are physically able to prepare their own meals, they may not be able to adequately chew their meal; therefore, putting them at a heightened risk for malnutrition.[4] Previous research supported the hypothesis that African-Americans and Mexican-Americans have a higher number of missing teeth compared to Caucasians who were less likely to be edentulous.[37] Poor dentition not only is a risk factor for malnutrition but also other nutritional and health complications.

Dentition and Vitamin Intake

Vitamin and mineral intake play a critical role in maintaining metabolically active tissues as well as overall health of the human body. These nutrients are vital for constant regenerative processes, coping with oxidative stress and maintaining sufficient immune responses.[40] Willershausen focused on the parameters of inflammation and the fast immune response related to oral and gum diseases, which is only possible where there is sufficient supply of food and micronutrients. The study found that elderly individuals suffering from mastication problems have lower nutrient intakes of β-carotene, vitamin C, folate, protein and dietary fiber.[2, 4, 40, 41] Key foods containing a significant amount of

these nutrients include carrots, oranges, strawberries, raw spinach and broccoli. These foods can be difficult to chew and break down in order for them to be processed and absorbed by the gastrointestinal tract. If there are missing teeth and the food is unable to be completely chewed and broken down, 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.[42] Individuals with proper dentition have been encouraged to increase the variety of foods to incorporate a high fiber diet.[4]

Studies that looked at aging and nutrition highlight the importance of decreasing macronutrient and micronutrient deficiencies. One study by Adegboye, et al. focused on calcium intake and its role in preventing dental caries and periodontitis. This study determined that low calcium intake is linked to fewer teeth in males and females as well as a significant increase in risk of tooth loss in the male population.[33] Other studies support similar findings that include a combination of factors from the malabsorption of nutrients to periodontal disease, which can cause these deficiencies. Oral health and dietary intake 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 an individual is willing to improve his/her dietary habits.

Summary

Overall findings suggest that dental health is a serious concern in the elderly population since it is the gateway to optimal nutrition status and an overall healthy lifestyle. The cycle of optimal nutrition begins at the site of the oral tissues during mastication, which from that point can positively or negatively affect all other systems and organs including 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. Ultimately, dietitians should be responsible for discussing dental health of elderly individuals before providing a thorough nutrition consult or diet plan. If an elderly individual is only consuming soft textured foods due to the inability to chew properly, the dietitian should ask pertinent questions regarding the client's dental health. The elderly individual may wish to be prescribed a diet consisting of fruits and vegetables, but he/she simply may not be able to tolerate such a diet due to oral complications and poor dentition. Therefore, the purpose of this project is to determine if there is a relationship between dental health and nutrition risk for homebound seniors, who participate in Meals on Wheels programs.

CHAPTER III

METHODS

This quantitative survey was designed to answer questions regarding the dental health of elderly homebound participants (independent variable), receiving homebound meals and relate it to their nutrition risk (dependent variable). The researcher administered both questionnaires at the client's home.

The first questionnaire, named the "Nutritional Counseling Mini Assessment" was used to assess participants' risk of malnutrition. This questionnaire was altered from the originally drafted DETERMINE Your Health Checklist that was published by the Academy of Nutrition and Dietetics and the American Academy of Physicians. It included questions regarding how many fruits and vegetables are consumed on a daily basis and whether or not the client was physically able to shop or cook himself/herself (see Appendix 1). Valerie King, the Aging Commission of Tennessee state dietitian, modified this questionnaire. The second questionnaire was used to assess overall dental health of participants within the program (see Appendix 1). The second questionnaire was self-developed by a former student at the University of Memphis, Ayisha Ahmed and was used to assess clients in the MIFA Meals on Wheels program. It includes pertinent questions regarding dental health such as whether clients currently had dental insurance or if they had seen their dentist within the past year.

Participants

The target population encompasses homebound senior citizens residing in Memphis, TN. Participant recruitment was conducted through clients currently enrolled in the MIFA Meals on Wheels program. The Meals on Wheels program is a non-profit

meal delivery program for seniors in need of home delivered meals. All home delivered meals are provided to participants Monday through Friday, between the hours of 10am and 12pm. In order for seniors to remain enrolled in the program, they have to remain eligible by meeting a certain functional score indicating a need for home delivered meals.

In this study, 50 Meals on Wheels clients were randomly selected. The participants included both male and female over the age of 60 years. Previously, fifty Meals on Wheels clients were assessed by the same guidelines of this study by Aiysha Ahmed. The clients used for this current study received one meal a day at home. Participants were ineligible for the study if they were under 60 years of age. Participants who are bed ridden were excluded since they are unable to perform activities of daily living. These clients are at a higher malnutrition risk compared to seniors who are able to be minimally or moderately active. Additionally, seniors who have severe dementia and are not capable of answering questions or understanding the content of the questionnaire were excluded.

Measures

Interviews were completed by the researcher conducting the study, who was also the MIFA registered dietitian. The participant's score was marked next to the specified item on the questionnaire based on his/her response. At the end of both questionnaires, the total scores were calculated.

Nutrition Status

Nutrition status was assessed with the questionnaire modified by the Aging Commission Tennessee state dietitian, Valerie King, specifically known as the "Nutrition Counseling Mini Assessment." The main purpose of this assessment was to determine 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 and transfer about the room (i.e. get in/out of bed or chair). The overall scoring used for the assessment was the total amount of yes responses. A score of 0-2 (yes responses) indicates a "good" nutritional score, a score of 3-5 indicates a "moderate" nutritional score and a score of 6 or more indicates a "poor" nutritional score.

Dental Health

The independent variable, dental health was used to determine if overall dentition is affected by nutrition status. Dental health questions evaluated whether or not fruit and vegetable intake declines as a result of poor dentition. In order to assess dental health the following questions were asked: "When was your last dental appointment?," "Do you have dentures?," and if so "Do they fit well?" These questions are pertinent since many seniors participating in the MIFA Meals on Wheels program are on Medicare and/or Medicaid, which does not cover dental health insurance. This can be a major barrier for seniors in need of dentures or a replacement of dentures due to improper fitting. The number and amount of teeth also tend to decrease with age; therefore, missing teeth may lead to further problems with chewing raw foods, which tend to be nutrient-rich foods. For example, seniors may have trouble chewing foods such as broccoli, apples and spinach, which are all rich in vitamin C and fiber.

Fruits and Vegetable Intake

Fruit and vegetable intake is another dependent variable that is used to observe how many fruits and vegetables are consumed on a daily basis amongst all seniors who participate in the study. Although many reasons for decreased consumption are due to

financial difficulty in obtaining a sufficient quantity of fruits and vegetables, the focus of the study was to observe the direct relationship of dental health on fruit and vegetable intake. Using the "Nutritional Counseling Mini Assessment" checklist allowed pertinent information to be obtained including how many fruits and vegetables were consumed on a daily basis. Although MIFA Meals on Wheels provides one serving of fruit and two servings of vegetables with the one meal delivered, it is important to assess if seniors are able to shop or obtain foods from other sources in order to meet the recommended amount of five servings of fruits and vegetables per day. If a senior does not drive or grocery shop then he/she has limited access to fruits and vegetables, therefore making it difficult for him/her to meet the nutrient requirements.

Retrospective Measurement

Two questionnaires were used in order to obtain data regarding dental health of homebound seniors. The first questionnaire is already used by MIFA Meals on Wheels, called the "Nutritional Counseling Mini Assessment". Key questions include "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 poses the following questions in which the client is responsible for answering "Yes" or "No".

The second questionnaire pertains to dental health among the elderly clients. It includes questions such as "When was your last dental visit?," "Do you have dentures?" and "If so, do they fit properly?" This questionnaire was scored similarly to the first questionnaire used by MIFA. Scores again were assessed by the number of "yes" answers and a score of 0-2 indicating a low risk dental health score, 3-5 indicating a moderate risk dental health score and a score of 6 or more indicating a high risk dental

health score. Again, all "yes" answers were given a score of one and are tallied at the end accordingly.

Procedures

Visiting participants at their homes was the main method of administering the questionnaires. Although the questions were mainly subjective, questions were asked to guide participants in helping them to understand the content of the questions. For example, when the client was asked "How many fruits and/or vegetables are consumed a day?", the interviewer was able to describe the serving of one fruit as "1/2 a banana" or "1/2 cup of canned fruit" in order for the participant to better understand the amount he/she is consuming each day.

In addition to the questionnaires, supplemental equipment was used for this study including a list of fruits and vegetables as well as current monthly menus from MIFA Meals on Wheels. These supplemental items assisted participants to recall information of their fruit and vegetable intake and help them gain a better understanding of what fruits and vegetables are included in their overall intake. For instance, many participants do not realize a potato or onion is considered a vegetable and can be included in the total vegetable count when it is found on sandwiches, hotdogs and hamburgers.

Statistical Analysis Plan

Descriptive statistics were conducted on the variables (means, standard deviations, frequencies, and percentages). In order to test the relationship between dental health and nutrition status, Pearson bivariate correlations were used. In addition, relationships were also assessed for the high-risk nutrition and dental clients using the Pearson bivariate correlation test. T-tests were used to differentiate any differences

found between males and females on dental health and nutrition status. The alpha level of 0.05 was used to note significance of statistical tests.[4]

CHAPTER IV

RESULTS

Fifty clients from the MIFA Meals on Wheels program participated in this study. All fifty clients agreed to participate and answer the questions asked. Participants included both male (n = 14) and female (n = 36), African Americans over the age of 60 years. The average age of participants was 81.4 years with a standard deviation of 10.2. Table 1 presents participant demographics.

Table 1. Demographic characteristics (N = 50).

	n (%)
Sex	
Male	14 (28)
Female	36 (72)
Age (years)*	
60-69	2 (5)
70-79	13 (35)
80-89	13 (35)
90-99	9 (24)
Race/Ethnicity	
African American	50 (100)

*Age percentages are out of 37 participants.

Each individual completed both the nutrition and dental questionnaires. The number of risk factors for nutrition and dental are shown in Table 2. The table displays low, moderate and high risk factors and the number of participants in each category for both nutrition and dental questionnaires.

Table 2. Number of nutrition and dental risk factors of participants.

	Number of Risk Factors	Nutrition % (n)	Dental % (n)
	0		4 (2)
Low Risk	1	2 (1)	12 (6)
	2	0 (0)	28 (14)
	3	16 (8)	0 (0)
Moderate Risk	4	30 (15)	16 (8)
	5	22 (11)	6 (3)
	6	14 (7)	8 (4)
	7	12 (6)	0 (0)
High Risk	8	2 (1)	0 (0)
	9	0 (0)	2 (1)
	10	2 (1)	0 (0)

The scores were totaled separately and compared. Upon analysis of the data, there was no significant relationship found between nutrition and dental health ($r = 0.262$, $p = 0.066$). However, results indicated that as nutrition status improves dental health improves and this relationship is approaching significance. A correlation was used to assess for a significant relationship in high-risk nutrition participants and dental health; however, the results were not significant ($p = 0.484$). The t-tests did not show significant difference between males and females on dental health ($p = 0.607$) and nutrition status ($p = 0.224$).

CHAPTER V

DISCUSSION

Current literature supports that malnutrition is an increasing risk factor for individuals beyond the age of 60 years. Several factors contribute to this health problem among this population group that include a decrease in physical activity and a decline in metabolism. As a result, it is necessary for these individuals to choose more foods such as fruit, vegetables and whole-grain products.[1] The dietary recommendations for this population may pose a possible threat for optimal nutrient intake when linked to poor dentition. Elderly individuals with poor dentition may have difficulty eating raw fruits and vegetables or low-fat meat. If these individuals do not receive proper oral health care then this may lead to problems receiving recommended nutrients.[2] Often these nutrient intakes consist of 33-55% of the Dietary Reference Intakes, leading to deficiencies.[3] The purpose of this study was to examine the correlation between oral health and nutrition health in these individuals over the age of sixty. The results of this study were not significant to reject the null hypothesis; however, the correlation displays the results trending toward significance. With proper oral health such as providing well-fitting dentures for individuals with poor dentition, it may increase the chance for these clients to reach adequate nutrition through oral intake.

Malnutrition is also linked with other medical conditions such as sarcopenia and cachexia leading to a decrease in appetite and inadequate nutrition intake.[25] Previously, this study was performed using Meals on Wheels clients both at congregate sites as well as homebound clients. This round of interviews focused specifically on homebound Meals on Wheels clients. The previous use of these questionnaires showed results that

supported elderly individuals who have a moderate risk or high risk dental health also have a moderate risk for malnutrition. This conclusion possibly suggests that these individuals with limited access to adequate dental care are at a disadvantage since they are more likely to develop nutritional deficiencies from limited oral intake.

The social setting plays a vital role in nutrition and intake during mealtime. The clients who are able to attend congregate meal sites avoid the obstacle of eating meals alone and typically tend to be more ambulatory and able to participate in group exercise. Poor nutrition status is often affected by these factors of inability to complete activities of daily living and general physical activity as well as loneliness during mealtime.[14, 15, 16, 17, 20] The increased quality of life for clients who have increased social interaction compared to spending days, specifically meal times, alone is notably higher.[18]

There were several limitations in this study that with further research may provide significant results. With an increased number of subjects specifically in homebound individuals, the results would likely be result significant. The data analyzed during this trial was trending toward significance. Another area of future focus is the dental health questionnaire that was developed by the previous researcher. The questionnaire has not been completely validated and therefore it would be beneficial to use an already validated questionnaire concerning dental health for this portion of the research. The scoring could also be changed so that there are only two categories: a low risk and high-risk category. This would allow for more opportunity to indicate of the homebound individuals are one of the other and therefore allow for significant difference to be found between the two groups. One other area that may have posed a limitation and should further be studied is

looking at each question separately. With analyzing each question separately, there may be difference that could be seen in certain questions compared to others.

Future studies should focus specifically on individuals over the age of sixty receiving Meals on Wheels. With further research and evidence showing significance relating poor dentition to poor nutrition and general health, there will ideally be more opportunities for individuals to focus on promoting general nutrition for these individuals and optimizing adequate dentition for those in need.

Conclusion

This study did not result in significant difference to support the hypothesis of poor dental health impacting nutrition. However, with previous research and results from this study trending toward significant difference ($p = 0.07$) it indicates that with further research and a larger sample size it will likely show a link between dental health and nutrition. Programs such as Meals on Wheels help to deliver meals to the low-income elderly individuals providing 1/3 of their nutritional needs for individuals, however there is limited effort and support available for dental care. This study, with further support, would be beneficial in helping to resolve the link between poor dental health and improving overall nutrition status in elderly individuals.

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APPENDIX A

Nutrition Risk Indicators*	**Yes**	**No**
Illness or condition that makes the consumer change the kind and/or amount 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[23]

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:

THE UNIVERSITY OF MEMPHIS

Institutional Review Board

To:	Olivia Wagoner Clinical Nutrition
From:	Chair, Institutional Review Board For the Protection of Human Subjects irb@memphis.edu
Subject:	The Relationship between Dental Health and Nutrition Risk Factors in Home Bound Senior Citizens (#2446)
Approval Date:	December 7, 2012

This is to notify you of the board approval of the above referenced protocol. This project was reviewed at the expedited level in accordance with all applicable statuses and regulations as well as ethical principles.

Approval of this project is given with the following obligations:

1. At the end of one year from the approval date, an approved renewal must be in effect to continue the project. If approval is not obtained, the human consent form is no longer valid and accrual of new subjects must stop.
2. When the project is finished or terminated, the attached form must be completed and sent to the board.
3. No change may be made in the approved protocol without board approval, except where necessary to eliminate apparent immediate hazards or threats to subjects. Such changes must be reported promptly to the board to obtain approval.
4. The stamped, approved human subjects consent form must be used unless your consent is electronic. Electronic consents may not be used after the approval expires. Photocopies of the form may be made.

This approval expires one year from the date above, and must be renewed prior to that date if the study is ongoing.