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Dietary Counseling Practices and Perceived Barriers Among Utah Dental Hygienists

A thesis

presented to

the faculty of the Department of Allied Health Sciences

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Master of Science in Allied Health

by

Natalie F. Carlson

May 2014

Dr. Susan Epps, Chair

Dr. Debbie Dotson

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Keywords: nutritional screening, dietary counseling, dental hygienist, preventive care

ABSTRACT

Dietary Counseling Practices and Perceived Barriers Among Utah Dental Hygienists

by

Natalie F. Carlson

Diet related factors are associated with the 2 most prevalent oral diseases- caries and periodontal disease. Furthermore, there is growing evidence of a synergistic link between nutrition, systemic health, and oral health. Regardless of this evidence and in spite of recommendations by dental associations, researchers have shown the majority of dental professionals are consistently excluding nutritional screenings and dietary counseling in their dental services. The purpose of this study was to examine the nutritional screening and dietary counseling practices of Utah dental hygienists and to evaluate possible associations between various factors influencing the implementation of nutritional services. Surveys were collected from members of the Utah Dental Hygienists' Association. Mean scores showed low frequency and low confidence levels in performing nutritional services and high perceptions of barriers to care. Little to no difference in mean scores occurred when differentiating between degree achievements, years in dental hygiene practice, or component affiliation.

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DEDICATION

I would like to dedicate this thesis to my parents Michael J. Flynn, D.D.S and Linda Flynn, ANP. You instilled in me a passion for learning and accomplishment and have always supported and encouraged my professional and education goals. I could not have dreamed of obtaining this success without your influence and support. Thank you.

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TABLE OF CONTENTS

	Page
ABSTRACT.....	2
DEDICATION.....	4
ACKNOWLEDGEMENTS.....	5
LIST OF TABLES.....	9
Chapter	
1. INTRODUCTION.....	10
Statement of the Problem.....	12
Research Questions.....	13
Significance of the Study.....	14
Delimitations.....	14
Limitations.....	14
Assumptions.....	15
Definition of Terms.....	15
2. REVIEW OF THE LITERATURE.....	17
Nutrition.....	17
Nutrition and Systemic Health.....	18
Systemic Health and Oral Health.....	19
Oral Health and Nutrition.....	21
Micronutrients and Oral Health.....	24
Sources of Malnutrition.....	27
Dietary Screening and Nutritional Counseling.....	29

Dental Hygienists' Knowledge of Nutrition.....	30
Dental Hygienist's Dietary Screening and Nutritional Counseling Practices..	31
Barriers to Care.....	32
Summary.....	33
3. METHODS.....	38
Overview.....	38
Research Design.....	38
Population.....	38
Informed Consent Consideration.....	39
Data Collection Procedure.....	39
Research Questions.....	40
Data Analysis Procedure.....	41
4. ANALYSIS OF DATA.....	42
Overview.....	42
Participants.....	42
Selection.....	42
Demographics.....	43
Results.....	44
Descriptive Statistics.....	44
Analysis of Variance.....	45
Pearson Correlation Coefficient.....	48
Discussion.....	49
5. CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS.....	52

Research Questions.....	53
Conclusions.....	54
Discussion.....	55
Recommendations.....	59
Recommendations for Practice or Implementation.....	59
Recommendations for Improving the Research.....	61
Recommendations for Future Research.....	61
REFERENCES.....	63
APPENDICES.....	72
Appendix A: Research Survey.....	72
Appendix B: Permission to use Research Survey.....	75
Appendix C: Invitation and Informed Consent for Participant.....	76
Appendix D: Follow Up.....	77
VITA.....	79

LIST OF TABLES

Table	Page
1 Nutrient, Systemic, and Oral Health Interactions.....	34
2 Drug-Nutrient Interactions.....	36
3 Descriptive Statistics.....	44
4 Degree and Confidence.....	46
5 Degree and Frequency.....	46
6 Years in Practice and Confidence.....	47
7 Years in Practice and Frequency.....	47
8 Component and Barriers.....	48
9 Component and Frequency.....	48
10 Frequency and Barriers.....	49
11 Frequency and Confidence.....	49

CHAPTER 1

INTRODUCTION

Dental hygiene is the scientific and medical profession of recognizing, treating, and preventing oral diseases (American Dental Hygienists' Association [ADHA], 2008). Providing preventive oral healthcare is a key aspect of a dental hygienist's services (Levy & Raab, 1993). This is primarily achieved by performing the role of clinician, educator, and researcher in the dental practice (ADHA, 2008).

Utah State Law allows dental hygienists to assess the dental hygiene status of their patients and provide dental hygiene care with the collaboration of the supervising dentist (Session Laws of Utah, 2012). According to the ADHA (2008) assessing the dental hygiene status of a patient requires performing a comprehensive individualized evaluation of the oral and general health status of a patient. This comprehensive evaluation includes reviewing the patient's health history and assessing his or her current health status. Inclusion of nutrition history and dietary practices is a significant aspect of a thorough evaluation (ADHA, 2008).

Levy and Raab (1993) demonstrated that diet related factors are associated with the two most prevalent oral diseases- caries and periodontal disease. According to Bell, Phillips, Paquette, Offenbacher, and Wilder (2012) the connection between oral and systemic health has been the interest of many researchers in recent years. Research has also been conducted investigating the significance of the role of nutrition in both systemic and oral health (Ritchie, Joshipura, Hung, & Douglass, 2002). Nutritional deficiencies have been found to be associated with tooth loss and can be indicated by various signs and symptoms in the oral cavity (van der Putten, Vanobbergen, De Visschere, Schols, & de Baat, 2009). Gingivitis has been linked with deficiencies in vitamin A, vitamin C, Calcium, and Zinc. Low levels of vitamin C have also

shown to increase the likelihood of spontaneous gingival bleeding and an overall decrease in immune response that increases the risk of infection. According to Carullo (2002) periodontal disease has been associated with insufficient intake of vitamin A, vitamin C, Magnesium, Calcium, and Zinc; caries incidence has also been linked with deficient amounts of vitamin A and B-complex vitamins. Decreased bone density, osteoporosis, and bone and jaw deformities have been associated with insufficient amounts of B-complex vitamins, vitamin D, Calcium, Zinc, and Copper (Carullo, 2002).

Diet and nutrition impact oral health and consequently should be considered during dental exams and treatment planning (Harper-Mallonee, 2011). Furthermore, because of their education and their frequent interactions with patients, dental hygienists are in a unique position to provide nutritional screening, assessment, and basic dietary counseling to patients. The ADHA (2008) encouraged dental hygienists to assess the potential association of systemic and oral health in their patients and to teach patients about the importance of good nutrition for maintaining good oral health.

In 2009 the American Dental Association (ADA) resolved to continue gathering evidence and information concerning associations between diet, nutrition, and oral health and to support collaborative efforts with other health professionals (ADA, 2010). This changing perception and understanding is reflected in the 2020 Healthy People Objectives where oral diseases was added to the list of health risks associated with poor nutrition (U.S. Department of health and Human Services, 2012). Additionally, the ADA has recently resolved to ensure that “issues specific to nutrition and oral health, as well as the systemic and oral health relationship be incorporated into educational materials,” ADA (2010, p. 206) and continuing educational courses for dental professionals.

In contrast to the growing evidence of a systemic-oral connection and despite the encouragement of both the ADA and the ADHA promoting nutritional screening and dietary counseling in the dental office, both past and current studies show the majority of dental practices are limiting their nutritional counseling only to refined carbohydrates and their impact on caries. Studies from the late 1980s and early 1990s showed that less than half of dental professionals were providing dietary counseling on a regular basis and only a handful (less than 10%) collected diet history information for assessment (Levy & Raab, 1993). In a 1995 survey of dental hygienists working with young children, researchers found nutritional counseling that only involved a recommendation for reducing or eliminating sugar and carbohydrates was insufficient as it often failed to consider the overall nutritional needs and realistic snacking practices of young children. The researchers recommended improved dental nutrition science education as part of the dental hygiene curriculum. They also recommended an increase in collaboration with dietitians in order to provide age appropriate nutritional counseling to patients (Faine & Oberg, 1995). Finally, in 2008 Brithwaite, Vann, Switzer, Boyd, and Lee showed that only 24% of pediatric dental offices provided nutrition counseling services to patients even though 56% agreed that comprehensive nutritional counseling should be provided.

Statement of the Problem

Growing evidence shows the association between dietary intake and oral health and poor nutrition has been linked with the two most prevalent oral diseases- caries and periodontal disease (Levy & Raab, 1993). Both the ADA and the ADHA recommend and encourage nutritional screenings and dietary counseling in the dental office. Utah State Law permits nutritional assessment and education by Utah dental hygienists with the collaboration of the supervising dentist; however, if patients are not being informed of the link between good

nutrition and oral health they are missing a critical component of dental hygiene services. The purpose of this quantitative study was to determine the dietary counseling practices and perceived barriers, if any, among Utah dental hygienists registered with the ADHA.

Research Questions

This study was guided by the following questions.

1. Is there a relationship between degree achievement and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
2. Is there a relationship between degree achievement and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
3. Is there a relationship between years in practice and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
4. Is there a relationship between years in practice and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
5. Is there a relationship between component affiliation (see definition of terms) and barriers to care? If a relationship exists, what are the characteristics of that relationship?
6. Is there a relationship between component affiliation and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
7. Is there a relationship between barriers to care and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?

8. Is there a relationship between confidence in providing dietary counseling and frequency of counseling? If a relationship exists, what are the characteristics of that relationship?

Significance of the Study

The information gained from this research could result in improved dietary screening and nutritional counseling practices by dental hygienists and subsequently an improvement of oral health in their patients.

Delimitations

The study was delimited to currently registered members of the Utah Dental Hygienists' Association (UDHA) with valid emails on file with the association. The ownership of at least one e-mail account registered with the UDHA by each participant was necessary in order to contact participants. Participants performing dental hygiene services less than 4 hours per week were excluded from the survey. Dental hygienists working exclusively in periodontic or pediatric dental offices were also excluded as these offices serve patients with unique needs which may impact dental hygiene practices. Men or women under the age of 18 were also excluded from the study. The study was also delimited to the survey used to obtain data.

Limitations

The results were based on self-reported responses and could have included both participant bias and dishonesty. The results of this study were limited by the difference in the number UDHA members given the opportunity to respond and the number who responded. The participants in this study may not be a representative sample of the population. The results of this study may not be transferrable to dental hygienists practicing in settings other than general

dentists' offices. The results of this study may also not be transferrable to dental hygienists who are not members of the UDHA or those practicing in other states.

Assumptions

It was assumed that all participants responded in an open and honest manner. It was also assumed that all participants provide some form of oral health instruction to their patients and that all participants had taken a basic course in nutrition as part of their dental hygiene curriculum as this is a requirement of national accreditation standards. It was believed that the recall of the participants would not be flawed because the survey design was essentially based on current life events surrounding the respondents and not events long past.

Definition of Terms

Component affiliation: the local level of organization within the ADHA a member is associated with based on his or her residence. The organization of the ADHA is tiered with National, Constituent (State), and component levels. Members may only be associated with one component and its corresponding Constituent and National tier (ADHA, 2012).

Dental Hygienist: a preventive oral health professional who has graduated from an accredited dental hygiene program in an institution of higher education, licensed in dental hygiene who provides educational, clinical, research, administrative, and therapeutic services supporting total health through the promotion of optimal oral health (ADHA, 2008).

Interprofessional teams: a group of healthcare professionals and their client who work together to achieve shared goals. The team can consist of a dentist, physician, registered dental hygienist, nurse practitioner, etc... (ADHA, 2008).

Nutritional counseling: counseling patients about good nutrition and its relation to good oral health (ADA, 2010).

Patient: refers to the potential or actual recipients of dental hygiene care and includes person, families, groups, and communities of all ages, genders, and socio-cultural and economic states (ADHA, 2008).

Risk: a characteristic, behavior, or exposure that is associated with a particular disease, i.e. smoking, diabetes, poor nutrition, poor oral hygiene (ADHA, 2008).

CHAPTER 2

REVIEW OF THE LITERATURE

Nutrition

Nutrients are substances that the body needs for growth and metabolism. Nutrients can be separated into two categories, macronutrients or micronutrients. Macronutrients include carbohydrates, proteins, and fats. Micronutrients include vitamins and minerals (University of Maryland Medical Center, 2011). The human body processes over 45 different nutrients from dietary intake necessary for growth, maintenance, and repair at cellular levels (Mixed Committee of the League of Nations, 1937; University of Maryland Medical Center, 2011).

A condition known as malnutrition may develop when the body does not get the right amount or variety of nutrients it needs to maintain healthy tissue and organ function. Malnutrition can occur at any point during an individual's lifetime as a result of poor nutrition or dietary intake (Sheetal, Hiremath, Patil, Sajjansetty, & Kumar, 2013). The elderly and people with renal disease may experience malnutrition as a result of a decrease in the body's capacity to absorb micronutrients (Moynihan, 2007). Protein-Energy Malnutrition (PEM) is a form of malnutrition that occurs when there are deficiencies in protein, energy foods, or both that are relative to a body's needs (Sheeta et al., 2013).

The study of nutrition and its impact on the human body dates back to the 18th century when the French chemist Lavoisier discovered a relationship between the metabolism of food and the process of breathing. By the early 20th century, scientists had discovered an association between diet and certain diseases that was ultimately attributed to the lack of specific nutrients (University of Maryland Medical Center, 2011). At the time, the understanding of the immune system was primitive, and there was little or no contact between immunologist or disease

specialists and those interested in nutrition. However, by the end of the 20th century scientists had linked micronutrient deficiency as a primary factor in host response to infection (Keusch, 2003). PEM and deficiencies of zinc, selenium, folate, and vitamins A, C, and E all influence the body's immune response (Moynihan, 2007). (See Table 1)

Nutrition and Systemic Health

The field of clinical nutrition is increasingly being incorporated into mainstream medical treatment. Enwonwu, Phillips, and Falkler (2002) reported that malnutrition in some cases alters the pathogenicity of an infecting agent. For example, deficiencies in Selenium can induce changes in the viral genomes of the coxsackievirus and the influenza virus making them both more hostile and virulent (Enwonwu et al., 2002). Furthermore, dietary intake and nutritional habits are now considered primary factors in many chronic diseases including heart disease, obesity, cancer, and diabetes. Reducing simple sugars (glucose, sucrose, fructose, and lactose) can help prevent diabetes, and diets high in fiber can help control diabetes (University of Maryland Medical Center, 2011). In a 2008 statement, the American Diabetes Association (ADA) encouraged individuals with diabetes to “be aware of the importance of acquiring daily vitamin and mineral requirements from natural food sources and a balanced diet” (p.67). They further stressed that uncontrolled diabetes is often associated with micronutrient deficiencies (ADA, 2008).

The American Heart Association (AHA, 2006) has released a similar statement asserting that diet is a critical component of preventing cardiovascular disease (CVD). Of the environmental factors that affect blood pressure (i.e., diet, physical inactivity, toxins, and psychosocial factors), dietary factors have a prominent, and likely predominant, role (AHA, 2006). According to the University of Maryland Medical Center (2011) several nutrients are

linked to heart health including antioxidants like Beta Carotene, Selenium, vitamin E, and vitamin C, which appear to protect against the development of heart disease. Diets high in Folate (found in leafy greens, dry beans and peas, fortified cereals and grain products, and some fruits and vegetables) may also lower risk of stroke and heart disease (University of Maryland Medical Center, 2011). Omega-3 fatty acids found in cold water fish such as herring, tuna, and salmon are associated with reduced inflammation in heart disease, and vitamin E in the diet from fruits and vegetables may reduce the risk of angina (chest pain) and heart attacks in people with atherosclerosis (University of Maryland Medical Center, 2011).

Systemic Health and Oral Health

In addition to the breakthroughs linking nutrition to chronic diseases such as diabetes and heart disease, at the end of the 20th century researchers began to investigate the association of chronic systemic diseases with oral health. In 1989 Mattila et al. released their findings showing a correlation between periodontal disease and heart disease. Since then, the connection between oral and systemic health has been the focus of many studies leading modern-day dental providers to increasingly emphasize the interrelationship between health of the teeth and oral tissues and the general health of the body (Bell et al., 2012; Lundin, Yucel-Lindberg, Dahlof, Marcus, & Modeer, 2004; Moynihan, 2005; Ritchie et al., 2002; Ritchie & Kinane, 2003).

Chronic inflammatory illnesses such as obesity, diabetes, and heart disease are now perceived as factors that influence the progression and severity of periodontal disease. Furthermore, periodontal disease may be a potential factor influencing the progression and severity of systemic inflammatory diseases (Hasturk, Kantarci, and Van Dyke, 2012; Wilkins, 2009). An example is Prpic, Kuis, and Pexelj-Ribaric's 2012 research study where they found a significant correlation between overall oral health and Body Mass Index (BMI) among

nonsmoking adults aged 31—60 years regardless of their tooth brushing routines. The researchers suggested the relationship between oral health and obesity may be reciprocal. Oral infections including caries and periodontitis can impact the functional ability to eat leading to changes in diet where nutrient-dense foods are replaced with softer foods rich in sugars and saturated fats promoting obesity. On the other hand, obesity is often marked by an imbalanced diet rich in sugars which stimulate the growth of cariogenic bacteria such as lactobacilli and mutans streptococci and favoring development of carious lesions (Prpic et al., 2012). Lundin et al. (2004) found a higher prevalence of periodontitis among obese patients. The researchers found an increase in the production of proinflammatory cytokines in obese patients that negatively affect the host immunity in oral tissues around teeth. Alm, Fahraeus, Wendt, Andersson- Gare, and Birkhed (2008) reported overweight and obese adolescents had more incidences of tooth decay than normal weight adolescents and showed that toddlers who snacked more than three times a day were more likely to have an increase of tooth decay at age 15 compared to toddlers who only snacked three times or less per day.

Current scientific evidence also reveals a synergetic relationship between diabetes and periodontitis. Diabetes is associated with an increased incidence and progression of periodontitis regardless of subgingival plaque and periodontal infection is associated with poor glycemic control in diabetes (Martinez, Arias-Herrera, Criado-Camara, Bascones, & Ilundain, 2011; Sima & Glogauer, 2013). Multiple mechanisms have been proposed to explain the association between diabetes and periodontitis. One approach is that diabetes and periodontitis can both be considered inappropriate responses of the immune system and to environmental factors including but not limited to bacterial plaques and dietary intakes (Martinez et al., 2011).

The relationship between periodontal disease and heart disease is not as clearly understood as with diabetes; however, although causation is disputed, the AHA's (2012) statement acknowledges an association between periodontal disease and heart disease independent of known confounders. Periodontal diseases and coronary diseases have, at least, a tendency to appear together in such a way that individuals with cardiovascular problems have a greater tendency to have a worse periodontal status and vice versa (Machuca, Segura-Egea, Jimenez-Beato, Lacalle, & Bullon, 2012).

Research continues in multiple health disciplines exploring the relationship between oral and systemic diseases. While causation is not clearly understood, commonly postulated mediators included infection, chronic inflammation, and genetic predisposition to both oral and systemic disease. Nutrition has also been indicated as an alternative mediator (Prpic et al., 2012). Healthy diets including fruits, vegetables, whole grains, and high dietary fiber intake provide essential nutrients and can help prevent or decrease heart disease, type II diabetes, and obesity, conditions that are associated with periodontal disease (Ritchie & Kinane, 2003).

Oral Health and Nutrition

Nutrition may also have a direct association with periodontal disease. Although literature regarding nutrition and periodontal disease is limited, it is likely that what has been researched regarding nutrition and systemic immunity is applicable to periodontal disease (Boyd & Madden, 2003). Periodontal disease is a bacterial infection of the periodontium including the gingival tissues, periodontal connective tissues, and the supporting alveolar bone (Nield-Gehrig & Willmann, 2008). When certain bacteria invade the periodontium an immune system response is triggered. Leukocytes rush to the infected area and begin a multifaceted attack. Lymphocytes produce antibodies that neutralize the bacteria and the bacterial toxin. Neutrophils and

macrophages work to engulf and digest bacteria using lysosomal enzymes through a process called phagocytosis. These leukocytes then produce and secrete inflammatory mediators known as the complement system. This system in turn causes lymphocytic infiltration, bone resorption, and dissolution of the extracellular matrix. Cytokines (cell proteins) regulate the body's inflammatory response by transmitting signals between cells, recruiting more leukocytes to the infected site, and influencing the behavior of other cells. Cytokines such as IL-1, IL-6, IL-8, and TNF- α are significant agents involved in periodontitis (Nield-Gehrig & Willmann, 2008). Prostaglandins cause vasodilation and edema and trigger osteoclast activity which results in the resorption of alveolar bone. Matrix metalloproteinase in an attempt to kill the invading bacteria breaks down the collagen matrix in gingiva, periodontal ligament, and alveolar bone (Hildebolt, 2005; Nield-Gehrig & Willmann, 2008).

The primary etiology of periodontal diseases is bacterial; however, host factors modulate the severity of disease. For example, the microorganisms associated with inflammatory periodontal disease include *Prevotella intermedia*, *Porphyromonas gingivalis*, *Bacteroides forsythus*, *Fusobacterium nucleatum*, *Peptostreptococcus micros*, and in localized juvenile periodontitis, *Actinobacillus actinomycetemcomitans* (Enwonwu et al., 2002). Malnutrition consistently impairs innate and adaptive defenses of the host including phagocytic function, cell mediated immunity, complement system, secretory antibody, and cytokine production and function (Moynihan & Petersen, 2004). In PEM there are marked changes in the oral microbial ecology resulting in a multitude of pathogenic anaerobic organisms, increased propensity of bacteria to bind to oral mucosal cells, and dysfunction of the cytokine system (Moynihan & Petersen, 2004). Malnourished children have significantly higher numbers and varieties of

anaerobes in the oral cavity including the primary periodontal associated microorganisms *P. gingivalis*, *P. intermedia*, *Actinomyces*, and *Fusobacterium* (Enwonwu et al., 2002).

Most bacteria live in complex communities called biofilms. Biofilm adheres to surfaces and embeds in an extracellular slime layer; dental plaque is a type of biofilm (Nield-Gehrig & Willmann, 2008). The development and composition of plaque biofilm is impacted by nutrition, primarily by providing a direct supply of nutrients to the bacteria. Bowden and Li (1997) showed an increased rate of bacterial growth in the early stages of biofilm development with the introduction of excess glucose to a plaque biofilm. Nutrition also impacts plaque biofilm indirectly by affecting the byproducts of the bacteria. When provided with specific nutrients such as glucose and other carbohydrates, bacteria produce insoluble plaque matrix polymers (extracellular dextran) that are then used by other bacteria to increase colonization (Bowden and Li, 1997; Moynihan & Petersen, 2004). For example, bacteria use sucrose to produce the glucans that facilitate the adherence of *Streptococcus mutans* and *Streptococcus sobrinus* to the dental pellicle (Boyd & Madden, 2003). *S. mutans* and *S. sobrinus* are important bacteria in the development of dental caries. These bacteria metabolize sucrose excreting lactic, acetic, and formic acids that demineralize enamel. These acids also lower the pH of the oral environment that is more hospitable to the development of certain bacteria such as *S. mutans*, *lactobacilli*, and *bifidobacteria* (Bowden & Li, 1997; Moynihan & Petersen, 2004).

The impact of diet on the formation of dental caries has long been known. As early as the 1930s, publications were issued citing deficiency of one or more nutrients and increased sugar intake as a leading cause of tooth decay (Mixed Committee of the League of Nations, 1937). Free sugars include all sugars added by the manufacturer during cooking and by the consumer plus the sugars naturally present in juices, syrups, and honey. Without a reduction in

free sugars consumption the prevalence of caries will continue to be a leading health concern, especially among children (Moynihan, 2005).

Micronutrients and Oral Health

Research in the study of nutrition and its influence on oral health is receiving increasing attention. Several studies of the 21st century have been aimed at discovering the impact of specific nutrient deficiencies on oral health. Vitamins A, B, C, and D along with minerals iron, calcium, zinc, and folic acid have all been associated with specific oral disorders in recent years (See Table 1). For example, enamel hypoplasia is a defect that occurs as a result of a disturbance in the formation of the organic enamel matrix. It is characterized by hypoplastic grooves or pits in the enamel, which are often horizontal or linear in appearance (Wilkins, 2009). Sheeta et al. (2013) reported that some hypoplasia and pits on the surface of the enamel are associated with a vitamin A deficiency. Vitamin A/ Retinol deficiency is also associated with salivary gland atrophy that consequently reduces the mouth's resistance against infection and its ability to buffer plaque acids (Moynihan & Petersen, 2004). Other researchers have linked insufficient amounts of vitamin A to gingivitis, periodontitis, and hyperplasia of the gingiva (Ehizele, Ojehanon, & Akhionbare, 2009; Moynihan, 2007).

Vitamin B is also connected to various oral conditions. A common consequence of vitamin B deficiency is a burning sensation in the mouth, especially on the tongue. Other oral symptoms may include cracked and red lips, inflammation of the lining of the oral cavity and the tongue, defoliation of the tongue, oral ulcers, a sore throat, and angular cheilitis (Sheetal et al., 2013). Angular cheilitis is an inflammatory lesion at the labial commissure, or corner of the mouth, and often occurs bilaterally. The condition manifests as deep cracks or splits, ulcerations, and erythema (Wilkins, 2009).

Vitamin B1/Thiamine deficiency is associated with cracked lips, a satin looking gingiva and tongue, and angular cheilitis (Ehizele et al., 2009). Vitamin B2/Riboflavin is primarily needed for the breakdown of fat, ketone bodies, carbohydrate, and proteins. However, a riboflavin deficiency causes Ariboflavinosis, which displays as cracked lips, fiery red inflammation of the tongue, and dryness or burning of the oral cavity (Sheetal et al., 2013). Insufficient amounts of vitamin B2 are also associated with ulcerative gingivitis (Moynihan, 2007). Vitamin B6/Pyridoxine has been linked with tooth decay, periodontal disease, anemia, and burning sensation in the oral cavity (Ehizele et al., 2009; Moynihan, 2007). Insufficient amounts of vitamin B9/ Folate and vitamin B12/Cobalamin is the most common cause of megaloblastic anemia. Megaloblastic anemias are a subgroup of macrocytic anemias caused by impaired DNA synthesis that results in macrocytic red blood cells, abnormalities in leukocytes and platelets, and epithelial changes, particularly in the rapidly dividing epithelial cells of the mouth and gastrointestinal tract. Oral signs and symptoms and megaloblastic anemia includes glossitis, angular cheilitis, recurrent oral ulcer, oral candidiasis, diffuse erythematous mucositis, and pale oral mucosa (Pontes et al., 2009). A deficiency of vitamin B12 can also lead to pernicious anemia, a condition resulting in immature red blood cells (Sheetal et al., 2013) and may have multiple effects on oral health including glossitis, recurrent oral ulcerations and erythema of oral mucosa, angular cheilitis, halitosis, bone loss, hemorrhagic gingivitis, detachment of periodontal fibers, and atrophy of tongue papillae (Ehizele et al., 2009; Field, Speechley, Rugman, Varga, & Tyldesley, 1995; Moynihan, 2007).

Vitamin C/Ascorbic Acid plays the main role in maintaining and repairing the healthy connective tissue and a severe deficiency can lead to the destruction of periodontal tissues and increased tooth mobility (Ehizele et al., 2009). Vitamin C is also known for its antioxidant

properties and insufficient intake can cause delayed wound healing and an exacerbation of oral infections (Carullo, 2002; Moynihan, 2007). Finally, deficiency of vitamin C is known to cause scurvy, which is characterized by defective collagen formation due to disturbances in the collagen synthesis. The oral manifestations of scurvy include spontaneous gingival bleeding and gingivitis (Sheetal et al., 2013).

Vitamin D/Calciferol is essential for the development and maintenance of bone including alveolar bone. Vitamin D may also have an anti-inflammatory effect. Dihydroxyvitamin D has been found to inhibit cytokine production and cell proliferation (Dietrich, Joshipura, Dawson-Hughes, & Bischoff-Ferrari, 2004). A deficiency in vitamin D has been associated with localized aggressive periodontal disease, oral bone loss, clinical attachment loss, absence of lamina dura, and tooth loss (Hildebolt, 2005) as well as with enamel hypoplasia that is a defective formation of enamel during the tooth's development (Sheetal et al., 2013). Enamel hypoplasia can cause cosmetic concerns, increased sensitivity, and increased susceptibility to caries due to the increased porosity of the tooth.

Calcium is closely related to vitamin D in its use by the body. Like vitamin D, calcium is used in the growth and preservation of bone. Insufficient amount of calcium intake is known to increase the risk of osteoporosis and alveolar bone loss is associated with overall skeletal bone loss and mineral density (Nishida et al., 2000). Hildebolt (2005) reported edentulous test subjects receiving vitamin C supplements had 36% less alveolar bone loss than did subjects receiving a placebo over a 1- year period. Nishida et al. (2000) and Sheetal et al. (2013) both reported findings showing an association between lower calcium intake and increased risk of periodontal disease and tooth loss. The association is likely related to alveolar bone change that eventually results in greater clinical attachment loss (Nishida et al., 2000).

In addition to vitamin B12, the body requires iron and folic acid to produce healthy red blood cells within the bone marrow. Consequently, the effects of iron and folic acid deficiencies are similar to those of the vitamin B deficiency including very red, painful tongue with a burning sensation, dysphagia, angular cheilitis, glossitis, atrophy of tongue papillae, and gingivitis (Ehizele et al., 2009; Moynihan, 2007).

Protein energy malnutrition also has an impact on oral health. PEM during early childhood can have substantial effects on the developing immune system and may permanently affects a person's ability to respond to colonization with periodontal pathogens, making PEM a primary risk factor for periodontal disease almost as great as smoking (Russell, Psoter, Jean-Charles, Prophte, & Gebrian, 2010). PEM can also influence tooth decay. Moynihan (2004) stated that PEM coupled with daily increased amount or frequency of sugars results in levels of caries greater than expected for the level of sugars intake. This may be because of the effect PEM has on saliva. PEM has been associated with hypo-functioning of the salivary glands resulting in decreased salivary flow rate and decreased buffering capacity. This subsequently reduces the proficiency of the oral cavity to protect against infection and to buffer the plaque acids (Sheetal et al., 2013).

Sources of Malnutrition

The human body relies on nutrients for growth, maintenance, and repair. Deficiencies of specific nutrients can have an impact in the body's ability to resist tooth decay, periodontal pathogens, and other oral diseases. The United States does not have a food shortage, and the majority of US citizens are not at risk of dying of starvation. Malnutrition and more commonly specific micronutrient deficiencies are, however, a reality. The number of older adults living in their own communities who are malnourished is in the hundreds of thousands, between 35% and

50% of senior residents of long-term care facilities are malnourished, and as many as 65% of the elders in hospitals may be malnourished (Florida International University, 2013).

Malnutrition can also come from less obvious scenarios such as a side effect of medications. Several prescription medications can affect metabolism of nutrients by accelerating the excretion of certain nutrients, hindering the absorption of nutrients, or interfering with the body's ability to convert nutrients into usable forms (Sprattto & Woods, 2010). For example, diuretics, commonly prescribed for people with heart disease and high blood pressure, often cause a deficiency of potassium. Potassium deficiency can cause a sensation of a raw, sore tongue and burning mouth when eating, drinking, or talking. It can also cause gingival bleeding (Ehizele et al., 2009). Corticosteroids are used for a variety of medical conditions including Addison's disease, arthritis, psoriasis, and allergies. Corticosteroids are known to increase catabolism of protein and interfere with absorption of calcium, vitamin D, folic acid, and other nutrients (Boyd & Madden, 2003). Several other medications as shown in Table 2 have been shown to affect use of nutrients.

Another potentially overlooked source of malnutrition is fad dieting. Fad diets such as Atkins, South Beach, and the Mediterranean diet often promote limiting or increasing certain food groups in order to lose weight. Eliminating or overindulging in specific food groups can affect the oral cavity. For example, high-protein diets increase body water excretion and may be associated with xerostomia. High-carbohydrate, low-fiber diets, including nutritional bars rich in highly concentrated and formulated fermentable carbohydrates, can increase caries risk. Diets that recommend the intake of caffeine-rich calorie-free drinks or herbal supplements might cause dehydration of oral tissues and dental erosion (Mobley, 2008). And any diet that restricts the intake of foods such as fruits and vegetables greatly limits the amount of vitamins and minerals

needed for homeostasis of the immune system. Severe reduction in calorie intake can also impact oral health. Restricting dietary intake to one or two meals a day interferes with salivary flow unless chewing gum or other stimulants are included in the diet. And eating disorders such as anorexia nervosa or bulimia nervosa are both associated with alterations in dental soft- and hard-tissue health (Mobley, 2008).

It is important for dental professionals to be able to identify patients at risk for nutritional deficiencies. Dental hygienists are in a unique position to provide nutritional screening, assessment, and basic dietary counseling to patients because of their frequent interactions with patients. Using their knowledge, dental hygienists can help patients select a healthy diet and recognize when a patient has nutrition needs beyond the scope of dentistry (Boyd & Dwyer, 1998).

Dietary Screening and Nutritional Counseling

Dental hygiene is the scientific and medical profession of recognizing, treating, and preventing oral diseases (ADHA, 2008). Providing preventive oral healthcare is a key aspect of a dental hygienist's services (Levy & Raab, 1993). This is primarily accomplished by performing the role of clinician, educator, and researcher in the dental practice (ADHA, 2008).

Utah State Law allows hygienists to assess the dental hygiene status of patients and provide dental hygiene care with the collaboration of the supervising dentist (Session Laws of Utah, 2012). According to the ADHA (2008) assessing the dental hygiene status of a patient requires performing a comprehensive individualized evaluation of the oral and general health status of a patient. This comprehensive evaluation includes reviewing the patient's health history and assessing his or her current health status. Diet and nutrition impact oral health, consequently inclusion of nutrition history and dietary practices is a significant aspect of a thorough evaluation

and should be considered during exams and treatment planning (ADHA, 2008; Boyd & Madden, 2003; Harper-Mallonee, 2011; Nield-Gehrig & Willmann, 2008; Wilkins, 2009). Understanding the implications of the interaction between nutritional status and the immune response to the bacterial challenge in periodontal disease is an important aspect of delivering comprehensive dental hygiene care (Boyd & Madden, 2003).

Dental Hygienists' Knowledge of Nutrition

As members of the dental team dental hygienists possess basic skills required for nutritional intervention. Basic nutrition is a required course in the dental hygiene curriculum and dental hygienists are also instructed in dietary screening and nutritional counseling during the clinical aspect of the program. In 2010 Kading, Wilder, Vann, and Curran reported that the amount of nutritional counseling taught to dental hygienists is increasing, and that dental hygienists who earned their degree between 2001 and 2008 received more training in nutritional counseling when compared to hygienists who graduated earlier.

Dental hygienists are in a unique position to provide nutritional screening, assessment, and basic dietary counseling to patients because of their frequent interactions with patients. Using their knowledge, dental hygienists can help patients select a healthy diet and recognize when a patient has nutrition needs beyond the scope of dentistry (Boyd & Dwyer, 1998). The ADHA (2008) encouraged dental hygienists to assess the potential association of systemic and oral health in their patients and to teach patients about the importance of good nutrition for maintaining good oral health and collaborate with the supervising dentist and other health and dental care providers.

Dental Hygienists' Dietary Screening and Nutritional Counseling Practices

The majority of dental hygienists agree that they have a role in helping patients improve their nutrition (Kading et al., 2010). However, Levy and Raab (1993) reported less than half of dental professionals were providing dietary counseling on a regular basis and only a handful (less than 10%) collected diet history information for assessment. In their study of dental hygienists working with young children Faine and Oberg (1995) found nutritional counseling that only involved a recommendation for reducing or eliminating sugar and carbohydrate intake was insufficient because it often failed to consider the overall nutritional needs and realistic snacking recommendations for young children. Additionally, Curran et al. (2010) revealed that only 4.8% of dentists offered nutritional counseling regarding obesity even though 43.3% of general dentists and 20.3% of pediatric dentists agreed that they were more likely to diagnosis gingivitis and periodontal problems in their overweight patients. Brithwaited, Vann, Switzer, Boyd, and Lee (2008) showed that only 24% of pediatric dental offices provided nutrition counseling services to patients even though 56% agreed that comprehensive nutritional counseling should be provided.

In 2010 the ADA resolved to continue to gather evidence and information concerning associations between diet, nutrition, and oral health and to support collaborative efforts with other health professionals. This changing perception and understanding is reflected in the 2020 Healthy People Objectives that added oral diseases to its list of health risks associated with poor nutrition (U.S. Department of Health and Human Services, 2012). Additionally, The ADA (2010) recently resolved to ensure that “issues specific to nutrition and oral health, as well as the systemic and oral health relationship be incorporated into educational materials” (p. 206) and continuing educational courses for dental professionals.

Barriers to Care

Nutritional counseling may be viewed as a service secondary to prophylaxis and periodontal treatment. Other secondary dental hygiene services that have been studied include tobacco use cessation and blood pressure monitoring. Barriers to secondary services have commonalities that are worth reviewing when examining the barriers to nutritional counseling. For example, an assessment of dental hygienists' self-confidence in health promotion counseling skills showed an association with self-efficacy and counseling activity (Mullen, Holcomb, & Frasser, 1988). Pendharkar (2009) supported this claim finding 75% of fourth-year dental students cited the perception of inadequate skills in providing tobacco intervention services as a barrier to care. Other frequently reported barriers to providing secondary services are time constraints and lack of value for the service by the supervising dentist (Hughes, Thompson, & Browning, 2004; Pendharkar, 2009). Finally, another potential barrier to care is the dental hygienist's perception of how he or she complies with the industry recommendations. Hatfield (2002) found that dental professionals who used tobacco products were less likely to enjoy counseling their patients in tobacco cessation than nonusers.

Although the literature examining dental hygienists' dietary screening and nutritional counseling is not extensive, the studies performed show many of the same attitudes, perceptions, and barriers to care as other secondary services. Curran et al. (2010) found lack of confidence in providing counseling including fear of offending patients and being unsure of how to approach the issue a perceived barrier to care. These same researchers also noted that the provider's personal dietary habits influenced the likelihood of the provider to perform dietary screenings and nutritional counseling with those with poorer habits being less likely to offer the service (Curran et al., 2010). Another reported barrier to care is lack of time. A survey of orthodontists

reported that when nutritional counseling was performed it was most often given through quick oral discussions lasting no more than 5 minutes (Huang, Becerra, Walker, & Hovell, 2006).

Summary

Our nation's health goals call for an increase in the provision of nutrition assessment and counseling with referral to qualified dietitians as needed (U.S. Department of Health and Human Services, 2012). The ADA (2010) encourages dental professionals to maintain current knowledge of nutrition recommendations as they relate to general and oral health and disease and to educate and counsel patients about proper nutrition and oral health. The ADHA (2008) also supports a multiple-faceted approach to care including the encouragement of eating habits consistent with the Dietary Guidelines for Americans. The relationship between nutrition, infectious disease, and the immune system is synergistic. Infection may promote malnutrition, malnutrition elicits dysfunction in the immune system, and impaired immunity intensifies infection. Nutrition affects plaque, saliva, and the pH levels of the oral cavity. It also impacts systemic diseases, obesity, and inflammatory markers all of which have been shown to be associated with periodontal disease. Adequate and appropriate nutrient intake is needed for growth, development, and maintenance of the oral tissues and for the prevention of dental caries, gingivitis, and periodontitis. Dental hygienists have been educated in these precepts and generally accept the importance of nutrition in oral health; however, previous researchers have noted that few dental hygienists routinely or systematically look for signs and symptoms of poor nutritional status in patients (Dwyer, Ham, Lipschitz, Wellman, & White, 1991; Levy & Raab, 1993). Reporting multiple barriers to care, many hygienists fail to perform dietary screenings and nutritional counseling regardless of their training and education and research findings showing associations between nutrition intake and oral disease.

Table 1

Nutrient, Systemic, and Oral Health Interactions

Nutritional Deficiency	Systemic response	Oral Manifestation
Vitamin A	Decreased- immune cell differentiation response to antigens antibody production immunoglobulin production production of lymphocytes Increased- bacterial adhesion	Gingivitis Periodontitis Hyperplasia of the gingiva Xerostomia Hyperkeratosis
Vitamin B1/ Thiamine	Decreased- carbohydrate metabolism amino acid metabolism myelin synthesis	Cracked lips A satin looking gingiva and tongue Angular cheilitis
Vitamin B2/ Riboflavin	Decreased- antibody synthesis cytotoxic T-cell activity lymphocyte response	Inflammation of the tongue. Niacin Fiery red inflammation of the tongue Angular cheilitis Ulcerative gingivitis
Vitamin B6	Decreased- antibody synthesis cytotoxic T-cell activity lymphocyte response	Teeth or bone decay Periodontal disease Anemia Sore tongue Burning sensation in the oral cavity
Vitamin B12	Decreased- production of lymphocytes cytotoxic T-cell activity phagocytic function of neutrophils	Angular cheilitis Halitosis Bone loss Hemorrhagic gingivitis Detachment of periodontal fibers Painful ulcers in the mouth Glossitis Atrophy of tongue papillae Erythema and edema of oral mucosa
Vitamin C	Decreased- phagocytic function of neutrophils and macrophages antibody response	Purplish red, swollen, bleeding gums Mobile teeth Delayed wound healing Exacerbation of oral infections

Table 1 (continued)

	cytotoxic T-cell activity collagen synthesis	Destruction of periodontal tissues in severe deficiency
Vitamin D	Decreased- calcium and phosphorus absorption bone mineral density antimicrobial peptides	Enamel hypoplasia Absence of lamina dura Abnormal alveolar bone patterns Inadequate bone healing
Iron	Decreased- lymphocyte proliferation neutrophil cytotoxic activity antibody response	Very red, painful tongue with a burning sensation Dysphagia Angular cheilitis Glossitis Mucosal thinning Ulcerations
Calcium	Decreased- bone mineral density cytoplasm function	Osteoporosis and possible alveolar bone loss
Zinc	Decreased- antibody response phagocytic function of macrophages B-cell and T-cell proliferation	Decreased or impaired wound healing Altered taste
Folic Acid	Decreased- production of lymphocytes cytotoxic T-cell activity phagocytic function of neutrophils	Painful glossitis Atrophy of tongue papillae Gingivitis
Protein Energy	Decreased- Salivary antimicrobial properties immunoglobulin production lysozymes activation of lymphocytes production of antibodies Increased- bacterial adhesion	Decreased resistance to periodontal pathogens Decreased salivary gland function

Note: Information from Boyd and Madden, 2003; Ehizele, Ojehanon, and Akhionbare, 2009; Moynihan., 2007; Nield-Gehrig and Willmann, 2008; Wilkins, 2009.

Table 2

Drug- Nutrient Interactions

Drug	Nutrient Interaction
Alcohol	Malabsorption of folic acid and vitamin B12
Aminopterin	Antagonizes folic acid; interferes with absorption of vitamin B12
Antacids	Cause phosphate depletion, muscle weakness, and vitamin D deficiency
Anti-infectives	Decrease use of folic acid and malabsorption of vitamin B12, Ca, and Mg; decrease bacterial synthesis of vitamin K; inactivate B6; impair amino acid transfer
Anticoagulants	Cause deficiencies of vitamin D, folic acid, and vitamin B12 by increasing vitamin turnover rate in the body
Antidiabetic agents (oral)	Impair absorption of vitamin B12
Aspirin	Causes folate deficiency
Atropine, cortisone, digitoxin, epinephrine, and ethacrynic acid	Alter pancreatic or intestinal digestive function
Cathartics	Diminish nutrient absorption
Clofibrate	Alters taste sensation; may suppress appetite and reduce nutrient intake; malabsorption of folic acid and vitamin B12, electrolytes, and sugar
Colchicine	Impairs absorption of vitamin B12, fat, lactose, and electrolytes
Contraceptives (oral)	Deplete folic acid and vitamin B6
Cycloserine	Causes folate deficiency
Diuretics and ganglionic blockers	Cause potassium depletion

Table 2 (continued)

H2 blockers	Interfere with vitamin D absorption; → osteopenia
Hydralazine and isoniazid	Deplete vitamin B6 by inhibiting production of enzymes needed to convert it into a form the body can use, or by combining to form a compound which is excreted
Methotrexate	Antagonizes folic acid
Mineral oil	Hinders absorption of vitamins D, E, K, and carotene
Neomycin	Impairs absorption of vitamin B12; alters pancreatic absorption or digestive function; interferes with bile activity
Phenobarbital	Causes folate deficiency
Phenothiazine, tricyclic antidepressants	Stimulate appetite, result in increased food intake and weight gain
Surface-acting agents	Alter absorption of nutrients by affecting fat dispersion
Thorazine	Induces hypercholesterolemia

Note: Adapted from “Drug Administration- Section 3: Drug interactions” in G. Spratto, and A. Woods, *Delmar nurse's drug handbook* (p. retrieved electronically), by G Spratto and A. Woods, 2010, <http://www.cengagesites.com/academic/assets/sites/5407/pdf/drug-admin/Section3.pdf>. Copyright 2003 by Cengage Learning.

CHAPTER 3

METHODS

Overview

Nutrition impacts oral health and dental hygienists are in a unique position to offer dietary screening and nutritional counseling in the dental office. Such services are encouraged by the ADHA and are allowed by Utah State Law. The purpose of this quantitative study was to determine the dietary counseling practices and perceived barriers, if any, among Utah dental hygienists registered with the ADHA.

Research Design

The data for this study were collected using a cross-sectional technique. Cross-sectional research can determine the current attitudes and behaviors of a given population (Cottrell & McKenzie, 2011). A survey questionnaire (Appendix A) was constructed via Survey Monkey, an online survey tool. The survey link was then emailed to all members of the study population. The use of the third party web site provided anonymity.

The measurement tool was obtained from and used with the permission of Levy and Raab (1993) (Appendix B). Levy and Raab (1993) had the questionnaire reviewed for content validity by nutrition faculty at Oregon State University as well as dental hygiene faculty at Oregon Institute of Technology. It was then pilot-tested with two focus groups of practicing dental hygienists (a total of 30 dental hygienists) to determine face and content validity (Levy & Raab, 1993).

Population

The population for this study was a convenience population limited to members of the Utah Dental Hygiene Association with valid emails on file with the association. The sample

included those who met the inclusion and exclusion criteria for this research study. Participants who worked 0-3 hours a week in a private practice general dentist office were excluded from the study. Data were collected September-November 2013.

Informed Consent Consideration

The approval of the institutional review board (IRB) at East Tennessee State University (ETSU) was sought and obtained (approval #c0813.34e) before any subjects began their participation in the study. Participants were provided information regarding the study including contact information of the investigator for further questions (Appendix C). Implied consent was obtained for all participants by their decision to link to the online survey tool and complete the questionnaire.

Data Collection Procedure

An invitation to participate with a link to the research survey was e-mailed to members of the Utah Dental Hygiene Association in September of 2013 (Appendix C). A follow-up e-mail was sent in both October and November to the population group thanking those who had participated and encouraging those who had not to participate (Appendix D).

The survey included demographic information, dental hygiene practices, and dental hygiene perceptions towards dietary screening and nutritional counseling. Demographic information included the subjects' level of education, institution(s) from which the respondents graduated, number of years practicing dental hygiene, and component affiliation. Component affiliation was used to determine geographic location of participants. Hours worked per week and office specialty was also included for purposes of excluding nonqualified participants. The 25-item questionnaire was based on a previous study and with the permission of its authors, Levy and Raab (1993).

Likert-scaled statements assessed the frequency (often/sometimes/seldom/never) with which specific dietary screening and nutritional counseling procedures were performed. Likert-scaled statements (strongly agree/ agree/disagree/strongly disagree) assessed the confidence in nutritional knowledge and counseling skills and perception of barriers to dietary services.

Research Questions

This study was guided by the following questions.

1. Is there a relationship between degree achievement and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
2. Is there a relationship between degree achievement and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
3. Is there a relationship between years in practice and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
4. Is there a relationship between years in practice and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
5. Is there a relationship between component affiliation (see definition of terms) and barriers to care? If a relationship exists, what are the characteristics of that relationship?
6. Is there a relationship between component affiliation and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?

7. Is there a relationship between barriers to care and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
8. Is there a relationship between confidence in providing dietary counseling and frequency of counseling? If a relationship exists, what are the characteristics of that relationship?

Data Analysis Procedure

Data were coded and a data file was created using IBM SPSS Version 18.0. Ratings were attributed to each of the Likert-scaled statements as follows: Frequency ratings: 1=often; 2=sometimes; 3=seldom; 4=never; Agree/Disagree Ratings: 1=strongly agree; 2= agree; 3=disagree; 4=strongly disagree. Frequency distributions were computed for each response as well as other descriptive statistics (mean, standard deviation, and range) for each variable. Data analysis included Pearson product-moment correlation and one-way analysis of variance (ANOVA). Statistical tests were conducted at the 5% ($p < .05$) significance level. Reported frequencies were adjusted to eliminate missing responses when composite scores were computed.

CHAPTER 4
ANALYSIS OF DATA

Overview

Nutrition impacts oral health and dental hygienists are in a unique position to offer dietary screening and nutritional counseling in the dental office. Such services are encouraged by the ADHA and are allowed by Utah State Law. The purpose of this quantitative study was to determine the dietary counseling practices and perceived barriers, if any, among Utah dental hygienists registered with the ADHA.

Participants

Selection

The population for this study was limited to members of the four geographic regional components, Northern, Salt Lake, Central, and Southern, of the Utah Dental Hygienists' Association. An email list was obtained from and with permission of the Utah Dental Hygiene Association. The email contact list was then copied and pasted into the third party online survey tool, Survey Monkey. Using Survey Monkey, an email invitation was then sent on September 25, 2013 to all members of the Utah Dental Hygienists' Association with email contacts on the provided list. Reminder emails were subsequently sent on October 19, 2013 and November 1, 2013. The recipient list contained 376 email contacts. Of these contacts, ten emails were returned undeliverable, seven participants opted out of the study, 335 participants did not respond to the invitation to participate, and two of the respondents did not complete the study. Of the 39 participants who completed the full survey, seven were excluded from the study because they did not work for a general dentist. Four of these worked exclusively in education,

one worked exclusively for a periodontist, and two were unemployed. The final response rate was 8.51% with 32 participants.

Demographics

Participants in this study were members of the Utah Dental Hygienists' Association. As part of the requirements for licensure as a dental hygienist in the state of Utah, candidates must hold a degree in dental hygiene from a school accredited by the Commission on Dental Accreditation of the American Dental Association (Session Laws of Utah, 2012). Participants in this study held degrees ranging from the associate's degree to master's degree. The majority, 71.88%, held a bachelor's degree, followed by 40.63% with an associate's degree and 9.38% with a master's degree. Almost half (43.75%) of participants were associated with the Northern component of the Utah Dental Hygienists' Association and 25% were associated with the Salt Lake component. Members of the Central and Southern components both equaled 15.63% of participants in this study.

The largest percentage, 46.88%, of respondents had been practicing dental hygiene 3 or fewer years. Twenty-five percent had been practicing 4-8 years, 18.75% 9-15 years, 6.25% 16-35 years, and 3.13% had been practicing dental hygiene for over 35 years. A limitation of this survey mandated that all participants must currently work in a general dentist's office, and respondents not meeting this requirement were excluded. Of the 32 qualified participants, 9.38% worked in periodontic or pediatric dental practices in addition to working in a general dentistry practice. Finally, the majority of participants (46.88%) practiced dental hygiene 20-32 hours in a typical week. Thirty-one and a quarter percent practiced dental hygiene 4 to 19 hours a week and 21.88% practiced 32 or more hours in a typical week.

Results

Descriptive Statistics

Participants' level of confidence in providing dietary counseling, frequency of providing dietary counseling, and perceived barriers to providing dietary counseling were determined through a self-evaluation survey. Four questions assessed level of confidence on a scale of 1-4. Each participant's responses were then averaged to determine a mean score of confidence level for each participant. Individual mean scores of confidence level were then averaged resulting in a mean statistic for the group of 32 participants of 2.78 with a standard deviation of .49. Frequency of providing dietary counseling (15 questions) and perceived barriers to providing dietary counseling were computed likewise with the following results. The mean statistic for frequency for the group of 32 participants for dietary counseling was 2.09 with a standard deviation of .54. The mean statistic for barriers for the group of 32 participants was 2.36 with a standard deviation of .40 (see Table 3).

Table 3

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Confidence	32	2.25	1.75	4.00	2.7812	.08749	.49493	.245
Frequency	32	1.93	1.20	3.13	2.0979	.09593	.54266	.294
Barrier	32	1.80	1.40	3.20	2.3578	.07103	.40183	.161
Valid N (listwise)	32							

Analysis of Variance

Analysis of Variance (ANOVA) was used to evaluate the following research questions.

1. Is there a relationship between degree achievement and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
2. Is there a relationship between degree achievement and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
3. Is there a relationship between years in practice and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
4. Is there a relationship between years in practice and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
5. Is there a relationship between component affiliation (see definition of terms) and barriers to care? If a relationship exists, what are the characteristics of that relationship?
6. Is there a relationship between component affiliation and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?

There was no significant difference found in level of confidence based upon degree level ($p=.113$) when comparing degree achievement to participants' mean score levels of confidence, at a 95% confidence interval ($\alpha=.05$). The results of the ANOVA are found in Table 4

Table 4

Degree and Confidence

ANOVA					
Mean Confidence					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.060	2	.530	2.352	.113
Within Groups	6.534	29	.225		
Total	7.594	31			

Critical Value $p < .05 = 3.33$

When comparing degree achievement to participants' mean score levels of frequency, at a 95% confidence interval ($\alpha = .05$), no significant difference was found in level of confidence based upon degree level ($p = .729$). The results of the ANOVA are found in Table 5.

Table 5

Degree and Frequency

ANOVA					
Mean Frequency					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.197	2	.098	.320	.729
Within Groups	8.932	29	.308		
Total	9.129	31			

Critical Value $p < .05 = 3.33$

There was no significant difference found in level of confidence based upon years in practice ($p = .616$) when comparing years in practice to participants' mean score levels of confidence, at a 95% confidence interval ($\alpha = .05$). The results of the ANOVA are found in Table 6.

Table 6

Years in Practice and Confidence

ANOVA					
Mean Confidence					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.689	4	.172	.674	.616
Within Groups	6.905	27	.256		
Total	7.594	31			

Critical Value $p < .05 = 2.73$

When comparing years in practice to participants' mean score levels of frequency, at a 95% confidence interval ($\alpha = .05$), no significant difference was found in level of confidence based upon degree level ($p = .850$). The results of the ANOVA are found in Table 7.

Table 7

Years in Practice and Frequency

ANOVA					
Mean Frequency					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.436	4	.109	.338	.850
Within Groups	8.693	27	.322		
Total	9.129	31			

Critical Value $p < .05 = 2.73$

When comparing component affiliation to participants' mean score levels of barrier perception, at a 95% confidence interval ($\alpha = .05$), no significant difference was found in level of confidence based upon degree level ($p = .169$). The results of the ANOVA are found in Table 8.

Table 8

Component and Barriers

ANOVA					
Mean Barrier					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.811	3	.270	1.805	.169
Within Groups	4.194	28	.150		
Total	5.006	31			

Critical Value $p < .05 = 2.95$

When comparing component affiliation to participants' mean score levels of frequency, at a 95% confidence interval ($\alpha = .05$), no significant difference was found in level of confidence based upon degree level ($p = .274$). The results of the ANOVA are found in Table 9.

Table 9

Component and Frequency

ANOVA					
Mean Frequency					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.164	3	.388	1.364	.274
Within Groups	7.965	28	.284		
Total	9.129	31			

Critical Value $p < .05 = 2.95$

Pearson Correlation Coefficient

Pearson Correlation Coefficient was used to evaluate the following research questions.

1. Is there a relationship between barriers to care and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
2. Is there a relationship between confidence in providing dietary counseling and frequency of counseling? If a relationship exists, what are the characteristics of that relationship?

Little to no relationship between barriers to care and frequency of providing dietary counseling ($r = .2$) was found. The correlation results are found in Table 10.

Table 10

Frequency and Barriers

		Mean Frequency	Mean Barrier
Mean Frequency	Pearson Correlation	1	.196
	Sig. (2-tailed)		.283
	N	32	32
Mean Barrier	Pearson Correlation	.196	1
	Sig. (2-tailed)	.283	
	N	32	32

The relationship between confidence in providing dietary counseling and frequency of counseling was weak ($r = .35$) with a slight increase in frequency with increasing confidence.

The results of Pearson Correlation Coefficient are found in Table 11.

Table 11

Frequency and Confidence

		Mean Frequency	Mean Confidence
Mean Frequency	Pearson Correlation	1	.349
	Sig. (2-tailed)		.051
	N	32	32
Mean Confidence	Pearson Correlation	.349	1
	Sig. (2-tailed)	.051	
	N	32	32

Discussion

The Dietary Counseling Practices and Perceived Barriers among Utah Dental Hygienists study was conducted from September 2013 to November 2013. Members of the Utah Dental Hygienists' Association were the target population. A survey invitation was sent out to the 376

email contacts list of the UDHA. After rejecting incomplete surveys and participants who did not fit the design study, the final response rate was 8.51% with 32 participants. All participants were members of the Utah Dental Hygienists' Association working at least 4 hours a week in a general dental practice.

Nutrition impacts oral health and dental hygienists are in a unique position to offer dietary screening and nutritional counseling in the dental office. Such services are encouraged by the ADHA and are allowed by Utah State Law. The results of this study showed the participants' overall mean score of confidence in providing dietary counseling to be 2.78 out of 4. Furthermore, the average score for frequency of performing dietary counseling was only 2.10 out of 4. And finally, the mean score for perception of barriers to providing dietary counseling was 2.36 out of 4, with 1 indicating strong barriers to care.

While the mean confidence and frequency levels of the participants for performing dietary counseling were moderate, ANOVA tests showed little to no difference in confidence and frequency levels when differentiating between degree achievement or component affiliation and little to no difference in confidence when differentiating between years in dental hygiene practice. Likewise, there was little to no difference in the degree of perceived barriers when differentiating between component affiliations.

The Pearson Correlation Coefficient tests showed little to no relationship with perception to barriers to care and the frequency of performing dietary counseling. Only a very weak relationship was shown to exist between levels of confidence and frequency in performing dietary counseling.

In summary, the survey shows only moderate levels of confidence in performing dietary counseling among participants with little to no difference in mean confidence levels between

various levels of degree achievement or years in practice. The frequency in providing dietary counseling among participants was also only moderate; however, little to no relationship was found between frequency and degree achievement, component affiliation, or perceived barriers to care. Finally only a weak relationship existed between levels of confidence and frequency of performing dietary counseling.

CHAPTER 5

CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Dental hygiene is the scientific and medical profession of recognizing, treating, and preventing oral diseases (ADHA, 2008). Providing preventive oral healthcare is a key aspect of a dental hygienist's services (Levy & Raab, 1993). This is primarily achieved by performing the role of clinician, educator, and researcher in the dental practice (ADHA, 2008).

Utah State Law allows dental hygienists to assess the dental hygiene status of their patients and provide dental hygiene care with the collaboration of the supervising dentist (Session Laws of Utah, 2012). According to the ADHA (2008) assessing the dental hygiene status of a patient requires performing a comprehensive individualized evaluation of the oral and general health status of a patient. This comprehensive evaluation includes reviewing the patient's health history and assessing his or her current health status. Inclusion of nutrition history and dietary practices is a significant aspect of a thorough evaluation (ADHA, 2008).

The ADA (2010) encourages dental professionals to maintain current knowledge of nutrition recommendations as they relate to general and oral health and disease and to educate and counsel patients about proper nutrition and oral health. The ADHA (2008) also supports a multiple-faceted approach to care including the encouragement of eating habits consistent with the Dietary Guidelines for Americans. The relationship between nutrition, infectious disease, and the immune system is synergistic. Infection may promote malnutrition, malnutrition elicits dysfunction in the immune system, and impaired immunity intensifies infection. Nutrition affects plaque, saliva, and the pH levels of the oral cavity. It also impacts systemic diseases, obesity, and inflammatory markers all of which have been shown to be associated with periodontal disease. Adequate and appropriate nutrient intake is needed for growth,

development, and maintenance of the oral tissues and for the prevention of dental caries, gingivitis, and periodontitis. Dental hygienists have been educated in these precepts and generally accept the importance of nutrition in oral health; however, previous researchers have noted that few dental hygienists routinely or systematically look for signs and symptoms of poor nutritional status in patients (Dwyer et al., 1991; Levy & Raab, 1993). Reporting multiple barriers to care, many hygienists fail to perform dietary screenings and nutritional counseling regardless of their training and education and research findings showing associations between nutrition intake and oral disease.

Research Questions

This study was guided by the following questions.

1. Is there a relationship between degree achievement and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
2. Is there a relationship between degree achievement and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
3. Is there a relationship between years in practice and confidence in providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
4. Is there a relationship between years in practice and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
5. Is there a relationship between component affiliation (see definition of terms) and barriers to care? If a relationship exists, what are the characteristics of that relationship?
6. Is there a relationship between component affiliation and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?

7. Is there a relationship between barriers to care and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
8. Is there a relationship between confidence in providing dietary counseling and frequency of counseling? If a relationship exists, what are the characteristics of that relationship?
9. Is there a relationship between barriers to care and frequency of providing dietary counseling? If a relationship exists, what are the characteristics of that relationship?
10. Is there a relationship between barriers to care and component affiliation? If a relationship exists, what are the characteristics of that relationship?

Conclusions

The Dietary Counseling Practices and Perceived Barriers among Utah Dental Hygienists study was conducted from September 2013 through November 2013. Members of the Utah Dental Hygienists' Association were the target population. A survey invitation was sent out to the 376 email contacts list of the UDHA. After rejecting incomplete surveys and participants who did not fit the design study, the final response rate was 8.51% with 32 participants. All participants were members of the Utah Dental Hygienists' Association working at least 4 hours a week in a general dental practice.

The results of this study showed the participants' overall mean score of confidence in providing dietary counseling to be 2.78 out of 4. Furthermore, the average score for frequency of performing dietary counseling was only 2.10 out of 4. And finally, the mean score for perception of barriers to providing dietary counseling was 2.36 out of 4, with 1 indicating very strong barriers to care.

While the mean confidence and frequency levels of the participants for performing dietary counseling were moderate, ANOVA tests showed little to no difference in confidence and frequency levels when differentiating between degree achievement, years in dental hygiene

practice, or component affiliation. Likewise there was little to no difference in the degree of perceived barriers when differentiating between component affiliations.

The Pearson Correlation Coefficient tests showed little to no relationship with perception to barriers to care and the frequency of performing dietary counseling. Only a very weak relationship was shown to exist between levels of confidence and frequency in performing dietary counseling.

In summary, the survey shows only moderate levels of confidence in performing dietary counseling among participants with little to no difference in mean confidence levels between various levels of degree achievement or years in practice. The frequency in providing dietary counseling among participants was also only moderate; however, little to no relationship was found between frequency and degree achievement, component affiliation, or perceived barriers to care. Finally only a weak relationship existed between levels of confidence and frequency of performing dietary counseling.

Discussion

The results of this study were formulated from a survey requiring volunteer participation. The low response rate of only 8.51% may have resulted from several factors. For example, Utah dental hygienists who are less likely to provide nutritional counseling may not have volunteered to participate. According to the Kaiser Family Foundation (2014) Utah adults have some of the lowest rates of obesity, diabetes, heart disease, smoking, and cancer when compared to adults in the rest of the nation. With overall health status better than the national average, Utah dental hygienists may not view nutritional counseling as a necessary part of the dental hygiene appointment and, therefore, may have chosen not to participate in a survey focused on nutrition.

In this case, the mean frequency score of Utah dental hygienists providing dietary counseling services may actually be even lower than the resulting low score of 2.10.

In addition to lack of interest in the survey subject, the consideration of time and effort involved in participating in a survey is also a major reason for subjects to decline participation (Ohme, Isaacs, & Trusheim, 2005). Hughes, Thompson, and Browning (2004) cited time constraints as a frequent barrier to providing secondary dental services such as nutritional screenings, hence it is likely that dental hygienists who already felt their schedules were overwhelmed were less likely to respond to this survey. Again, this may have affected the survey results as it is possible that only dental hygienists with low perceptions of barriers to care responded to the survey.

One more possible factor in the low response rate may be that dental hygienists with self-perceived low levels of confidence in nutritional knowledge and or counseling services may have shied away from participating in a survey focused on nutrition and dietary practices in the dental office. Mullen et al. (1988) and Pendharkar (2009) cited associations between levels of confidence and participation of related activities. Therefore, it is possible that only dental hygienists with higher levels of confidence in nutritional knowledge and dietary counseling volunteered to participate in the survey regarding such subjects. Again, this may indicate that the mean confidence in providing nutritional screenings and dietary counseling score of Utah dental hygienists is actually lower than 2.78.

While the response rate was relatively low and may have had some impact on the survey results, the mean scores are consistent with Levy and Rabb's (1993) findings. The researchers reported a mean frequency score of Oregon dental hygienists providing dietary counseling

services of 2.9, a mean confidence score of 2.6, and a mean barrier score of 2.4 (Levy & Raab, 1993).

ANOVA tests showed little to no difference in confidence or frequency levels when differentiating between degree achievements. These results indicate that although basic nutrition is a required course in the dental hygiene curriculum and dental hygienists are instructed in dietary screening and nutritional counseling during the clinical aspect of the program, expanded education in nutrition and further development of counseling skills may not be included in the curriculums of bachelor or master degree programs.

ANOVA tests also showed little to no difference in confidence levels or frequency levels when differentiating between years in dental hygiene practice. This may be due to a combination of factors. For example if a dental hygienist lacks the confidence to perform nutritional screenings and dietary counseling and sees them as elective services he or she may elect not to perform such services on a routine basis. Synergistically, if the same dental hygienist is not performing nutritional screenings and dietary counseling on a regular basis, he or she may never develop improved levels of confidence.

ANOVA tests showed little to no difference in frequency levels or the degree of perceived barriers when differentiating between component affiliations. This could be an indication of consistent attitudes regarding nutrition throughout the state or a consistency in the education and training in nutrition among various dental hygiene education centers. As stated earlier, Utahans in general have overall better health than other US citizens. When health statistics are evaluated individually by county, the range of scores is minimal. For example, according to the University of Wisconsin Population Health Institute (2013) the percentage of the Utah population with diabetes ranged between 4% and 10% by county and adult obesity

ranged between 16% and 30% by county. The greatest variance in percentage points between counties reported on the site was for adults who smoked with a range of 5%-21% (University of Wisconsin Population Health Institute, 2013).

Accreditations for dental programs are based on national standards. The results of the ANOVA test showing little to no difference in frequency levels or the degree of perceived barriers when differentiating between component affiliations may also reflect an adherence to national education standards and consistency in curriculums among various dental hygiene programs. Likewise, because many perceived barriers are dependent on employment settings and supervising dentists' support, these results may also indicate a consistency in curriculums among various dental schools.

No previous research could be found regarding the relationship between frequency, confidence, and perceived barriers of providing nutritional screenings and dietary counseling among dental professionals when compared to degree achievement, years in practice, or geographic location. Other studies have focused on the relationship between barriers to care, frequency of performing secondary dental services, and confidence levels in performing such services. Curran et al. (2010) found lack of confidence in providing counseling as a perceived barrier to care. They also reported that barriers to care influenced the frequency of providing specific services. Mullen et al. (1988) likewise reported an association with dental hygienists' self-confidence in health promotion counseling and counseling activity.

The Pearson Correlation Coefficient tests in this study showed little to no relationship with perception to barriers to care and the frequency of performing dietary counseling and only a very weak relationship was shown to exist between levels of confidence and frequency in performing dietary counseling. Findings in this study may not be consistent with findings of

other similar studies due to the low response rate of 8.51% with only 32 participants. According to Cottrell and McKenzie (2011) the minimum sample size of a population should never be lower than 30 and the greater the sample size the greater the proximity to the study population. In other words a greater number of participants may have produced study results more clearly resembling those of previous studies. Additionally, when computing correlations, low variability in one or both variables decreases the likelihood of finding a correlation (Salkind, 2011). The standard deviation for all three categories was relatively low, confidence =.494, frequency =.542, and perceived barriers =.401. This minimal amount of variability may have been due to a lack of diversity in the sample due to its small size or it may have been a result of the limited range in score possibilities in the survey design.

Recommendations

Recommendations for Practice or Implementation

Performing nutritional screenings and providing dietary counseling is a significant aspect of a thorough dental hygiene appointment and yet this study indicates the service is infrequently being offered to patients by members of the Utah dental hygienists' association. With nutrition awareness and promotion on the rise nationally, dental hygienists should be making more efforts to provide this service to every patient at every dental hygiene appointment. Furthermore as research continues to develop the understanding of the relationships between nutrition, systemic health, and oral health, dental hygienists failing to implement this service in their dental care routines may find themselves liable for malpractice.

The lack of confidence in performing dietary counseling is alarming. National accreditation standards dictate the minimum requirements for nutrition education in a dental hygiene program. The consistency of low confidence levels among different geographical

regions in the study may indicate a need to re-evaluate the national dental hygiene education standards for nutrition. Furthermore, dental hygienists lacking confidence in this service should seek out further training and education as part of their yearly continuing education requirements.

Barriers to care for secondary dental hygiene services continues to deter dental hygienists from performing services that should be included as a part of the standard of care. The mean score of Utah dental hygienists in this study indicated a strong perception of barriers to providing nutritional screenings and dietary counseling to patients. As nutrition is associated with systemic and oral health, dental hygienists should collaborate with their supervising dentists to minimize barriers to care. For example, cost effectiveness of nutritional counseling is a reported barrier to care but may be offset with the use of ADA CDT code D1310. This code described as “Nutritional counseling for control of dental disease” allows for the counseling on food selection and dietary habits as a part of treatment and control of periodontal disease and caries (Delta Dental, 2014). Although not covered by most insurance plans, this service may be well accepted by patients when presented as a preventive measure against more costly procedures such as fillings and periodontal services.

In addition to efforts on an individual scale, national affiliations such as the American Dental Association and the American Dental Hygienists’ Association should increase efforts to promote nutritional screenings and dietary counseling as routine services in dental hygiene practice. Such efforts could include applying pressure on insurance companies to cover ADA code D1310 along with other preventive dental services such as sealants and fluoride. Also, promotion of public awareness to the need for and availability of these services through advertising could increase public expectations and demand for nutritional screenings and dietary counseling as part of their routine dental check-ups.

Recommendation for Improving the Research

This was a quantitative study based on survey results in multiple categories. Answers in each category were than averaged and compared to other categories. While this approach allowed the researcher to generalize about the study results, specific details of the study were lost that could have an impact on the dental profession. For example, while no significant difference was found in the mean level of confidence based upon degree level, the results may have differed when comparing individual questions in the confidence category with the varying degree achievements.

The design of the survey limited the responses for frequency intervals, confidence levels, and perceived barriers to four possible choices. This limited range of 1-4 decreased the variability spread of each category possibility limiting the resulting associations between categories. Increasing the scale range for responses may serve to more clearly define possible associations between variables.

Lastly, although 376 invitations to participate were sent out with multiple reminders the response rate was significantly low at only 8.51%. The low sample size may have affected the results of the study and decreased the likelihood of accurately reflecting the population. Alternative methods of collecting data such as paper surveys distributed at component meetings or state dental conventions may have improved response rates. Also including incentives for participation such as prize drawings may have increased response success.

Recommendations for Future Research

The overall mean scores for providing nutritional screening and dietary counseling indicate a need for more research in this area. Future studies could include larger population samples such as all Utah dental hygienists or all members of the American Dental Hygienists

Association. Studies focused solely on frequency intervals, or confidence levels, or barriers to providing nutritional dental hygiene services are warranted to better understand the scope of each individual variable. Additionally, qualitative studies could help the profession better understand the reasoning individual hygienists have in excluding or including nutritional screenings and dietary counseling and may identify variables not considered in this study.

Finally, dental hygienists and their dental hygiene practices are influenced by others including supervising dentists, dental hygiene educators, dental hygienists' associations, and dental patients. It would be valuable for future studies in this field to explore the associations between these influencers and nutritional screening and dietary counseling practices.

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APPENDICES

Appendix A
Research Survey

Demographic Information

1. Degree achievement and Institution (please specify all that apply)

Associate degree	<input type="text"/>
Bachelor degree	<input type="text"/>
Master degree	<input type="text"/>
Doctorate degree	<input type="text"/>

2. How many years have you practiced dental hygiene?

- 0-3
- 4-8
- 9-15
- 16-35
- 35+

3. Which component of the Utah dental hygienists' association are you affiliated with?

- Northern
- Salt Lake
- Central
- Southern

4. In a typical week, how many hours do you practice dental hygiene?

- 0-3
- 4-19
- 20-32
- 32+

5. At which type of dental practice(s) are you currently employed? (Check all that apply)

- General
- Periodontic
- Pediatric

Other (please specify)

Nutritional Counseling

6. Rate the frequency you-

	Never	Seldom	Sometimes	Often
ask a patient to record his/her food intake for a given period of time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
evaluate patients' diet for nutritional adequacy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
give patients information related to the food they eat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
recommend dietary modifications based on patients' present diets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
refer patients to nutrition professionals, e.g., registered dietitians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*

7. Rate the frequency you discuss the following nutritional topics in relation to oral health with your patients.

	Never	Seldom	Sometimes	Often
Diet and Caries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition and periodontal disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition and tissue healing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition and development of oral structures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrient functions in the body	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of vitamin/mineral supplements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My Plate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dietary guidelines for Americans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recommended Dietary Allowances	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutritional labeling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*

8. Rate the following statements related to your personal practice of dental hygiene.

	Strongly Disagree	Disagree	Agree	Strongly Agree
When patients ask questions about nutrition I feel prepared to answer them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I feel confident in recommending dietary modifications to my patients.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I developed adequate counseling skills through my dental hygiene curriculum.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel confident in my knowledge of nutrition.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*

9. Rate the following statements related to your dental practice of employment.

	Strongly Disagree	Disagree	Agree	Strongly Disagree
The dental practice supports the concept of dietary counseling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dietary counseling is considered cost effective for the dental practice.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of insurance reimbursement is not an obstacle to dietary counseling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dietary counseling is likely to be well received by my dental patients.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is ample time during each dental hygiene appointment to perform dietary counseling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B
Permission to use Research Survey

Dear Natalie,

As requested, I am giving you permission to use the research survey from my study, Dental Hygienists and Dietary Counseling: Extent and Quality, 1990.

I would love to read your study when you complete it. Best of luck!

Sincerely,
Theresa Richards

[Theresa Levy Richards, D.Ed.](#)
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Office of Learning
Oregon Department of Education
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E-mail: Theresa.richards@state.or.us
Phone: 503-947-5736

Appendix C Invitation and Informed Consent for Participant

Utah Dental Hygienists Association member,

You are invited to participate in a research study being conducted by Natalie F. Carlson, a master's degree candidate at East Tennessee State University, in Johnson City, Tennessee. The survey is the basis for a research project that will examine the dietary screening and nutritional counseling practices and perceived barriers to such practices by Utah dental hygienists. Your participation involves completing an on-line survey that should only take 10-15 minutes of your time. Please note that all of your responses will be completely anonymous and no identifying information will be collected. Participation is voluntary and you may refuse to participate or quit at any time. Results of the research project will be used for scholarly purposes only and may be provided to persons outside the study for the purposes of improving oral health care practices.

If you have any questions or concerns about this research project, please contact:

Natalie F. Carlson, RDH

(801) 549-7143

carlsonn@goldmail.etsu.edu

By clicking on the link below, I acknowledge the following:

1. I am 18 years of age or older.
2. I am a member of the Utah Dental Hygiene Association.
3. I am currently employed as a dental hygienist in the State of Utah.
4. I have read and understand this informed consent document.
5. I voluntarily agree to participate in the research study.

To participate in the research project, click the link below:

<http://www.surveymonkey.com/s.aspx>

Please note: If you do not wish to receive further emails from us, please click here

<http://www.surveymonkey.com/optout.aspx> and you will be automatically removed from our mailing list.

Appendix D Follow Up

Two weeks ago, a notice regarding a survey of Utah Dental Hygienists Dietary Screening and Nutritional Counseling Practices was emailed to you.

If you have already completed the survey, please accept my sincere appreciation for doing so. If not, please complete the survey today. Your answers are extremely important to our profession and the overall oral health of our community.

If by some chance you did not receive the survey request, or if it was mistakenly deleted, I have included the original message along with the survey link below.

Original message-

You are invited to participate in a research study being conducted by Natalie F. Carlson, a master's degree candidate at East Tennessee State University, in Johnson City, Tennessee. The survey is the basis for a research project that will examine the dietary screening and nutritional counseling practices and perceived barriers to such practices by Utah dental hygienists. Your participation involves completing an on-line survey that should only take 10-15 minutes of your time. Please note that all of your responses will be completely anonymous and no identifying information will be collected. Participation is voluntary and you may refuse to participate or quit at any time.

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If by some chance you did not receive the survey request, or if it was mistakenly deleted, please e-mail me at carlsonn@goldmail.etsu.edu and I will send you another one today. Thank you!

Natalie F Carlson, RDH, BS
Master's Candidate, East Tennessee State University

VITA

NATALIE FLYNN CARLSON

Education: Public Schools, Bountiful, Utah

A.A.S Dental Hygiene, University of Alaska, Anchorage, Alaska
2005

B.S. Dental Hygiene, East Tennessee State University, Johnson
City, Tennessee 2010

M.S. Allied Health, East Tennessee State University, Johnson City,
Tennessee 2014

Professional Experience: Dental Assistant, Flynn Dentistry, Bountiful, Utah 1999-2002

Dental Hygienist, Dr. James Yassik, Eagle River, Alaska 2005-
2005

Dental Hygienist, Flynn Dentistry, Kaysville, Utah 2006-2012

Administrator, Flynn Dentistry, Bountiful 2012-2013