Knowledge and Perceptions of Vitamin D among College Females Age 18-22 Years

by

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Abstract

The purpose of this study is to assess the knowledge and perceptions regarding vitamin D among female college students, age 18-22, at a public university in the southeastern US. The study is a cross sectional design utilizing a qualitative method (focus groups) to create detailed descriptions of the knowledge and perceptions that college-age women have regarding vitamin D at a public university in South Carolina. A total of 22 undergraduate females participated in focus groups and personal interviews. Main outcome measures were knowledge and perceptions of supplements and vitamin D, as well as understanding college sources of health information and ways college students would disseminate messages about vitamin D. Data analysis was done by calculating mean and standard deviation found for continuous variables, percentage and frequency found for categorical variables, and by the creation of a codebook for focus groups themes. Results determined that college females have a broad knowledge of vitamin D, its sources, and its roles in the body. Further research is warranted in other racial and ethnic populations.

Preface

The views expressed in this paper are those of the author and do not reflect the University of South Carolina, its faculty, staff, or students.

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Chapter I

Introduction

Problem Identification

Vitamin D deficiency in the United States (US) was once thought to have been resolved through milk fortification, but now vitamin D deficiency is present in many children and adults (Holick, 2007). Vitamin D is now being linked to decreasing the risk of many chronic diseases and conditions, such as breast cancer, cardiovascular disease, diabetes, bone health, and depression (Holick, 2007).

Problem Definition

There are not many foods that naturally contain vitamin D, and few foods are fortified either, but a diet high in fatty fish (tuna, salmon, and mackerel) has been shown to prevent vitamin D deficiency (Holick, 2007; IOM, 1997.). In the US, fortified foods provide most of the vitamin D in our diets. A milk fortification program in the 1930's was established to combat rickets. Rickets is a disease caused by low calcium, phosphate, or vitamin D levels, which leads to the softening and weakening of the bones (Wharton & Bishop, 2003). However, the intake and popularity of milk often decreases in women during the teen years (Lytle, 2002). Osteoporosis is also a concern of nutritional adequacy, especially of vitamin D and calcium, and it is an increasing public health problem. College students are still in the influential years for attaining peak bone mass,

and osteoporosis could become problem for them later in life (National Institute of Health [NIH], 2000).

In addition to dairy products, other vitamin D fortified foods include breakfast cereals, orange juice, yogurt, and some margarines (IOM, 1997). Sunlight is another good source of vitamin D for some people because Ultraviolet B (UVB) radiation can penetrate the skin and eventually be converted into vitamin D (Peterlik, Boonen, Cross, & Lamberg- Allardt, 2009). Factors that affect ultraviolet radiation exposure and vitamin D synthesis include: time of day, latitude, geographic location, cloud cover, smog, melanin content in the skin, and sunscreen use. Research has suggested that about 5-30 minutes of sun exposure at least two times per week to the face, legs, arms, or back without sunscreen usually produces sufficient vitamin D (Holick, 2007). For example, in someone with fair skin, a 30 minute, full body exposure to sun in the summer at noon will cause the release of 20,000 IU of vitamin D into circulation. In someone with dark skin, the same amount of sun at the same time in the summer would create about half as much vitamin D (Giovannucci, n.d.). Tanning beds that emit 2% to 6% UVB radiation can also be effective (Holick, 2007). However, it is very important to be careful when making recommendations about sun exposure to increase vitamin D as too much sun exposure has many downsides, such as skin cancer and early aging (Giovannucci, n.d). Skin cancer accounts for almost 50% of all cancers in the US, and it is the most common type of cancer. There are more than one million cases of non-melanoma skin cancer found every year, and the American Cancer Society (ACS) estimated that 68,720 new cases of melanoma will be diagnosed in the US in 2009. One of the most common risk factors for

skin cancer is unprotected and/or excessive exposure to UV radiation (American Cancer Society, 2009).

Vitamin D deficiency has been found to be more predominant in certain populations of the US. It is more common in African Americans (AA) and least common among whites (McKinney, Breitkopf, & Berenson, 2008). Dietary intake of vitamin D has also been found to be different across various racial and ethnic groups. According to the National Health and Nutrition Examination Survey (NHANES) 1999-2000, few women ages 19-50 years old, or men and women over 51 years old, get the recommended vitamin D levels from food. In addition, the average dietary intake of vitamin D from food and supplements were consistently highest in white populations (Moore, Murphy, & Holick, 2005). Dairy foods can be good sources of vitamin D through fortification; however, a study using National Health and Nutrition Examination Survey [NHANES] 1999-2000 data found that AA women consume less milk, cheese, and yogurt than non-AA women (Fulgoni, 2007). Lactose intolerance can be a problem for many people, and can cause lower intake of dairy products, and thus also both calcium and vitamin D, than among people who are not lactose intolerant (Buchowski, Semenya, & Johnson, 2002). Lactose intolerance is caused by a deficiency of lactase, an enzyme that breaks down lactose. Lactose intolerance can be confused with a milk allergy, but milk allergies usually appear in the first years of life, while lactose intolerance typically occurs in adulthood (National Digestive Diseases Information Clearinghouse [NDDIC], 2009). Also, low dairy intakes may occur in vegans, who do not eat any animal products, as well as ovo-vegetarians, who do not eat meat or dairy. Due to decreased dairy intake, vegans and ovo-vegetarians should pay special attention to their vitamin D intake. Since they do

not consume fish or dairy, it is especially important for them to receive their vitamin D from fortified foods, fortified soy products, and supplements (Center for Young Women's Health, 2009). It is very important for the public to have a greater understanding of vitamin D to decrease deficiencies through knowledge and awareness of the populations at highest risk as well as sources of vitamin D.

Formal Statement of the Problem

Objectives

The aim of this research is to assess the knowledge and perceptions regarding vitamin D among female college students, age 18-22, at the University of South Carolina, Columbia.

Research Questions

Research Question 1:
What do college-age women, aged 18-22 years old, know about vitamin D?

Research Question 2:
What do college-age women, aged 18-22 years old, know about dietary supplements?

Research Question 3:
What do college-age women, aged 18-22 years old, know about the health consequences attributed to vitamin D deficiency?

Research Question 4:
What do college-age women, aged 18-22 years old, know about the food and non-food sources of vitamin D?

Research Question 5:
Is there a difference in knowledge & perceptions of dairy foods in African American students and non-Hispanic white students?

Research Question 6:
What are college-age women, aged 18-22 years old, practicing in terms of behaviors (i.e., dietary intakes, sun exposure, and general health) related to vitamin D?

Justification of Research

The proposed research will add to the body of science in the knowledge and perceptions of vitamin D that college women have. More specifically, this research will add insight into the knowledge that college women possess about vitamin D; supplements; food and non-food sources of vitamin D; health consequences of vitamin D deficiency; and sources of health information. A lack of knowledge about vitamin D, its sources (food and non-food), and the consequences of deficiency can have implications on a person's intake of vitamin D. The intake (or lack of) can have public health consequences, as research has shown the effect that vitamin D deficiency can have on chronic disease. The information found in this research will also add to the literature regarding vitamin D and college women with regard to both their sun exposure and tanning bed use. As this time, there is limited research on the knowledge and perceptions of vitamin D in a college-age female population.

Preview

Chapter 2 will provide a literature review of vitamin D deficiency among various racial and ethnic groups; vitamin D's impact on health; vitamin D and its relationship with obesity; vitamin D and mood/depression; vitamin D and teens and young adults; supplement use; dairy intake; and college students and health information. Chapter 3 will discuss the methodology of the research in which college women, age 18-22, will answer a 16-item questionnaire on variables related to demographics, sun exposure, diet, and health behaviors. Chapter 4 will consist of the manuscript for submittal to potential

journals of interest. Chapter 5 will present a summary of the research, implications, and practice recommendations.

Chapter II

Literature Review

Introduction

It is becoming more and more clear from recent research that vitamin D has a protective factor against many chronic diseases and conditions, such as cardiovascular disease, diabetes and some cancers (Holick, 2004.). Getting adequate vitamin D intake from food alone can be difficult, so both the consumption of fortified foods and supplements, and being exposed to sunlight is essential for the maintenance of adequate vitamin D status. Teens and young adults, people with dark skin, populations with limited sun exposure, and obese individuals are all at greater risk for developing a vitamin D deficiency (Peterlik, Boonen, Cross, & Lamberg- Allardt, 2009). Therefore, the literature selected for review includes research among various racial and ethnic groups, health impacts, obesity, mood/depression, and teens and young adults. Vitamin D status should be promoted among college students to increase vitamin D status because of the possible health benefits, low cost and low risk of supplementation. This literature review is organized by topic area: vitamin D and impact on health, vitamin D deficiency among racial and ethnic groups, vitamin D and its relationship with obesity, vitamin D and mood/depression, vitamin D and teens and young adults, supplement usage, dairy intake, and college students and health information.

Vitamin D is a fat soluble vitamin that humans can receive from sunlight exposure, from their diet, and from dietary supplements. Vitamin D plays many vital roles in the body, including the promotion of calcium absorption, neuromuscular and immune function, and inflammation reduction (van den Berg, 1997.). There are few foods that either naturally contain or are fortified with vitamin D. Vitamin D comes in two forms, vitamin D_2 or D_3; both are found in over-the-counter vitamin D supplements, but vitamin D_2 is found in prescriptions in the US (Holick, 2007).

The best indicator of vitamin D status is the serum concentration of 25(OH)D, which reflects both vitamin D made cutaneously and vitamin D from food and supplements (Institute of Medicine[IOM], 1997). There have been many recent discussions regarding the serum 25(OH)D concentrations for vitamin D deficiency, adequacy for healthy bones, and overall health. According to Vieth, et al (2007), serum 25(OH)D less than 15ng/mL (or <37.5nmol/L) is considered inadequate. Currently, the Food and Nutrition Board (FNB) at the IOM suggests that serum 25(OH)D levels less than 10-11ng/mL (or 25-27.5nmol/L) is considered a vitamin D deficiency and can lead to rickets in infants and children and osteomalacia in adults. The IOM also suggests that serum 25(OH)D levels less than10-15ng/mL (or 25-37.5nmol/L) is considered inadequate for bone and overall health in healthy people. The current recommendation for serum 25(OH)D levels is greater than 15ng/mL (or >37.5nmol/L) (IOM, 1997), which is considered adequate for bone and overall health in healthy people. However some scientists and researchers think that higher levels are needed for overall health (>30ng/mL or >75nmol/L), but there is not enough current data to support the claim (Scientific Advisory Committee on Nutrition, 2007).

The current Adequate Intake (AI) for vitamin D is 200IU's for women age 19-50 years old. The AI was established by FNB, and an AI is created when there is not enough evidence to create a Recommended Dietary Allowance (RDA) (IOM, 1997). Recently, the American Academy of Pediatrics stated that 400IU/day of vitamin D in pediatric and adolescent populations is appropriate (Wagner & Greer, 2008). Also, in 2008, the FNB established an expert committee to review the current Daily Reference Intakes (DRI) for vitamin D, and the report is expected to be available in May 2010.

Vitamin D and its impact on health

Vitamin D deficiency has been associated with higher risks of many diseases, such as cardiovascular disease (CVD), hypertension, cancers (including breast cancer), diabetes and bone health (Holick, 2006), but mounting evidence suggests that increasing vitamin D intake can decrease the risk of these diseases. This information is important for college females to understand given that the health behaviors they practice as young adults may have a serious impact on their health later..

Cardiovascular Disease

Although it is not completely known why vitamin D sufficiency protects against cardiovascular disease (CVD), it is thought there may be many mechanisms (Holick, 2005). A study by Zittermann, et al (2009) examined the effect of vitamin D on weight loss and cardiovascular disease markers in overweight subjects. Subjects who were healthy, but overweight, were given a vitamin D supplement of 83µg or a placebo for 12 months as part of a weight reduction program. The vitamin D supplement and placebo were given in a double-blind manner. The results showed that weight loss was not

significantly affected by the vitamin D or the placebo. In the vitamin D group, the mean 25(OH)D and calcitrol concentration increased by 55.5mmol/L and 40.0pmol/K, respectively. In the placebo, the 25(OH)D and calcitrol levels increased by 11.8nmol/L and 9.3pmol/L, respectively. Also, there was a great decrease in blood concentrations of the beneficial biochemical markers of parathyroid hormone, triglycerides, and the inflammation tumor marker necrosis factor in the vitamin D group. These results show the vitamin D supplementation of 83μg positively affects weight loss and significantly improves many cardiovascular disease markers.

A cross-sectional study was conducted by Kendrick, Targher, Smits, and Chonchol (2008) using data from NHANES III. This study examined the association between serum 25(OH)D levels and prevalence of cardiovascular disease (CVD). The sample used was a representative population-based sample of 16,603 men and women who were ≥18 years old. It was found that 8% of subjects had a history of CVD, 4.1% had a history of angina, 3.2% had a history of MI, and 1.9% had a history of stroke. The prevalence of 25(OH)D deficiency (>20ng/ml) was 22%. Participants with CVD had a higher frequency of 25(OH)D deficiency than those without CVD. Also, the mean serum 25(OH)D concentrations were significantly lower ($p<0.0001$) in participants with CVD than those without. The increase of the prevalence of CVD with lowering levels of 25(OH)D was linear, which suggests a dose-effect relationship. Finally, after adjusting for a variety of variables, participants with 25(OH)D deficiency had a 20% increased odds of CVD ($P=0.03$). These findings point to a strong and independent relationship between 25(OH)D deficiency and prevalent CVD in a large representative sample of adults in the US.

Another study examining vitamin D deficiency and the risk of CVD was conducted by Wang et al (2008). The study assessed Framingham Offspring Study participants to determine if vitamin D deficiency unfavorably affects CVD. There was a significant association found between 25(OH)D deficiency and CVD (P=0.01). When vitamin D status was divided into three categories (≥15, 10 to ≤15, and <10ng/mL), there was an increase in risk of CVD across the categories (P=0.01). In participants who had hypertension, vitamin D <15ng/mL was associated with cardiovascular events (P=0.03). A significant interaction was found between 25(OH)D levels and hypertension (P=0.015), and a significant association was found between 25(OH)D and risk of CVD in participants with hypertension (P=0.03). These results show a higher risk of CVD with vitamin D deficiency, especially in people who have hypertension. Similarly, it has also been noted in another study that patients with CVD are more likely to develop heart failure if they are deficient in vitamin D (Zitterman et al., 2003). Another study found that patients with peripheral vascular disease and lower leg pain were often found to be vitamin D deficient, and the deficiency was found to be causing muscle weakness and the pain (Fahrleitner et al., 2002).

An association among dairy products, calcium, and vitamin D with the incidence of hypertension was the topic assessed by Wang, Manson, Buring, Lee, and Sesso (2008). The Women's Health Study (WHS) was a randomized, double-blind, placebo-controlled trial that assessed the risks and benefits on low-dose aspirin and vitamin E in the primary prevention of cardiovascular disease. A total of 28,886 women were assessed, with a mean age equal to 53.8 years old. The median intake of total dairy products varied from 0.56 servings to 3.69 servings/day. In the ten years of follow-up, 8710 cases of incident

hypertension were identified. With the consumption of the four major dairy products, there was a reduction of 10% to 15% in hypertension risk when the highest intake category was compared to the lowest category, but the reduction was only statistically significant for yogurt (P=0.005) and skim milk (P<0.0001). There was no significant interaction found between total, individual low fat dairy intake with BMI, alcohol intake, physical activity, or blood pressure at baseline. Hypertension risk decreased with the higher quintiles of dietary calcium and vitamin, but there was no change with vitamin D or calcium supplements. The results of the study found an inverse association (higher consumption, lower HTN) with dairy products, calcium and vitamin D in middle-age and older women, which suggests their potential role in the prevention of hypertension and cardiovascular problems. Given that heart disease is the number one cause of death among women in the US (Medline Plus, 2010), it is important for young women to be aware of the link between vitamin D and heart disease.

Metabolic Syndrome and Diabetes

Vitamin D deficiency has also been shown to have an effect on metabolic syndrome. Participants in the 1958 British Birth Cohort were surveyed between 2002 and 2004 in a cross-sectional study. This study found that the prevalence of metabolic syndrome was lowest for the highest tertile of 25(OH)D (Hyppönen, Boucher, Berry, and Power, 2008). As far as having an effect on glucose levels and diabetes, Need, O'Loughkin, Horowitz, and Nordin (2005) observed postmenopausal women attending an outpatient clinic, and found that fasting glucose was inversely related to 25(OH)D level (P<0.01). Another study by Pittas et al (2006), as part of the Burse's Health Study, observed women to determine an association between vitamin D and calcium intake and

the risk of type 2 diabetes. There was a significant inverse association found between vitamin D intake and diabetes. Women who took 800IU or greater of vitamin D each day had a 23% lower risk for developing diabetes when compared with the women who took <200IU/day. The women who took a vitamin D supplement of ≥400IU/day had a 13% lower risk of diabetes than the women who took ≤100IU/day. Women with the highest vitamin D (>800IU/day) and the highest calcium (>1,200mg/day) had the lowest risk of diabetes. Finally, it was found that women who consumed three or more servings of dairy each day had an 11% lower risk of developing type 2 diabetes than those who consumed less than one serving per day. These results show that vitamin D and calcium are inversely associated with developing type 2 diabetes, and the benefits seem to additive. Once again, with the number of young women who are overweight or obese increasing (National Institute for Healthcare Management Institute, 2004) , it is essential to understand the possible protective effects of vitamin D with regard to metabolic syndrome and diabetes.

Breast Cancer

Although direct evidence of association between vitamin D and breast cancer is limited, there are studies that show a relationship between the two. A study by Rossi, et. al (2008) assessed the relationship between breast cancer and dietary intake of vitamin D. Researchers used data from a case-control study done in Italy from June 1991 to April 1994, and subjects were 2569 women with histologically conformed breast cancer and 2588 controls with no incidence of breast cancer. Results showed that no trend is found up to the seventh decile. Vitamin D intake after the seventh decile (>3.57 µg or 143 IU) seems to have a 'favorable effect' on breast cancer. There is a significant effect above the

ninth decile, which indicates a threshold effect. In this study, it was found that there was an inverse association between vitamin D intake and breast cancer in the three highest deciles, which supports existing evidence that high levels of vitamin D intake are associated with decreased risk for breast cancers.

A similar study by Abbas et al (2007) set out to assess the association of 25(OH)D with the risk of post-menopausal breast cancer. Data used was from a large population-based case-control study, called the MARIE study (Mamma Carcinoma Risk factor Investigation) in Germany, which recruited women, age 50-74, who were incident breast cancer patients. Researchers found a significant inverse association between the risk of post-menopausal breast cancer and serum 25(OH)D. When compared with the lowest category (<30nM), the odds ratios (OR) for the higher serum concentration were 0.57 and 0.31, respectively. For women who never used menopausal hormone therapy (HT), the association was stronger than compared with past and current HT users. The study also found a stronger protective effect for post-menopausal breast cancers via better supply of vitamin D as illustrated by serum 25(OH)D measurements and a stronger inverse association in women with low serum 25(OH)D concentrations (<50nM). Also, Garland et al (2007) lead a pooled, dose-response analysis of two case-control studies where women who had breast cancer had significantly lower 25(OH)D levels from the control groups. It was also noted that a 25(OH)D level of 52ng/mL (30nmol/L) had a 50% lower risk for developing breast cancer when compared to women whose levels were less than 13ng/mL (32.5nmol/L). To achieve a 25(OH)D a higher 25(OH)D level of 52ng/mL, about 4,000IU of vitamin D would need to be consumed on a daily basis, or 2,000IU of vitamin D with very moderate exposure to the sun. The results of these two

studies regarding vitamin D and breast cancer may be relevant to female college students especially given the fact that breast cancer awareness is already a focus of college health programming, especially in the month of October which is Breast Cancer Awareness Month (cite). Some college women who are already aware of their own risk for breast cancer because of the diagnosis of a family member or friend may be especially receptive to messaging that highlights to possible link between vitamin D and breast cancer prevention.

Vitamin D and Bone Health

Osteoporosis is important for college females to think about at an early age, since college students are still in the influential years for attaining peak bone mass, which are 20-30 years of age (National Institute of Health [NIH], 2000). Osteoporosis is usually associated with low calcium intakes but inadequate vitamin D can affect bone health and can contribute to osteoporosis by decreasing the absorption of calcium (Heaney, 2003). Understanding the connection between vitamin D and bone health is a critical piece of information for college age women to understand.

Adequate vitamin D levels can preserve bone strength and might help prevent osteoporosis in older adults and post-menopausal women (LeBoff, 1999). A study by Basaran, Guzel, Coskun-Benlidayi, and Guler-Uysal (2007) sought to determine whether vitamin D status has any affect of quality of life (QOL) in women with osteoporosis. Of the 259 patients included in the study, 78.8% were already receiving treatment for their osteoporosis; therefore, vitamin D levels were compared between patients receiving treatment and not receiving treatment. Vitamin D levels were found to correlate with all

subscales and total score of the Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO) (P=0.0001). It was found that 132 patients (51%) had vitamin D insufficiency (<20ng/mL). Of the patients who were vitamin D deficient (<12ng/mL), all subscales and total QOL were lower compared to the groups that had vitamin D levels of ≥12 and <20ng/ml and ≥20ng/ml (P=0.0001). Vitamin D level was determined to be a significant factor that affects QOL total score and physical function subscale in this population.

There have been many recent studies assessing whether or not calcium and vitamin D supplements will lower fracture risk in adults. A study by Grados et al (2003) was conducted to evaluate the effects of vitamin D and calcium supplements on bone mineral density (BMD) and laboratory parameters in vitamin D deficient elderly women. The women were randomized into both a supplemental group and placebo group. There was a statistically significant increase in 25(OH)D levels in the supplemental group compared to the placebo group (P <0.0001). BMD was significantly increased in the supplemental group in various areas of the body: the femoral neck (P =0.015), the trochanter (P =0.015), and the whole body (P =0.01). Finally, it was found that the median decrease in main bone markers was significantly higher in the supplemental group than in the placebo group. These results show that supplemental calcium and vitamin D in women who are vitamin D deficient can increase bone mass significantly in different areas of the body, as well as improve bone markers.

Similarly, a study by Daniele et al (2004) assessed the outcomes of both calcium and vitamin D supplements on BMD and bone mineral content (BMC) over a 30-month period. The sample included 120 women over 45 years old who were either peri-

menopausal or post-menopausal. Changes in total BMD for the treatment group were significantly different from the changes in the placebo group ($P<0.005$). Also, significantly different were found between the BMD of the groups at 15 months and at 30 months ($P<0.005$). The BMD in the placebo group actually decreased at a rate of 0.4% per year. The results of this study are similar to the Grados et al (2003) study in that calcium and vitamin D supplements can be beneficial to the bone health of women. Female college students must understand how vulnerable women are to osteoporosis, especially in regard to the connection between vitamin D and calcium and bone density.

Vitamin D deficiency among racial and ethnic groups

Low levels of vitamin D are common in nonwhite populations, as well as populations with low dietary intake, low supplemental intake, or minimal sun exposure (Holick, 2004). When looking at the differences among racial and ethnic groups, many studies have found great differences in vitamin D levels. A study by Egan, et al (2008) aimed to determine the prevalence of vitamin D insufficiency in AA and white residents in the southeastern United States (US). Vitamin D deficiency was found in a large segment of the AA sample that was studied, even among those living in the South and those who met the recommendations for vitamin D intake. Among 395 adults aged 40-79, vitamin D deficiency was found in 45% of AA's and 11% of whites. Vitamin D intake from diet and supplements caused small increases in the levels of hydroxyvitamin D [25(OH)D], which is the circulating form of vitamin D. However, vitamin D deficiency was still found in 32% of AA's who had an intake of >400IU/day. Among AA women, body mass index (BMI) was determined to be a strong forecaster of vitamin D deficiency risk, and exposure to ultraviolet radiation (UVR) estimated by housing location was

positively associated with 25(OH)D levels in all groups except white women. Housing location means that the measurements were taken at a monitoring station that was closest to the participant's house, but could still be a significant distance away.

A cross-sectional study by McKinney, Breitkopf, and Berenson (2008) sought to find an estimate of the status of vitamin D in young women, age 16 to 33, living in south-east Texas and to establish factors to predict 25(OH)D concentration. Eight hundred non-Hispanic white, non-Hispanic black and Hispanic women who were seen in an outpatient clinic were assessed. Information on race, smoking, exercise and dietary intake of vitamin D was collected. The relationship between 25(OH)D and percentage total body fat (%TBF), season, race, BMI, dietary vitamin D, age, and smoking was established. Smoking status was reported in pack years. Results found that serum 25(OH)D levels were significantly different among racial groups ($P<0.001$). The lowest levels were found in non-Hispanic blacks (37.7nmol/L), and the highest levels were found in non-Hispanic whites (71.8nmol/L). Serum 25(OH)D was negatively correlated with %TBF, body mass index (BMI), and total body fat (TBF) ($P<0.01$), and positively correlated to vitamin D intake and pack years of smoking ($P<0.01$). Summer months were shown to have higher serum 25(OH)D values than winter months. Based on the results, the researchers conclude that a positive environment does not result in an adequate vitamin D status for young women, especially Hispanic, non-Hispanic blacks, and obese individuals. As recent data from shows that AA's are 1.4 times more likely to be obese than non-Hispanic whites (Office of Minority Health, 2009), it is important for minority populations to be aware of the relationship between obesity, race, and vitamin D.

A study by Gozdzik et al (2008) evaluated the vitamin D intake of young adults of diverse descent in wintertime Canada to assess the impact of skin pigmentation and dietary intake on serum 25(OH)D levels. There were 107 subjects (58 females and 49 males) recruited from the University of Toronto during wintertime 2007. Results showed that the mean serum 25(OH)D concentration was highest in Europeans (55.9nmol/L), followed by East Asians (34.5nmol/L), and was lowest in South Asians (30.5). Optimal 25(OH)D concentrations were defined as >75nmol/L, and only 6.6% of the total sample reached optimal concentrations. Serum 25(OH)D concentrations varied widely according to ancestry: 34.4% of European ancestry participants had concentration <50nmol/L, 85.2% of East Asians and 93.5% of South Asians had 25(OH)D levels <50nmol/L (P<0.001). Total vitamin D intake was much higher in the European samples than in East Asians and South Asian samples, and the total daily vitamin D intake was significantly different among groups (P=0.034). Other factors that are known to affect vitamin D status were also assessed: age, body mass index (BMI), vitamin D intake, and skin pigmentation. Two of these variables were found to have a statistically significant relationship with 25(OH)D concentrations: vitamin D intake (P<0.001) and skin pigmentation (P=0.033). The findings of this study suggest that low levels of vitamin D were widespread in wintertime among young adults living in Canada. Also, the vitamin D levels were even lower in subjects with East Asian and South Asian ancestry than in those with European ancestry. Also, vitamin D status in the wintertime seems to be affected not only by vitamin D intake, but also by skin pigmentation.

As evidenced in a study by Moore, Murphy, and Holick (2005), there are differences between the intake of vitamin D-rich foods in different racial groups. Data

was used from dietary recalls from the National Health and Nutrition Examination Survey (NHANES) 1999-2000, and a total of 8276 people ages ≥ 1 who provided dietary recalls themselves or through parents/caregivers and met the criteria. The mean intakes of vitamin D using the NHANES 1999-2000 consumption data were estimated. It was determined that in all populations, fortified foods made up most of the dietary vitamin D, and fortified milk contributed the most vitamin D from all of the fortified food sources used in analysis. Vitamin D intakes were greatest in children and teenagers, and lowest in the older age categories. The adequate intakes (AI) for vitamin D from food among children age one to eight years old were met or surpassed by 69% of Mexican American, 59% of non-Hispanic (NH) whites, and 48% of NH blacks. Only 4% of adults ≥51 years old met or exceeded the AI for vitamin D. When looking at food plus supplement sources of vitamin D, about 30% of men and 32% of women ≥ 51 years old met or exceed the AI for vitamin D, while significantly more NH men and women met the recommendations than NH black and Mexican Americans. The results of this study highlight a profound difference in the vitamin D intake of people from food plus supplements and recommended amounts, especially in NH blacks and Mexican American adults.

Vitamin D and its relationship with obesity

Low levels of vitamin D have also been found in obese individuals, and numerous studies have found a correlation. A study by Winters, Chennubhatla, Wang, and Miller (2009) assessed whether vitamin D-binding protein (VDBP) has a part in the low levels of 25(OH)D and obesity in AA's. VDBP and 25(OH)D levels were examined by race and BMI in 88 women aged 18 to 44 years old who were being evaluated at the University of Louisville Hospital Emergency Department. Of the 88 women evaluated, 45 (51%) were

severely deficient, 25 (28%) were deficient, 12 (14%) were relatively insufficient, and 6 (7%) had adequate vitamin D. Also, the mean 25(OH)D levels were lower in AA women than whites. Serum 25(OH)D levels were lower in obese women than normal-weight white women, but levels were unaffected by obesity in AA women. The data confirms that there is an interaction between race and obesity in vitamin D metabolism.

Another study on obesity by Alemzadeh, Kichler, Babar, and Calhoun (2007) looked at the prevalence of low 25(OH)D by studying hypovitaminosis D (<75nmol/L), vitamin D sufficiency (>75nmol/L), vitamin D insufficiency (50-74.9 nmol/L), and vitamin D deficiency (<50nmol/L) in obese children and their relationship to other calcitropic hormones and adiposity. In 127 participants age 6.0-17.9 years old who met the obese criteria (BMI > 95th percentile for age) were used in the study. Findings showed a vitamin D deficiency in 32.3% of the cohort. Participants in the vitamin D-deficient groups had greater BMI (P<0.001, P<0.01) and fat mass (FM) (P<0.001, P<0.01) and had lower fat-free mass (FFM)/FM ratio (P<0.001, P<0.0001). Also, the vitamin D-deficient group had greater iPTH levels (P<0.001) with lower serum iCa levels than the vitamin D sufficiency group. The vitamin D-deficient group has higher HbA1C and serum insulin levels (P<0.05) than the vitamin D-sufficient group. When stratified by ethnicity and race, hypovitaminosis was more prevalent in Hispanics (76.9%, P<0.05) and AA's (87.2%, P<0.05). Vitamin D deficiency was more prevalent in Hispanics and AA's (P<0.0001), and also corresponded to lower vitamin D intakes. Vitamin D sufficiency was seen more in whites (P<0.05) than AA's, but not in Hispanics. The frequency of vitamin D deficiency was observed more in fall/winter than summer/spring (P<0.0001), and vitamin D sufficiency was lower in fall/winter than summer/spring

(P<0.0001. Therefore, hypovitaminosis D was seen in about three quarters of obese participants and was influenced by vitamin D intake, season, race/ethnicity, and adiposity.

A study by Rodriguez-Rodriguez, Navia, Lopez-Sobaler, and Ortega (2009) examined the differences in anthropometric and dietetic variables in a group of young, overweight/obese Spanish women with respect to their vitamin D status. The study included 66 white Spanish women age 20-35 years old. The women were divided into two groups depending on their serum vitamin D concentrations: LD (women with <90nmol/l 25(OH)D) and HD (women with ≥90nmol/l 25(OH)D). The results of the study found that the mean serum 25(OH)D of the LD and HD groups were 47.9 and 130.2nmol/l, respectively. The waist circumference and BMI of the HD women were smaller than those of the LD groups, but the waist/hip ratio was comparable (P<0.05). Women with a BMI of <27.7kg/m^2 were more likely to have serum vitamin D concentrations ≥90nmol/l (P<0.05). These results indicate that, among white Spanish women, overweight/obese women are at greater risk of vitamin D deficiency, mostly due to excess adiposity, not inadequate intake.

Obesity was also the topic in a study by Goldner et al (2008), which assessed 25(OH)D, among other variables, in 41 patients planning to undergo Roux-en-Y gastric bypass. Vitamin D deficiency was defined in this study was 25(OH)D <50nmol/l, and insufficiency was defined was 25(OH)D 50-75nmol/l. The mean BMI for the bariatric group was 56.4kg/m^2, and the control group's BMI was 24.7 kg/m^2 (p<0.0001). Among the bariatric surgery group, the mean 25(OH)D level was 47.7nmol/l, while the control group had a mean 25(OH)D level of 90.8nmol/l (p<0.0001). In the bariatric surgery

patients, 61% had 25(OH)D levels <50nmol/l, but only 12% of the control did. Also, 90% of bariatric surgery patients has levels <75nmol/l, versus 32% of controls (p<0.0001). It was also found that BMI was inversely correlated with 25(OH)D levels (p=0.6). After adjusting for reported calcium/vitamin D intake, the bariatric surgery group remained at increased risk for vitamin D deficiency (25(OH)D <50nmol/l; OR= 11.1, 95%CI 2.8-43.4, p=0.0006). When looking at both vitamin D deficiency and insufficiency, (25O)H)D <75nmol/l) there were significantly more control subjects with low vitamin D in the winter months (53%) than summer months (14%, p=0.008). The prevalence of vitamin D deficiency in obese patients was 61% and was 90% when vitamin D deficiency and insufficiency were combined. These results signify the differences between vitamin D levels in obese and non-obese people.

A study by Ernst, Thurnheer, Schmid, Wilms, and Schultes (2008) assessed the serum 25(OH)D levels in 248 subjects with a large range of obesity. The subjects were made up of 176 women and 72 men with BMI's >30kg/m^2. The serum 25(OH)D level <75nmol/l was defined as vitamin D insufficiency, serum level <50nmol/l was defined as deficiency, and serum level <25nmol/l was defined was severe deficiency. The subjects were divided into three different levels to analyze serum 25(OH)D according to different degrees of obesity: 30-40 kg/m^2, 40-50 kg/m^2, and >50 kg/m^2. The study population was also divided into tertiles according to their fat mass (FM): tertile 1= FM<50kg; tertile 2= FM 50-62kg; tertile 3 =FM >62kg. It was found that BMI was inversely correlated with serum 25(OH)D concentrations (P=0.017), and the correlation stayed significant after adjusting for age and sex. FM also displayed an inverse correlation with serum 25(OH)D (P=0.018), and the correlation again stayed significant after adjusting for age and sex.

Serum 25(OH)D levels showed an overall marked variation across the seasons of the year (P<0.001), and the highest levels were in the summer and the lowest in the winter. Despite the season, there was a significant decrease in levels with increasing FM and BMI (both P<0.001). These results indicate a marked seasonal variation in serum 25(OH)D concentrations and prevalence of vitamin D deficiency in mild to extremely obese subjects. According to a American College Health Association-National College Health Assessment (ACHA-NCHA) web summary, which summarized the BMI of college students, it was found that in the Fall 2006 semester, 17% of females were overweight (BMI 25-29.9), 6% had class 1 obesity (BMI 30-34.9), and 4% had either class 2 (BMI 35-39.9) or class 3 obesity (BMI >40) (American College Health Association [ACHA], 2007). Due to these high rates of overweight and obesity among college females (ACHA, 2007), it is important for young women to be aware of the link between vitamin D and obesity.

Vitamin D and Mood/Depression

As evidenced by previously discussed studies, it is known that low vitamin D levels are associated with obesity, and obesity is known to be strongly associated with depression, especially in women (Simon et al, 2008). However, there are few studies where a relationship had been made between vitamin D intake/vitamin D levels and depression symptoms in obese individuals. A study by Lansdowne and Provost (1998) examined vitamin D supplementation and change in mood during winter months. Forty-four healthy college students who were enrolled in an undergraduate psychology class were recruited by advertising in the department. Participants were randomly assigned to receive one of three vitamin D_3 supplements: 0IU/day; 400IU/day; 800IU/day. The

supplementation and testing were done in late winter when vitamin D_3 levels were apt to be at a minimum. The Positive and Negative Affect Schedule (PANAS) was used to determine self-report of both positive and negative affectivity, and it contained measures both of Positive Affect (PA) and Negative Affect (NA). The majority of the participants who received the vitamin D_3 supplements reported feeling "really good" for the five days, but none of the control group participants made such comments. A vitamin D_3 of either 400IU or 800IU was shown the significantly enhance positive affect (mean PA with 400IU= 36.5; mean PA with 800IU=36.0) and reduced NA relative to the controls (mean NA with 400IU=12.6; mean NA with 800IU=12.8). The PA for both the low dose (400IU) and the high dose (800IU) was raised almost a whole standard deviation above the population norms. The control group stayed about equal to the population norms. Although more research is needed, these results show that vitamin D_3 supplementation has the potential to have positive effects on mood in the winter, and further studies should be done.

Another study assessing vitamin D supplementation and depressive symptoms was done by Jorde, Sneve, Figenschau, Svartberg, & Waterloo (2008). It examined the relationship between 25(OH)D levels and depression in people who were overweight and obese, as well as whether vitamin D supplementation had an effect of depressive symptoms. The participants were randomized into three groups: group DD (two capsules of vitamin D [20.000IU cholecalciferol per capsule] per week); group DP (one capsule of vitamin D and one capsule of placebo per week); and group PP (two placebo capsules per week). Depressed mood was estimated by the Beck Depression Inventory (BDI) in the beginning and at the end of the study. Results showed that after three months and during

the study, the serum 25(OH)D levels were doubled in the DD groups, remained stable in the PP group, and the DP group was between the DD and PP groups. At the end of the study, there was significant reduction (improvement) of BDI in the DD group, and no significant changes in the PP group. Also, an improvement in BMI 1-13 in the DD and DP groups were seen in females and in those who had high baseline BDI 1-13 scores. This study found that overweight and obese participants with serum 25(OH)D levels <40nmol/L have higher scores on the BDI total and BDI 1-13 subscale when compared to participants with serum 25(OH)D levels ≥40nmol/L. It was also determined that supplementation with high doses of vitamin D for one year may improve these scores.

Hoogendijk et al. (2008) attempted to determine whether there is an association between depression and altered 25(OH)D and parathyroid hormone (PTH) levels. Participants were drawn from The Longitudinal Aging Study Amsterdam, which is an ongoing cohort study looking at the predictors and consequences of changes in autonomy, mood, and well-being in an aging population. A total of 1,282 people age 65 to 95 yeas old participated. Depression status and severity were assessed by using the Center for Epidemiological Studies Depression Scale (CES-D). People with clinically relevant symptoms (CES-D score ≥16) were asked to undergo a diagnostic psychiatric evaluation using the Diagnostic Interview Schedule. Of the 1,282 participants, 26 people had current major depressive disorder (MMD), 169 had minor depression (CES-D score ≥16), and 1,087 people were not depressed. The 25(OH)D levels were 14% lower in the 169 people with minor depression and 14% lower in the 26 people with MDD when compared to the non-depressed participants (P<.001). Severity of depression (CES-D scale score) was associated with lower serum 25(OH)D (P<.001). Even after adjusting for

age, sex, BMI, smoking status, and number of chronic conditions, the CES-D scale scores were still linked to decreased 25(OH)D (P=.01). This study demonstrates an association between depression status and severity (measured with the CES-D scale) with low 25(OH)D levels. With various stressors that many college students experience, it is important for college females to have an increased awareness of the association between vitamin D and depression.

Vitamin D and Teens and Young Adults

Recent studies have focused on adequate vitamin D levels in children and adolescents. These studies have found a high prevalence of low vitamin D status in the winter, especially in adolescents, and low prevalence in the summer. Peterlik, Boonen, Cross, and Lamberg-Allardt (2009) discussed the incidence of low vitamin D status across the world. The proportion of males and females in the U.S., age 12-19 years old with low serum 24(OH)D levels ranged from 24 to 31%. Another recent study used NHANES 2001-2004 data to determine that 7.6 million children in the U.S. are vitamin D deficient, while 50.8 million are vitamin D insufficient. Children who were more likely to be vitamin D deficient were those who were older, girls, non-Hispanic black or Mexican American, obese, as well as those who drank milk less than once a week or used television, computer, or video games more than 4 hours per week (Kumar, Muntner, Kaskel, Hailpern, & Melamed, 2009).

A study by Weng, Shults, Leonard, Stallings, and Zemel (2007) attempted to find the prevalence and factors connected with low 25(OH)D levels in children and young adults. A total of 382 healthy children and young adults were recruited for participation

in the study in the northeastern US. Serum 25(OH)D levels were measured. For this study, hypovitaminosis D was defined as 25 (OH)D levels <30ng/mL. Fifty five percent of the participants had 25(OH)D levels that were inadequate (<30mg/mL). Children who were examined during wintertime had a 68% prevalence of hypovitaminosis D. The prevalence of hypovitaminosis D was 51% in whites and 94% in blacks. Low vitamin D was more likely to be found in participants who were older, black, members of a household with low annual income, members of a household with lower caregiver educational levels, evaluated during the winter, and had greater fat mass and BMI. Of all of the variables analyzed, only male sex, height, and daily energy intake were not significantly associated with vitamin D (P>0.20). It was also determined that interaction between total daily vitamin D intake and study evaluation during the winter (P=0.11) and between race and evaluation during the winter (P=0.79) were not statistically significant, therefore there was no association between vitamin D and race, and vitamin D status did not vary according to the season.

A study by Looker, et al. (2002) assessed the vitamin D status of adolescents and adults ≥ 12 years old participating in the Third National Health and Nutrition Examination Survey (NHANES III). Data from 18,875 people from selected groups of the population was analyzed. A value of <17.5nmol/L was used to indicate vitamin D deficiency, and <25, <37.5, <50 and <62.5nmol/L were used to show vitamin D insufficiency. To deal with the seasonal characteristic of the NHANES design, the sample was stratified into two seasonal subpopulations based on the month blood was collected: November-March (winter/lower latitude) or April-October (summer/higher latitude). It was found that less than 1% of the winter/lower latitude and the summer/higher latitude

subpopulations were at 25(OH)D levels that indicated vitamin D deficiency, but the prevalence rates of vitamin D insufficiency were more common. Prevalence rates were much higher in females than males of the same age ($P<0.00001$). Differences in 25(OH)D levels between the two subpopulations was dependent on age. In younger adults, the mean levels in the winter/lower latitude subpopulation were lower in people of comparable age and gender in the summer/higher latitude subpopulation ($P<0.02$). Mean 25 (OH)D levels were greatest in non-Hispanic whites, intermediate in Mexican Americans, and lowest in non-Hispanic blacks. The results show that vitamin D deficiency is not as likely in the two subpopulations, but vitamin D insufficiency is more frequent.

Finally, a study by Gordon, DePeter, Feldman, Grace, and Emans (2004) attempted to find the prevalence of vitamin D deficiency in healthy adolescents. Participants were 307 primary care patients (11-18 years old) who consecutively came for an annual physical exam at an outpatient clinic at Boston's Children's Hospital. The prevalence of vitamin D deficiency [25(OH)D levels ≤15ng/mL] was 24.1%, and the highest prevalence of deficiency was found in AA adolescents. Severe vitamin D deficiency [25(OH)D levels ≤8ng/mL] was found in 14 patients (4.6%), and vitamin D insufficiency [25(H)D levels ≤20ng/mL] was found in129 patients (42.0%). Significant relationships were found between consumption of selected food and vitamin D deficiency. A positive relationship was determined between vitamin D deficiency and drinking soft drinks, fruit juice, and iced tea, while an inverse correlation was found between vitamin D deficiency and consuming milk and cold cereal (which is usually fortified with vitamin D). Also, 25(OH)D levels were significantly higher in multivitamin

users (P=0.01), increased milk (P=0.02), and cold cereal consumption (P<0.001), and the 25(OH)D levels were higher in the summer (P<0.001). However, the levels decreased with the consumptions of juice (P=0.03) and soft drinks (P=0.06), as well as with higher BMI (P=0.006). Multivitamin use varied significantly by ethnic groups (P=0.004), with white participants having higher consumption (22.4%) than AAs (8.5%), Hispanics (10.3%), and other participants (10.3%). Between boys and girls, there was a small, but significant, correlation between vitamin D intake and serum 25(OH)D levels (adolescent girls, P=0.004; adolescent boys, P=0.01). Finally, the following variables were found to have significant associations with 25(OH)D levels: ethnicity (P<0.001), season (P<0.001), BMI (P=0.003), milk (P=0.003) and juice consumption (P=0.02), and physical activity (P=0.008). The results show that there is a high prevalence of vitamin D deficiency in otherwise healthy adolescents.

Supplement usage

The use of dietary supplements can have a great impact on vitamin D status, as above studies show that individuals who use multivitamin supplements typically have higher serum 25(OH)D levels (Gordon, DePeter, Feldman, Grace, & Emans, 2004). Several studies have assessed the use of supplements among US adolescents and college students, as well as finding the determinants of supplement usage. In a study looking at the use of over-the-counter (OTC) medications and herbal or dietary supplements in college students at a private southeastern university, 201 students completed surveys to determine the frequency of supplement usage in the past week. When looking at vitamins and minerals, 59.7% of students used them in the previous week. When broken down by academic term, 66.3% of students used vitamin and mineral supplements during the

spring term, 51.0% used them during the summer term, and a significance difference was found between vitamin and mineral use during these two terms ($P<0.05$) (Stasio, Curry, Sutton-Skinner, & Glassman, 2008).

A similar study by Wilson, et al (2006) studied the use of complementary and alternative medicine, as well as dietary supplements in adolescents. Of the 1280 adolescents who completed an online survey, 54.2% of adolescents reported currently using vitamins and 66.9% reported being lifetime users of vitamins. When lifetime vitamin users were broken down by gender, 60.5% of males and 73.6% of females ($P<0.001$) reported using vitamins. Differences in age group were not found to be statistically significant, but 63.8% of 14-15 year olds, 69.6% of 16-17 years olds, and 67.3% of 18-19 years older reported lifetime vitamin use. Finally, statistically significant differences were found for differences in race/ethnicity: 71.5% of whites, 65.0% of Hispanics, 57.3% of other ethnicities, and 49.7% of AA's reported lifetime supplement use ($P<0.001$). Factors associated with vitamin use included being female, age 16-17, and being white.

Another study regarding supplement usage examines the determinants of vitamin and herbal supplement usage in 24,834 participants in the National Health Interview Survey (NHIS) of 2000 (Fennell, 2004). For this study, a "vitamin or mineral supplement" referred to whether a participant has taken either mineral or vitamin supplements in the previous 12 months. Multiple vitamins referred to whether a participant has used a multiple vitamin in the previous 12 months. For the sample, 52.7% used a vitamin or mineral supplement and 43.07% used multiple vitamins. When looking at demographics, vitamin or mineral users were more likely to be non-Latino white

(57.8%), female (57.9%), age 55-69 (61%), and have a college degree (63.6%). Also, when looking at the college-age group, 40.2% were vitamin or mineral users. As noted in this study, vitamin or mineral users are more likely to be non-Latino whites, female, older, and have a college degree (Fennell, 2004).

Finally, another study addressed vitamin and mineral supplements in children and adolescents age 2 to 17 years old. Data was collected from the 1999-2004 National Health and Nutrition Examination Survey (NHANES) on 10,828 children. Statistically significant differences between the many variables were found, and the following variables had the higher percentages of vitamin and mineral users: age (43.1% of children age 2-4; $P<0.001$); race/ethnicity (41.5% of non-Hispanic whites; $P<0.001$); country of birth (35.1% were born in the U.S.; $P<0.001$); poverty status (43.1% were non-poor; $P<0.001$); household food security (37.6% were fully food secure; $P<0.001$); adult food security (37.5% were fully food secure; $P<0.001$); child food security (36.1% has food quality and quantity unaffected; $P<0.001$); authorized for food stamps in the past year (38% has no one in the household authorized for food stamps in the past year; $P<0.001$); number of months authorized for food stamps (36.3% had zero months; $P<0.001$); participation in WIC program (36.9% did not participate, $P<0.001$); school breakfast price (36.7% paid full price, $P<0.001$); and school lunch price (40.2% paid full price; $P<0.001$). The results of this study indicate that there are many factors that influence vitamin and mineral supplementation in children and adolescents (Shaikh, Byrd, and Auinger; 2009). As all of these factors impact supplementation in adolescents, these factors are likely to also impact supplementation use in college students, as well.

Dairy Intake

Dairy intake is an important determinant of vitamin D status, as it had been shown to have a positive effect on vitamin D status (Gordon et al, 2004). The intake of dairy has also been shown to decrease the risk of hypertension (Wang et al, 2008) and type II diabetes (Pittas et al, 2006). However, dairy intake can be diminished by lactose intolerance, which is a condition that causes the body to be unable to digest lactose, the sugar found in milk and milk products (National Institute of Digestive and Diabetes and Kidney Diseases [NIDDK], 2008). Lactose intolerance has been very common in many adults, and about 30 million Americans have some sort of lactose intolerance by age 20 (Medline Plus, 2009). Specific populations have a higher risk of lactose intolerance including: 95% of Asians, 60% to 80% of AA's and Ashkenazi Jews, 80% to 100% of American Indians, and 50% to 80% of Hispanics. People of European descent have the lowest prevalence of lactose intolerance, which is about 2% (Swagerty, Walling, and Klein, 2002).

Being lactose intolerant usually leads to the self-imposed, decreased intake of milk and dairy products, which are main sources of dietary calcium in the US. A study by Buchowski, Semenya, and Johnson (2002) examined how lactose intolerance and the subsequent low intake of dairy products affected calcium intake in AA women. Of the group of premenopausal women, 26 were lactose intolerant (LI group) and 24 were lactose tolerant (LT group). Results showed that the LI group had a significantly higher daily average calorie intake than the LT group ($P<0.001$). The LT group had a significantly higher daily calcium intake than LI women ($P<0.001$), although neither

group achieved the recommended Dairy Reference Intake (DRI) of 1,000mg of calcium. The calcium density (calcium intake divided by energy intake) was found to be significantly higher in the LT group ($P<0.001$). The LT group's major calcium sources were milk, yogurt, and dairy products. The LI group's major sources of calcium were mixed foods, including breads, noodles, salad dressings, meat, and eggs. It was also found that the women in this study had lower intakes of vitamin D, which was likely to impact their calcium requirement. Finally, a negative association was found between calcium intake and BMI ($P<0.001$). The major result of this study was that lactose intolerant AA women have significantly lower calcium intakes than those who are tolerant to milk and dairy.

A study by Fulgoni et al (2007) looked at the intake of dairy in AA's compared to non-AA's. Data was received from the Continuing Survey of Food Intakes by Individuals 1994-1996 (CSFII) and the NHANES 1999-2000 survey. Results from the CSFII survey found that AA females had significantly lower dairy intakes compared to non-AA females ($P<0.05$) and consumed less milk and yogurt than non-AA's. Also, AA's had lower intakes of magnesium and phosphorus and statistically significant lower calcium intakes than non-AA females ($P<0.05$). Results from the NHANES survey found very similar results to the CSFII survey. AA females had significantly lower intake of dairy than non-AA females ($P<0.05$) and consumed less milk and cheese ($P<0.05$) as well as yogurt. AA females also had significantly lower calcium, magnesium, and phosphorus intakes than non-AA females ($P<0.05$). For AA women age 19-30, the median intake of calcium was about 500mg/day, which is almost 50% of the Adequate Intake (AI) for calcium. The IOM has set an AI for calcium, which reflects the amount of calcium

needed to maintain adequate calcium retention and bone health in healthy people (IOM, 1997). Non-AA women of the same age had a median calcium intake of about 675mg/day, which is around 68% of the AI. The data found in this study suggests than AA women eat fewer dairy products than their non-AA counterparts, and that many AA women do not consume enough calcium, magnesium, or phosphorus (Fulgoni et al, 2007). As mentioned earlier, AA's also make about half as much vitamin D from sun exposure compared to someone with fair skin (Giovannucci, n.d.). All of these factors affecting vitamin D intake are important for AA's women to be aware of, since this can put them at increased risk of vitamin D deficiency.

Women's perception of dairy food can affect their daily intake of dairy. A study by Haggy, Brochetti, and Duncan (2000) sought to identify what women perceived as health benefits of dairy, barriers to dairy consumption, and issues that had an influence on dairy intake. Women age 30-55 participated in four focus group discussions. Open-ended questions were based on those created by Eddy, Brochetti, Duncan, & Hagy (1999). Of the 39 women, 30 took vitamin/mineral supplements and 9 women did not. Women thought that calcium was the main health benefit of dairy, but mainly in the form of milk, and only a few women mentioned vitamins A and D as being a health benefit to dairy foods. Also, many women stated they took supplements because they thought it was a beneficial health practice, and mentioned that supplements were needed to help reach their calcium needs. Some women were skeptical about the effectiveness of supplements and were worried about taking calcium supplements with medication. One disadvantage to dairy that was mentioned by the women was fat, and most stated they frequently use low-fat milk, cheese, and ice cream. Lactose was brought up in terms of milk allergies

and lactose intolerance, but many women knew about lactose-reduced milk and lactase tablets. Women stated that their mothers influenced the type of dairy they ate as children, and they also mentioned their own children's role in the dairy foods they currently purchase, especially milk. The participants were aware of media campaigns regarding dairy, but disliked them because they thought they were geared at a younger audience. In regards to dairy preferences, most women stated that sensory attributes were involved. Many women reported that they did not like the taste of certain dairy foods, like milk, cottage cheese, yogurt, eggnog, and sour cream. Finally, the cost of food was very important to the women, but most did not think that the cost of dairy was too high because dairy was seen as a necessary item. The findings of this study indicate why women choose, or do not choose dairy foods, and how media messages can influence nutrition messages. This might be important for healthcare providers, college campuses, and media outlets to be aware of, as it highlights how women view dairy foods and what may impact their intakes of dairy.

College Students and Health Information

Health promotion and health education programs are common throughout college campuses. Colleges and universities have an exceptional position to promote health behaviors by providing these programs to students. A study by Brener and Gowda (2001) discussed the amount of health information students reported receiving from their colleges and universities, the characteristics of the students who do receive health information, and the specific sources of information that students receive. About 77.4% of students state they received some type of prevention information from their college or university on at least one of the following topics: tobacco use, alcohol and other drugs,

injury and safety, violence, pregnancy, suicide, STDs, HIV/AIDS, dietary behaviors, nutrition, and physical activity and fitness. While this study mainly looked at HIV/AIDS information, 34.0% of women and 26.0% of men reported receiving nutritional information. Brochures, pamphlets, and newsletters were most commonly reported sources of information on HIV/AIDS.

The Internet is becoming a major source of health information. A study by Escoffery et al (2005) surveyed 743 undergraduate students to look at their Internet use, health-seeking behaviors, and attitudes regarding using the Internet to get health information. They found that 72.9% of students used the Internet to get health information, with a search engine being the most common way to find health-related information. About 15% said they used the Internet to find health information in the past week or day, while 32% stated doing this in the past month. Also, 36.7% reported that using the Internet to get health information improved the way they took care of their health *a lot* or *some*. There was a significant difference in the number of female students (77.9%) than male students (68.6%) who found their health information online ($P<0.05$). Also, 47.2% of the students used the Internet to find diet and nutrition information. The article states that future studies should use these findings to discover more factors related to using the Internet for health information among college students. The implications for colleges and universities suggest great possibilities for using the Internet for health education purposes. The authors offer the following recommendations for college and university health centers: (1) incorporate web-based education and programs into university student health; (2) train both college health staff and students not only to search the Internet for health information but also to evaluate health information on Web

sites; and (3) offer a Web portal for common college health issues (Escoffery, C. et al, 2005).

On a different note, Siebert, Wilke, Delva, Smith, and Howell (2003) found that both AA students (74%) and white students (76%) reported that their parents were their main sources of health information. The next most frequently used source for white students was friends (59%), while 70% of AA students reported information from leaflets, pamphlets, and fliers. Sixty percent of AA students stated their friends were resources, but they ranked them sixth, behind the Internet and magazines. Students also stated that health educators were the most believable sources, but they did not use them as frequently as they used their parents and friends. Finally, AA students determined peer educators and religious centers to be more believable sources of information than white students. The findings of this study emphasize the influence that parents have on their children attending college. These findings also show that students find health educators to be a credible source of information; therefore colleges and universities need to find a way to promote increased communication between students and health educators.

From the literature, the impact of vitamin D on health is great, and many populations are at increased risk of vitamin D deficiency for various reasons. The intake of dairy foods is also varied in different populations, which may be affected by lactose intolerance. Finally, supplement use by college students and young adults, as well as sources of health information provide insight into the health behaviors of college students. To date, there is little information available on the knowledge and perceptions of vitamin D in female college students.

Chapter III

Methodology

Study Design

This study is a cross sectional design utilizing a qualitative method (focus groups) to create detailed descriptions of the knowledge and perceptions that female college students have regarding vitamin D at a public university in South Carolina. A questionnaire of demographic data (16 questions) and six focus groups will be the main method of data collection.

Subject Recruitment

The target population of this study is female undergraduate students enrolled at the University of South Carolina in Columbia, SC. Participants were recruited via an emailed invitation to undergraduate students by thesis committee members. Thesis committee members (Dr. Montgomery and Dr. Corwin) served as intermediaries for recruitment of participants. Specifically, committee members, as well as instructors Fiegel, Harring, and Weis, emailed an invitation to participate to their undergraduate students from 2008-2010 major semesters using the Blackboard Academic Suite™. The researcher also visited three undergraduate classes to increase participant recruitment. In the invitation email, students were asked to contact the researcher directly via email or phone. The researcher responded to each email/phone call by verifying that potential participants:

1. Understood the purpose and procedures of the study;
2. Met the inclusion criteria; and,
3. Were available for one of the three dates/times the focus groups were scheduled.

This process continued until 22 participants were registered. Although the research had intentions of over-recruiting to have a final sample size of 60, recruitment proved to be difficult. Due to time constraints, the researcher stopped recruitment at 22 participants.

Criteria for inclusion in the study included: (1) female; (2) age 18 -22; (3) undergraduate, English-speaking college student at the University of South Carolina; and (4) willingness to take part in a group discussion with other female college students. Those students who met inclusion criteria and agreed to participate were asked to complete a four-page demographic questionnaire and participate in a focus group with other participants.

The procedures were approved by the Institutional Review Board (Appendix E) at the University of South Carolina. Participants received an informational letter (Appendix D) which provided details about the purpose and voluntary nature of the study. The study did not gather any identifying information from the participants.

Survey Instrument

The participant demographic form (Appendix A) contained questions that were created by the researcher, as well as additional questions that were drawn from previous questionnaires (Fred Hutchinson Cancer Research Center [FHCRC], 2010; Midlife in the United States Program [MIDUS], n.d; Centers for Disease Control [CDC], 2005). Demographic questions (questions 1 through 7) were developed by the researcher to include date of birth, race, on-campus living, zip code, undergraduate status, employment

status, and on-campus meal plan (including how often the participant eats breakfast, lunch, and dinner on-campus). Sun exposure questions (questions 8 and 9) were also created by the researcher to assess participant's exposure to the sun, including sunscreen use and deliberate tanning. Deliberate tanning consisted of sources of tanning and time spent in the tanning bed (if applicable).

Diet questions (questions 8 through 12) were obtained from a food frequency questionnaire developed by the Nutrition Assessment Shared Resource (NASR) of the Fred Hutchinson Cancer Research Center (FHCRC, 2010). Dairy questions from the food frequency questionnaire were selected to assess the dairy intake of the participants. Responses to question 12 (A through E) were modified from the NASR version to better fit this study and its target population. Other health behavior questions were obtained from the Midlife in the United States Program (MIDUS): A National Study of Health and Well-Being and the 2005 Youth Risk Behavior Survey (YRBS). To assess sleep (questions 13 through 15), three questions were obtained from the MIDUS Project, specifically MIDUS II, Project 4 (MIDUS, n.d.). One of the three questions (question 13) was modified slightly by the researcher, but other questions remained unchanged. The final question (question 16) was obtained from the 2005 YRBS, and it measured students' perceptions of their health (CDC, 2005). A thesis committee member reviewed the questionnaire to ensure formatting and readability was correct.

Variables

All data was found via the participant demographic form, as well as focus groups and personal interviews. The demographic variables that were collected were: (1) date of birth (continuous variable); (2) race (categorical variable); (3) on-campus living (categorical variable); (4) zip code (categorical variable); (5) undergraduate status (categorical variable); (6) employment status (categorical variable); and (7) on-campus meal plan (including how often the participant eats breakfast, lunch, and dinner on-campus) (categorical variable).

Other variables related to vitamin D are the following collected through the study. They include the following:

Sun exposure: Sun exposure was assessed by closed and open-ended questions. Frequency of sunscreen use was determined by a closed-ended question with multiple choice responses (*all of the time, most of the time, some of the time, and none of the time*). Deliberate tanning was assessed by a *yes* or *no*, closed-ended question. If the participant responded *yes* they deliberately tanned in the tanning bed, sources of tanning and length of tanning sessions were asked in an open-ended format (length of tanning session was assessed in times per week and minutes each tanning session).

Sources of dairy: Dairy sources in the diet were assessed by closed-ended questions with either *yes* or *no* responses or a series of responses. Milk intake was assessed by two *yes* or *no* questions (Do you put milk on cereal? Do you drink milk?). Frequency of dairy intake was measured by closed-ended questions with daily, weekly, or monthly responses inquiring about the intake of the following dairy foods: milk as a beverage, milk on

cereal, cottage cheese, all other cheeses (including low or reduced fat, American, cheddar, and cream), and yogurt.

Other health behaviors: Other health behaviors were measured by a series of closed and open-ended questions assessing sleep and perception of overall health. The open-ended question assessed *hours per night* spent sleeping. Quality of sleep was determined by a closed ended question with response options of *very good*, *fairly good*, *fairly bad*, or *very bad*. Frequency of medication for sleep was assessed with a closed-ended question using the responses of *not during the past month, less than once a week, once or twice a week,* or *three or more times a week*. Finally, perception of overall health was measured with a closed-ended question asking participants to rate their overall health. Response options were *excellent, very good, good, fair,* or *poor*.

Questions used in focus group discussions were created by the researcher. Topics include sources of health information, perception of vitamin D, sources of vitamin D, perceptions of supplements, and dissemination of vitamin D messages. The line of questioning used in the focus groups is seen in Table 3.1.

TABLE 3.1
Focus Group Questions about Vitamin D asked of Female College Students Age 18-22 (n=22)

1.	First, we would like to know where you all get most of your health information.
2.	Tell me what you think of when you hear the words "vitamin D."
3.	Now, we would like to hear about where we can get vitamin D.
4.	Now, when you hear the word "supplement" what comes to mind?
5.	If you wanted to get the word out about vitamin D, how would you do it?
6.	Before we break up for the evening, we would like to know if there is anything you would like to add? Are there things regarding vitamin D that we didn't discuss?

Data Collection

The investigator conducted the focus groups. Prior to the start of the focus groups, the investigator received training from faculty mentors on proper techniques used in focus groups. The investigator was aided by a non-participant observer (also trained by faculty mentors), who assisted in keeping detailed notes and observations of the focus groups. The focus group discussion was recorded by a note-taker, trained by the researcher and experienced in note-taking.

Prior to the day the focus group took place, the researcher contacted each participant to remind them of the focus group's time and location. An on-campus classroom was reserved for the focus groups, with doors that close as a means of protecting participants' confidentiality and identity. When participants arrived, written informed content was completed by each participant. Each participant was given a copy of the consent form. Consent was read to the participants, and the investigator answered any questions. Participants were also required to read and sign a confidentiality agreement (Appendix C). The researcher stressed that participation was voluntary in nature, that participants could withdraw at any time, and that all measures were utilized to protect confidentiality.

Each participant was asked to complete a participant demographic form after informed consent was given. The form did not include the participant's name or any other identifying information. The demographic data was used to provide a summary of the characteristics of the sample – *not individual level data*. The focus group questions were completed in a particular order and were implemented using the "Focus Group Implementation Guide" (Appendix B). After asking a question, the researcher gave

participants time to express their thoughts. The facilitator used probes to help the participants describe their thoughts in more details. For example, a probe included "tell me more about that" or "can you give me an example of where you heard that information?"

Upon completion of the focus group, participants had the option to put their name (on a blank index card) into a basket for a random drawing for a $20 gift card as a "thank you" for their time. Light refreshments (soda, juice, popcorn, fruit, etc.) were provided during each group.

After the focus groups were complete, the researcher and note-taker debriefed and recorded any additional observations in their field notes. The manual field notes were typed in Microsoft Word and all potentially personal identifying information (i.e. names) was omitted. The original handwritten field notes were kept in a locked filing cabinet in the thesis chair's office. The Word file copies were stored on the researcher's password protected laptop. Backup file copies were kept on a disk or flash drive stored in the thesis chair's locked filing cabinet. All written files were transcribed verbatim into Microsoft Word by the researcher.

Analysis Plan

The information collected on the participant demographic form was entered into Microsoft Excel. No individual identifiers were collected or entered. Once all forms were entered into Excel, summary statistics (percents, frequencies, averages, and ranges) were calculated. This data was used to generally describe study participants. Mean and standard deviations were determined for continuous variables (i.e. age, number of meals eaten on campus, time spent tanning, and hours slept per night). Frequencies and

percentages were determined for the categorical demographic variables (i.e. race, living on campus, undergraduate status, employment status, and on campus meal plan) and for other selected questions on the participant demographic form: sunscreen use, deliberate tanning, sources of tanning, dairy intake, quality of sleep, medication use for sleep, and perception of overall health. The hard copy forms were stored in a locked filing cabinet in the thesis chair's office. The Excel file was stored on the researchers' password protected laptop. In accordance with IRB policies, the data files, focus group notes, and demographic forms will be destroyed one year after the study's end.

To create the codebook, one transcription from the focus groups was randomly selected. The transcription was read by the researcher and two thesis committee members. The researcher and thesis committee members used the discussion guide as a preliminary framework, and when texts expressed a unique meaning or idea, those texts were marked and assigned a semantic code. They then compared notes and ideas to conclude if their ideas and codes had similar interpretations. The researcher and thesis committee members organized the code list to create a codebook (Appendix F). To update the codebook, the researcher coded each of the transcripts for all four focus groups and two personal interviews, adding new codes as needed.

The codebook was then used to create a table to better show the common themes that were present throughout the focus groups and personal interviews (Appendix G). The themes from the codebook were used to create headings in the table. Each heading was organized by question number and theme. As significant details emerged from the first focus group, those details were added under each heading, and an "x" was put under the focus group number to show which focus group discussed which theme. This process was

repeated for each focus group and personal interview. A theme discussed in more than three focus groups or personal interview was considered significant in the results.

The first question asked during the focus groups was regarding places that students received health information. Based on the responses from the focus group and personal interview participants, many common themes emerged, including the Internet, healthcare providers, family and friends, campus, and the media. The second question discussed during the focus groups and personal interviews was about types of supplements. The common themes that surfaced were pills, multivitamins, liquids, powders, bars, and shakes. Reasons to use supplements were similar across focus groups, including non-dietary, athletic, and deficiency-related reasons. Side effects of supplements were commonly seen as negative side effects, as more groups discussed negative than positive side effects.

Also, most of the focus groups had similar discussions regarding the role of vitamin D in the body, as well as vitamin D and disease prevention. Participants in the focus groups and personal interviews also had common themes appear when discussing sources of vitamin D, which mainly included dairy foods and the sun. It was then explained to the participants that many Americans are not getting enough vitamin D and that low levels of vitamin D are associated with many chronic diseases. When asked how that made the participants feel, the common themes of frustration, shock, unawareness, and conflicting information were raised. Although some of these themes had less than three common responses, they were still used in the results because the researcher felt they were important themes. Finally, when asked about how to disseminate vitamin D messages to the public, the common themes of communication outlets, communication

types, and communication messages emerged. Creating a table from the codebook allowed the researcher to clearly see the common themes that materialized in the focus groups and personal interviews.

Chapter IV

Results

This chapter contains a manuscript which examines the results from focus groups regarding the participant's knowledge and perceptions of vitamin D, as well as results from a demographic form given to focus group participants.

Manuscript

"Knowledge and Perceptions of Vitamin D among College Women Age 18-22 Years," to be submitted to the *Journal of Nutrition Education and Behavior*.

Abstract

Objective: To assess the knowledge and perceptions regarding vitamin D among female college students, age 18-22, at a public university in the southeastern US.

Design: Cross sectional design utilizing a qualitative method.

Setting: University of South Carolina, a public university in the southeast.

Participants: 20 students participated in focus groups, 2 participated in personal interviews, for a total of 22 total participants.

Intervention: Focus groups and personal interviews.

Main Outcome Measures: Knowledge and perceptions of supplements and vitamin D, sources of health information, and how to disseminate messages about vitamin D.

Analysis: Mean and standard deviation found for continuous variables; percentage and frequency found for categorical variables; codebook creation for themes of focus groups.

Results: Majority of participants consumed milk and cheese often, deliberately tanned, reported their overall sleep quality was “fairly good”, and reported their overall health was “very good”. Participants were knowledgeable about various aspects of vitamin D, as well as how to disseminate vitamin D messages.

Conclusions and Implications: Further research is warranted in other racial and ethnic populations.

Introduction

Vitamin D deficiency in the United States (US) was once thought to have been resolved through milk fortification, but now vitamin D deficiency is present in many children and adults. Vitamin D is now being linked to decreasing the risk of many chronic diseases and conditions, such as breast cancer, cardiovascular disease, diabetes, bone health, and depression (Holick, 2004). There are not many foods that naturally contain vitamin D, and few foods are fortified either, but a diet high in fatty fish (tuna, salmon, and mackerel) has been shown to prevent vitamin D deficiency (Holick, 2007; IOM, 1997). In the US, fortified foods provide most of the vitamin D in our diets. A milk fortification program in the 1930's was established to combat rickets. Rickets is a disease caused by low calcium, phosphate, or vitamin D levels, which leads to the softening and weakening of the bones (Wharton & Bishop, 2003). However, the intake and popularity of milk often decreases in women during the teen years (Lytle, 2002). Osteoporosis is also a concern of nutritional adequacy, especially with regard to vitamin D and calcium, and it is an increasing public health problem. College students are still in the influential years for attaining peak bone mass, and osteoporosis could be a problem for them later in life (National Institute of Health [NIH], 2000).

Other vitamin D fortified foods include breakfast cereals, orange juice, yogurt, and some margarines (IOM, 1997). Sunlight is another good source of vitamin D for some people because Ultraviolet B (UVB) radiation can penetrate the skin and eventually

be converted into vitamin D (Peterlik, Boonen, Cross, & Lamberg-Allardt, 2009). Factors that affect ultraviolet radiation exposure and vitamin D synthesis include: time of day, latitude, geographic location, cloud cover, smog, melanin content in the skin, and sunscreen use. Research has suggested that about 5-30 minutes of sun exposure at least two times per week to the face, leg, arms, or back without sunscreen usually produces sufficient vitamin D (Holick, 2007). For example, in someone with fair skin, a 30 minute, full body exposure to sun in the summer at noon will cause the release of 20,000IU of vitamin D into circulation. In someone with dark skin, the same amount of sun at the same time in the summer would create about half as much vitamin D (Giovannucci, n.d.). Tanning beds that emit 2% to 6% UVB radiation can also be effective (Holick, 2007). However, it is very important to be careful when making recommendations about sun exposure to increase vitamin D as too much sun exposure has many downsides, such as skin cancer and early aging (Giovannucci, n.d). Skin cancer accounts for almost 50% of all cancers in the U.S., and it is the most common type of cancer. There are more than 1 million cases of non-melanoma skin cancer found every year, and the American Cancer Society estimated that 68,720 new cases of melanoma will be diagnosed in the US in 2009. One of the most common risk factors for skin cancer is unprotected and/or excessive exposure to UV radiation (American Cancer Society [ACS], 2009).

Vitamin D deficiency has been found to be more predominant in certain populations of the US. It is more common in African Americans (AA) and least common among whites (McKinney, Breitkopf, & Berenson, 2008). Dietary intake of vitamin D has also been found to be different across various racial and ethnic groups. According to the National Health and Nutrition Examination Survey (NHANES) 1999-2000, few

women ages 19-50, or men and women over 51 years old, get recommended vitamin D levels from food. In addition, the average dietary intake of vitamin D from food and supplements were consistently highest in white populations (Moore, Murphy, & Holick, 2005). Dairy foods can also be good sources of vitamin D through fortification; however, a study using National Health and Nutrition Examination Survey [NHANES] 1999-2000 data found that AA women consume less milk, cheese, and yogurt than non-AA women (Fulgoni et al, 2007). Lactose intolerance can be a problem for many people, and can lead to lower intake of dairy products, which naturally contain or are fortified with calcium, and vitamin D than people who are not lactose intolerant (Buchowski, Semenya, & Johnson, 2002). Lactose intolerance is caused by a deficiency of lactase, an enzyme that breaks down lactose. Lactose intolerance can be confused with a milk allergy, but milk allergies usually appear in the first years on life, while lactose intolerance typically occurs in adulthood (National Digestive Diseases Information Clearinghouse [NDDIC], 2009). Also, low dairy intakes may occur in vegans, who do not eat any animal products, as well as ovo-vegetarians, who do not eat meat or dairy. Due to decreased dairy intake, vegans and ovo-vegetarians should pay special attention to their vitamin D intake. Since they do not consume fish or dairy, it is especially important for them to receive their vitamin D from fortified foods, fortified soy products, and supplements (Center for Young Women's Health, 2009). Through this knowledge of vitamin D sources and populations at risk, it is very important for the public to have a greater understanding of vitamin D to decrease deficiencies.

Methods

Study Design

This study was a cross sectional design utilizing a qualitative method (focus groups) to create detailed descriptions of the knowledge and perceptions that college-age women have regarding vitamin D at a public university in South Carolina. A questionnaire of demographic data (16 questions), four focus groups, and two personal interviews were the main methods of data collection.

Participants and Recruitment

The target population of this study was female undergraduate students enrolled at the University of South Carolina in Columbia, SC. Participants were recruited via an emailed invitation to undergraduate students by thesis committee members. Thesis committee members served as intermediaries for recruitment of participants. Specifically, committee members, as well as other instructors, emailed an invitation to participate to their undergraduate students from 2008-2009 major semesters using the Blackboard Academic Suite™. The researcher also visited three undergraduate classes to increase participant recruitment. In the invitation email, students were asked to contact the researcher directly via email or phone. The researcher responded to each email/phone call by verifying that potential participants: understood the purpose and procedures of the study; met the inclusion criteria and were available for one of the dates/times the focus groups were scheduled. This process continued until 22 participants were registered. Although the research had intentions of over-recruiting to have a final sample size of 60, recruitment proved to be difficult. Due to time constraints, the researcher stopped recruitment at 22 participants.

Criteria for inclusion in the study included: (1) female; (2) age 18 -22; (3) undergraduate English-speaking college student at the University of South Carolina; and (4) willingness to take part in a group discussion with other female college students. Those who met inclusion criteria and agreed to participate were asked to complete a 4-page demographic form and participate in a focus group with other participants. The procedures were approved by the Institutional Review Board (IRB) at the University of South Carolina. Participants received an informational letter (Appendix D) which provided details about the purpose and voluntary nature of the study. This study did not gather any identifying information from the participants.

Instruments

The participant demographic form (Appendix A) contained questions that were created by the researcher, as well as additional questions that were drawn from previous questionnaires. Demographic questions (questions 1 through 7) were developed by the researcher to include date of birth, race, on-campus living, zip code, undergraduate status, employment status, and on-campus meal plan (including how often the participant eats breakfast, lunch, and dinner on-campus). Sun exposure questions (questions 8 and 9) were also created by the researcher to assess participant's exposure to the sun, including sunscreen use and deliberate tanning. Deliberate tanning consisted of sources of tanning and time spent in the tanning bed (if applicable).

Diet questions (questions 8 through 12) were obtained from a food frequency questionnaire developed by the Nutrition Assessment Shared Resource (NASR) of the Fred Hutchinson Cancer Research Center (Fred Hutchinson Cancer Research Center [FHCRC], 2010). Dairy questions from the food frequency questionnaire were used to

assess the dairy intake of the participants. Responses to question 12 (A through E) were modified from the NASR version to better fit this study and its target population. Other health behavior questions were obtained from the Midlife in the United States Program (MIDUS): A National Study of Health and Well-Being and 2005 Youth Risk Behavior Survey. To assess sleep (questions 13 through 15), three questions were obtained from the MIDUS Project, specifically MIDUS II, Project 4 (Midlife in the United States Program [MIDUS], n.d.). One of the three questions (question 13) was modified slightly by the researcher, but other questions remained unchanged. The final question (question 16) was obtained from 2005 Youth Risk Behavior Survey (YRBSS), and it measured student's perceptions of their health (Centers for Disease Control [CDC], 2005).

A thesis committee member reviewed the questionnaire to ensure formatting and readability was correct.

Procedures

The investigator conducted the focus groups. Prior to the start of the focus groups, the investigator received training from faculty mentors on proper techniques used in focus groups. The investigator was aided by a non-participant observer (also trained by faculty mentors), who assisted in keeping detailed notes and observations of the focus groups. The focus group discussion were recorded by a note-taker, trained by the researcher and experienced in note-taking.

Prior to the day the focus group takes place, the researcher contacted each participant to remind them of the focus group's time and location. Several anticipated locations were reserved for the focus groups, such as on campus classrooms and meeting

rooms with doors that close as a means of protecting participant's confidentiality and identity. When participants arrived, written informed consent was completed by each participant. Each woman was given a copy of the consent form. Consent was read to the participants, and the investigator answered any questions. Participants were also required to read and sign a confidentiality agreement (Appendix C). The researcher stressed that participation is voluntary nature, that participants could withdraw at any time, and that all measures were utilized to protect confidentiality.

Each participant was asked to complete a participant demographic form after informed consent was given. The form did not include the participant's name or any other identifying information. The demographic data was used to provide a summary of the characteristics of the sample – *not individual level data*. The focus group questions were completed in a particular order and will be implemented using the "Focus Group Implementation Guide" (Appendix B). After asking a question, the researcher gave participants time to express their thoughts. The facilitator used probes to help the participants describe their thoughts in more details. For example, a probe included "tell me more about that" or "can you give me an example of where you heard that information". Upon completion of the focus group, participants had the option to put their name (on a blank index card) into a bag for a random drawing for a $20 gift card as a "thank you" for their time. Light refreshments (soda, juice, popcorn, fruit, etc.) were provided during each group.

After the focus groups were completed, the researcher and note-taker debriefed and recorded any additional observations in their field notes. The manual field notes were typed in Microsoft Word and <u>all</u> potentially personal identifying information (i.e. names)

was omitted. The original handwritten field notes were kept in a locked filing cabinet in the thesis chair's office. The Word file copies were stored on the researchers' password protected laptop. All written files were transcribed verbatim into Microsoft Word by the researcher. To confirm accuracy and completeness, a thesis committee member compared the field notes with the transcribed document and made any necessary corrections.

Data Analysis

The information collected on the participant demographic form was entered into Microsoft Excel. No individual identifiers were collected or entered. Once all forms were entered into Excel, summary statistics (percents, frequencies, averages, and ranges) were calculated. This data was used to generally describe study participants. Mean and standard deviations were determined for continuous variables (i.e. age, number of meals eaten on campus, time spent tanning, and hours slept per night). Frequencies and percentages were determined for categorical demographic variables (i.e. race, living on campus, undergraduate status, employment status, and on campus meal plan) and for other selected categorical variables on the participant demographic form: sunscreen use, deliberate tanning, sources of tanning, dairy intake, quality of sleep, medication use for sleep, and perception of overall health. The hard copy forms were stored in a locked filing cabinet in the thesis chair's office. The Excel file was stored on the researchers' password protected laptop. In accordance with IRB policies, the data files, focus group notes, and demographic forms will be destroyed one year after the study's end.

To create the codebook, one transcription of a focus group was randomly selected. Transcriptions were read by the researcher and two thesis committee members. The researcher and thesis committee members used the discussion guide as a preliminary

framework, and when texts express a unique meaning or idea, those texts were marked and assigned a semantic code. They then compared notes and ideas to conclude if their ideas and codes had similar interpretations. The researcher and thesis committee members organized the two code lists to create a codebook. To update the codebook, they coded each of the transcripts for all four focus groups and two personal interviews, adding new codes as needed.

The codebook was then used to create a table to better show the common themes that were present throughout the focus groups and personal interviews (Appendix G). The themes from the codebook, as seen in Table 4.1, were used to create headings in the table. Each heading was organized by question number and theme. As significant details emerged from the first focus group, those details were added under each heading, and an "x" was put under the focus group number to show which focus group discussed which theme. This process was repeated for each focus group and personal interview. A theme discussed in more than three focus groups or personal interview was considered significant in the results. The themes of the focus groups and personal interviews are seen in Table 4.1

The first question asked during the focus groups was regarding places that students received health information. Based on the responses from the focus group and personal interview participants, many common themes emerged, including the Internet, healthcare providers, family and friends, campus, and the media. The second question discussed during the focus groups and personal interviews was about types of supplements. The common themes that surfaced were pills, multivitamins, liquids, powders, bars, and shakes. Reasons to use supplements were similar in many of the focus

groups, including non-dietary, athletic, and deficiency-related reasons. Side effects of supplements were commonly seen as negative side effects, as more groups discussed negative than positive side effects.

Also, most of the focus groups had similar discussions regarding the role of vitamin D in the body, as well as vitamin D and disease prevention. Participants in the focus groups and personal interviews also had common themes appear when discussing sources of vitamin D, which mainly included dairy foods and the sun. It was then explained to the participants that many Americans are not getting enough vitamin D and that low levels of vitamin D are associated with many chronic disease. When asked how that made the participants feel, the common themes of frustration, shock, unawareness, and conflicting information were raised. Although some of these themes had less than three common responses, they were still used in the results because the researcher felt they were important themes. Finally, when asked about how to disseminate vitamin D messages to the public, the common themes of communication outlets, communication type, and communication messages emerged. Creating a table from the codebook allowed the researcher to clearly see the common themes that materialized in the focus groups and personal interviews.

Table 4.1
Themes Characterizing Focus Group Discussions

- **Sources of Health Information**
  - Internet
  - Classes
  - Family/Friends
  - Job
  - Healthcare Providers
  - On-Campus
  - Media (newspaper, TV, radio, magazines)
  - Food labels
  - Gym/personal trainer
  - Restaurant nutrition information
- **Supplements**
  - Types of Supplements
    - Pills
    - Liquid
    - Injections
    - Powders
    - Bars
    - Shakes
  - Reasons to Use Supplements
    - Non-dietary
    - Athletic
    - Deficiency
  - Side Effects of Supplements
    - Positive
    - Negative
- **Sources of Vitamin D**
  - Non-food
  - Food
- **Feelings about Vitamin D**
  - Frustrated
  - Unaware
  - Fear
  - Conflicting information
  - Increase knowledge
  - Shocking
- **Communication Outlets**
  - Posters
  - Healthcare provider
  - Media
  - On-campus
  - Classes

Table 4.1 (Continued)
Themes Characterizing Focus Group Discussions

Internet and Social Networks
Communication Type
Print
Poster
Celebrity Endorsement
Promotional Event
Fliers
Word-of-mouth
Slogan
Personal connection
Email
Communication to Children
Deficiencies
Sources
Scare Tactics
Importance

Results

Sociodemographic Characteristics of Participants

Table 4.2 shows the demographic characteristics of the participants. The average age of the 22 participants was 20.14 years old (SD=0.83), and 100% of the participants were non-Hispanic white. Five participants lived on-campus (22.72%), while 17 participants (77.27%) lived off-campus. Only one participant was a freshman (4.55%), 8 were sophomores (36.36%), 12 were juniors. (54.55%), and one was a senior (4.55%). Nine participants were currently employed (40.91%) and13 (59.09%) were not. Sixteen participants did not have an on-campus meal plan (72.72%), while 6 participants did (27.27%). Of those 6 participants with a meal plan, an average of 3.67 breakfasts (SD=2.42), 3.5 lunches (SD=1.22), and 2.0 dinners (SD=1.79) were eaten on campus per week.

Table 4.2
Demographic Characteristics of Participants (N= 22)

Item	N	Mean	SD
Age	22	20.14	0.83

Item	N	%
Race		
White, non-Hispanic	22	100%
Live on campus		
Yes	5	22.72%
No	17	77.27%
Undergraduate status		
Freshman	1	4.55%
Sophomore	8	36.36%
Junior	12	54.55%
Senior	1	4.55%
Employed		
Yes	9	40.91%
No	13	59.09%
On campus meal plan		
Yes	6	27.27%
No	16	72.72%

Item	N	Mean	SD
Average number of breakfasts eaten on campus weekly	6	3.67	2.42
Average number of lunches eaten on campus weekly	6	3.5	1.22
Average number of dinners eaten on campus weekly	6	2.0	1.79

Table 4.3 shows participant's dairy intake. When assessing dairy intake, questions were asked regarding the frequency of the participant's intake of milk as a beverage, milk on cereal, cottage cheese, cheese, and yogurt. The most frequently chosen dairy products were milk and cheese, with few participants regularly eating cottage cheese. When looking at milk as a beverage, one participant (4.55%) reported having milk as a beverage 4-5 times per day, two participants (9.09%) chose milk as a beverage 2-3 times per day, and two participants (9.09%) chose milk 1 time per day. Seven participants (31.82%) stated they drank milk as a beverage 2-4 times per week, two participants reported drinking milk 1 time per week (9.09%), three participants (13.64%) said they drank milk 1-3 times per month, while five participants (22.73%) stated they never drank milk as a beverage. Next, frequency of putting milk on cereal was assessed, and it was found that two participants put milk on cereal once per day (9.09%), one participant (4.55%) puts milk on cereal 4-5 times per week, and eight participants (36.36%) put milk on cereal 2-4 times per week. Four participants put milk on cereal one time per week (18.18%), three participants (13.64%) put milk on cereal 1-3 three participants (13.64%) reported never putting milk on their cereal.

The intake of cottage cheese was also asked on the questionnaire, and few participants chose cottage cheese on a regular basis. One participant (4.55%) reported choosing cottage cheese 2-4 times per week and one participant (4.55%) reported choosing cottage cheese 1 time per week. Three participants (13.64%) reported eating cottage cheese 1-3 times per month, and 17 (77.27%) participants reported never eating cottage cheese in the past month. Cheese was one of the most frequently chosen dairy food of the participants. One participant (4.55%) reported eating cheese 4-5 times per

day, one participant (4.55%) reported eating cheese 2-3 times per day, and four participants (18.18%) reported eating cheese 1 time per day. Six participants (27.27%) reported eating cheese 5-6 times per week, seven participants (31.82%) reported eating cheese 2-4 times per week, and two participants (9.09%) reported eating cheese 1 time per week. Only one person (4.55%) stated eatingt cheese 1-3 times per month, and no participant reported eating cheese less than 1-3 times per month. Finally, the intake of yogurt was assessed. Five participants (22.73%) reported eating yogurt 1 time per day, one participant (4.55%) stated they ate yogurt 5-6 times per week, and seven participants (31.82%) reported eating yogurt 2-4 times per week. Four participants (18.18%) stated they ate yogurt 1 time per week, one participant reported eating yogurt1-3 times per month, two participants (9.09%) reported eating yogurt less than once per month, and two participants stated they never eat yogurt.

Table 4.3
Dairy intake of participants (N= 22)

	Milk as a Beverage		Milk on cereal		Cottage cheese		All cheese		Yogurt	
Frequency	N	%	N	%	N	%	N	%	N	%
Never	5	22.73%	3	13.64%	17	77.27%	0	0%	2	9.09%
<1 per month	0	0%	1	4.55%	0	0%	0	0%	2	9.09%
1-3 times per month	3	13.64%	3	13.64%	3	13.64%	1	4.55%	1	4.55%
1 per week	2	9.09%	4	18.18%	1	4.55%	2	9.09%	4	18.18%
2-4 per week	7	31.82%	8	36.36%	1	4.55%	7	31.82%	7	31.82%
5-6 per week	0	0%	1	4.55%	0	0%	6	27.27%	1	4.55%
1 per day	2	9.09%	2	9.09%	0	0%	4	18.18%	5	22.73%
2-3 per day	2	9.09%	0	0%	0	0%	1	4.55%	0	0%
4-5 per day	1	4.55%	0	0%	0	0%	1	4.55%	0	0%
6+ per day	0	0%	0	0%	0	0%	0	0%	0	0%

Table 4.4 depicts the sun exposure of participants. When looking the sunscreen use of the participants, the researcher found that two participants (9.10%) never use sunscreen, sixteen participants (72.72%) use sunscreen some of the time, four participants (18.18%) use sunscreen most of the time, and none reported using sunscreen all of the time. Sixteen participants (72.72%) reported they deliberately tan, while six participants (27.27%) stated they do not deliberately tan. Of those sixteen participants who did report deliberately tanning, ten participants (62.5%) reported using natural sun, two participants (12.5%) use a tanning bed, and four participants (25.0%) reported using both the sun and a tanning bed .The average number of times participants tanned per week was 2.75 times (SD=1.25), with an average of 14.83 minutes (SD=4.31) each time the participant tanned.

Table 4.4
Sun Exposure of Participants (N= 22)

Item	N	%
Sunscreen use		
None of the time	2	9.10%
Some of the time	16	72.72%
Most of the time	4	18.18%
All of the time	0	0%
Deliberately tan		
Yes	16	72.72%
No	6	27.27%
If yes:		
Sources of tanning		
Natural sun	10	62.50%
Tanning bed	2	12.50%
Both	4	25.0%

Item	N	Mean	SD
Time spent tanning			
Average times per week	16	2.75	1.25
Average minutes each time participant tanned	16	14.83	4.31

Finally, Table 4.5 shows the health behaviors of the college women in the study. These health behaviors were assessed via the participant demographic form, such as sleep habits, medicine for sleep, and overall health. It was determined that participants slept an average of 7.41 hours (SD=1.04) per night. Six participants (27.27%) rated their overall quality of sleep as very good, thirteen participants (59.01%) reported their quality of sleep was fairly good, three participants (13.64%) reported their sleep quality was fairly bad, and no participant reported their quality of sleep was very bad.

Table 4.5
Health Behaviors of Participants (N= 22)

Item	N	Mean	SD
Average hours of sleep per night	22	7.41	1.04

Item	N	%
Rate overall quality of sleep		
Very good	6	27.27%
Fairly good	13	59.01%
Fairly bad	3	13.64%
Very bad	0	0%
Medicine for sleep		
Not during the past month	19	86.36%
Less than once a week	2	9.09%
Once or twice a week	1	4.55%
Three or more times a Week	0	0%
Overall health		
Excellent	3	13.64%
Very good	14	63.64%
Good	5	22.73%
Fair	0	0%
Poor	0	0%

When assessing using medicine for sleep, the vast majority of women (86.36%) did not use medicine for sleep in the past month, two participants (9.09%) used medicine for sleep less than once a week, one participant (4.55%) used medicine for sleep once or twice a week, and none used medicine for sleep three or more times a week. Finally, participants were asked to rate their overall health. Three participants (13.64%) reported their health was excellent, fourteen participants (63.64%) stated their health was very good, and five participants (22.73%) reported their health was good. No one stated their health was fair or poor.

Knowledge about Supplements

These female college students were aware of various forms of supplements. Forms of supplements mentioned included pills, liquids, chewable pills, injections, powders, bars, and shakes. Pills were discussed as micronutrient sources, such as iron pills, calcium supplements, or multivitamin supplements, as well as other types of dietary supplements, such as fish oil, omega-3 fatty acids, and flaxseed oil. Liquid supplements were recognized as juices, liquid nutritional supplements (such as Boost and Ensure), tea (including green tea), energy drinks, and supplements added into smoothies. Participants discussed adding supplements to juices and smoothies, as seen in the following statements: "…*juices that combine different types of fruit are supplements*" and "*My stepmom buys smoothies and you can add lots of things to them, such as calcium, vitamin D, but there's a list of 15 vitamins and minerals they offer to add into the smoothies.*" Chewable pills were discussed by participants to include things such as Viactiv chews (which participants believed contain vitamin D and calcium) and Flintstone vitamins. Powders were mostly discussed by participants as protein supplements used by athletes to

become stronger and build muscle. They were unsure of the efficacy of protein powders, as evidenced by the following statements: *"Whey protein is used to make you stronger, but my brother uses them, and it hasn't worked for him*" and "*People think they need more protein than they actually do.*" Creatine was also discussed as a powder supplement used by athletes to help with muscle recovery. Nutrition bars, protein bars, and protein shakes were also mentioned, but participants were not sure of the ingredients in those supplements.

Reasons for Supplements

When asked why people might use supplements, participants' answers fell into three main categories: non-dietary, athletic/"working out", and deficiency. First, the female college students in the study felt that one of the main reasons people use supplements is when the dietary intakes are not meeting complete nutritional needs, as seen in the following statement: "*People who don't drink milk take supplements.*" Participants also attributed the public's misinformation about nutrition as reasons to supplement, as the following illustrates: "*GNC tries to sell so many supplements… unnecessary things, green tea pills… just trying to prey on people who are vulnerable… play on people's misinformation*." Other non-dietary supplemental reasons were mentioned, such as health remedies (vitamin C, echinacea, etc), energy boosting supplements, teas that help you sleep, and teas that boost metabolism. Athletics/"working out" was also mentioned as another reason to use supplements. Participants discussed protein supplements, creatine, steroids, and various other supplements as being used by athletes to increase muscle and enhance athletic performance. Finally, deficiencies were discussed as a reason to use supplements, as participants felt supplements helped people

replace what they were not getting through food. When asked about the contents of all of the previously mentioned supplements (pills, chewable supplements, bars, shakes, etc), participants were not very knowledgeable about what was found in supplements. Overall, the women thought that supplements have many inactive ingredients and lot of fillers, and were not sure what was in nutrition bars but felt they probably had extra calories and sugar.

Side Effects of Supplements

When asked about side effects to supplements, this group of college females felt there were many more negative side effects than positive. In a positive light, participants felt taking supplements was good because they felt that doing so can help a person get what they need if they are not receiving it through food. One participant felt that the side effects of nutritional supplements would be beneficial and that side effects are usually listed on the supplement's package for consumers to read.

There were also many negative side effects discussed, with some being more vague than others. Participants knew there could be complications if too much of a certain vitamin or mineral was consumed. Other side effects mentioned were colored urine, stomach cramps, nausea and vomiting, and diarrhea and gas. Participants felt that too much protein could be converted to fat, that it could cause weight gain if exercise is not being done while taking protein supplements or that excess protein is excreted through urine. Participants also thought that too much vitamin D could turn the skin orange, which is a misperception. Finally, some of the young women reported never having heard of any side effects of supplements.

Role of Vitamin D in the Body

The college females in this study seemed to associate the role of vitamin D in the body with bone health and calcium absorption, as evidenced in the following statement: "*Vitamin D helps the body absorb calcium, if you don't get enough vitamin D you won't be able to absorb calcium and may get osteoporosis.*" and "*… helps you grow calcium for bone health, vitamin D and calcium are necessary for bone health.*" One student discussed a prescription from her doctor regarding vitamin D and calcium absorption: "*I had a bad stress fracture and my doctor prescribed vitamin D for calcium absorption.*" Other students thought that other roles of vitamin D included weight loss and female health, as well as feeling that estrogen was tied in somehow and that women need more during pregnancy, but participants were unsure of why all of these topics were involved with vitamin D in the body.

Another role of vitamin D as mentioned by the students was the effect of vitamin D on mood. The young women felt that vitamin D affected mood, as seen in the following statements: "*It makes you happy.*" and "*People get grumpy when there's no sun.*" They discussed that vitamin D affected Seasonal Affective Disorder (SAD). One participant talked about a prescription of being out in the sun to help with depression, as indicated in the following statement: "*I had a friend who was prescribed sun for 30 minutes per day to help with depression.*" Participants felt that being out in the sun had an effect on mood, which was associated with vitamin D, but they were unsure of the mechanisms behind it. When asked about vitamin D's role in disease prevention, participants knew that vitamin D was associated with rickets in children, as evidenced by the following statements "*If you don't get enough vitamin D as a child, you will get bone*

problems." and "*Kids get rickets from not getting enough vitamin D.*" Participants also felt that vitamin D was linked to osteoporosis in adults ("*not enough vitamin D leads to bone deterioration*"), cancer, and diabetes. Finally, vitamin D was felt to be associated with scurvy.

Sources of Vitamin D

The students were in agreement that the main sources of vitamin D were the sun and milk. The way vitamin D is produced in the skin was unclear to many women but some knew that the UV rays from the sun cause vitamin D to be produced when the sun's rays hit the skin. On a similar note, some participants were aware that vitamin D is also produced from the UV rays found in the tanning bed, as evidenced by the following statement: "*A friend of mine was told to go to the tanning bed because she doesn't get enough vitamin D.*" One young woman mentioned receiving vitamin D from lotions but was unaware of how vitamin D was received from lotion. Dairy products were another popular source of vitamin D, including milk, cheese, and yogurt. Some students were aware that dairy products are fortified with vitamin D and the vitamin D is not naturally occurring. Other vitamin D-fortified foods mentioned by participants include soymilk and cereal. Few other food sources of vitamin D were mentioned by the students, but some mentioned that vitamin D is found in certain types of fish, eggs, liver, and dark leafy green vegetables. It was also stated by a participant that there are not many naturally-occurring good sources of vitamin D.

Feelings about Low Vitamin D in Many Americans

It was explained to the students that recent studies show that many Americans do not get enough vitamin D, and current research has also shown that not getting enough vitamin D can have an effect on bone health, cardiovascular disease, diabetes, and breast cancer. The participants were then asked how that made them feel. Frustration was one feeling that was discussed as indicated in the following statement: "*It's kind of frustrating. My roommate doesn't drink milk… and to choose not to drink it… if you just had a glass you could stop some problems.*" Many participants were unaware of that vitamin D had an effect on so many diseases and that many Americans are vitamin D deficient or insufficient. Many participants said they did not realize vitamin D affected so many diseases. Participants also discussed the need for increased awareness of the general public, as seen in the following statement: "*People need to say more about it and make people more aware. If more people knew it, it might provide an incentive to add it to their daily intake.*" Participants felt that understanding vitamin D's effect on diseases makes them more aware, and one participant stated she is going to start drinking more milk.

Another feeling mentioned was fear, that it was scary that vitamin D is connected to so many diseases. Also, it was mentioned was how shocking it is that so many diseases are associated with vitamin D, and it would probably be even more shocking to the general public. The young women also felt that there needs to be more of an emphasis on vitamin D in the media to try to increase knowledge. The final feeling discussed was about conflicting information regarding vitamin D and the sun, as stated by the following statement: "… *a hard thing because skin cancer is also a problem, maybe sunscreen is*

having an effect because if you don't drink milk or eat dairy, the dietary sources are limited." and "*… (they are) pushing bad things about the tanning beds and say to use sunscreen, but they don't talk about vitamin D… its one-sided.*"

Many other comments were made when discussing their feelings about this topic. One main topic covered was how participants felt it was easier to get vitamin D in the summer and harder to get when the sun is not out a long (such as in the winter). Participants also mentioned how it can be harder to get sun in different geographic locations due to shorter days. Another interesting comment relates to the differences in vitamin D among AA's due to skin pigments, as noted in the following statement: "*African Americans and others have a harder time absorbing it… they might need to take more supplements*." Another significant comment came when discussing why Americans are unaware of vitamin D and do not get enough vitamin D. One student stated "*As a society, we still haven't completely moved towards prevention*."

Messages and Communication of Vitamin D Information

When the study subjects were asked how they would disseminate messages regarding vitamin D to their peers, their answers fell into three major categories: (1) communication outlets, (2) communication types, and (3) communication messages. First, the most common outlets discussed to get out messages about vitamin D were healthcare providers, television, campus, and the Internet (including Facebook and Twitter). The students agreed they would receive messages about vitamin D well from a doctor, nurse, or RD. Most participants agreed that they would receive information equally well from a doctor or nurse, but one group discussed that doctors focus on negative consequences of bad habits, but an RD can help you fix those bad habits. When

asked about receiving messages about vitamin D from an on-campus doctors or nurse at the Student Health Center, some participants were more skeptical than others about using those services, saying they prefer "*someone who is more aware of their personal history.*" Other participants discussed that they would receive information better from the on-campus RD, as evidenced in the following statements: "*I would receive the information better from the dietitian than from the doctors… I went to see the RD, and she helped me see what I wasn't consuming.*" and "*… would take more advice from the dietitian who is more specialized in it*".

Television was another commonly mentioned communication outlet to receive information about vitamin D. Overall, the young women stated that television would be helpful because "*… people correlate what is on TV to their health*". Other television outlets mentioned were public service announcements (local and national) and the news. The Internet and social networks were also a popular method of getting out information about vitamin D. Participants discussed sending out emails (but stated the emails needed to be "short and sweet"), and also putting messages on Blackboard Academic Suite™. Blackboard Academic Suite™ is the online course management system for the university community, which allows university departments and organizations share information. Social networks such as Facebook and Twitter were also mentioned as communication outlets, and participants stated it would be good to create an advertisement, Facebook group, or event to send to the student population.

The most popular communication outlet mentioned by the participants was on-campus methods. One popular method mentioned was putting vitamin D information in the Daily Gamecock, the University's daily student newspaper. Participants mentioned

putting ads or articles in the Daily Gamecock, but stated an article would need to incorporate the following information into its message: "*needs to be shocking*", "*include more interesting aspects of vitamin D*", "*discuss the major consequences of vitamin D deficiency*", "*something that is relevant and age appropriate*", and "*discuss steps to help prevent vitamin D deficiency*". Finally, ideas were discussed about having presentations during class time, as well as holding seminars at the on-campus wellness and fitness center.

The young women came up with many different types of communication about the best ways to get out vitamin D messages to their peers. These included print materials and posters, celebrity endorsements, promotional events, and fliers. Participants felt that giving out print materials, such as including vitamin D information with breast cancer materials, and making pamphlets easily accessible in the dorms or cafeterias would be a good way to reach college students with messages about vitamin D. Next, participants felt that a celebrity endorsement would be helpful, such as having someone famous promote it or come to the University to speak about vitamin D. It was also mentioned that the celebrity would need to be well-qualified, such as Dr. Oz or another well-known doctor or healthcare professional. Other ideas of communication types were in the form the promotional events around campus, such as having a "Milk-a-Thon" for students to track how much milk they drink, handing out free milk on campus to promote bone health, have specific menus in the cafeteria to show what foods are good sources of vitamin D, pass out flyers on campus, and give out incentives (such as free t-shirts) to students who visited a booth about vitamin D.

The students discussed their ideas about the messages that should be included when giving information to other college students, both male and female. The most common messages were about vitamin D deficiencies, food sources of vitamin D, non-food sources of vitamin D, and the importance of getting enough vitamin D. Participants felt that deficiency messages should include the effects of not getting enough, that many of Americans do not get enough vitamin D, and there are more consequences to vitamin D deficiency than many Americans realize. The young woman also believed that it was important for Americans to be more aware of the food sources, as well as the non-food sources. Also mentioned to include in the messaging was the proper way to supplement vitamin D if you do not have access to food sources. Finally, participants felt that Americans need to be aware of the importance of vitamin D, that it needs to be re-emphasized that vitamin D is good for you.

Participants also discussed the importance of communicating vitamin D message to children, adolescents, and their parents. They had many great ideas of how to convey vitamin D messages to these different age groups. It was mentioned by a participants that we need to start educating younger and we need to teach parents about it was well, as seen in the following statement: "*If parents are educated on it, they pass it to their kids.*" Also noted was the importance of teaching children when they are younger and giving them continual exposure to vitamin D messages to help emphasize the importance of it. The young women thought that posters in elementary and high schools were important to emphasize to students the importance of eat balanced meals, and that we need to start at an earlier age to instill health values in the school setting. Finally, these young women

also felt it was important to incorporate knowledge of vitamin D into the classroom, especially in middle or high school health classes.

Sources of Health Information

When asked where they receive most their health information, the majority of the participants stated that the Internet, media (including television, newspapers, radio, and magazines), family and friends, healthcare providers (doctors, nurses, registered dietitians, etc), college classes, and the University campus were the main sources.

Internet

The participants used Internet sites such as online newspapers, WebMD, magazine websites, and the MyPyramid website. WebMD was used primarily for the symptom checker, but it was also stated that WebMD can provide many different diagnoses for the symptoms put into the website. However, most participants felt that WebMD was more credible than online search engines such as Google and Yahoo. Another online source discussed was restaurant websites, which was used to find calories in food items. The MyPyramid website (MyPyramid.gov) was also used by participants to look up nutrition and calorie information.

Family and Friends

Participants in the focus groups also relied on family and friends for health information, especially their parents. When asked why their parents were such important sources of health information, responses included: "*I listen to my dad because he is in good shape and is a good example.*" and "*My mom has helped me along this far, and I*

always feel better after talking to her". Mothers who were also health professionals were included was well, as two of the young women felt their mothers, who were a nurse and a Registered Dietitian (RD), were good sources of information because they both have personal experience. Finally, friends were not mentioned as much as parents, but these were influenced by their friends who were "*health nuts*".

Healthcare Providers

Healthcare providers were another popular source of information and were trusted by the participants. Doctors, nurses, RD's (including the RD on campus), pharmacists, nurse practitioners, and physician's assistants were all stated to be credible and utilized sources of health information. Participants felt that doctors can "…*make recommendations based on the information you give them*" but "….. *don't go into too much detail*."

On-campus resources and classes

On-campus resources were another popular source of health information among the young women. Students were aware of the on-campus RD, the Campus Wellness program, the on-campus Wellness and Fitness Centers, and posters around campus. Participants knew about the services available from the RD on the University campus, but also discussed that many students with health majors were more aware of health-related services at the University because of their major. When asked why, they said they felt that "…*health-related services are advertised more in the buildings that have health-related majors* (such as public health and exercise science)*, and people in other majors may not be aware of health services offered*". The students also felt that students who

were previously more aware of their health used the RD more, as the following illustrates: "S*tudents who used those services are already health-conscious anyway.*" Posters around campus were noted, but participants stated that they were "… *not a lot of information, but they are reminders*" and *"Good sources of information but don't go in depth*". Since the participants were college students, many of them listed their classes as sources of health information. They stated they could look up information in their books, or that they learned a lot from certain health-related classes. The students who had previously taken nutrition classes felt that they learned a lot about nutrition and health from their classes, and they used their books and diet analysis software that came with the book to look up nutrition related questions.

Media

The final prominent source of health information was the media. Magazines were popular sources of exercise and nutrition information, but the students thought that magazines seem to focus on only one thing when it came to the diets (such as eliminating one food group or low-carbohydrate diets). The young women did think that newspapers often gave information about current research or supplements, but felt that articles in newspapers "…. *didn't really move them to action*". Television was another popular source of health information but participants discussed many different ways to get health information from television. News shows, such as "The Today Show", were mentioned as providing information for weight loss, fad diets, etc, but participants noted that often information on television shows can be taken out of context, as they are trying to appeal to a wider population. When asked about the credibility of health information from television, the students discussed how information from the media can be slanted one

way, as seen in the following statement "… *skewed – like H_1N_1, they made a big deal about it but it was over and done*". Commercials were also discussed as sources of health information but mostly through the selling of products. Examples included diet pill commercials, the "Got Milk?" ads, and popular exercise infomercials. Participants knew that the public needs to be a knowledgeable consumer (for example knowing that the "Got Milk?" commercials may be funded by the dairy industry). When discussing diet pill commercials, participants were aware of the marketing involved in producing those commercials, as illustrated by the following comments: "*… it's all a joke, who actually buys it?*" and *"… hard to trust since they are trying to sell a product and make money*". With the exercise infomercials, participants felt that people who personally see results from those infomercials (such as having a friend purchase the exercise program and have results with it), they were more likely to believe it.

Discussion

Dairy intake is an important determinant of vitamin D status, as it has been shown to have a positive effect on vitamin D status (Gordon et al, 2004). Gordon et al (2004) found an inverse correlation between vitamin D deficiency and consuming milk and cold cereal (which is usually fortified with vitamin D). The results from dairy intake questions on the participant demographic form in this study found that the majority of participants drink milk, as well as put milk on their cereal 2-4 times per week. Also, the majority of participants ate cheese and yogurt more than 2-4 times per week. This indicates good intake of dairy by these college females, which in turn will increase their dietary intake of vitamin D.

The women in the study were knowledgeable about various forms of supplements. This is not surprising because many college females use vitamin and mineral supplements regularly. Stasio, Curry, Sutton-Skinner, and Glassman, (2008) researched supplement usage in college students, and found that 59.7% of students used vitamins and mineral supplements in the previous week. Similarly, Wilson et al (2006) found that 73.6% of adolescent females reported vitamin use. Discussions about reasons to use supplements centered on non-dietary reasons, athletic performance, and deficiencies. Participants were not aware of the ingredients in supplements.

Participants in the study knew that vitamin D plays a role in calcium absorption, and discussed calcium and vitamin D in relation to bone health. Most participants were unaware of many other roles of vitamin D in the body, and some participants associated vitamin D with pregnancy and women's health. The young women also discussed vitamin D in association with the prevention of osteoporosis (in adults) and rickets (in children). Some participants knew that vitamin D had an effect on mood and depression, but most participants associated this effect on being out in the sun, not on the vitamin D itself. Few of the college students in the study were aware of vitamin D's effects on other diseases, such as breast cancer, metabolic syndrome, diabetes, and cardiovascular disease. Because vitamin D is so associated with bone health, health educators on college campuses should include other diseases associated with vitamin D in their public health messages.

The main sources of vitamin D discussed in the focus groups were dairy products and the sun. Participants were aware of the fortification of vitamin D into dairy foods, as well as into other foods, such as cereal and soymilk, in addition to the use of vitamin

supplements to receive vitamin D. Tanning beds were also mentioned as being sources of the UV rays that produce vitamin D in the body, but participants did express concerns about mixed messages that the public may receive from using tanning beds to get vitamin D, as tanning beds are known to cause skin cancer. Other sources of vitamin D were only mentioned in two focus groups, and the sources mentioned were eggs, liver, fish, and vegetables (participants were aware of the vitamin D in green vegetables). It is important to note a study limitation with regards to participants' knowledge of vitamin D sources, because the majority of the participants likely had a health-related major. It is believed that most of the participants had a health-related major because primary email recruitment was done by two thesis committee members, who are professors in the Health Promotion, Education, and Behavior program, to their current and former students. Also, students were recruited from classes (Applied Aspects of Human Nutrition, Personal Community Health, and Introduction to Public Health). Since participants were likely had a health-related major, it is to be expected they had a higher knowledge of nutrition prior to participation in the focus groups.

When discussing outlets and types of communication to best reach college students with vitamin D messages, participants' answers were consistent with the findings found in the Brener and Gowda (2001), which found that 77.4% of students said they received some type of prevention information from their college or university. Every focus group mentioned using on-campus resources to spread the word about vitamin D. Our focus groups were very specific to the University of South Carolina, Columbia campus. Participants in the focus groups had ideas to use certain University programs, such as Campus Wellness and the University's wellness and fitness center. Because of

these findings, it is important for university educators to take note of the overwhelming responses in the focus groups signifying the importance of a college or university's impact on its students.

Another popular communication outlet mentioned by the participants was the Internet and online social networking sites. Escoffery et al (2005) surveyed 743 undergraduate students to look at their Internet use, health-seeking behaviors, and attitudes regarding using the Internet to get health information. Their results showed that 72.9% of students used the Internet to get health information, with significantly more female students (77.9%) than male students (68.6%) using the Internet to find health information. These findings, as well as the findings from our focus groups, should help university educators understand the impact the Internet and social networking sites are having on college students today.

One communication outlet that was not mentioned in any focus group was targeting parents to help increase vitamin D awareness in college students. Siebert, Wilke, Delva, Smith, and Howell (2003) found that both AA students (74%) and white students (76%) reported that their parents were their main sources of health information. This study also found that most of the focus groups reported that family and friends were major sources of health information, but our focus group participants did not mention using family or friends as a communication outlet for vitamin D messages.

The participants in this student believed that communication messages about vitamin D should include information about vitamin D deficiencies, such as the effects of a deficiency, as well as the food and non-food sources. The students also discussed ways

to communicate health messages to children. Participants believed that it was important to start educating children younger, and to include teaching parents/caregivers as well. This theme is similar to what the participants discussed when they talked about parents being an important source of health information. Because the theme of parental influence was re-iterated throughout the focus groups, college health educators might consider working with parents to improve health messages to children, as well as college students. Universities across the country have a variety of programs that serve as liaisons with parents, such as an Office of Parents Programs, which offer opportunities for parents/caregivers to be educated about available campus/area resources to support their student's growth and development. These programs should consider educating parents/caregivers about campus health-related services to help disseminate health messages more efficiently to students.

Brener and Gowda (2001) found that 77.4% of students stated they received some type of prevention information from their college or university, and 34.0% of women reported receiving nutritional information. Also, Escoffery et al. (2005) found that 72.9% of students used the Internet to get health information, with 47.2% of the students using the Internet to find diet and nutrition information. Siebert, Wilke, Delva, Smith, and Howell (2003) found that common sources of health information among students were parents, friends, Internet, magazines, and health educators to be the most used sources of health information. These finding are consistent with the sources of health information reported by the participants in the focus groups. The participants discussed commonly using the Internet, media, family and friends, healthcare providers, college classes, and the University campus as the main sources of their health information. Unlike the finding

in the Siebert, Wilke, Delva, Smith, and Howell (2003) article, the participants in this study discussed some distrust of the credibility of on-campus healthcare providers, which is something of which these professionals on college campuses should be aware.

Limitations

Several limitations from this study are due to recruitment. Selection bias is likely present in the study because participants were recruited via email by thesis committee members. Emails were sent out to former and current undergraduate students, who would have previously taken public health-related classes (including a nutrition class) with these professors. Also, the researcher spoke in three health-related undergraduate classes to recruit participants. Because some participants had previously taken nutrition or public health classes, they are more likely to have increased knowledge of vitamin D compared to other undergraduate students.

Another limitation was the sample. Recruitment of AA female students was a problem. At the University of South Carolina during the Fall 2009 semester, 11% of the undergraduate student population was AA, while 77% was white (University of South Carolina, 2009). Lack of access to other students, particularly students of color, led to lack of recruitment to AA students. Since there were no AA participants in the study, one of the research questions was left unanswered. Finally, during the last month of data collection, there were several health stories in the media regarding vitamin D. A partnership between Aetna, a health insurance provider, and Walgreens pharmacy was established to let the public know about vitamin D. They handed out coupons that residents could use at Walgreens stores for free 100-day Vitamin D supplies. The

program was piloted in Richland and Lexington counties in South Carolina. The University of South Carolina, Columbia is found in Richland County, and Lexington County is a neighboring county. Aetna and Walgreens created print and radio advertisements in the Columbia area, and mailed flyers to county residents, letting them know about the giveaway. Also, they educated area health care providers about using Vitamin D. This may have caused participants, or their healthcare providers, to have increased awareness and knowledge of vitamin D.

Implications for Research and Practice

The findings in this study highlight the places that college students receive their health information, as well as what they have already heard or what their perceptions are about vitamin D. Also included is how participants would publicize messages about vitamin D. Mass media campaigns that include Internet, television commercials, social media, and college campuses are useful ways to reach college students with health messages. College campuses should be the main campaign target for health messages, as college students believe this to be an easy way to reach their peers. Collaboration with several on-campus wellness programs could also prove beneficial in disseminating health messages to college students.

Future studies may need to evaluate the knowledge and perceptions of vitamin D AA and other race/ethnicity groups to find differences to determine if there are any differences. Also, other studies may benefit from using a mix of college students and people who did not attend college to determine if educational level played a factor in knowledge of vitamin D.

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Chapter V

Summary, Implications, and Recommendations

Overall Conclusions

This chapter summarizes and discusses the results of this study. Key findings of the research questions are provided below, as well as a discussion of the findings of the study. Limitations and implications of the research are included, as are possible areas of future research. The purpose of this study was to assess the knowledge and perception of vitamin D among college females age 18 to 22 years old.

Research Question 1: What do college-age women, aged 18-22 years old, know about vitamin D?

***Key Findings*:** When asked about vitamin D, most discussions centered around dairy sources of vitamin D, as well as the sun as being a good source of vitamin D. Women were knowledgeable about the association of vitamin D with bone health, but were not as aware of other roles that vitamin D plays in the body.

Research Question 2: What do college-age women, aged 18-22 years old, know about dietary supplements?

***Key Findings*:** Participants were aware of the various forms of supplements (pills, powders, bars, shakes, etc), but were not as knowledgeable about the contents of

supplements. Participants attributed supplements use to non-dietary reasons, athletes/"working out", and deficiencies.

Research Question 3: What do college-age women, aged 18-22 years old, know about the health consequences attributed to vitamin D deficiency?

Key Findings: Participants associated the health consequences of vitamin D deficiency with bone health. Most participants were unaware of other health consequences related to vitamin D deficiency.

Research Question 4: What do college-age women, aged 18-22 years old, know about the food and non-food sources of vitamin D?

***Key Findings*:** The most commonly mentioned sources of vitamin D were the sun and milk. Participants could name few other sources of vitamin D, some of which were incorrect.

Research Question 5: Is there a difference in knowledge & perceptions of dairy foods in AA students and non-Hispanic white students?

Key Findings: Due to 100% of the participants being non-Hispanic white, this research question could not be appropriately addressed in this paper.

Research Question 6: What are college-age women, aged 18-22 years old, practicing in terms of behaviors (i.e., dietary intakes, sun exposure, and general health) related to vitamin D?

***Key Findings*:** The majority of participant had intake of dairy >2-4 times per week. Most participants reported deliberately tanning, with the sun being the most

common methods of tanning. The mean hours of sleep per night was 7.42, and the majority of participants reported fairly good sleep quality, no use of medicine for sleep, and "very good" overall health.

The participants were aware of various forms of supplements. Forms mentioned were pills, liquids, chewable pills, injections, powders, bars, and shakes. Pills were discussed as micronutrient sources, such as iron pills, calcium supplements, or multivitamin supplements, as well as other types of supplements, such as fish oil, omega-3 fatty acids, and flaxseed oil. Liquid supplements were recognized as juices, liquid nutritional supplements (such as Boost and Ensure), tea (including green tea), energy drinks, and supplements added into smoothies. Nutrition bars, protein bars, and protein shakes were also mentioned, but participants were not sure of the ingredients in those supplements.

When asked why people might use supplements, participant's answers fell into three main categories: non-dietary, athletics/"working out", and deficiency. First, participants felt that one of the main reasons people use supplements is when dietary intakes are not meeting complete nutritional needs. Participants also attributed the public's misinformation with reasons to supplement. Athletics/"working out" was also mentioned as another reason to use supplements. Participants discussed protein supplements, creatine, steroids, and various other supplements as being used by athletes to increase muscle and enhance athletic performance. Finally, deficiencies were discussed as a reason to use supplements, as participants felt supplements helped people replac what they were not getting through food. When asked about the contents of all of the previously mentioned supplements (pills, chewable supplements, bars, shakes, etc),

participants were not very knowledgeable regarding what was found in supplements. When asked about side effects to supplements, participants felt there were many more negative side effects than positive, but some participants reported never having heard of any side effects of supplements.

Participants seemed to associate the role of vitamin D in the body with bone health and calcium absorption. Participants thought that other roles of vitamin D included weight loss and female health, as well as feeling that estrogen was tied in somehow and that women need more during pregnancy, but participants were unsure of why all of these topics were involved with vitamin D in the body. Another role of vitamin D as mentioned by participants was the effect of vitamin D on mood. They discussed that vitamin D affected Seasonal Affective Disorder (SAD). One participant talked about a prescription of being out in the sun to help with depression. Participants felt that being out in the sun had an effect on mood, which was associated with vitamin D, but they were unsure of the mechanisms behind it. When asked about vitamin D's role in disease prevention, participants knew that vitamin D was associated with rickets and osteoporosis.

Participants were in agreement that the main sources of vitamin D were the sun and milk. The way vitamin D is produced in the skin was unclear to many participants but some knew that the UV rays from the sun causes vitamin D to be produced when the sun's rays hit the skin. On a similar note, some participants were aware that vitamin D is also produced from the UV rays found in the tanning bed. Dairy products were another popular source of vitamin D, including milk, cheese, and yogurt. Some participants were aware that dairy products are fortified with vitamin D and the vitamin D is not naturally

occurring. Other vitamin D-fortified foods mentioned by participants include soymilk and cereal, but few other food sources of vitamin D were mentioned.

It was explained to the participants that recent studies show that many Americans do not get enough vitamin D, and current research has also shown that not getting enough vitamin D can have an effect on bone health, cardiovascular disease, diabetes, and breast cancer. The participants were then asked how that made them feel. Frustration was one feeling that was discussed, as well as unawareness of deficiency, fear, and shock. Participants felt that there needs to be more of an emphasis on vitamin D in the media to try to increase knowledge.

When participants were asked how they would disseminate messages regarding vitamin D to their peers, their answers fell into three major categories: communication outlets, communication types, and communication messages. First, the most common outlets discussed to get out messages about vitamin D were healthcare providers, television, campus, and the Internet (including Facebook and Twitter). Participants agreed they would receive messages about vitamin D well from a doctor, nurse, or RD. When asked about receiving messages about vitamin D from an on-campus doctors or nurse at the Student Health Center, some participants were more skeptical than others about using those services. The Internet and social networks were also a popular method of getting out information about vitamin D. The most popular communication outlets mentioned by the participants were on-campus methods.

Participants came up with many different types of communication about the best ways to get out vitamin D messages. They included print materials and posters, celebrity

endorsements, promotional events, and fliers. Participants felt that giving out print materials, such as including vitamin D information with breast cancer materials, and making pamphlets easily accessible in the dorms or cafeteria would be a good way to reach college students with messages about vitamin D. Next, participants felt that a celebrity endorsement would be helpful, such as having someone famous promote it or come to the University to speak about vitamin D, but the celebrity would need to be a well-qualified celebrity. Also, participants discussed their ideas about the messages that should be included when giving information to college-students. The most common messages were about vitamin D deficiencies, food sources of vitamin D, non-food sources of vitamin D, and the importance of getting enough vitamin D.

Finally, participants discussed receiving most of their health information from the Internet, media (including television, newspapers, radio, and magazines), family and friends, healthcare providers (doctors, nurses, registered dietitians, etc), college classes, and the University campus. The participants used Internet sites such as online newspapers, WebMD, magazine websites, and the MyPyramid website (MyPyramid.gov). Participants in the focus groups also relied on family and friends for health information, especially their parents. Mothers who were also health professionals were included was well, as two participants felt their mothers, who were a nurse and a Registered Dietitian (RD), were good sources of information because they have personal experience. Friends were not mentioned nearly as often as parents. Healthcare providers such as doctors, nurses, RD's (including the RD on campus), pharmacists, nurse practitioners, and physician's assistants were all stated to be credible and utilized sources of health information. On-campus resources were another popular source of health

information among participants. Students were aware of the on-campus RD, Campus Wellness, the on-campus Wellness and Fitness Center, and posters around campus. Participants knew about the services available from the RD on the University campus, but they also discussed that many students with health majors were more aware of health-related services at the University because of their major. The final prominent source of health information was the media. Magazines were popular sources of exercise and nutrition information, but participants thought that magazines seem to focus on only one thing when it came to the diets (such as eliminating one food group or low-carbohydrate diets). News shows, such as "The Today Show", were mentioned as providing information for weight loss, fad diets, etc, but participants noted that often information on television shows can be taken out of context, as they are trying to appeal to a wider population. Commercials were also discussed as sources of health information but mostly through the selling of products.

Limitations of the Research

Several limitations from this study are due to recruitment. Selection bias is likely present in the study because participants were recruited via email by thesis committee members. First, participants were recruited via email by thesis committee members. Emails were sent out to former and current undergraduate students, who would have previously taken public health-related classes (including a nutrition class) with these professors. Also, the researcher spoke in three health-related undergraduate classes to recruit participants. Because some participants had previously taken nutrition or public health classes, they are more likely to have increased knowledge of vitamin D compared to other undergraduate students.

Another limitation was the sample, as recruitment of AA female students was a problem. At the University of South Carolina during the Fall 2009 semester, 11% of the undergraduate student population was AA, while 77% was white (University of South Carolina, 2009). Lack of access to other students, particularly student of color, led to lack of recruitment of AA students. Since there were no AA participants in the study, one of the research questions was left unanswered. Finally, during the last month of data collection, there were several health stories in the media regarding vitamin D. A partnership between Aetna, a health insurance provider, and Walgreens pharmacy was launched to let the public know about vitamin D. They handed out coupons that residents could use at Walgreens stores for free 100-day Vitamin D supplies. The program was piloted in Richland and Lexington counties in South Carolina. The University of South Carolina, Columbia is found in Richland County, and Lexington County is a neighboring county. Aetna and Walgreens created print and radio advertisements in the Columbia area, and mailed flyers to county residents, letting them know about the giveaway. Also, they educated area healthcare providers about using Vitamin D. This may have caused participants, or their healthcare providers, to have increased awareness and knowledge of vitamin D.

Implications for Future Research

The findings in this study highlight the places that college students receive their health information, as well as what they have already heard or what their perceptions are about vitamin D. Also included is how participants would publicize messages about vitamin D. Sleep habits of the participants were of particular concern, as some participants reported using medicine for sleep. Also of concern was the participant's

perception of their overall health, as many participants reported their health as "very good" or "good" instead of "excellent". Supplement knowledge of the participants is an area that may need to be strengthened in college students, as the participants in this study had limited knowledge of supplement's contents and side effects. Healthy Campus 2010 creates national college health objectives and functions as a basis for developing plans to improve student health (American College Health Association, 2009). The University of South Carolina has a clearinghouse to gather and disseminate information regarding the Healthy Campus initiatives. Due to the health behavior results of this study, future initiatives at the University of South Carolina could focus on not only nutrition aspects of Healthy Campus 2010, but other overall health behaviors of students, such as sleep and perceptions of health.

Mass media campaigns that include Internet, television commercials, social media, and college campuses are useful ways to reach college students with health messages. College campuses should be the main campaign target for health messages, as college students believe this to be an easy way to reach their peers. Collaboration with several on-campus wellness programs could also prove beneficial in disseminating health messages to college students. Future studies may need to evaluate the knowledge and perceptions of vitamin D AA and other race/ethnicity groups to find differences to determine of there are any differences. Also, other studies may benefit from using a mix of college students and people who did not attend college to determine if educational level played a factor in knowledge of vitamin D.

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Appendix A

Survey of College Females on Vitamin D

Participant Demographic Form

Tell us about yourself …

1. What is your date of birth: __ __ / __ __ / __ __ __ __

2. Which best describes you? (✓only one.)
   - □ African American, non-Hispanic
   - □ White, non-Hispanic
   - □ Hispanic/Latino
   - □ Native American Indian
   - □ Asian American
   - □ Multi-Racial

3. Do you live on-campus? 1. No 2. Yes

4. What is your zip code? ___ ___ ___ ___ ___

5. What is your current undergraduate status at the University of South Carolina?

   1. Freshman
   2. Sophomore
   3. Junior
   4. Senior

6. Do you have a paying job? 1. No 2. Yes

7. Do you use an on-campus meal plan? 1. No 2. Yes

   a. If "yes", how often do you eat breakfast in a campus dining location?

   _____# times per week (Monday – Sunday, 7 days)

   b. If "yes", how often do you eat lunch in a campus dining location?

   _____# times per week (Monday – Sunday, 7 days)

   c.. If "yes", how often do you eat dinner in a campus dining location?

   _____# times per week (Monday – Sunday, 7 days)

Tell us about your sun exposure…

8. When going outdoors, how often do you use sunscreen?

___ All of the time ____ Most of the time ____Some of the time ____ None of the time

9. Do you deliberately tan? 1. No 2. Yes

If yes:

A. What sources of tanning do you use (not including self-tanning lotions, spray tans, Mystic tans or makeup)?

_____

B. If you answered tanning bed, how many times per week do you tan and for how long each time?

_____ times per week _____ minutes each time I tan

Tell us about your diet …

10. Do you put milk on cereal? 1. No 2. Yes

11. Do you drink milk (includes beverages made with milk such as lattes, cappuccinos, mochas or hot chocolate)? 1. No 2. Yes

12. How often do you eat or drink the following foods?

A. Milk as a beverage **(✓only one.)**

___ I never drink milk as a beverage.

Daily	Weekly	Monthly
___1 per day	___1 per week	___Less than once per month
___2-3 per day	___2-4 per week	___1-3 per month
___4-5 per day	___5-6 per week	
___6+ per day		

B. Milk on cereal

___ I never put milk on cereal.

Daily	Weekly	Monthly
___1 per day	___1 per week	___Less than once per month
___2-3 per day	___2-4 per week	___1-3 per month
___4-5 per day	___5-6 per week	
___6+ per day		

C. Cottage cheese

___ I never eat cottage cheese

Daily	Weekly	Monthly
___1 per day	___1 per week	___Less than once per month
___2-3 per day	___2-4 per week	___1-3 per month
___4-5 per day	___5-6 per week	
___6+ per day		

D. All other cheese (including low or reduced fat, American, cheddar, and cream) including cheese used in cooking.

___ I never eat cheese (including low or reduced fat, American, cheddar, and cream) including cheese used in cooking.

Daily	Weekly	Monthly
___1 per day	___1 per week	___Less than once per month
___2-3 per day	___2-4 per week	___1-3 per month
___4-5 per day	___5-6 per week	
___6+ per day		

E. Yogurt, all types except frozen.

___ I never eat yogurt.

Daily	Weekly	Monthly
___1 per day	___1 per week	___Less than once per month
___2-3 per day	___2-4 per week	___1-3 per month
___4-5 per day	___5-6 per week	
___6+ per day		

Tell us more about other health behaviors…

13. How many hours of sleep do you get on a typical night? _____ hours per night

14. During the past month, how would you rate your sleep quality overall?

___Very good ___Fairly good ___Fairly bad ___ Very bad

15. During the past month, have you taken any medicine (over the counter or prescription) to help you sleep?

___Not during the past month

___Less than once a week

___Once or twice a week

___Three or more times a week

16. How would you rate your overall health?

___Excellent

___Very good

___Good

___Fair

___Poor

Appendix B

Focus Group Implementation Guide

Directions: ***Sections written in Italic font are to be read to participants.***

Materials and Equipment
15 pencils
15 demographic questionnaires
30 informed consent forms
15 Confidentiality Agreement forms
Name tags for each participant

Introduction and Informed Consent (15 minutes)
As participants arrive they will be given a name-tag and a demographic questionnaire to complete. After an initial welcome, the moderator will briefly describe the purpose of the focus group, emphasizing the following points:

"You have been invited to participate in a group discussion about vitamin D. We will be discussing what everyone knows about vitamin D and what you all think about vitamin D."

Next, informed consent will be obtained. Distribute two copies of the consent form to each participant. Ask the participants to follow along as you read the form out loud. After reading the form, emphasize the following points:

"We will be tape recording the session. We don't want to miss any of your comments. Only members of the research team will have access to the tapes. If anyone is uncomfortable with being tape recorded, please say so, and of course, you are free to leave. The tapes will be kept in a locked file cabinet. Once the tapes have been listened to and we don't need them anymore, they will be destroyed. In any reports of the findings, names will not be used. We also ask that each of you keep confidential the information shared in this group and the names of participants."

At this point, ask participants if they have any questions. Once all questions have been answered, ask the participants to sign one copy of the consent form and the confidentiality statement and return them to you.

In order to facilitate group interaction, the moderator will ask each participant to introduce him or herself using a first name. Emphasize that they can use any name they choose.

Following the introductions, the moderator will describe what is expected of participants in terms of the group discussions (e.g., the ground rules):

"Before we get into our discussion, let me make a few requests of you. First, speak up so that everyone can hear you and let's try to have just one person speak at a time. Please say exactly what you think. Don't worry about what I think or your neighbor thinks. There are no right or wrong responses. Everyone's ideas and experiences are important."

Introduction of Focus Group Questions/Topics (60 minutes)

The moderator will introduce each question, and explore it thoroughly before moving on to another question/topic. Approximately 10 minutes is allocated for discussion of each of the following questions/topics. The moderator will elicit opinions from each participant, and use probes as needed to assist participants to provide detailed descriptions of their experience and to give examples whenever possible. Questions are to be addressed in the following order.

1. First, we would like to know where you all get most of your health information (10 minutes).
   Probes:
   -Ask to give specific places
   -Ask how they feel about the places they get their health information; it is a credible source?

2. Now, when you hear the word "supplement" what comes to mind? (10 minutes)
   Probes:
   -What kind of supplements?
   -What's in them?
   -What form are they in (powder, liquid, pill, etc)?
   -Any side affects?

3. Tell me what you think of when you hear the words "vitamin D" (10 minutes).
   -role in the body/diet (knowledge)/health benefits
   -what happens if you don't get enough?

4. Now, we would like to hear about where we can get vitamin D (10 minutes).
   Probes:
   -Food sources/dietary behaviors
   -What types of non-food sources/non-dietary behaviors might help in vitamin D production?

5. Recent studies show that many Americans do not get enough vitamin D. Current research has also shown that not getting enough vitamin D can have an effect on bone health, cardiovascular disease, diabetes, and breast cancer.

   How do you feel about that?

6. If you wanted to get the word out about vitamin D, how would you do it? (10 minutes)
   Probes:
   -What would your messages be?
   - How would you feel receiving information about vitamin D from your doctor or a nurse?

Wrap-Up

"Before we break up for the evening, we would like to know if there is anything you would like to add. Are there things regarding vitamin D that we didn't discuss?"

At this point, thank the participants for attending the focus group and providing useful information. Complete the drawing for the gift certificate.

Appendix C

Confidentiality Agreement

I agree to keep in the strictest confidence any information about the other focus group participants. I will not discuss the identity of the participants or any statements they make with anyone outside the group.

Participant signature _____ Date_____

Investigator signature _____ Date_____

Appendix D

Invitation Letter/Email

Knowledge and Perceptions of Vitamin D among College Women Age 18-22 Years

Conducted by
Ellen Wingard, RD, LD, MSPH candidate
School of Public Health
University of South Carolina

My name is Ellen Wingard, and I am a graduate student in the Arnold School of Public Health at the University of South Carolina. I am conducting a research study as part of the requirements of my degree in the Health Promotion, Education, and Behavior program, and I would like to invite you to participate.

I am studying college women's knowledge and perceptions of vitamin D. If you decide to participate, you will be asked to complete a demographics survey, as well as participate in a group discussion about vitamin D. In particular, you will be asked questions about what you know about vitamin D and its sources, supplements, and your perceptions of dairy foods. The meeting will take place on the campus of USC, and should last about 1 hour. The information discussed in the focus group session will be recorded by a note-taker so that I can accurately reflect on what is discussed. The notes will only be reviewed by members of the research team who will transcribe and analyze them. They will then be destroyed.

You may feel uncomfortable answering some of the questions. You do not have to answer any questions that you do not wish to. Although you probably won't benefit directly from participating in this study, we hope that others in the community/society in general will benefit by understanding more about vitamin D.

Participation is confidential. Study information will be kept in a secure location at the University of South Carolina. The results of the study may be published or presented at professional meetings. Participation is anonymous, which means that no one (not even the research team) will know what your answers are. So, please do not write your name or other identifying information on any of the study materials.

Others in the group will hear what you say, and it is possible that they could tell someone else. Because we will be talking in a group, we cannot promise that what you say will remain completely private, but we will ask that you and all other group members respect the privacy of everyone in the group.

Your name will be placed into a pool for a random drawing for the chance to win a $20 gift card.

Taking part in the study is your decision. You do not have to be in this study if you do not want to. You may also quit being in the study at any time or decide not to answer any question you
are not comfortable answering. Participation, non-participation or withdrawal will not affect your grades in any way.

We will be happy to answer any questions you have about the study. You may contact me at
803-837-1262 or elliotee@email.sc.edu, or my faculty advisor, Dr. Kara Montgomery, 803-777-777-0057 or kmkreut@mailbox.sc.edu, if you have study related questions or problems. If you have any questions about your rights as a research participant, you may contact the Office of Research Compliance, Mr. Thomas Coggins at the University of South Carolina at 803-777-7095.

Thank you for your consideration. If you would like to participate, please contact me via phone or email.

With kind regards,

Ellen Wingard, RD, LD, MSPH candidate
Arnold School of Public Health
800 Sumter Street, 216E
Columbia, SC 29208
803-837-1262
elliotee@email.sc.edu

Appendix E

IRB Approval Letter

OFFICE OF RESEARCH COMPLIANCE

February 15, 2010

Mrs. Elizabeth Wingard
Arnold School of Public Health
Health Promotion, Education & Behavior
800 Sumter St, HESC 112
Columbia, SC 29208

Re: Pro00005695
Study entitled: *Knowledge and Perceptions of Vitamin D among College Women Age 18-22 Years*

FYI: University of South Carolina Assurance number: FWA 00000404 / IRB Registration number: 00000240

Dear Mrs. Wingard:

In accordance with 45 CFR 46.101(b)(2), the referenced study is exempt from Human Research Subject Regulations. No further action or Institutional Review Board (IRB) oversight is required, as long as the project remains the same. However, you must inform this office of any changes in procedures involving human subjects. Changes to the current research protocol could result in a reclassification of the study and further review by the IRB.

Because this project was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

Research related records should be retained for a minimum of three years after termination of the study.

If you have questions concerning the IRB process, please contact Arlene McWhorter at arlenem@mailbox.sc.edu or (803) 777-7095.

Sincerely,

Thomas A. Coggins (am)
Thomas A. Coggins
Director
/am

University of South Carolina-Columbia, South Carolina – 803/777-7095 – Fax 803/576-5589

Appendix F

Vitamin D Codebook

Question 1

A: Healthinfo

AA: Healthinfo/Source

AAA: Healthinfo/Source/Internet

AAB: Healthinfo/Source/Classes

AAC: Healthinfo/Source/Family and Friends

AAD: Healthinfo/Source/Employment

AAE: Healthinfo/Source/Healthcare Providers

AAF: Healthinfo/Source/Campus

AAG: Healthinfo/Source/Media (Newspaper, TV, Radio, Magazine)

AAH: Healthinfo/Source/Food label

AAI: Healthinfo/Source/Gym or personal trainer

AAJ: Healthinfo/Source/restaurant nutrition info

AB: Healthinfo/source/credible

Question 2

B: Supplement

BA: Supplement/Types

BAA: Supplement/Types/Pills

BABA: Supplement/Types/Pills/Vitamins or MVI

BAB: Supplement/Types/Liquid

BAC: Supplement/Types/Chewable pills

BAD: Supplement/Types/Injections

BAE: Supplement/Types/Powders

BAF: Supplement/Types/Bars

BAG: Supplement/Types/Shakes

BB: Supplement/Reason

BBA: Supplement/Reason/Non-dietary

BBB: Supplement/Reason/Athlete

BBC: Supplement/Reason/Deficiency (line94)

BC: Supplements/Contents

BD: Supplements/Side Effects

BDA: Supplements/Side Effects/Positive

BDB: Supplements/Side Effects/None (#70)

BDC: Supplements/Side Effects/Negative

Question 3 & 4

C: VitaD

CA: VitaD/Meaning

CB: VitaD/Role

CBA: VitaD/Role/Prevention

CBB: VitaD/Role/Mood

CC: VitaD/Source

CCA: VitaD/Source/Sun

CCB: VitaD/Source/Dairy

CCC: VitaD/Source/Supplement

CCD: VitaD/Source/Fortified foods

CCE: VitaD/Source/Eggs

CCF: VitaD/Source/liver

CCG: VitaD/Source/Fish

CCH: VitaD/Source/Tanning Bed

CCI: VitaD/Source/Leafy Greens

CCJ: VitaD/Source/Lotions

Question 5

CD: VitaD/Feeling

CDA: VitaD/Feeling/Frustrated

CDB: VitaD/Feeling/Unaware

CDC: VitaD/Feeling/Fear

CDD: VitaD/Feeling/Conflicting info

CDE: VitaD/Feeling/Increase knowledge

CDF: VitaD/Feeling/Shocking

Question 6

CE: VitaD/Communicate

CEA: VitaD/Communicate/Outlets

CEAA: VitaD/Communicate/Outlets/Poster

CEAB: VitaD/Communicate/Outlets/Healthcare Provider

CEAC: VitaD/Communicate/Outlets/TV

CEAD: VitaD/Communicate/Outlets/Campus

CEAE: VitaD/Communicate/Outlets/Courses

CEAF: VitaD/Communicate/Outlets/Internet

CEAG: VitaD/Communicate/Outlets/Social Networking (Facebook, Twitter)

CEB: VitaD/Communicate/Type

CEBA: VitaD/Communicate/Type/Print

CEBB: VitaD/Communicate/Type/Poster

CEBC: VitaD/Communicate/Type/Celebrity Endorsement

CEBD: VitaD/Communicate/Type/promotional event

CEBE: VitaD/Communicate/Type/Fliers

CEBF: VitaD/Communicate/Type/Word of mouth

CEBG: VitaD/Communicate/Type/Slogan

CEBH: VitaD/Communicate/Type/Personal connection

CEBI: VitaD/Communicate/Type/Email

CEC: VitaD/Communicate/Children (school)

CEDA: VitaD/Communicate/Messages

CEDA: VitaD/Communicate/Messages/Deficiencies

CEDB: VitaD/Communicate/Messages/Food Sources

CEDC: VitaD/Communicate/Messages/Non-food Sources

CEDD: VitaD/Communicate/Messages/Campus Dietitian

CEDE: VitaD/Communicate/Messages/Scare tactics

CEDF: VitaD/Communicate/Messages/Importance

Appendix G

Code Book Themes

Code book themes	FG1 3/1/10	FG2 3/3/10	FG3 3/4/10 – 1pm	FG4 3/4/10- 5:30pm	PI 1 3/9/10- 2:30pm	PI 2 3/18/10 12:30pm
Question 1						
Health Info Source						
Internet – -online, online newspapers will have section on health – helpful but not enough to change your lifestyle, WebMD can give many different diagnoses for symptoms you have - WebMD, use symptom checker, better than Google. Go online and look of kcals from restaurants. Internet – WebMD, Google, magazine websites (self, shape) - WebMD, Yahoo – looks at health stories on her Yahoo homepage. Feels WebMD is more credible than Yahoo b/c that's what other people have said - MyPyramid website – will look up nutrition info, calorie info	x	x		x	x	x
Classes -health psychology, clinical exercise psychology, learned a lot from nutrition class - books from previous classes, diet analysis software -Class- get daily recommendations on food	x	x		x		x
Family and Friends - friends are health nuts, mom was a nurse and has personal experience - Mom b/c she has helped her along this far, always feels better after talking to mom; Friends - Mom is RD- gets info if she wants to know why foods are good, balance. - Mom/family – drink milk, eat vegetables, nutrition information, still pretty credible, listen to dad since he is in good shape and is a good example	x	x	x	x		
Employment -She's a vet tech but you have to take it and see if its relatable		x			x	x

- Works for an orthopedic surgeon – PA will answer her questions						
Healthcare Providers - doctors make recommendations based on info you give them - Dietitian has lots of fliers, myth sheet, she's credible - MD – shadowed pediatrician who would give plugs but did not go into too many details - USC RD – anyone can make an appt, credible, people that utilize her are health conscious already -Doctors – gynecologist ask if taking supplements, diet, exercise - Pharmacy – pamphlets about medicine, answers questions -Doctor's office – will call and nurse practitioner is good about answering her medical questions – credible source -Nutritionist – works at SC&G, will email her and ask her questions about nutrition, unsure of nutrition credentials but feels she is credible sources of info	x	x	x	x	x	
Campus - Campus Wellness – Lunch Demonstration – Info on healthy ways to cook on a budget. Dietician had a lot of flyers. Myth sheet. Believes information was credible. - Posters around campus. Not a lot of information, but they are reminders. Good source of information. Not really in depth. - On-campus - classes, around campus, health center, Strom – have places to access, nutritionist, body fat/BMI calculated – credible sources - USC RD – anyone can make an appt, credible, people that utilize her are health conscious already, advertisement only in HESC and ASPH buildings. People in other majors may not be as aware of health services offered - Campus wellness – brochures, dietician will help make a diet plan, plan out meals, plan out workouts		x	x	x		
Media (Newspaper, TV, Radio, Magazine) - magazine (Seventeen, Cosmo) have good workout info, but focus on one thing when it comes to diets - Commercials – all types of info but mostly info on medications and PSA's. Media/ news hear more blown out-of-proportion stuff	x	x	x	x		x

-Newspapers – really don't move them to action -Magazine- *Self*, has sections on healthy eating, does a good job of covering exercise, nutrition -PSA's in general – alerts about sunscreen, tanning beds etc. -Health section of NYT about current research, supplements -Feels sometimes creditable. Oversimplified, contradictory – for example, if you eat this its great for something, but it does other things - Commercials for products will try to tie in health info to sell something - Today Show – weight loss, fad diets, comparing them – can be taken out of context – oversimplified, trying to appeal to wider population, may not be what study is really saying. -Got Milk posters, but may be from Dairy Industry – need to be a knowledgeable consumer. Trying to appeal to more ppl. Studies not accessible to general public. Don't really teach you through posters, just getting their image out there TV – diet pill commercials - All a joke, wonder who actually buys it, hard to trust since they are trying to sell a product and make money, pictures are not believable. P90X – if you see the results personally, you are more likely to believe them, not just taking a pill – need to exercise and eat right. Difference between exercise programs and taking pills						
Food label			x			
Gym or personal trainer -fitness info, diet, healthier options				x		
restaurant nutrition info – uses Chic-fil-a nutrition info to make food choices	x					
Health info source credibility – info from classes are credible, school and class are more credible than friends, MD's are credible, WebMD not as credible - info depends but feels better hearing info from parents than friends -Depends on sources it coming from, if it's a brand name, of course they're going to say its better. Info from news and media is skewed-like H1N1, made a big deal about it but it was over done - Health section of NYT - Oversimplified, contradictory – for example, if	x			x		x

you eat this its great for something, but it does other things Internet: o Credibility depends on the person who is writing it o Can't believe everything you read, should look for it on other places o Every vegetable is a super vegetable o They can freak you out when looking up symptoms - On-campus sources are credible -Got Milk posters, but may be from Dairy Industry – need to be a knowledgeable consumer. Trying to appeal to more ppl. Studies not accessible to general public. Don't really teach you through posters, just getting their image out there - Mom/family - still pretty credible, listen to dad since he is in good shape and is a good example - TV – diet pills ----All a joke, wonder who actually buys it, hard to trust since they are trying to sell a product and make money - P90X - you see the results personally, you are more likely to believe them - Feels WebMD is more credible than Yahoo b/c that's what other people have said						
Question 2						
Supplement Types						
Pills - Iron supplements in liquid forms, fish oil & omega -3, flax oil. – capsule or liquid form - Ca supplements, and type of supplement- fish oil - MVI – pill form, can cause nausea but can enhance health if you're not getting enough vitamins and minerals from food			x	x		x
MVI or vitamin -Pill that's not a drug - Micronutrient	x	x	x	x	x	x

Liquid – juices that combine different types of fruit -Iron supplements in liquid forms, fish oil & omega -3, flax oil. – capsule or liquid form - Boost and Ensure – liquid form - Tea, green tea -Energy drinks - Supplements in smoothies – stepmom buys smoothies and you can add lots of things to them, such as calcium, vitamin D (there's a list of 15 vitamins/minerals they offer to add into the smoothies)	x	x	x		x	
Chewable pills -Viactive chews – Ca and vitamin D, taste bad - Flintstone vitamins		x	x	x		
Injections		x				
Powders -Protein supplements- whey protein to make you strong, brother uses them but hasn't worked for him – powder form - People think they need more protein than they actually do. - Take protein supplements to get stronger and build muscle - A lot of protein supplements have more than just protein - Fiber powder supplements – Metamucil, old people, regularity - Creatine – athletes drink them, have protein in them to help with muscle recovery – powder form	x	x	x	x	x	x
Bars – protein bars - Nutrition bars – not sure what's in them	x			x	x	
Shakes – protein shakes	x			x		x
Supplement Reasons						
Non-dietary		x	x	x		

-people won't don't drink milk take a supplement -GNC, body builder, try to sell so many supplements – unnecessary things, green tea pills, just trying to prey on ppl who are vulnerable, so trying to sell you stuff. Play on ppl's misinformation, from health standpoint -Health remedies, vitamin C when getting sick. Emergency-C, Zicam – echinacea - Energy boosting supplements, taking different things to make hair stronger or skim better , – Biotin helps build strong hair and nails -Teas – to help you sleep, herbal remedy. Green tea – boost metabolism - Fiber supplement – regularity						
Athlete -thinks muscles and steroids b/c of being around athletes (athletic trainer?) - Performance enhancing, creatine, steroids		x	x			
Deficiency – help you replace what you're not getting	x					
Supplement Contents						
- ingredients on Alli – long list, lots of fillers in the products						
Supplement Side Effects						
Positive – take supplements b/c body isn't making enough of something - if they are nutritional supplements, side effects would be beneficial - Side effects are usually listed on the supplement	x	x				
Negative – wasting $$, taking too much can be bad for your health - colored urine, smells - stomach cramps - n/v – certain vitamins if you take too much - Complications associated with each type of vitamin when too much is consumed - Diarrhea, gas -Too much protein can be converted to fat, you can pee it out - Too much vitamin D can turn you orange - MVI – pill form, can cause nausea but can enhance health if you're not	x			x	x	x

getting enough vitamins and minerals from food - Getting too much protein isn't good for you, can cause weight gain if you're not exercising while taking the supplements -Nutrition bars – not sure what's in them, probably have extra calories and sugar						
None -hasn't heard of any	x	x				
Questions 3 & 4						
Vitamin D Meaning						
Vitamin D Role						
Role – makes bones stronger - absorption of Ca -calcium-vitamin D helps body absorb Ca, if you don't get enough vitamin D you won't be able to absorb Ca, osteoporosis --- had a bad stress fracture and MD pushes vitamin D for Ca absorption -bone health -weight loss -Estrogen tied in somehow -helps you grow Ca for bone health, vitamin D and Ca are necessary for bone health -vitamin D helps absorb Ca from food - fat soluble - important for pregnancy – you need more - female health	x	x	x	x		x
Prevention - Rickets - prevent osteoporosis, maintain strong bones - Rickets – if you don't get vitamin D as a child, will get bone problems - helps prevent cancer and diabetes	x	x	x	x	x	x

-scurvy - osteoporosis – not enough vitamin D leads to bone deterioration - Rickets in kids from not getting enough vitamin D						
Mood - had friend who was prescribed sun for 30 min/day to help with depression - SADS - effects mood, makes you happy - makes you happy- people get grump when there's no sun, not sure why	x				x	x
Vitamin D Sources						
Sun -soak in vitamin D through skin, get it through skin, protein, melanin -gives you vitamin D, produced in your body - helps your body make vitamin D, compound in your skin that makes vitamin D active	x	x	x	x	x	x
Dairy – milk, yogurt and cheese - milk is fortified with vitamin D, yogurt, cheese -Dairy products – milk, cheese - milk - has vitamin D added into it, helps absorb calcium	x	x	x	x	x	x
Supplement - supplement of vitamin D - calcium supplements – need to take vitamin D with it to help with absorption - Vitamin D supplements, pill or chewable		x		x	x	
Fortified Foods - milk is fortified with vitamin D -fortified stuff - fortified cereal – maybe Kashi cereal – she knows it has fiber and it might have vitamin D, too. - soymilk		x	x	x	x	
Eggs			x			
Liver			x			

Fish -certain types of fish -fatty fish			x	x		
Tanning Bed – UV rays from tanning bed - friend was told to go to tanning bed b/c doesn't get enough vitamin D - UV rays	x			x		
Vegetables – unsure if veggies have vitamin D - dark, leafy greens - green vegetables such as spinach	x			x	x	
Lotions				x		
- not many naturally occurring good sources of vitamin D						
Question 5						
Feelings about Vitamin D						
Frustrated -it's kind of frustrating. Roommate doesn't drink milk. And to choose not to drink it, if you just had a glass you could stop some problems.		x				
Unaware – people need to say more about it and make people more aware, if more people knew it might provide an incentive to add it to daily intake - being uneducated about it, you don't think what every individual vitamin does for your body, the little things add up – makes her more aware of how much she drinks and takes in -didn't know it affected all those things -Didn't realize it effected all those things - going to start drinking more milk	x	x	x	x		x
Fear -its kind of scary b/c didn't know it was connected to all those things		x				
Conflicting info - Hard thing b/c skin cancer is also a problem, maybe sunscreen is having an effect, b/c if you don't drink milk or dairy, dietary sources are limited -Push bad things about tanning beds and sunscreen, but don't talk about			x			

vitamin D – one-sided -Been a semi-popular push among women and eating dairy, Skinny Bitch talks about eating decreasing dairy – push veganism						
Increase knowledge - Need to put more emphasis on vitamin D in media and try to increase knowledge					x	
Shocking - A lot of factors that are associated with low vitamin D levels, shocking and she's a health major, so it would probably be really shocking to the general public who doesn't know as much about health as she does					x	
Other comments: - You can get you entire vitamin D needs by being outside for 15 minutes, correlates to obesity - Easier to get it in the summer, harder when the sun isn't out as long - Geographic locations makes it harder to get it due to shorter days - African Americans and others have a harder time absorbing it – might need to take more supplements - Babies might need to get it from another source than the sun - As a society, we still haven't completely moved towards prevention. - Need to add it to more foods, such as juices				x	x	
Question 6						
Communication Outlets						
Poster -Posters, info in places mentioned earlier			x			
Healthcare provider -would receive info well from MD or nurse -would receive info better from dietitian than from doctors-went to see the RD, helped her see what she wasn't consuming - can have grad students or RD come in and talk -inform students that there is a RD, student's don't realize the services		x	x	x		x

available to them - Great idea to get it from MD or nurse b/c its not given out as much as it should -Would feel comfortable with on-campus MD or nurse - More doctors need to provide information - On campus doctor – MD initials make it more credible, take more advice from the dietician who is more specialized in it, doctors tell you more about the negative consequences of things, dietician can help you fix it						
TV -media, commercials b/c people correlate what it on TV to their health - TV is a good source – replace infomercials with educational commercials - Put it on the news and internet		x		x	x	
Campus – - hard b/c only individual milk containers fit into meal plan and they're aren't enough, too expensive to get free-pour milk and they are usually whole/2%, - use USC nutrition group to send out more info, use campus lead organization for people who are seeking more info -Make appointment with RD, would be more comfortable with her, USC wouldn't hire someone who didn't know what they were talking about. MD's and nurses seem oblivious. -could set up something on Greene St, pass out flyers and have milk of people to drink – and you associate that you're going to get something for free, so incentives -things with Campus Wellness - have a Milk-a-Thon and have people track how much milk they drink -U101 could incorporate RD coming in - A lot of students don't know about the services Campus Wellness offers -Put services available in the Daily Gamecock -Cafeteria- put sources, what its good for -Locker room at Strom – already making an effort to be healthy -Give out free out free milk on Greene St for bone health - Have the menus in Russell house show what has Vitamin D	x	x	x	x	x	x

- Cards in mailbox about what is going on - Ad in the Daily Gamecock - Article in Daily Gamecock – shocking, more interesting aspects, major consequence of deficiency, something that is relevant and age-appropriate, steps to help prevent, basic facts - Doctors should approve the message going into the Daily Gamecock - Make pamphlets easily accessible, put in dorms and Russell House - Russell House – big group of people in cafeteria to handout info about it - Strom – have seminar about it - U101 – have someone come and talk about it - Dorms – have someone come talk about it						
Courses – incorporate more in classroom b/c student learn most from classroom -give extra credit for attending things about vitamin D -have class for overall health	x	x				
Internet - Send out an email about services - Blackboard, email - Put it on the news and internet - Emails - make it short and sweet, talk about importance of vitamin D and where to get it		x		x	x	x
Social Networking (Facebook, Twitter) -create an advertisement on Facebook, create an event and send it out Internet – Facebook (side ad), group		x		x		
Communication Type						
Print - include vitamin D info in breast cancer awareness materials; - could set up something on Greene St, pass out flyers - Make pamphlets easily accessible, put in dorms and Russell House	x	x			x	
Poster – make posters - Posters, info in places mentioned earlier	x	x	x			x

Celebrity Endorsement -celebrity to promote the issue - have someone famous come talk about it - Possibly use Dr. Oz or a well known qualified celebrity to endorse Vitamin D		x		x		
Promotional Event - Give out free out free milk on Greene St for bone health - T-shirts – everyone wants a fee t-shirt, dramatic statistic and eye catching -chalk on pavement – everywhere - giveaways – sample pills or something that have multivitamins or vitamin D - Russell House – big group of people in cafeteria to handout info about it - Strom – have seminar about it			x	x	x	
Fliers -MD's office have flyers on healthy eating and ways to get vitamins and give them to kids		x				
Word-of-mouth – tell friends - tell my family	x			x		
Slogan - slogan or a song about vitamin D				x		
Personal Connection - real-life stories, more personal connection - Shocking story - Relate it back to image – always look to improve appearance - Picture of someone who is crippled				x		
Email -Send out an email about services		x				
Communication – Children		x				
- MD's office have flyers on healthy eating and ways to get vitamins and give them to kids		x		x		
- Start educating younger, Teach kids more about eating and the parents as		x				

well. Parents are educated on it and they pass it on to their kids.						
- High school, elementary school – posters telling you to eat a balanced meal, but kids might not choose healthy foods. Start from earlier age of instilling healthy values in school setting - Teach kids when they are young and continual exposure - Try to incorporate in middle school or high school health classes - Grocery store appeals – character promoting vitamin D that kids recognize - gummy vitamins for kids - Young kids won't know what you are talking about		x		x		
Communication Messages						
Deficiencies - the effects of not getting enough vitamin D - Should know ways it effect body and that most Americans don't get enough - There's more than bone health at risk if you don't get an adequate amount - Need to know the effects of not getting enough vitamin D		x	x	x		x
Food Sources – re-emphasize that in moderation foods with vitamin D are good for you - food sources you can get them from - Make ppl aware of sources, balance diet and get a variety of sources - Emails - make it short and sweet, talk about importance of vitamin D and where to get it	x	x	x		x	x
Non-food Sources – make it known that you can get it from sitting in the sun and that there are more way to get it than just dairy, it's easy b/c people in the South like to sit in the sun, they already want to sit in the sun -alternative sources -Make ppl aware of sources, balance diet and get a variety of sources - Ways to supplement it if you don't have access to dairy	x	x	x			
Scare tactics - sometimes use scare tactics				x		

Importance – re-emphasize that vitamin D is good for you - you need it - Emails - make it short and sweet, talk about importance of vitamin D and where to get it	x			x	x	