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Do Individuals Consuming a Vegetarian Diet Suffer Less Chronic Disease than the General Public in a Midwestern County?

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Do Individuals Consuming a Vegetarian Diet Suffer Less Chronic Disease than the General Public in a Midwestern County?

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Abstract

The main purpose of this study was to determine if vegetarians living in Oklahoma County suffered from less heart disease, stroke, cancer, and diabetes than the general public of Oklahoma County. The secondary purpose of this study was to collect descriptive statistics on vegetarians living in Oklahoma County. Criteria for participation were adults living in Oklahoma County consuming any type of vegetarian diet. The questionnaire combined questions from national health surveys and questions written by the author. A pilot survey was conducted determining that the questions on the survey were easy to understand and interpret. A total of 24 qualified participants completed the survey in the two week allotment. Of the participants reporting chronic diseases or risk factors for chronic diseases, 85.8% were diagnosed before consuming a vegetarian diet, leaving very few diagnoses coming after participants were already vegetarians. The small sample size of participants who were diagnosed after consuming a vegetarian diet, which was the focus of this study, may have led to erroneous results for comparison to the general public so no tests of significance were run. However, results did indicate that vegetarians believed they were overall healthy and many believed that the vegetarian diet did lead to better health outcomes. Other results indicated that vegetarian participants consumed a higher level of fruits and vegetables than the general public and may have had lower levels of obesity than the general public. More research is needed to determine if vegetarians suffer less chronic disease than the general public at significant levels.

Chapter One: Introduction

Significance of the Study

The main purpose of this study was to determine if vegetarians in Oklahoma County suffered heart disease, stroke, cancer, and diabetes at lower rates than the general public of Oklahoma County. The World Health Organization (WHO) reports that chronic diseases are the leading causes of death worldwide, accounting for 63 percent of all deaths (Alwan, 2010). The WHO defines chronic diseases as conditions that are slow to develop and are generally lengthy; chronic diseases are often the result of lifestyle choices, so many may be preventable (Alwan, Armstrong, Cowan, & Riley, 2011). These trends are also reflected in Oklahoma County statistics. Oklahoma County is located in central Oklahoma; it encompasses the state capital, Oklahoma City, and surrounding cities. The Oklahoma State Department of Health (OSDH), using statistics from the U.S. Centers for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance System (BRFSS) survey (2002 – 2009), rates citizens of Oklahoma County as being in the "middle" for behavioral health risk factors in the state, indicating that the participants from Oklahoma County are representative of the state's general population (OSDH, 2011). The six leading causes of death in Oklahoma County in 2011 were: heart disease, cancer, stroke, lower respiratory disease, unintentional injuries, and diabetes (OSDH, n.d.). Four of these top six conditions are chronic and may be related to diet; individuals who eat a vegetarian diet have been shown to have less incidence of heart disease (Thorogood, Carter, McPherson, & Mann, 1987), cancer (Key, Appleby, Spencer, Travis, Roddam & Allen, 2009), risk factors associated with stroke (Elliott et al., 2006; Steffen, et al., 2005), and diabetes (Tonstad, Butler, Yan, & Fraser, 2009). Mortality rates for Oklahoma County were collected through Oklahoma Statistics on Health Available for Everyone (OK2SHARE) and published in the State of the

State's Health Report. OK2SHARE is a web-based system developed for accessing vital statistics throughout the state. Mortality rates in Oklahoma County for each of the four diseases from 2005 – 2007 (per 100,000) were: 231.0 for heart disease, 185.9 for cancer, 52.5 for stroke, and 26.6 for diabetes (OSDH, n.d.).

The OSDH publishes a State of the State's Health Report annually. The State of the State's Health Report includes information and statistics on health issues burdening the state such as death rates, incidence of chronic diseases, and lifestyle factors that contribute to those chronic diseases. Dietary risk factors associated with these chronic conditions, according to the OSDH (2011), include fruit and vegetable consumption as well as obesity. The OSDH (2011) recommends consuming five or more servings of fruits and vegetables per day.

The BRFSS survey is an on-going telephone survey which began in 1984. The annual survey includes health information and health risk behaviors from more than 350,000 individuals in all 50 states, the District of Columbia, the U.S. Virgin Islands, Puerto Rico, and Guam. According to data collected from the BRFSS from 2002 - 2009, 7.6 percent of Oklahoma County citizens suffered from heart disease, 3.9 percent from cancer, and 9.9 percent from diabetes. Only 14.6 percent of the Oklahoma County population consumed the recommended amount of fruit and vegetables daily while 32.0 percent were considered obese. Statistics from OK2SHARE (2006 – 2009) revealed that 3.8 percent of citizens in Oklahoma County had suffered a stroke (OSDH, 2011).

Another issue with chronic disease and lifestyle is cost. Using statistics from OK2SHARE from 1993 - 2003 and cost estimates available from the CDC, the OSDH estimated the cost of treating chronic diseases in Oklahoma County. Heart disease costs the county over

$700 million annually, while diabetes and obesity cost nearly $550 million annually and more than $60 million annually respectively.

According to the CDC, stroke (2010) and heart disease (2012) were both associated with high blood cholesterol, high blood pressure, and diabetes. Due to the overlap in risks for stroke and heart disease, the two subjects were discussed together for this survey. Research not only included associations between a vegetarian lifestyle and the diseases themselves, but also a vegetarian diet association with cholesterol and blood pressure. Diabetes was discussed separately, as was cancer and obesity.

Statement of the Problem

Chronic diseases form a vicious cycle; susceptibility to one can lead to increased risk for others along with numerous health problems. Beyond mortality and cost, chronic conditions and lifestyle factors lead to other issues for the individual. Approximately 33 percent of all individuals with heart failure also have diabetes; individuals with heart failure tend to also have decreased kidney function, increased edema, shortness of breath, high blood pressure, and frequently suffer from arthritis (Heart Failure Society of America, 2004). Depression and decreased quality of life are also common among individuals who have heart failure (Gottlieb et al., 2004). Complications of stroke include recurrent strokes, seizures, increased susceptibility to certain infections, falls, depression, (Langhorne et al., 2000), bedsores, pneumonia, and deep venous thrombosis (American Stroke Association, 2012). Complications of cancer arise from not only the disease itself, but the harsh treatments used in an effort to destroy cancerous cells. Symptoms of cancer include generalized pain, shortness of breath, fatigue, delirium, and hemorrhage (National Cancer Institute, 2013). Cancer treatments may lead to cardiovascular issues including heart attack, high blood pressure, arrhythmias and thromboembolism (Yeh &

Bickford, 2009). Diabetes has a lengthy list of complications including eye complications such as glaucoma and cataracts; foot complications such as neuropathy and foot ulcers; skin conditions such as bacterial and fungal infections; heart disease; high blood pressure; kidney disease; stroke; stress; and depression (American Diabetes Association, 2013). For individuals living with these chronic conditions, quality of life may be considerably decreased. Individuals consuming vegetarian diets have been shown to have lower incidence of these specific chronic diseases (Steffen, et al., 2005; Key, et al., 2009; Tonstad, et al., 2009).

Purpose and Hypothesis

The purpose of this study was to determine incidence rates of heart disease, cancer, stroke, and diabetes among vegetarians living in Oklahoma County and to compare those rates to the general public of Oklahoma County. Fruit and vegetable consumption and BMI were also calculated and compared to the general public. Rates of chronic diseases and demographics were calculated by diet type and compared among the diet types. Chronic disease rates and demographics were also compared between each diet type and the general public. Based on the research, the hypothesis was that vegetarians, especially vegans, living in Oklahoma County would suffer from heart disease, cancer, stroke, and diabetes at lower rates than the general public of Oklahoma County.

Limitations

The survey was available to vegetarians on an online survey site. Participants included self-reported vegetarians from a vegetarian social group and a religious group. Possible limitations of this study included the use of self-reported responses which may not be accurate. Flood, Webb, Lazarus, and Pang (2000) found that individuals tended to overestimate height and underestimate weight for BMI calculations. The authors collected self-reported height and

weight from 227 participants in Sydney, Australia then measured height and weight on all participants. Results were compared, and it was concluded that individuals underestimated weight and overestimated height leading to erroneously lower BMIs. Likewise, Newby, Tucker, and Wolk (2005), in a study of vegetarian diets and obesity correlation, noted that some self-reported vegetarians had reported consuming meat products in a food questionnaire. For this study, response rate was a possible limitation as a small number of participants may lead to skewed results. The broad use of definitions of vegetarian groups and the wording of questions may have also been limitations. Although a pilot survey was conducted, it was still possible that some participants may not have answered the questions in the manner the author was seeking. It should be noted that the general population of Oklahoma City, the comparison group for this study, may have included vegetarians as well.

Delimitations

Delimitations included the lack of inclusion of other indicators of chronic disease such as lifestyle and medical history. The survey lacked generalizability as the participants lived in Oklahoma County and were members of a social or religious group. This survey only considered four chronic conditions and two lifestyle risks; vegetarians may be more at risk for other conditions not accounted for in this survey.

Assumptions

Assumptions of the survey included that participants provided honest feedback. The author assumed that participants read questions completely and responded as asked. Other assumptions were that participants understood terminology used on the survey and that each participant had knowledge of his or her own health conditions (i.e. the participant may have been an undiagnosed diabetic).

Definition of Terms

The following definitions were used in this survey unless otherwise indicated.

Body Mass Index (BMI) – calculation used to determine body weight in relation to height; commonly used to define underweight, normal weight, overweight, and obese (HHS, 2005)

Diabetes – endocrine disorder possibly leading to other disease states; type 2 is generally considered at least partially preventable by lifestyle choices (Wing et al., 2001)

Elevated blood pressure (EBP) – systolic (upper number) ≥ 140 mm Hg and diastolic (lower number) measurement ≥ 90 mm Hg; only one of the measurements, not both, has to be increased (HHS, 2005)

Heart disease – an umbrella term which encompasses any condition of the heart including heart attack, coronary heart disease, and congestive heart failure (American Heart Association, 2011)

Lacto-ovo vegetarian – individual consuming dairy and eggs but no "meat, fish, or poultry" (Fraser, 2009, p. 1609S)

Nonvegetarian – individual consuming meat, fish, and poultry more than once a week (Fraser, 2009)

Normal blood pressure – systolic measurement (upper number) less than 120 mm Hg and the diastolic (lower number) measurement less than 80 mm Hg (HHS, 2005)

Normal weight – body mass index 18.5 – 24.9 kg/m^2 (HHS, 2000)

Obese – body mass index ≥ 30.0 kg/m^2 (HHS, 2000)

Overweight – body mass index 25.0 – 29.9 kg/m^2 (HHS, 2000)

Pescovegetarian – individual consuming dairy, eggs, and fish but no meat or poultry (Fraser, 2009)

Prehypertension – blood pressure that lies between 120 – 139 mm Hg systolic measurement (upper number) and 80 – 89 mm Hg diastolic (lower number) measurement (HHS, 2005)

Semi-vegetarian – individual consuming meat, fish, and poultry "less than once a week" (Fraser, 2009, p. 1609S)

Underweight – body mass index < 18.5 kg/m^2 (HHS, 2000)

Vegan – individual consuming no animal products (Fraser, 2009)

Vegetarian – an umbrella term used to describe different types of vegetarian diet (Frazer, 2009)

Chapter Two: Review of the Literature

Introduction

The purpose of this study was to determine if vegetarians in Oklahoma County suffered less chronic disease than the general public of Oklahoma County. A review of the literature was conducted to compare the relationship between vegetarian-based diets and chronic disease and nonvegetarian-based diets and chronic disease. The key points examined were heart disease, stroke, cancer, diabetes, and obesity. Due to similarities among the risk factors, high blood pressure, heart disease, and stroke were examined in the same section. The next sections analyzed the relationship of cancer and diabetes with diet. Finally, the connection between obesity, chronic disease, weight loss, and diet were reviewed.

Heart Disease and Stroke

Elliott et al. (2006) used data from the INTERMAP study to determine if protein intake was associated with blood pressure. The INTERMAP study included participants, aged 40 to 59, from the four countries of Japan, the People's Republic of China, the United States, and the United Kingdom; the purpose of the study was to assess if there was a correlation between nutrients and patterns of blood pressure worldwide. The survey consisted of 4,680 individuals who had blood pressure measurements taken and answered questions on demographics, diet, and medical and family histories. Protein was divided into two groups: plant protein (legumes, grains, etc.) and animal protein. Multiple regression analysis was used to study the relationship between the protein and blood pressure. Results were separated by systolic and diastolic measurements. With adjustments for age and gender, participants with higher vegetable protein intake had lower blood pressure than those with lower vegetable protein levels. On average, their systolic measurements were 2.72 mm Hg lower while their diastolic blood pressure was 1.67 mm

Hg lower ($p < 0.001$). When the numbers were adjusted additionally for height and weight, the participants with higher vegetable protein intake had a systolic reading 1.95 mm Hg lower and a diastolic reading 1.22 mm Hg less than participants with higher animal protein intake ($p < 0.001$). Participants from the U.S. had the largest inverse relationship between blood pressure and vegetable protein intake. Associations between blood pressure and animal protein were significant in unadjusted models ($p < 0.05$); however, after adjusting for height and weight, the associations were nonsignficant. Limitations of the study included the use of self-reported questionnaires, inability of the authors to explain relationships between protein intake and blood pressure, and the differences in food tables among different countries. The authors concluded that there was an inverse relationship between vegetable protein and blood pressure and recommended diets high in vegetables to decrease the risk of high blood pressure.

Steffen et al. (2005) also conducted the Coronary Artery Risk Development in Young Adults (CARDIA) Study to determine if diet influenced blood pressure. This study consisted of 4,304 black and white participants, aged 18-30 at baseline, who were evaluated at specific intervals for 15 years. The authors defined elevated blood pressure (EBP) as systolic ≥ 130 mm Hg and diastolic as ≥ 85 mm Hg or having been prescribed antihypertensive medication. Dietary assessments were taken years zero and seven and averaged; blood pressure was measured at years zero, two, five, seven, ten and fifteen. Body weight and height were also measured to determine BMI. Foods were grouped by plant, dairy, or meat and then typed more specifically within each group; intake was measured as times per day or per week averaged into quintiles (Q). Cox proportional hazards regression analysis was used to determine if there was a correlation between average dietary consumption and blood pressure over the 15 year study period. During the 15 year time span, 13.7 percent (591) of participants experienced

hypertension while 9.4 percent (406) had measurements at the upper end of the normal range. Results were divided into food groups (i.e. plant, dairy, and meat) and by quintile with Q1 being the standard. Plant food consumption was significantly and inversely associated with EBP after adjustments for age, race, education, and lifestyle behaviors ($p = 0.01$ for trend). The association between EBP and dairy was weaker than with plants ($p = 0.06$) whereas the association with EBP and meat intake, after adjustments, was positively related ($p < 0.001$). When food groups were examined more specifically, it was discovered that milk and dairy desserts were inversely related to EBP ($p = 0.03$, $p = 0.01$ respectively), but cheese ($p = 0.57$) and yogurt ($p = 0.14$) were not. Fish and poultry were not associated with EBP ($p = 0.19$, $p = 0.21$, respectively), but red and processed meats were ($p = 0.006$). By gender and race, 54 percent of black and white men had EBP while only 40 percent of black and white women experienced EBP. Participants with lower BMIs were more likely to have lower systolic blood pressure. Limitations of the study included the use of self-reported answers, the categorization of certain foods into groups, and participants' interpretation of portion size. The authors concluded that plant foods were inversely associated with EBP while meat was positively associated with EBP. Steffen et al. (2005) stated that diets higher in plant foods and lower in meat may help to decrease the risk of EBP.

Researchers in Britain conducted a survey to determine if blood cholesterol levels in vegetarians were different than in nonvegetarians. Thorogood et al. (1987) recruited 114 vegans, 1,550 lacto-ovo vegetarians, 415 fish eaters (pescovegetarians), and 1,198 meat eaters (nonvegetarians) to have blood drawn at a physician's office to test for blood cholesterol; participants were placed into diet groups by the researchers based on information from a dietary questionnaire. Linear models were performed by age, gender, and diet. Laboratory tests included total cholesterol, low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Low-

density lipoproteins and HDL are components of total cholesterol; LDL, also known as "bad" cholesterol, promotes heart disease and stroke, while HDL, or "good" cholesterol, reduces risk of heart disease and stroke (CDC, 2012). Results of the survey revealed that total cholesterol levels and LDL levels were higher among meat eaters than participants in each of the other diet groups, while concentrations in vegans were significantly lower than all other groups ($p < 0.001$). Fish eaters had significantly higher levels of HDL compared to the other groups ($p < 0.01$), and there were no significant differences for HDL among the other groups. Results also suggested that total and LDL cholesterol levels may increase with age, especially in females. Females' total and LDL cholesterol levels increased steadily with age while total and LDL cholesterol levels among males did not begin steadily increasing until after the age of 40. High-density lipoproteins did not show any trends for age. Thorogood et al. (1987) calculated that lifelong vegetarians had a 24 percent lower incidence of heart disease, and vegans had a 57 percent reduced risk of heart disease when compared to meat eaters. Limitations of the study included the use of self-reported answers on the questionnaire. The authors recruited participants based on willingness to have blood drawn and fill out a questionnaire; therefore, the participants may not be representative of the diet group in which they were included. In conclusion, the authors found significant differences in total cholesterol, LDL, and HDL levels between vegetarians and nonvegetarians, while vegans had the lowest risk of heart disease overall.

Cancer

Vegetarian diets may also play a part in decreased cancer risk. Researchers in Italy used case studies from hospitals to determine if red meat was associated with cancer. Tavani et al. (2000) collected information from hospital data between the years of 1983 and 1996 on 10,149 patients. The patients, aged 75 and under, had confirmed cancer diagnoses and were sent

questionnaires measuring lifestyle, demographics, medical history, and food consumption frequency. A control group consisting of 7,990 patients, aged 75 and under, was also used. Patients in the control group were admitted to the hospital due to conditions other than cancer, chronic conditions, or conditions that had dietary restrictions. The authors defined red meat as beef, veal, and pork; canned and preserved meats were not included. Red meat consumption was divided into tertiles; odds ratios (OR) and the 95% confidence interval (CI) were calculated using linear regressions. The ORs for the highest versus lowest tertile of red meat intake were: 2.1, 2.0, 1.8, 1.6, 1.5, 1.5, and 1.2 for cancers of the colon, rectum, stomach, pancreas, endometrium, bladder, and breast, respectively ($p \leq 0.01$ for all). Though no significant relationship was found between red meat intake and other cancers of blood or organs systems, the authors did not find any significant inverse relationship between red meat intake and any cancer. Limitations of the study included the lack of generalizability, reliance on self-reported answers, and the inability to consider other risk factors not covered in the questionnaire. The authors concluded that red meat was a determining factor for risk of human cancer.

Key et al. (2009) used data from the European Prospective Investigation into Cancer and Nutrition (EPIC) Oxford cohort to determine associations between cancer risk and vegetarian diets. The EPIC study was designed to examine if diet was related to cancer risk. The original study included 25,639 males and females aged 40 – 79 and took place from 1993 – 1997. The study has since expanded to include other chronic diseases including type 2 diabetes. The expanded EPIC study included several different cohorts across the country, divided geographically. Information for this study was collected from 52,706 participants under the age of 90. Participants had no known previous neoplasm with the exception of skin cancer. Recruitment began between 1990 and 1999, and researchers used data collected up to December

31, 2005. Questionnaire results were used to divide the participants into meat-eaters, fish-eaters, vegetarians, and vegans. Due to the small numbers of vegans with cancer, the authors included vegans in the vegetarian category for the study. Incidence rate ratios (IRR), standardized for age and sex, for both vegetarians and nonvegetarians were compared to national data for England. Cox regression was used to calculate the IRRs. Researchers confirmed 2,179 cases of cancer over the course of the study. The risk of almost all neoplasms was lower among vegetarians than nonvegetarians, though not significantly (IRR: 0.93; 95% CI: 0.83, 1.04). The risk of colorectal cancer was significantly higher in the vegetarian than the nonvegetarian group (IRR: 1.49; 95% CI: 1.09, 2.03). The median BMI was 1.2 kg/m^2 lower in vegetarians than nonvegetarians. Body mass index was found to be significantly associated with breast cancer; the IRR was 0.65 when comparing women with BMI < 20.0 kg/m^2 to women with BMI 20.0 – 22.4 kg/m^2. No other cancers were found to be statistically associated with BMI. When broken down into meat-eaters, fish-eaters and vegetarians, it was found that colorectal cancer was lower in fish eaters compared to meat eaters, though not significantly. As compared to meat eaters, fish eaters had overall lower risk of neoplasms (IRR 0.83; 95% CI: 0.71, 0.96) as did vegetarians (IRR: 0.89, 95% CI: 0.80, 1.00), but risks were not significant ($p = 0.052$). The researchers noted, however, that meat consumption in the meat eater group was “moderate” and though the consumption of fruits and vegetables was higher among vegetarians than meat eaters “the differences were not large (<20%)” (Key, et al., 2009, p.1625S). According to the authors, observations of less cancer in vegetarians in this cohort may have been skewed due to possible inaccuracies in classifying vegetarian diet and low levels of obesity among participants. Other limitations of this study included factors unaccounted for which may contribute to cancer risk and accuracy of diet type.

In conclusion, Key et al. (2009) determined that fish eaters and vegetarians have lower rates of neoplasms than meat eaters with the exception of colorectal cancer.

Diabetes

Diabetes has also been shown to be affected by diet. Tonstad et al. (2009) determined that a relationship exists between diet type and type 2 diabetes. The researchers studied survey data from members of Seventh-Day Adventist churches across North America. This study included 60,903 members with variations in gender, race, and diet type. Questionnaires for the study included questions on diet, physical activity, illness, demographics, height, and weight. Blood samples were collected from 1,007 subjects for measurement of fasting serum glucose level, a screening test for diabetes levels; ≥ 126 mg/dL was considered potentially diabetic by the researchers. Of the subjects surveyed, 3,430 (5.6%) reported having type 2 diabetes. The percentages of type 2 diabetes increased as more animal products were introduced into the diet. Only 2.95% of vegans, 3.2% of lacto-ovo vegetarians, and 4.8% of pescovegetarians reported type 2 diabetes, while self-report among semi-vegetarians and nonvegetarians was 6.1% and 7.6% respectively. The differences between vegan and nonvegetarian diets for type 2 diabetes were statistically significant ($p < 0.0001$). Results showed the same trends in relations to BMI and type 2 diabetes prevalence. Interestingly, in participants with BMI ≥ 30 kg/m^2 (obese), type 2 diabetes steadily increased as animal proteins were added to diet. The prevalence for type 2 diabetes was 8.0%, 9.4%, 10.4%, 11.4%, and 13.8% in vegans, lacto-ovo vegetarians, pescovegeterians, semi-vegetarians, and nonvegetarians respectively. For participants whose BMI was < 30 kg/m^2, the prevalence for type 2 diabetes also increased with the addition of animal proteins although percentages were lower, (2.0% for vegans, 2.1% for lacto-ovo vegetarians, 3.3% for pescovegetarians, 3.7% for semi-vegetarians, and 4.6% for

nonvegetarians). Tonstad et al. (2009) reached several conclusions from this study. The researchers calculated that individuals who followed vegan and lacto-ovo vegetarian diets were half as likely to be at risk for acquiring type 2 diabetes; pescovegetarians and semi-vegetarians were between one-third and one-fourth as likely to acquire type 2 diabetes. Including meat and fish (even in small amounts) in the diet seemed to diminish factors that led to decreased risk of type 2 diabetes among vegans and lacto-ovo vegetarians. Body Mass Index seemed to play a role in protection against type 2 diabetes, and vegans were the only participants who averaged a BMI < 25 kg/m^2. Limitations of the Tonstad et al. (2009) study included the use of self-reported answers and the lack of representation of the general population among study participants. However, results did indicate that all types of vegetarian diets were related to decreased risk of type 2 diabetes.

Song, Manson, Buring, and Liu (2004) conducted a study utilizing data from the Women's Health Study (WHS) to determine if red meat consumption was associated with type 2 diabetes. The WHS was originally designed to examine if aspirin and vitamin E aided in preventing cancer and cardiovascular disease; however, data collected from this study have been used for multiple research studies. Data collection for the WHS began in 1993; data were collected from 39,876 females who were in the health professions and over the age of 45. The original randomized trial was completed in 2004, but follow-up questionnaires are still sent annually to participants. (For more information on the WHS, please see http://whs.bwh.harvard.edu.)

Participants of the Song et al. (2004) study filled out questionnaires on food frequency and information about diet and disease state. Participant data were excluded if the food frequency data were not complete and the participant had confirmed diabetes at baseline; this left

37,309 subjects for analysis. Song et al. (2004) allocated the amount of red and processed meat intake into quintiles (Q) and calculated incidence of type 2 diabetes for each quintile. In 1993, women in the highest quintile consumed approximately ten times more meat than those in the lowest quintile. Cox proportional hazards models were used to estimate the relative risk (RR) of diabetes, comparing the lowest quintile of red and processed meat consumers to the other four. On average, there was an 8.8 year follow-up; during this time, 1,558 participants were diagnosed with type 2 diabetes. After adjusting for age, BMI, smoking, physical activity, alcohol, family history of diabetes, dietary fiber intake, glycemic load, and total fat intake, participants in the highest quintile were statistically more likely to acquire type 2 diabetes than the participants in the lowest quintile ($p < 0.001$ for red meat and $p = 0.001$ for processed meat). The adjusted RRs of type 2 diabetes were: Q1 (the standard) 1.00; Q2 was 0.90; Q3 was 1.07; Q4 was 1.08; and Q5 was 1.24 for red meat (trend $p = 0.005$). For processed meats these were: Q1 was 1.00; Q2 was 0.96; Q3 was 0.95; Q4 was 1.08; and Q 5 was 1.19 (trend $p = 0.007$). Other results of interest from the study included findings that participants with higher intake of red meat also had higher BMIs, tended to smoke more and exercise less, and were more likely to have histories of hypertension and family histories of diabetes. Limitations of the Song et al. (2004) study included incomplete data on other lifestyle choices related to type 2 diabetes risk. Information was limited on the variety of red and processed meat intakes. According to the authors, chemicals in processed meats may be associated with risk factors for type 2 diabetes; the authors were not able to determine the amount of chemicals in the diets of the participants. Song et al. (2004) concluded that higher consumption of red meat, especially processed meat, did correlate with an increased risk in type 2 diabetes though the underlying mechanism required further investigation.

Researchers in Europe conducted a study to determine if quantity and variety of fruit and vegetable intake was associated with a decreased risk of type 2 diabetes. Cooper et al. (2012) used data from the Norfolk cohort of the EPIC study; the EPIC study was described previously in this literature review. The authors then randomly selected 3,704 participants who represented demographics from the baseline population for the study's cohort. The cohort filled out food diaries for seven day intervals to determine weekly food consumption. Type 2 diabetes diagnosis was determined by questionnaire or by having brought diabetes medication to a health check; blood and body measurements were taken by trained nurses for measurement of hemoglobin A_{1c} (a blood test used in diagnosing diabetes) and to calculate BMIs. Means and standard deviations were calculated for all participants in the cohort by quantity and variety of fruit and vegetable consumption; from these numbers, participants were divided into tertiles. Prentice-weighted Cox regression was used to determine correlations with fruit variety, vegetable variety, and combined fruit and vegetable consumption by tertiles with the lowest tertile being the reference. Results were adjusted for gender, BMI, lifestyle issues, family history of diabetes, socioeconomic factors, fruit quantity and variety, vegetable quantity and variety, and combined fruit and vegetable quantity and variety. Results from the Cooper et al. (2012) were collected over an average of 10.9 (9.8 – 11.8) years. The median quantity of combined fruit and vegetable intake among participants was 3.7 servings per day, while their mean fruit and vegetable variety consumption was 11.7 items per week. Statistically significant inverse relationships were observed between type 2 diabetes for variety of fruits consumed ($p = 0.002$), variety of vegetables consumed ($p = 0.03$), the combination of fruit and vegetable variety consumed ($p < 0.001$), quantity of vegetables consumed ($p = 0.03$), and quantity of the combination of fruit and vegetables consumed ($p = 0.04$), but not for quantity of fruit consumption ($p = 0.46$). Statistically

significant differences were demonstrated between the lowest and highest tertiles in combined fruit and vegetable consumption, variety in fruit and vegetable consumption separately, quantity of combined fruit and vegetable consumption, and quantity of fruit and vegetable consumption separately ($p < 0.001$ for all measurements). According to the authors, every two servings extra of variety in fruit and vegetable intake reduced the risk of acquiring type 2 diabetes by eight percent. The authors recommended at least 3.5 servings of fruit and vegetables per day and at least 12 different types of fruit and vegetable consumption per week for reducing the risk of type 2 diabetes. Limitations of the study included the inability to study unmeasured determinants and lifestyle factors and the use of self-reported data. Also, 99.1% of the cohort were middle aged and European-Caucasian; participants may not have represented the general population. Cooper et al. (2012) concluded that diets emphasizing variety of fruit, variety of vegetables, quantity of combined fruit and vegetable consumption, and quantity of vegetable intake did in fact correlate with a decreased risk of type 2 diabetes.

Obesity

Studies have shown that diet plays a role in body weight. Spencer, Appleby, Davey, and Key (2003) used data from the EPIC-Oxford to determine if different diets led to different BMIs; the EPIC study was discussed previously in this chapter. Spencer et al. (2003) used data from the Oxford cohort to determine BMIs. After certain exclusions (such as removing participants with a BMI < 15 kg/m^2 and > 60 kg/m^2), information was collected from 8,871 men and 20,004 women. The authors defined the participants as meat-eaters, fish-eaters (consumed fish but no meat), vegetarians (consumed no meat or fish), and vegans (consumed no animal products). Analysis of variance and F ratios were calculated to determine the differences between the groups. The authors considered $p < 0.01$ statistically significant. Spencer et al. (2003) found that

meat-eaters had the highest BMIs, vegans had the lowest, and fish-eaters and vegetarians were in the middle among all participants. The mean-adjusted BMIs for men, in kg/m^2, were 24.09 for meat-eaters, 23.45 for fish-eaters, 23.67 for vegetarians, and 23.13 for vegans; in women, BMIs in kg/m^2 were 23.24 for meat-eaters, 22.83 for fish-eaters, 22.96 for vegetarians, and 22.56 for vegans. The differences between adjusted-mean BMIs between meat-eaters and vegans were statistically significant ($p < 0.01$). Meat-eaters had significantly higher adjusted BMIs than the vegetarians and fish-eaters ($p < 0.01$) while the vegans had significantly lower adjusted BMIs than the vegetarians and fish-eaters ($p < 0.01$). There was no significant difference between the vegetarians and fish-eaters. Limitations of the study included the use of self-reported answers, lifestyle factors not accounted for in the survey, and the inability to distinguish cause and effect. The authors concluded that diets including meat are associated with higher BMIs than vegan diets, and to some extent, than fish-eater and vegetarian diets.

In 1948, an aggressive study began to help identify risk factors associated with heart disease. The Framingham Heart Study (FHS) was initiated by what is now the National Heart, Lung, and Blood Institute (NHLBI). The original cohort group of the FHS consisted of 5,209 randomly chosen adults aged 30 - 62 from Framingham, Massachusetts. Every two years the participants would engage in extensive physical testing, blood testing, and lifestyle interviews. The original cohort group still had participants being examined in 2010. In 1971, testing began on the second cohort group which consisted of the original cohort group's offspring and the offsprings' spouses. The offspring cohort also has extensive testing every two years. The latest round of testing of the cohort group began in 2011. By 2005, 4,095 of third-generation participants completed the testing. In the 1990s it was recognized that residents of Framingham were becoming more diverse. In 1994, 506 men and women from minority groups were added to

the study; the Omni cohort and Omni offspring cohort still participate to this day. According to FHS researchers, this study identified major cardiovascular disease risk factors, two of those being obesity and diabetes. (For more information on the FHS studies, please go to http://www.framinghamheartstudy.org.) Kenchaiah et al. (2002) gathered data from the FHS to study a link between BMI and the incidence of heart failure. They also examined models to evaluate the effect of BMI on other diseases including type 2 diabetes. During the FHS, height and weight were not self-reported but were measured using standardized protocol. Cox proportional hazards regression models were conducted using information from 5,881 participants from the original and offspring cohort groups; BMI was compared to the occurrence of heart failure. The researchers defined heart failure as participants having two major heart criteria at the same time, or one major and two minor heart criteria at the same time; criteria was defined by the FHS. Results demonstrated that obese females had double the chance of heart failure than non-obese females; obese men's risk for heart disease was 90% higher than non-obese men. Results from this study also showed that diabetes increased with weight. Normal weight females (BMI = 18.5 – 24.9 kg/m^2) had a 7.7% prevalence of diabetes, while overweight (BMI = 25.0 – 29.9 kg/m^2) women had a prevalence nearly double that at 14.4% living with diabetes. Obese women (BMI $\geq$ 30 kg/m^2) had an even higher prevalence of 17.7%. Ten percent of normal-weight men had diabetes, while 14.2% of overweight men and 15.5% of obese men had the disease. According to results, around 11% of heart conditions in men and 14% of heart conditions in women were related to obesity. The authors concluded that obesity is an important risk factor in heart disease and that promoting healthy weight may decrease the likelihood of heart failure.

Mokdad et al. (2003) designed a survey to determine if there was a link between obesity and diabetes. The authors conducted a phone survey of 195,005 American adults. The questions asked by the surveyors were height, weight, and a physician's diagnosis of diabetes, hypertension, or high cholesterol. The participants were also asked to rate their general health as excellent, very good, good, fair, or poor. Because of the large sample size, the authors did not run statistical tests but generated odds ratios (OR) with 95% confidence intervals (CI) for the relationship between BMI and other medical issues. The authors found that both obesity and being overweight were significantly associated with diabetes, high cholesterol, hypertension, and fair or poor health. The higher the BMIs were, the higher the odds of the individual having a medical condition. Individuals with BMIs $\geq$ 40 kg/m^2 had an OR for diabetes of 7.37 (95% CI = 6.39 – 8.50), a 6.38 OR (95% CI = 5.67 – 7.17) for hypertension, an OR of 1.88 (95% CI = 1.67 – 2.31) for high cholesterol, and an OR of 4.19 (95% CI = 3.86 -4.76) for fair or poor health. Limitations of this study were self-reported height and weight. Individuals without telephones were not included in this study, so it may not have represented individuals of low socioeconomic status who did not own telephones. Also, undiagnosed diabetes was not included. The authors concluded that health professionals need to encourage healthy diet and exercise for patients who are overweight and obese and that programs should be developed on a national level to promote weight control.

The Cancer Prevention Study II (CPS-II), which was conducted by the American Cancer Society (ACS), began in 1982 with participants answering questionnaires about demographics, family history, and other lifestyle factors related to cancer (ACS, 2013). Death statistics are updated every two years through the National Death Index (NDI); the NDI is a computerized program run by the CDC which tracks deaths for medical and health research purposes. (For

more information please see http://www.cancer.org/Research/ResearchProgramsFunding/cancer-prevention-study-overviews.) Calle, Walker-Thurmond, and Thun (2003) used information from the CPS-II cohort group to determine the influence of body weight on deaths due to cancer. The authors removed from the study any individual who already had cancer and all individuals who were considered underweight (BMI = < 18.5 kg/m^2). The total population number was 900,053 participants: 404,576 men and 495,477 women. Results were calculated by gender; all participants were at least 30 years old. By 1998, there were 57,145 deaths caused by cancer among the study population. The relative risk (RR) of death of overweight individuals due to cancer was calculated as compared to normal-weight individuals. Linear trends were tested by entering weight categories in regression models and using a chi-square to determine significant differences between the categories. Statistics were calculated for several types of cancer separately and all cancers combined in men and women. The authors found that for the highest weight category (BMI $\geq$ 40 kg/m^2), there was a 52% higher death rate in men and a 62% higher death rate in women for all cancers combined. Increasing BMI was associated with positive significant trends for all cancers (p = .001), esophageal cancer (p = .008), stomach cancer (p = .03), colorectal cancer (p = <.001), liver cancer (p = < 001), gall bladder cancer (p = .02), pancreatic cancer (p = <.001), prostate cancer (p = <.001), kidney cancer (p = .002), non-Hodgkin's lymphoma (p = <.001), multiple myeloma (p = .002), and leukemia (p = <.001) in men. For women, significant positive trends were found for all cancers (p = <.001), colorectal cancer (p = <.001), liver cancer (p = .04), gallbladder cancer (p = <.001), pancreatic cancer (p = <.001), breast cancer (p = <.001), cervical cancer (p = .001), ovarian cancer (p = .001), kidney cancer (p = <.001), non-Hodgkin's lymphoma (p = <.001), multiple myeloma (p = .004), and "other" cancers (p = <.001) as BMI increased. Men with BMI $\geq$ 35 kg/m^2 had significantly

higher RR of death rate due to cancer compared to men of normal weight; rates ranged from 1.23 (95% CI = 1.22 – 1.36) for all cancers to 4.52 (95% CI = 2.94 – 6.94) for liver cancer. Relative risk rate of death for any cancer in women with a BMI $\geq$ 40 kg/m^2 was 1.62 (95% CI = 1.40 – 1.87) as compared to women of normal weight. The authors estimated that the proportion of cancer deaths due to overweight and obesity in men was between 4.2% and 14.2%, and for women, the proportions were 14.3% to 19.8%. It was estimated that over 90,000 cancer deaths per year might be avoided if adult men and women would maintain a BMI < 25 kg/m^2 all through life. One limitation of the study was that self-reported data were used. The authors concluded that, due to the large number of deaths that could be prevented, physical activity and healthy diet practices should be promoted by policymakers, clinicians, schools, employers and educators to achieve the goal of helping individuals maintain a healthy weight throughout life.

Vegetarian diets may lead to a decrease in obesity and excess weight in individuals. Newby et al. (2005) used data from the Swedish Mammography Cohort (SMC) to determine if vegetarians are less prone to being overweight or obese. The SMC is a screening program based in two counties in Sweden; data from 90,903 women were collected from 1987 – 1990. Information collected included a questionnaire asking the women to describe their diet type, a food-frequency questionnaire (FFQ), and participant height and weight. After certain exclusions, data from 55,459 women were used for this study. Newby et al. (2005) used the diet types omnivore (nonvegetarian), semi-vegetarian, lactovegetarian (lacto-ovo vegetarian), and vegan. The vegetarian groups made up a small portion of the participants; 1.73% were semi-vegetarian, 0.29% were lactovegetarian, and 0.15% were vegan. Body mass index was highest in the omnivores (24.7 ± 3.9 kg/m^2), followed by semi-vegetarians (23.6 ± 3.5 kg/m^2) and lactovegetarians (23.4 ± 3.5 kg/m^2), and lowest in vegans (23.3 ± 3.8 kg/m^2). The difference

between omnivores and vegans was significant (p <0.005). Overweight and obesity (BMI ≥ 25 kg/m^2) was highest in prevalence among the omnivores (40%), less among semi-vegetarians and vegans (both at 29%), and least for lactovegetarians (25%). Newby et al. (2005) concluded that weight, BMI, and risk for obesity and overweight were more prevalent in omnivores than the three vegetarian groups. Omnivores had BMIs around one unit higher than participants in all vegetarian groups. The authors performed logistic regression analyses and determined that vegans may have the smallest possibility of becoming overweight; the analyses included cofounders such as smoking status and education level. Limitations included the cross-sectional design that does not show causality between diet and BMI and a cohort that may not generalize to a different population. The use of self-reported answers was an issue with this study. Also, while studying the FFQ, researchers realized that some of the participants who reported themselves to be vegetarian did eat some meat products though the quantities were small. However, Newby et al. (2009) concluded that, even if some animal products were consumed, self-reported vegetarians of all types had lower obesity and overweight risks than omnivores; the researchers suggested that increasing more plant foods and decreasing intake of animal products may help with weight control.

Turner-McGrievy, Barndard, and Scialli (2007) conducted a survey to determine differences in weight after one and two years between those consuming a vegan diet and participants consuming a moderate low-fat diet. Fifty-nine postmenopausal, overweight or obese (BMI = 26 to 44 kg/m^2) women were recruited from the Washington D.C. area to participate in the study. The authors chose postmenopausal women so that certain hormonal effects would not interfere with weight loss. Participants were randomly chosen to follow either the National Cholesterol Education Program (NCEP) diet or a vegan diet. Criteria for the NCEP diet included

consuming ≥ five servings of grains, ≥ five servings of fruits and vegetables, ≤ six ounces of lean meat, and ≤ two servings of high fat items (avocado, oil, mayonnaise, etc.) on a daily basis. Criteria for the vegan diet included ≤ one serving of dairy, ≤ three ounces of meat or fish, ≤ one egg per week, and ≤ two servings of high fat items per day. The diet lasted for 14 weeks, and follow-up data were collected at one and two years. The Wilcoxon test was used to determine changes in weight data within and between the groups at baseline and at one and two years. Results demonstrated that the vegan group lost more weight at one year (-3.1 kg more, $p = 0.021$) and at two years (-2.3 kg more, $p = 0.022$) than did the NCEP group. Furthermore, the vegan group lost a significant amount of weight at both one year ($p < 0.001$) and two years ($p < 0.01$) while the NCEP group lost a significant amount of weight at year one ($p < 0.05$) but not at year two. Limitations of the study, according to the authors, included the use of self-reported data and measurement of body weight instead of body fat. The authors concluded that the vegan diet was associated with a greater loss of weight than a more traditional low-fat diet at one and two years after the intervention.

Conclusion

Research concluded that vegetarians tended to suffer less chronic disease than nonvegetarians. Generally, vegans endured significantly less chronic disease than other diet types, including nonvegetarians, at least partially due to lower BMIs. Nonvegetarians seemed to significantly experience more chronic disease than all vegetarian diet types as defined by the authors. Diets high in plant protein and low in animal protein seem to result in normal blood pressure. Red meat, especially highly preserved meat, has been associated with cancer; vegetarians tended to have less cancer rates with few exceptions. Research demonstrated that increasing one's variety of fruits and vegetables as well as the quantity of vegetables in one's

diet has led to a decreased risk of diabetes and that small amounts of meat may attenuate those protective factors. Studies supported the notion that increased BMIs led to increased rates of diabetes, heart disease, and elevated blood pressure. Participants who began studies overweight or obese generally had worse health indicators throughout the studies. Normal weight males and females had lower levels of diabetes and heart disease. In studies conducted to determine the success of different methods of weight loss, vegans tended to lose more weight and increases in plant foods tended to aid participants in losing weight. Continuing research on this subject is needed to determine the validity and usefulness of these results.

Chapter Three: Methodology

Participants

The main purpose of this study was to determine if vegetarians living in Oklahoma County suffered heart disease, stroke, cancer, and diabetes at lower levels than the general public of Oklahoma County. The secondary purpose of the study was to collect descriptive statistics on vegetarians living in Oklahoma County. Participants for this study included vegans, lacto-ovo vegetarians, pescovegetarians and semi-vegetarians aged 18 and older, of any gender, living in Oklahoma County; semi-vegetarians were included to increase participation. A vegetarian social group and a religious group whose members have adopted a vegetarian lifestyle were the focus of participant recruitment. The Vegetarians of Oklahoma (VegOK) is a social and educational group based in central Oklahoma. (For more information, please visit http://www.vegok.org.) VegOK has an e-mail list reaching approximately 600 individuals living mainly in Oklahoma County. The group was initially contacted by the author via email to the group's secretary. The author was invited to a social dinner with the group to explain the research and answer any questions the members may have had about the study. At this dinner, the group members voted that the survey link could be sent through the email list. The group's secretary emailed the approval to the author to be forwarded for approval by the University of Central Oklahoma's (UCO) Institutional Review Board (IRB).

The author contacted the Dharma Center of Oklahoma via email. The respondent of the email did not want to send the link through their email list but agreed, via email, to post a flyer in the physical building. The Dharma Center of Oklahoma posted the flyer (Appendix F) with survey information including the link to take the online survey. The survey was made available through UCO's Qualtrics Survey Site.

The Instrument

The survey (Appendix C) was written by the author and included demographics and indicators used by OSDH. It consisted of 18 questions and was estimated to take approximately 10 – 15 minutes to complete. Because different diet types have been associated with varying degrees of incidence of chronic disease and risk of chronic disease (Tonstad et al., 2009; Thorogood et al., 1987) and obesity (Newby et al., 2005; Spencer et al., 2003), type of diet was addressed. Participants were asked about diet over the past 12 months. A nonvegetarian option was included due to differences in (and overlap of) definitions; participants indicating a nonvegetarian diet were excluded. Research indicated that the health status of vegetarians may be due to the consumption of fruits and vegetables (Cooper et al., 2012), so participants were questioned about daily consumption of fruits and vegetables. Participants were asked to indicate a previous diagnosis of elevated cholesterol, heart disease, cancer, high blood pressure, stroke, and diabetes. If a diagnosis was indicated, the participant was asked if the diagnosis was before or after consuming a vegetarian diet. Participants were asked to indicate an age range and gender for descriptive statistics. Past research demonstrated that individuals are more prone to risk factors at older ages regardless of diet (Thorogood et al., 1987). Participants were also asked zip code of residence to determine if the participant lived in Oklahoma County. Finally, self-reported height and weight were collected as to calculate BMI.

A pilot survey was performed to validate the survey. Vegetarians were not included in the pilot survey as the author preferred all vegetarians to be able to participate in the actual survey, not the pilot survey. For validation, the author presented the survey, in writing, to six co-workers of varying education levels to simply ascertain if they understood the questions as asked and to obtain ideas on improving questions if necessary; a form was included for pilot survey

participants to complete (Appendix D). The pilot survey specifically asked participants for the date, if they understood the questions as written, if there were any questions that were difficult to interpret, and if any questions were difficult to interpret, how may the question be better written.

The instrument was developed using UCO's Qualtrics Survey Site; the site can be accessed through UCO's Technology Resource Center website. A Qualtrics account was created by the author using a username and password to ensure confidentiality of survey results. Qualtrics includes a "default question block" under the "create survey" tab; the default format allows the user to choose a question type (i.e. multiple choice or short answer), answer type (single or multiple), and answer position (vertical or horizontal). The author manually entered all questions and answers under the multiple choice, single answer, and vertical answer default format. Once questions and answers were entered and proofread for accuracy, the "launch survey" button was selected which prompted Qualtrics to create the survey link. Qualtrics also gives the author the option of selecting opening and closing dates for the survey. The opening date, November 12, 2013, was chosen based upon the completion of the pilot survey; the closing date, November 26, 2013, was two weeks after the opening date leaving participants two weeks to complete the survey. Once the survey was closed, results were available under the "view results" tab; these results were manually entered into Statistical Package for the Social Sciences (SPSS) 18.0 by the author.

Statistical Analysis

Descriptive statistics were calculated for all indicators. Incidence rates, in percentages, for heart disease, stroke, cancer, diabetes, fruit and vegetable consumption, and obesity were calculated separately for the vegetarian population and compared to incidence rates of the general population of Oklahoma County. Each vegetarian type also had BMIs calculated

separately. The BMIs among individuals consuming a vegetarian diet were then compared to the general population separately for heart disease, cancer, stroke, and diabetes. All statistical testing was performed using SPSS 18.0 software. The BMIs were first calculated on an online calculator through the CDC (n.d.) and then placed into the SPSS 18.0 data set.

In the SPSS data set, histograms were produced and statistical analyses between participants were run. The histograms were created by selecting "graphs" from the status bar and then selecting "chart builder." Under the gallery selections, "bar" was chosen and a variable was selected and dragged into the "chart preview." After clicking "OK" the histogram was produced. The crosstabs function was used to perform comparisons between participant variables. To perform crosstabs in SPSS, "analyze" was chosen from the status bar. Under analyze, "descriptive statistics" was chosen and then "crosstabs." Variables could then be clicked and dragged into rows and columns. After choosing variables, "OK" was clicked and the statistics were available in output window of SPSS. These data were integrated into tables by the author using Microsoft Word 2010.

Procedure

Approval from the UCO Institutional Review Board (IRB) is required before conducting research on human subjects; UCO provides an online application for IRB review and approval. The IRB application consisted of questions pertaining to general information about the research and the investigators along with specific questions about recruitment, participants, informed consent, confidentiality of participant data, and usefulness of the survey.

Application of the IRB began with statement of the hypothesis and explanation of the survey. Subjects needed for the survey were vegetarians living in Oklahoma County and recruitment was via email to the secretary of VegOK and the email listed on the Dharma

Center's website. The survey link went out via email blast to VegOK members after approval by the VegOK board, and a flyer (Appendix F) was posted at the Dharma Center of Oklahoma. As the survey was to be conducted online, a copy of the IRB application was submitted to UCO's Office of Information Technology to be approved for online privacy and confidentiality. The questionnaire was submitted and described as part of IRB approval; data were to be collected via UCO's Qualtrics Survey Site then entered into SPSS for statistical analysis. The maximum number of expected participants was upon based on the number of individuals on the VegOK email list as well as an estimate of visitors and members of the Dharma Center of Oklahoma. The pilot survey was to begin immediately after IRB approval while the research survey was to begin one week after the pilot survey ended; this time would allow for any necessary changes, and, if changes were made to the research survey, time to resubmit to the IRB for approval.

Acknowledgement of informed consent was required before participants could begin the survey. The IRB application provided a template for composing an informed consent document. The informed consent document used for this survey was written by following this template and including information in a question and answer format and posting it on the online survey. When participants went to the survey site, they would have to acknowledge that they had read the informed consent before taking the survey. Confidentiality was guaranteed by the use of aggregate information and the use of a UCO approved survey website. A Protecting Human Research Participants (PHRP) certification, completed within the last two years, was required by the researcher and all study personnel; certification dates were submitted to the IRB by the researcher and each faculty member on the thesis committee.

After completing the IRB application, it was submitted online to the IRB chair and a hard copy was submitted to the UCO-IRB office. The hard copy required signatures from the primary

principal investigator, co-primary principal investigator, department chair, college dean or assistant dean, and the information technology representative. Once the IRB representative had all necessary information, approval was granted (Appendix B) and the surveys began.

The pilot survey (Appendix D) was conducted on Friday, October 25, 2013; this survey was completed by six individuals of varying education levels at the Oklahoma University Medical Center (OUMC) laboratory in Oklahoma City where the author was employed on a part-time basis. The author explained, in person, the purpose of the research and the pilot survey and described the pilot questionnaire to two individuals with no college degree, two individuals with as associate's level college degree, and two individuals with a bachelor's level degree. The author also asked that, if participating, the questionnaire be returned to her box instead of in person to maintain some confidentiality and explained that no other person would see the completed questionnaires. All six agreed to answer the survey. After completion of the pilot survey, it was determined that no changes were required for the survey; therefore, recruitment flyers, the survey, and informed consent (Appendix A) were made available for participants. The survey was online and available for two weeks after opening. An e-mail with a short description of the survey (Appendix E) and a link to the survey were sent through the VegOK mailing list via the Society's secretary; a reminder was sent after one week. Flyers with information on the survey and a link to the website (Appendix F) were posted at the Dharma Center of Oklahoma. After completion of the survey, data were accessed through UCO Qualtrics Survey Site and entered into SPSS at UCO's Chambers Library.

Chapter Four: Results

Introduction

The main purpose of this study was to determine if vegetarians in Oklahoma County suffered from heart disease, stroke, cancer, and diabetes at lower rates than the general public of Oklahoma County. The secondary purpose of this survey was to collect data and descriptive statistics on vegetarians in Oklahoma County. The results section describes data obtained from the survey.

Pilot Survey

A pilot survey (Appendix D) was conducted to determine if the questions were easy to interpret; six individuals of varying education levels completed the survey. Results from this survey indicated that the questions were easy to understand and interpret. Based on this pilot survey, no changes were made to the research survey.

Descriptive Statistics

Thirty-five (35) individuals completed the online survey. Of the 35 participants, one individual indicated a nonvegetarian diet and 11 respondents lived outside of Oklahoma County, leaving a total of 24 qualified participants. Nineteen (79.2%) of the participants were female while five (20.8%) were male. Eleven (45.8%) participants were between the ages of 18-44, nine (37.5%) were 45-64, and 4 (16.6%) were over 64 years of age (Figure 1). Nine (37.5%) of the participants self-reported as being vegan, eleven (45.8%) reported that they were lacto-ovo vegetarians, three (12.5%) indicated that they were pescovegetarian, and one (4.2%) noted her diet as semi-vegetarian (Figure 2). Two (8.3%) respondents considered themselves vegetarian for less than one year, eight (33.3%) for one-five years, four (16.7%) for six-ten years, five (20.8%) for 10-20 years, and an additional five (20.8%) participants stated they had been vegetarian for

more than 20 years (Figure 3). Nine (37.5%) of the participants perceived their health status to be excellent, 11 (45.8%) reported very good health, three (12.5%) maintained they were in good health, and one (4.2%) participant reported her health as fair (Figure 4).

Body Mass Index

Body Mass Index was calculated for all participants, entered into SPSS, and compared with other variables from the survey. One participant (4.2%) was calculated as being underweight, 12 (50.0%) were normal weight, six (25.0%) were overweight, and five (20.8%) were obese (Figure 5). By diet type (Table 1), vegans accounted for the one (100% of total) underweight participant, six (50%) of the normal weight participants, two (33.3%) of the overweight participants, and none were obese. Lacto-ovo vegetarians accounted for three (25.0%) normal weight participants, four (66.7%) overweight participants, and four (80%) obese participants. Pescovegetarians accounted for two (8.3%) normal weight participants and one (20.0%) of the obese participants. The one (8.3%) semivegetarian fit into the normal weight category.

Comparing years as a vegetarian to BMI (Table 2), one (100%) underweight participant had been a vegetarian for > 20 years. One (8.3%) normal weight participant had been a vegetarian for less than one year, four (33.3%) normal weight participants were in the one-five year category, one (8.3%) normal weight individual was in the six-ten year category, three (25%) normal weight participants were in the 10-20 year category, while three (25%) normal weight participants had been vegetarians for > 20 years. One (16.6%) overweight participant had been a vegetarian for less than one year, one (16.7%) overweight participant had been a vegetarian for one-five years, two (33.3%) overweight participants had been a vegetarian for 10-20 years, while one (16.7%) had been a vegetarian for > 20 years. Three (60%) obese participants had been a

vegetarian for one-five years, one (20%) obese participant had been a vegetarian for six-ten years and one (20%) obese participant had been a vegetarian for > 20 years. The range of BMIs for all participants was 16.8 – 58.5 kg/m^2.

Chronic Diseases

The main purpose of this survey was to determine if vegetarians living in Oklahoma County suffered from certain chronic diseases at lower rates than the general population of Oklahoma County. This section will list and discuss chronic diseases and risk factors reported by participants. Four (16.7%) participants reporting having elevated blood pressure in the past; all four (100%) reported that the diagnosis was made before adopting a vegetarian lifestyle. Twelve (50%) reported having high cholesterol in the past; 11 (91.7%) of the 12 participants reported that the diagnosis was made before adopting a vegetarian lifestyle while one (8.3%) reported that the diagnosis had come after beginning a vegetarian diet. One participant (4.2%) reported suffering from heart disease; this diagnosis was made before the participant adopted a vegetarian lifestyle. None of the participants reported ever suffering from a stroke. One participant (4.2%) had been diagnosed with cancer; this diagnosis came after adopting a vegetarian lifestyle. Three (12.5%) participants reporting having been diagnosed with diabetes or pre-diabetes; one (33.3%) was diagnosed after becoming a vegetarian while the other two (66.7%) were diagnosed before adopting a vegetarian lifestyle. These results, along with the general public's incidence report, are depicted in table three. Of the participants reporting diagnoses after becoming a vegetarian, one (with elevated cholesterol) was over the age of 65, had been a vegetarian for more than 20 years, consumed a lacto-ovo vegetarian diet and was overweight (BMI = 26.4 kg/m^2). The participant who reported a cancer diagnosis was in the 18-44 age group, had been a vegetarian for more than 20 years, consumed a lacto-ovo vegetarian diet, and was normal weight (BMI =

24.1 kg/m^2). Finally, the participant who was diagnosed with diabetes was in the18-44 age group, had been a vegetarian 10-20 years, was a lacto-ovo vegetarian, and was considered obese (BMI = 58.5 kg/m^2; Table 4).

Nutrition

The following results describe the reported nutrition status of the study participants. Eighteen (75%) participants reported consuming one-two servings of fruit each day, while five (20.8%) consumed three-five servings of fruit each day, and one (4.2%) consumed over five servings of fruit per day. Two (8.3%) participants reported consuming no beans or tofu daily, 19 (79.2%) consumed beans or tofu one - two times per day, one (4.2%) participant consumed three-five servings of beans or tofu each day, and two (8.3%) participants consumed greater than five servings of beans or tofu each day. Two (8.3%) participants reported consuming no dark green vegetables each day, 18 (75.0%) participants consumed one-two servings of dark green vegetables each day, while three (12.5%) participants consumed three-five servings of dark green vegetables each day, and one (4.2%) participant consumed over five servings of dark green vegetables each day. Four (16.7%) participants reported consuming no orange vegetables each day, 18 (75.0%) participants consumed one-two orange vegetables each day, and two (8.3%) participants consumed three-five orange vegetables each day. Sixteen (66.7%) participants reported consuming one-two other vegetables each day, four (16.7%) participants consumed three-five other vegetables each day, and four (16.7%) participants consumed greater than five servings of other vegetables per day. These results are depicted in table five.

As there were four questions over fruit and vegetable consumption, and the most commonly reported servings were one-two, the one-two was multiplied by four to obtain the following categories: < four-eight, four-eight, or > four-eight. Twenty (83%) of participants

consumed at least four-eight servings of fruit and vegetables each day (Figure 6). By diet type, the < four-eight group was reported by two (22.2% of total) vegans, one (9.1%) lacto-ovo vegetarian, and one (100.0%) semi-vegetarian. The four-eight group consisted of four (44.4%) vegans, three (27.3%) lacto-ovo vegetarians, and one (33.3%) pescovegetarian. The > four-eight group consisted of three (33.3%) vegans, seven (63.6%) lacto-ovo vegetarians, and two (66.7%) pescovegetarians (Table 6). By BMI category, the < four-eight consisted of one (100% of total) underweight participant, one (8.3%) normal weight, one (16.7%) overweight, and one (20%) obese participant. The four-eight category consisted of no underweight, five (41.7%) normal weight, one (16.7%) overweight, and two (40%) obese participants. The > four-eight category consisted of no underweight, six (50%) normal weight, four (66.7%) overweight, and two (40%) obese participants (Table 7).

Chapter Five: Discussion and Conclusion and Recommendations

Summary of Findings

The main purpose of this study was to determine, through an online survey, if vegetarians in Oklahoma County suffered from certain chronic diseases at rates less than the general public in Oklahoma County. The secondary purpose was to collect descriptive statistics from vegetarians in Oklahoma County. The information used for this survey was collected between November 12, 2013 and November 26, 2013 from 24 participants.

The hypothesis stated that vegetarians, especially vegans, living in Oklahoma County suffered heart disease, cancer, stroke, and diabetes at lower rates than the general public of Oklahoma County. The small sample size for this survey may have led to erroneous results. Although several participants indicated incidence of certain conditions, the number of participants who were diagnosed after becoming a vegetarian (the purpose of this survey) was so low that results were inconclusive. More research is needed to determine if vegetarians in Oklahoma County suffer less chronic disease than the general population.

Discussion and Conclusions

Most (85.8%) of the participants that reported being diagnosed with a condition or risk factor also indicated that the diagnosis was made before leading a vegetarian lifestyle. The diagnosis may have been a factor in the participant's diet change. In a qualitative study conducted on 33 vegetarians to determine motivation for diet decision, Fox and Ward (2008) found that one of the major motivations was health. Several of the participants in the Fox and Ward (2008) study cited blood pressure and cholesterol as specific motivating factors while others complained that their diets were unhealthy as children and that they changed them to improve their health. Half of the participants in the current survey reported high cholesterol

levels; most were diagnosed before becoming vegetarian. This could have been a factor precipitating the change in diet. Most (77.8%) of the participants reporting high cholesterol also reported being vegetarian for one-five years; this suggested that high cholesterol was prevalent in participants who have been vegetarians for a relatively short time. Follow-up surveys may indicate that the change in diet improved cholesterol levels.

Participants consumed fruits, dark green vegetables, and other vegetables at higher rates than orange vegetables. The greatest amount of fruit and vegetable consumption (> four-eight) by BMI was highest among overweight participants (66.7%). This may be explained by overweight participants eating more food in general thus leading to higher weights. Another reason for the higher BMIs in this group may be the manner in which the foods are prepared (i.e., fried versus steamed, etc.). The one underweight participant was in the < four-eight consumption category; this may be due to the participant eating small amounts of food overall leading to less weight or it could be due to the wording of the questions. The greatest percentage of fruit and vegetable consumption by diet type was by the pescovegetarians (66.7%) followed closely by the lacto-ovo vegetarians (63.6%). These differences may be skewed, however, due to the small number (three) of pescovegetarians participating in the survey. Unexpected results may also be the result of the way the questions were worded. The nutrition questions asked how many fruits/vegetables per day; participants who did not eat a fruit or certain vegetable each day may have answered “0” yet may have actually consumed the food on a weekly or monthly basis. Also, most participants selected “1-2” servings on all food categories which may have not accurate but, instead, the result of other factors. Galesic and Bosnjak (2009) determined that the length of a survey may affect participant responses. The authors randomly assigned 3,472 participants to a survey for the purpose of determining response rates to surveys that were stated

to take varying amounts of time. Among other results, Galesic and Bosnjak (2009) discovered that the further a question was away from the beginning of the survey, the less variability there was in answers. These later questions also had lower response suggesting, according to the authors, that the answers may not be quality answers due to "fatigue and boredom" (p. 358). Most participants in the current survey indicated consuming one-two servings of beans/tofu daily, making up at least a portion of protein intake. Meat consumption was not assessed for this survey so it could not be determined if higher meat intake was correlated to any disease in this sample. No direct comparison could be made between survey participants and the general public for fruit and vegetable consumption as the numbers recommended by the OSHD (five or more servings per day) did not match the ranges for the survey. However, comparisons between the general public's consumption of at least five servings daily (14.6% of the population) was lower than the survey participants' four-eight and >four-eight servings (83.0% combined).

The vegetarian participants had a lower percentage of obese individuals (20.8%) compared to the general public's (32.0%). Nearly half (45.8%) of all participants in the survey were either overweight or obese. Of the six individuals who were overweight, four (66.7%) were lacto-ovo vegetarians and two (33.3%) were vegans. Of the five individuals who were obese, four (80%) were lacto-ovo vegetarian and one (20%) was pescovegetarian. No vegans were calculated as being obese. The literature was mixed on the healthiness of lacto-ovo and pescovegetarians; results from this survey suggested that lacto-ovo vegetarianism may have been associated with higher BMIs. Lacto-ovo vegetarians were also the only group with members that reported diagnoses of chronic diseases or risk factors after consuming a vegetarian diet. This suggested that dairy and/or egg consumption may have been more associated with higher levels of chronic conditions, possibly due to higher BMIs. More research is warranted to validate this

determination. It should be noted that BMI measurements have limitations. According to the CDC (n.d.) BMI does not differentiate between body fat, bone mass, and muscle mass. Another issue with self-reported BMI results is accuracy due to underestimation of weight and overestimation of height (Flood et al., 2000).

Age ranges varied for the three participants indicating diagnoses after becoming a vegetarian and although all three had been vegetarians for at least ten years, the survey did not question participants on when the diagnoses actually occurred. The diagnoses may have come as participants were just converting to vegetarianism and may have been lingering effects of a nonvegetarian diet; the diseases may have also been undiagnosed before participants switched to a vegetarian diet.

In conclusion, more research is needed to determine if vegetarians in Oklahoma County suffer lower levels of chronic disease than the general population. Aside from the small response rate, other variables were contradicting. Participants seemed to consume more fruits and vegetables than the general population which, according to the OSDH, is an indicator of greater health. However, nearly half of the vegetarian participants were overweight or obese which generally leads to higher incidence of chronic disease especially for those individuals who are obese.

Recommendations

Recommendations for future studies include utilizing a larger sample size. Small sample sizes may not be representative of a population and can lead to erroneous results. Reaching a more general population may also increase accuracy. The individuals participating in this survey all belonged to a group which could increase favorable outcomes; social isolation may be an indicator of increased health risk. Hefner, Waring, Roberts, Eaton, and Grambling (2011)

conducted research comparing C-reactive protein (CRP) levels, a possible indication of heart disease, between individuals of varying of social isolation. The authors conducted household interviews to determine social isolation status using the validated Pawtucket Heart Health Program (PHHP) survey. The PHHP includes questions on marital status, contact with other individuals, and participation in religious and group activities. Participants enrolled in the PHHP already had blood drawn for CRP testing. Hefner et al. (2011) determined that the most isolated individuals were more likely to die from coronary heart disease than those who were the least socially isolated though the authors could not explain the findings.

Since several participants reporting chronic disease had recently begun a vegetarian diet (within one-five years), follow-up studies may be conducted to determine if any health changes were noted. Determining motivation factors of the participants to becoming vegetarian may be indicated. As noted, some individuals follow or convert to a vegetarian diet for health reasons though some may not consider health as part of their decision. Other variables not included in this study could also be considered when determining health status; these variables may include smoking status, family history, education levels, socioeconomic status, and physical activity level.

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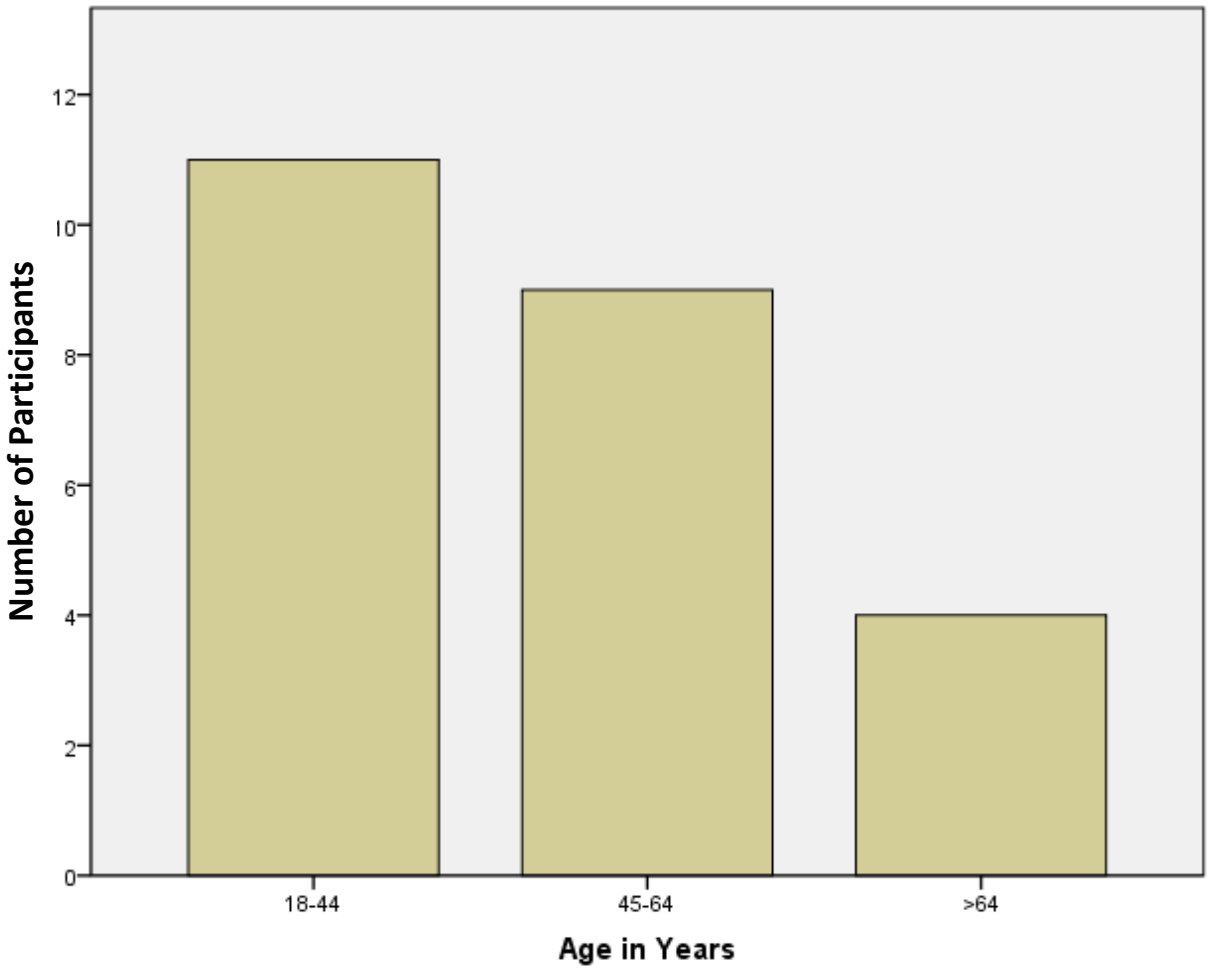

Figure 1. Histogram depicting the ages of the participants in years.

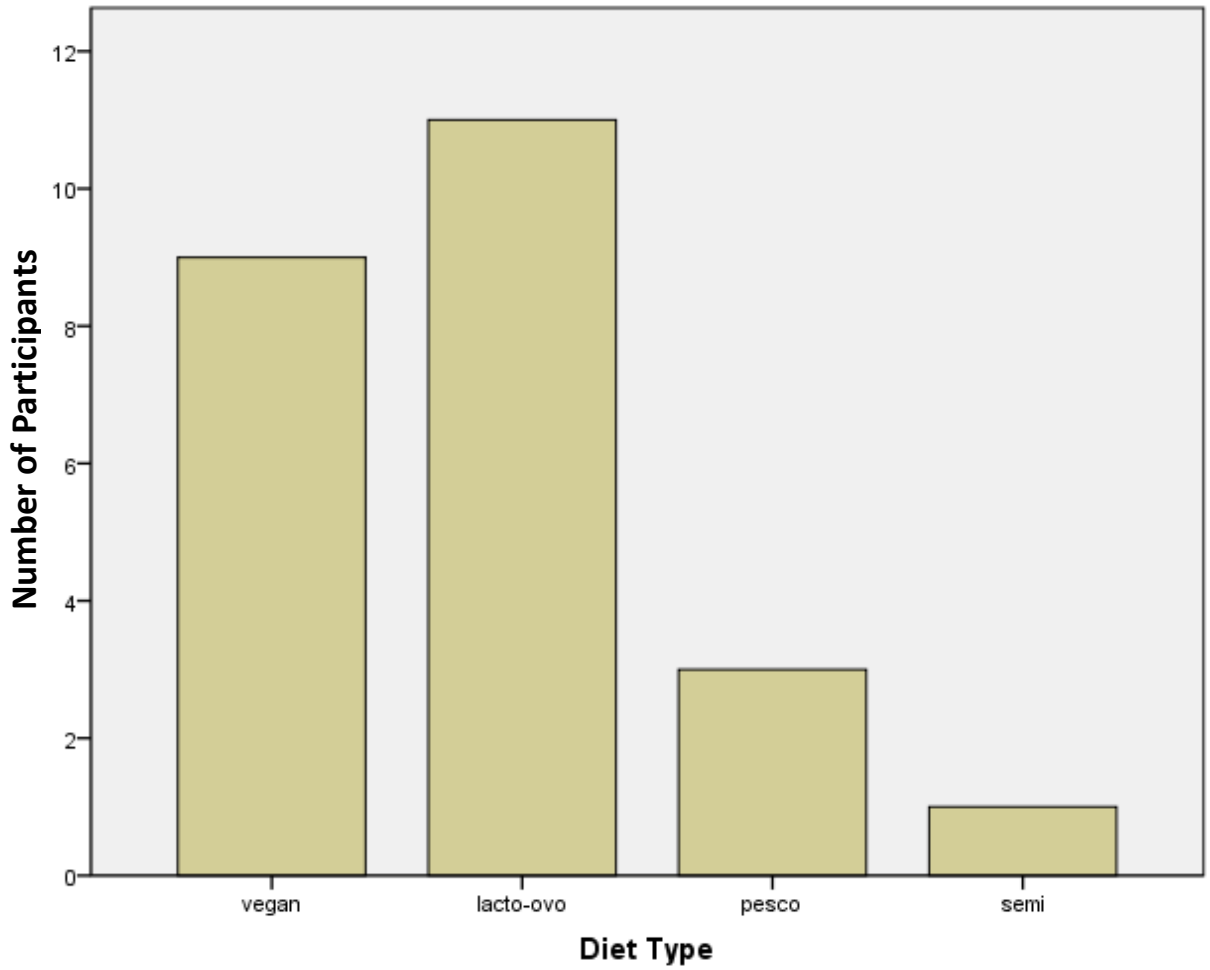

Figure 2. Histogram depicting the diet types of the survey participants.

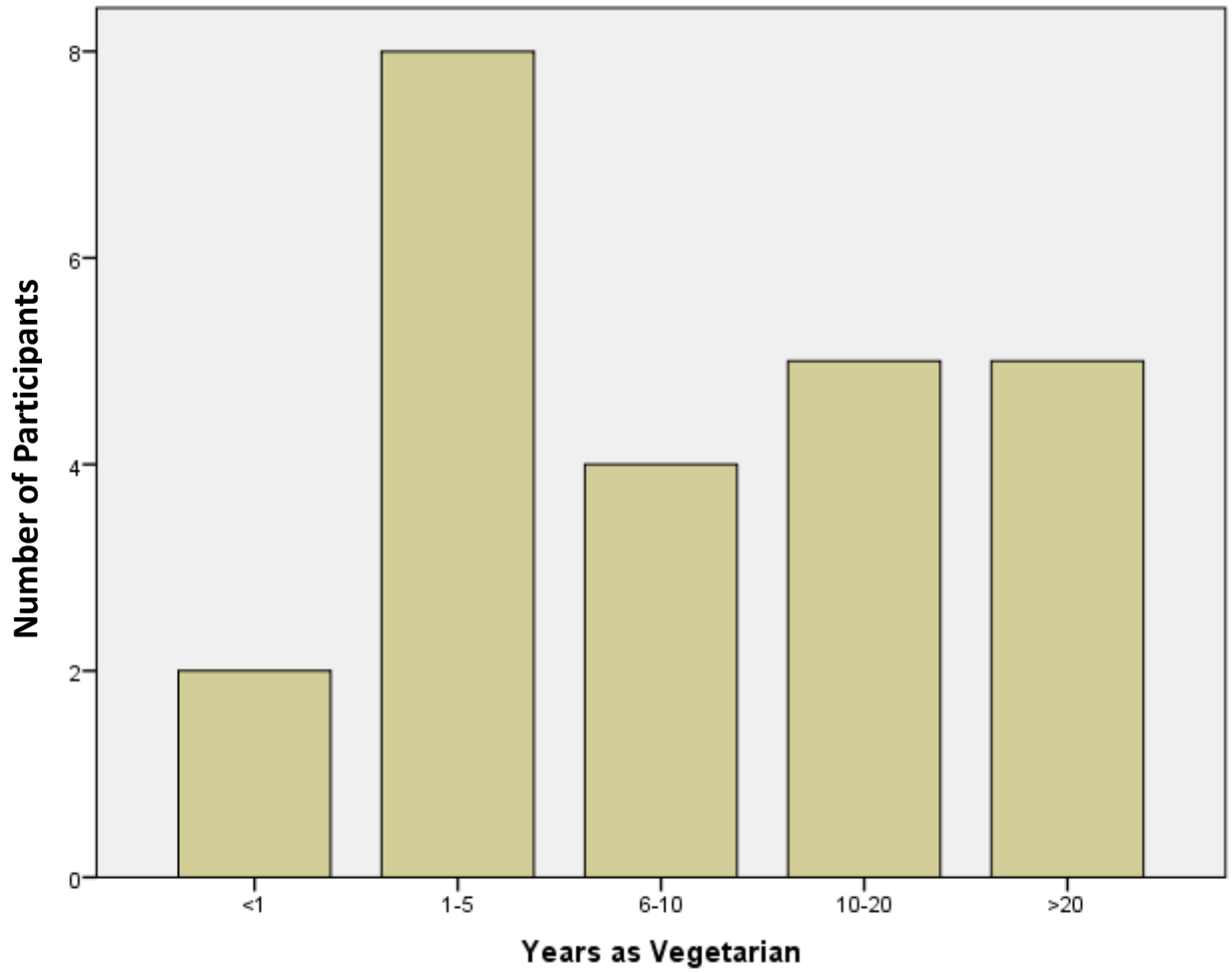

Figure 3. Histogram depicting the number of years participants reported consuming a vegetarian diet.

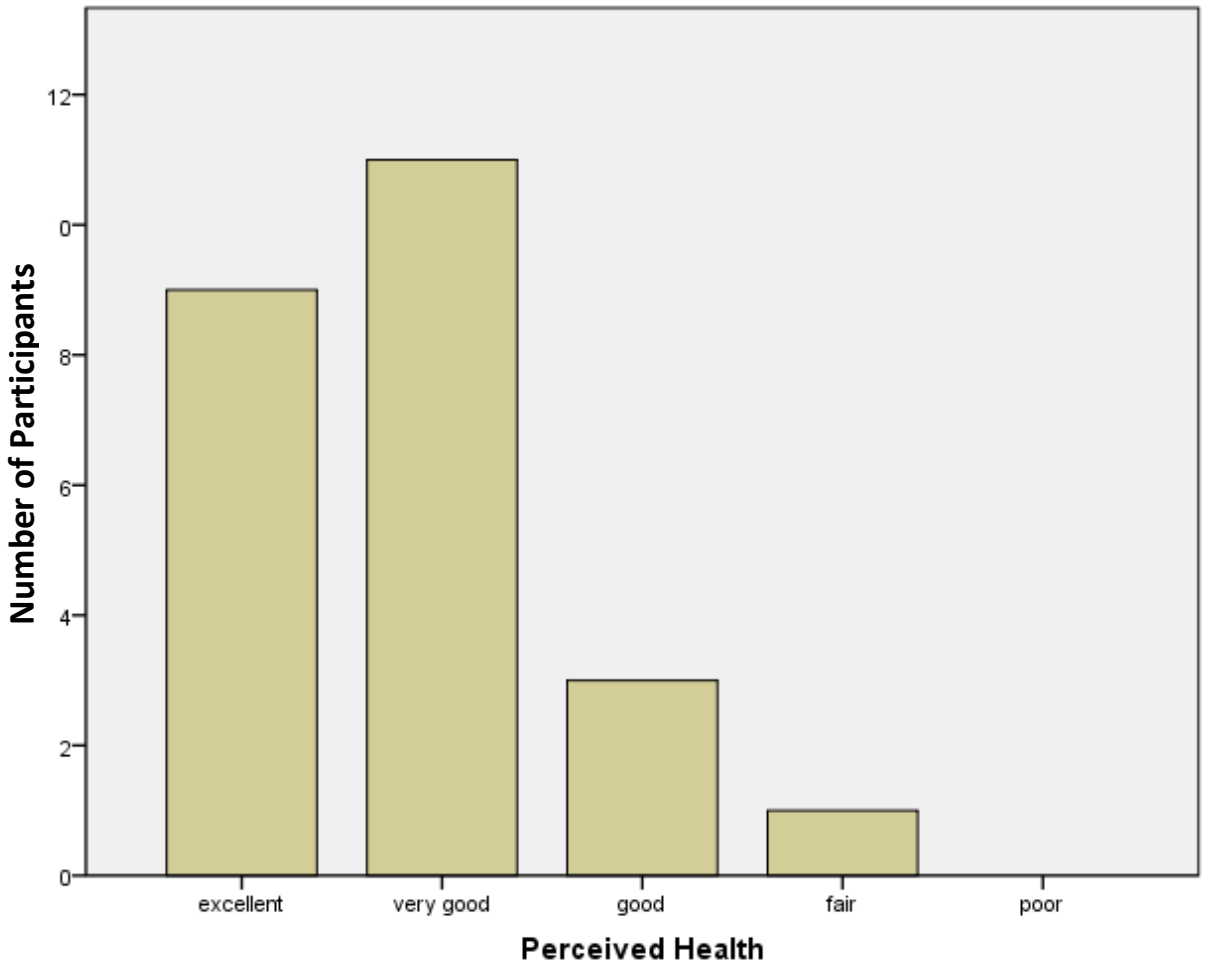

Figure 4. Histogram depicting the perceived health of survey participants.

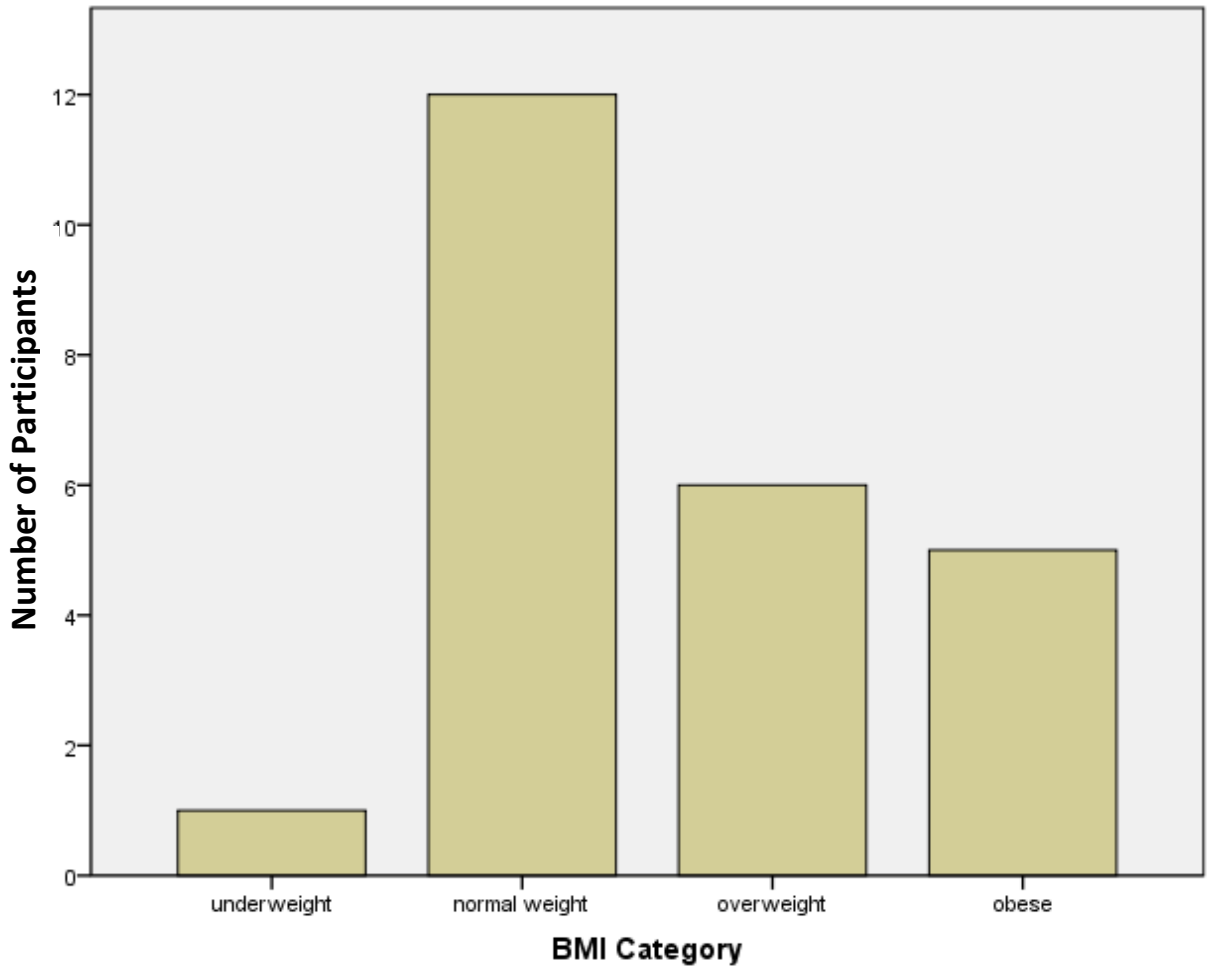

Figure 5. Histogram depicting BMI categories of survey participants.

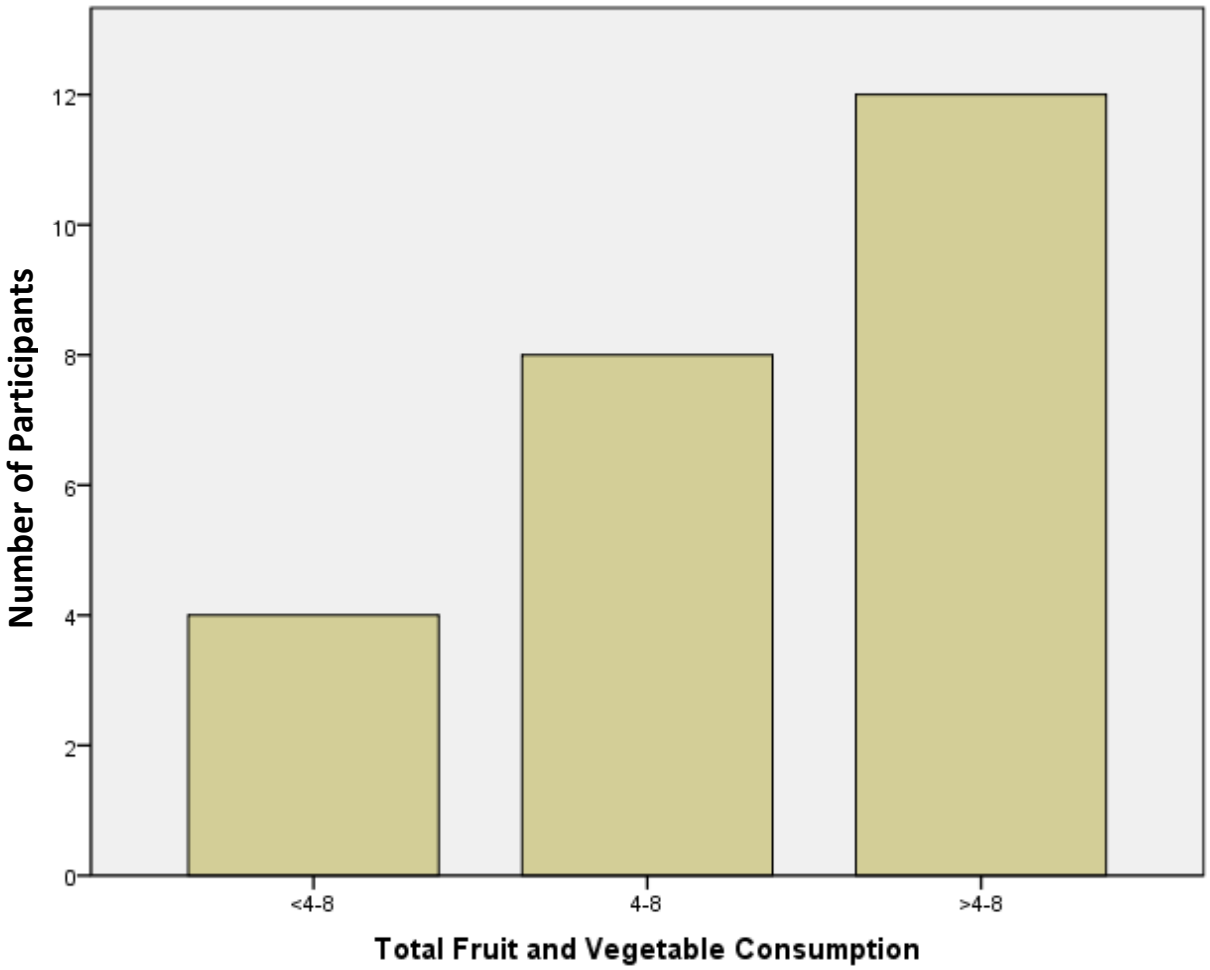

Figure 6. Histogram depicting reported combined fruit and vegetable consumption per day of survey participants.

Table 1

Comparison of BMI category to diet type of participants.

Diet type	Underweight	Normal weight	Overweight	Obese	Total
Vegan	1 (100.0%)	6 (50.0%)	2 (33.3%)	0 (0.0%)	9
Lacto-ovo	0 (0.0%)	3 (25.0%)	4 (66.7%)	4 (80.0%)	11
Pescovegetarian	0 (0.0%)	2 (8.3%)	0 (0.0%)	1 (20.0%)	3
Semivegetarian	0 (0.0%)	1 (8.7%)	0 (0.0%)	0 (0.0%)	1

Table 2

Comparison of BMI category to number of years the participant had been consuming a vegetarian diet.

BMI category	<1	1-5	6-10	10-20	>20	Total
Underweight	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100%)	1
Normal weight	1 (8.3%)	4 (33.3%)	1 (8.3%)	3 (25.0%)	3 (25%.0)	12
Overweight	1 (16.7%)	1 (16.7%)	2 (33.3%)	1(16.7%)	1 (16.7%)	6
Obese	3 (60.0%)	0	1 (20.0%)	1 (20.0%)	0 (0.0%)	5

Table 3

Participants diagnosed with certain conditions compared to the general public.

Condition	Participant Diagnosis	Before	After	General Public
Elevated blood pressure	4 (16.7%)	4 (100%)	0 (0%)	NA
Elevated cholesterol	12 (50%)	11 (91.7%)	1 (8.3%)	NA
Heart disease	1 (4.2%)	1 (100%)	0 (0%)	7.6%
Stroke	0 (0%)	0 (0%)	0 (0%)	3.8%
Cancer	1 (4.2%)	0 (0%)	1 (100%)	3.9%
Diabetes	3 (12.5%)	2 (66.7%)	1 (33.3%)	9.9%

Note: Before = before beginning a vegetarian diet. After = after beginning a vegetarian diet.

Table 4

Participants diagnosed with conditions after becoming a vegetarian compared with age group, number of years as a vegetarian, and diet type.

Condition	Age group	Years	Diet	BMI category
Elevated cholesterol	>64	>20	lacto-ovo	overweight
Cancer	18-44	>20	lacto-ovo	normal weight
Diabetes	18-44	10-20	lacto-ovo	obese

Note: One participant per condition. Years = number of years the participant has consumed a vegetarian diet.

Table 5

Table depicting the reported quantity of fruits and vegetable consumed per day by participants.

Category	0	1-2	3-5	>5	Total
Fruit	0 (0.0%)	18 (75%)	5 (20.8%)	1 (4.2%)	24
Beans/tofu	2 (8.3%)	19 (79.2%)	1 (4.2%)	2 (8.3%)	24
Dark green vegetable	2 (8.3%)	18 (75.0%)	3 (12.5%)	1 (4.2%)	24
Orange vegetables	4 (16.7%)	18 (75.0%)	2 (8.3%)	0 (0.0%)	24
Other vegetables	0 (0.0%)	16 (66.7%)	4 (16.7%)	4 (16.7%)	24

Table 6

Table representing total fruit and vegetable consumption per day by diet type of participants.

	Total fruit and vegetable consumption			
Diet type	<4-8	4-8	>4-8	Total
Vegan	2 (22.2%)	4 (44.4%)	3 (33.3%)	9
Lacto-ovo vegetarian	1 (9.1%)	3 (27.3%)	7 (63.6%)	11
Pescovegetarian	0 (0.0%)	1 (33.3%)	2 (66.7%)	3
Semivegetarian	1 (100.0%)	0 (0.0%)	0 (0.0%)	1

Table 7

Table representing total fruit and vegetable consumption per day by BMI category.

	Total fruit and vegetable consumption			
BMI category	<4-8	4-8	>4-8	Total
Underweight	1 (100%)	0 (0%)	0 (0%)	1
Normal weight	1 (8.3%)	5 (41.7%)	6 (50%)	12
Overweight	1 (16.7%)	1 (16.7%)	4 (66.7%)	6
Obese	1 (20.0%)	2 (40.0%)	2 (40.0%)	5

Appendix A

UNIVERSITY OF CENTRAL OKLAHOMA
Research Participant Information and Consent Form

Title of the Study: Do vegetarians suffer less chronic disease than the general population in a Midwestern county?

Principal Investigator: Angi Tilley
phone: 405-733-7517
email: atilley@uco.edu

DESCRIPTION OF THE RESEARCH

You are invited to participate in a research study about the rate of incidence of heart disease, stroke, high blood pressure, cancer, and diabetes in vegetarians. You have been asked to participate because you are an adult, 18 years of age or older who consumes a type of vegetarian diet. The purpose of the research is to determine if consuming a vegetarian diet lowers your risk for heart disease, cancer, stroke, high blood pressure, and diabetes. This study will include questions over diet, diet type, age, incidence of chronic disease, height, and weight. The survey will be an online survey with a direct link at the bottom of this e-mail. The survey should take approximately 10 - 15 minutes to complete.

WHAT WILL MY PARTICIPATION INVOLVE?

If you decide to participate in this survey you will be asked to answer questions about diet, gender, age, height, weight, and incidence of several chronic diseases. You will be asked to complete one survey. Your participation will take approximately 10-15 minutes per session and will require one session.

ARE THERE ANY RISKS TO ME?

We do not anticipate any risks to you from participation in this study.

ARE THERE ANY BENEFITS TO ME?

We do not expect any direct benefits to you from participation in this study.

WILL I BE COMPENSATED FOR MY PARTICIPATION?

Participation in this study is completely voluntary, and you will not be compensated for your participation. However, your participation is greatly appreciated.

HOW WILL MY CONFIDENTIALITY BE PROTECTED?

This study is anonymous. You will not be asked for your name or any other personal/identifiable information.

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS?

You may ask any questions about the research at any time. If you have questions about the research after you leave today you should contact the Principal Investigator, Angi Tilley, at 405-733-7517 or atilley@uco.edu. You may also contact Dr. Sunshine Cowan at the University of Central Oklahoma at 405-974-5238 or jcowan1@uco.edu. You may also contact Dr. Richard Sneed, Chair of the UCO Institutional Review Board at 405-974-5479 or irb@uco.edu.

Your participation is completely voluntary. If you decide not to participate or to withdraw from the study it will have no effect on you.

By clicking on the survey link, you indicate that you have read this consent form, had an opportunity to ask any questions about your participation in this research, and voluntarily consent to participate. If you would like a copy of the consent form for your records, you may print a duplicate of this page.

Appendix B

September 27, 2013 IRB Application #: 13139

Proposal Title: Do Individuals Consuming a Vegetarian Diet Suffer Less Chronic Disease than the General Public in a Midwestern County?

Type of Review: Initial-Expedited

Investigators:

Ms. Angela Tilley
Dr. Sunshine Cowan
Department of Kinesiology and Health Studies
College of Education and Professional Studies
Campus Box 189
University of Central Oklahoma
Edmond, OK 73034

Dear Ms. Tilley and Dr. Cowan:

Re: Application for IRB Review of Research Involving Human Subjects

We have received your materials for your application. The UCO IRB has determined that the above named application is APPROVED BY EXPEDITED REVIEW. The Board has provided expedited review under 45 CFR 46.110, for research involving no more that minimal risk and research category 7.

Date of Approval: 9/27/2013
Date of Approval Expiration: 9/26/2014

If applicable, informed consent (and HIPAA authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. A stamped, approved copy of the informed consent form will be sent to you via campus mail. The IRB-approved consent form and process must be used. While this project is approved for the period noted above, any modification to the procedures and/or consent form must be approved prior to incorporation into the study. A written request is needed to initiate the amendment process. You will be contacted in writing prior to the approval expiration to determine if a continuing review is needed, which must be obtained before the anniversary date. Notification of the completion of the project must be sent to the IRB office in writing and all records must be retained and available for audit for at least 3 years after the research has ended.

It is the responsibility of the investigators to promptly report to the IRB any serious or unexpected adverse events or unanticipated problems that may be a risk to the subjects.

On behalf of the UCO IRB, I wish you the best of luck with your research project. If our office can be of any further assistance, please do not hesitate to contact us.

Sincerely,

Richard Sneed, Ph.D.
Chair, Institutional Review Board
Director of Research Compliance, Academic Affairs
Campus Box 159
University of Central Oklahoma
Edmond, OK 73034
405-974-5479
rsneed1@uco.edu

Appendix C

Please select the answer which best describes you.

1. Which best describes your diet over the last 12 months?

Vegan – no animal products consumed
Lacto-ovo vegetarian – consume milk and/or eggs but no meat, fish, or poultry
Pescovegetarian – consume milk, eggs, and fish but no meat or poultry
Semi-vegetarian – consume meat, poultry and/or fish less than once a week
Nonvegetarian – consume meat, fish, and/or poultry more than once a week

2. How long have you considered yourself a vegetarian?

<1 year 1-5 years 6-10 years 10-20 years >20 years

3. Would you say that in general your health is—?

Excellent Very good Good Fair Poor

4a. Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?

Yes No

4b. If you answered "yes" to question 4a (high blood pressure), please indicate if the diagnosis was made before or after beginning a vegetarian diet.

I was diagnosed <u>before</u> I began a vegetarian diet
or
I was diagnosed <u>after</u> I was already consuming a vegetarian diet

5a. Have you EVER been told by a doctor, nurse or other health professional that your blood cholesterol is high?

Yes No

5b. If you answered "yes" to question 5a (high blood cholesterol), please indicate if the diagnosis was made before or after beginning a vegetarian diet.

I was diagnosed <u>before</u> I began a vegetarian diet
or
I was diagnosed <u>after</u> I was already consuming a vegetarian diet

6a. Has a doctor, nurse, or other health professional EVER told you that you had a heart attack (also called a myocardial infarction), angina, or heart disease?

Yes No

6b. If you answered "yes" to question 6a (heart attack, angina, or heart disease), please indicate if the diagnosis was made before or after beginning a vegetarian diet.

I was diagnosed before I began a vegetarian diet
or
I was diagnosed after I was already consuming a vegetarian diet

7a. Has a doctor, nurse, or other health professional EVER told you that you had a stroke?

Yes No

7b. If you answered "yes" to question 7a (stoke), please indicate if the diagnosis was made before or after beginning a vegetarian diet.

I was diagnosed before I began a vegetarian diet
or
I was diagnosed after I was already consuming a vegetarian diet

8a. Has a doctor, nurse, or other health professional EVER told you that you had any types of cancer?

Yes No

8b. If you answered "yes" to question 8a (cancer), please indicate if the diagnosis was made before or after beginning a vegetarian diet.

I was diagnosed before I began a vegetarian diet
or
I was diagnosed after I was already consuming a vegetarian diet

9a. Has a doctor, nurse, or other health professional EVER told you that you had diabetes, pre-diabetes, or borderline diabetes?

Yes No

9b. If you answered "yes" to question 9a (diabetes, pre-diabetes, or borderline diabetes), please indicate if the diagnosis was made before or after beginning a vegetarian diet.

I was diagnosed before I began a vegetarian diet

or

I was diagnosed after I was already consuming a vegetarian diet

10. During the past month, not counting juice, how many times per day did you eat fruit? Count fresh, frozen, or canned fruit.

0 1-2 3-5 >5

11. During the past month, how many times per day did you eat cooked or canned beans, such as refried, baked, black, garbanzo beans, beans in soup, soybeans, edamame, tofu or lentils? Do NOT include long green beans.

0 1-2 3-5 >5

12. During the past month, how many times per day did you eat dark green vegetables, for example broccoli or dark leafy greens including romaine, chard, collard greens or spinach?

0 1-2 3-5 >5

13. During the past month, how many times per day did you eat orange-colored vegetables such as sweet potatoes, pumpkin, winter squash, or carrots?

0 1-2 3-5 >5

14. Not counting what you described, during the past month, about how many times per day did you eat OTHER vegetables? Examples of other vegetables include tomatoes, tomato juice or V-8® juice, corn, eggplant, peas, lettuce, cabbage, and white potatoes that are not fried such as baked or mashed potatoes?

0 1-2 3-5 >5

15. Please indicate your age group in years.

18 – 44 45 – 64 >64

16. What is your gender?

FEMALE MALE

17. Please enter the zip code where you live._____

18. Please enter your height in inches and weight in pounds.

Height _____ inches
Weight_____pounds

Appendix D

Date:_____

Did you understand the survey questions as written?

Are there any questions that were difficult to interpret?

If any questions were difficult to interpret, how could the questions be written to decrease the difficulty of interpretation?

Appendix E

Dear Vegetarian,

As part of the thesis process for my masters program in Wellness Management at the University of Central Oklahoma (UCO), I am conducting a survey on the relationship between vegetarian diets and chronic disease for individuals at least 18 years of age. I would like to invite you to participate in my study.

Research suggests that individuals eating a vegetarian diet may suffer less chronic disease than individuals eating a nonvegetarian diet. Chronic diseases are currently the cause of most mortality and cost of healthcare in the US, including Oklahoma County, as well as the world. Interventions are required to decrease this trend and help citizens live longer, healthier lives.

The purpose of my study is to determine if vegetarians in Oklahoma County suffer specific chronic diseases at lower rates than the general population of Oklahoma County. Results of this study may help determine if a vegetarian diet could be recommended to decrease risk for these chronic diseases.

The survey should take no longer than 10-15 minutes of your time. Your participation is voluntary and results will be kept confidential; your name and email address will not be associated with any answers. By clicking the link to this survey you are agreeing to participate; you may skip any questions and may withdraw at any time. Please complete the survey by Thursday, November 26, 2013. Feel free to contact me at atilley@uco.edu for questions about the survey or survey results. You may also contact Dr. Richard Sneed at irb@uco.edu or at 405-974-5497 with questions. The link to the survey is included at the bottom of this e-mail. This research has been approved by the University of Central Oklahoma Institutional Review Board.

Thank you for your participation,

Angi Tilley
atilley@uco.edu

survey link

https://uco.co1.qualtrics.com/SE/?SID=SV_0fhwmxEZTkRaJYF

Appendix F

VOLUNTEERS NEEDED FOR RESEARCH STUDY.

Do Vegetarians Suffer Less Chronic Disease than the General Public in a Midwestern County?

Research is being conducted to determine if vegetarians in Oklahoma County suffer less chronic disease than the general public of Oklahoma County.

Participants should:

- Consume a vegetarian diet
- Live in Oklahoma County
- Be 18 years old or older

The survey is a short, confidential, online survey asking questions relating to your diet, history of chronic disease, and personal demographics (gender, age, etc.). Please pull off a tab at the bottom for the link to the survey. This research has been reviewed and approved by the University of Central Oklahoma Institutional Review Board.

For more information, please contact Angi Tilley at atilley@uco.edu

Vegetarian survey
https://uco.co1.qualtrics.com/SE/?SID=SV_0fhwmxEZTkRaJYE

Vegetarian survey
https://uco.co1.qualtrics.com/SE/?SID=SV_0fhwmxEZTkRaJYE

Vegetarian survey
https://uco.co1.qualtrics.com/SE/?SID=SV_0fhwmxEZTkRaJYE

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