10-2014

The Effects of a Plant Based Diet on the Cholesterol Profile in Young Adults

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October 23, 2014

A Literature Review

A Paper Presented to Meet Partial Requirements

NRSG 594 A

MSN Capstone

Southern Adventist University

School of Nursing

The Effects of a Plant Based Diet on the Cholesterol Profile in Young Adults

Clinical Significance and Background

The term "Heart disease" is used to describe a group of conditions that affect the heart; such conditions generally include diseases that affect the blood vessels. These disease processes consist of coronary artery disease or (CAD), cardiac arrhythmias, and congenital heart defects. Although the terms heart disease and cardiovascular disease are often used interchangeably, cardiovascular disease refers to a subset of conditions that involve narrowed or blocked blood vessels that may eventually lead to a heart attack, chest pain, or even a cerebrovascular accident.

Currently in the United States, about 600,000 people a year die from heart disease. Coronary artery disease kills 380,000 people each year, and is known to be the most common form of heart disease. In the United States alone, $108.9 billion dollars a year is spent on expenses related to coronary artery disease, including-but not limited to-health care cost, medications, and a loss in productivity (Heidenreich et al., 2011). Heart disease is the leading cause of death in the United States for most ethnicities, accounting deaths in Caucasians at 25.1 percent, African Americans are at 24.5 percent, Pacific Islanders at 23.2 percent, Hispanics at 20.8 percent, and American Indians accounting for 18.0 percent (Heron, 2012).

Risk factors for developing heart disease can be divided into two groups. The first group includes factors that are not modifiable, like sex, age, and family history. For instance, men are at a greater risk of developing heart disease than women; although a woman's risk will increase greatly after menopause. As a result of aging the vessels of the heart can become narrowed and damaged, along with a weakening and or thickening of the cardiac muscle. As this occurs, obstruction of the blood flow eventually develops which leads to decreased perfusion. The hypertrophied cardiac muscle becomes less effective, leading to other complications. In

addition, having a family history of heart disease increases the risk of developing CVD, especially with first-degree relatives who were diagnosed at an early age.

The second group of risk factors includes factors that can be modified. Modifiable risk factors include diet, the use of tobacco products, stress, poor hygiene, obesity, physical activity, and substance abuse. People who have diets that are high in fat, sugar, salt, and cholesterol are at an increased risk for developing heart disease. In addition, comorbid conditions such as diabetes, elevated blood pressure, and elevated cholesterol levels contribute to the development of CVD. The effects of these disease processes can cause hardening of the arteries, and narrowing of the vessels as a result of uncontrolled blood pressure. In addition, having elevated levels of cholesterol in the blood leads to the formation of plaque and atherosclerosis. The chronic state of inflammation caused by the elevated blood glucose levels associated with diabetes can contribute to cardiovascular disease as well. Cholesterol, also known as a lipid, is a byproduct of dietary fat consumption which is required by the body to carry out certain functions. Cholesterol in the bloodstream is transported by lipoproteins, which include very low density (VLDL), low density (LDL), and high density lipoproteins (HDL). As a result of apolipoprotein B-100 recognition by the tissues, high concentrations of VLDL and LDL in the blood stream contribute to plaque formation, injury to the vessel wall, inflammation, and eventually atherosclerosis. HDL does not contain the apolipoprotein B-100, and is therefore responsible for reverse transportation. This reverse transportation allows the HDL to carry cholesterol from the tissues to the liver, thus protecting the individual from the development of atherosclerosis. Individuals who have a high ratio between HDL and LDL have a reduced probability of developing atherosclerosis. Diagnoses such as obesity, excessive alcohol use, and

physical inactivity can contribute to an elevation in the LDL, a decreased HDL, and elevated blood pressure.

With so many individuals at risk of developing cardiovascular disease, the focus of health care providers should be directed at primary prevention such as the implementation of dietary changes, and not secondary treatment of disease processes. According to Healthy People 2020, the leading cause of death in the United States is heart disease, and stroke comes in at a strong third. These two diseases alone are among the most widespread and costly health problems facing the nation today. It is fortunate for us that they also happen to be among the most preventable disease processes to date (Healthy People 2020 website, 2014). There has been a huge emphasis placed on the initiation of lifestyle modification in an effort to combat cardiovascular disease in general, but specifically in lowering cholesterol. The risk of coronary artery disease prevalence increases 3-4% for each 1mg/dl reduction in HDL. One such lifestyle modification in an effort to control cholesterol levels, is the initiation of a plant-based diet. Recent research has shown that individuals who maintain a vegetarian diet, generally have lower serum lipid levels, especially LDL and triglycerides, compared to those that consume meat products (De Biase, Carrocha Fernandes, Gianini, & Garcia Duarte, 2005). This knowledge is further confirmed by the fact that, the lower reported total dietary fat intake is associated with a greater reliance on a plant-based diet. The majority of the saturated fats consumed in the standard American diet is contributed by cheese and meat products. Poly-unsaturated fats are derived primarily from plant-based foods and oils. There are several variations of a plant-based diet; some of the more common include a vegan diet, a lacto-vegetarian diet and a lacto-ovo diet. Individuals who consume a strictly vegan diet, restrict all animal products in their food. The lacto-vegetarian diet allows for the consumption of milk and animal byproducts like cheese and

dairy. A lacto-ovo diet allows for the inclusion of eggs along with milk and dairy products. Along with the initiation of a plant-based diet, close attention should be paid to the regulation of total and saturated fats and dietary cholesterol. The National Heart Foundation of Australia (1999) conducted a literature review on the relationship between dietary fat and cardiovascular disease (CVD) in terms of clinical end points, well established risk factors, and other determinants of CVD. Dietary fat was assessed in terms of both total fat, as well as the type of fat. For the purposes of this review saturated fatty acids (SFA), trans fatty acids (TFA), mono-unsaturated fatty acids (MUFAs), n-6 polyunsaturated fatty acids (n-6 PUFAs), and n-3 polyunsaturated fatty acids (n-3 PUFAs), and dietary cholesterols were the acids assessed as types of fat consumed. The conclusion from this study indicates that reducing total SFA was less effective than replacing SFA with n-6 PUFA. SFA intake has been consistently shown to have an adverse effect on LDL and total cholesterol levels. Studies conducted utilizing animal models have demonstrated a positive effect of n-6 PUFAs when compared to SFAs in reducing the development of atherosclerosis, due to the protective properties of n-6 PUFAs against CVD. There is good evidence that suggests replacing SFAs with MUFAs can lower total cholesterol and LDLs. The literature demonstrates a significant correlation between dietary fat intake and the reduction of cholesterol levels in the blood.

Theoretical Framework

This literature review is based on the theoretical framework of Betty Neuman's Systems Model (see Appendix A for graphic model). This model is structured on the premise that the client is viewed as an open system that responds to stressors in the environment. In the Systems Model, the variables that affect the client's response to the environment include five

components. These variables are physiological, psychological, sociocultural, developmental, and spiritual. The client system is composed of a core structure that is protected by lines of resistance. These lines of resistance are intended to stabilize or realign the client to his or her usual state of wellness. The normal line of defense is the standard from which health deviations are measured. This normal line of defense is protected by a flexible line of defense. Wellness exists on a continuum of available energy, which supports the system's ability to maintain stability in its optimal state of health. Stressors are considered to be intra, inter, and extra personal in nature, and arise from internal, external, and even created environments. When stressors are allowed to penetrate the flexible lines of defense, the lines of resistance are activated to realign or stabilize the system as a whole (Theoretical Foundations of Nursing website, 2011). It is believed that cardiovascular disease is currently threatening our client systems flexible lines of defense at an alarming rate. In this instance the normal line of defense would be represented by the target population at baseline, or an optimal heath status. Cardiovascular risk factors along with the diagnosis of disease processes that place our clients at an increased incidence of developing CVD act as stressors to the client system. Initiating life style modifications such as a plant-based diet to prevent the development of CVD, serves as a definitive line of resistance for the client system. As healthcare providers, it is our responsibility to strengthen the lines of resistance with the knowledge and information to prevent this disease process as aggressively and early as possible.

PICO Question

Decreasing the incidence of, and or preventing the development of cardiovascular disease has been the topic of extensive research. To date the implementation of lifestyle modification is

shown to be a key method to primary prevention. Many studies have been conducted to identify the most effective methods of lifestyle interventions to prolong or prevent the development of CVD. Among these interventions, the reduction of serum cholesterol levels have shown great promise. The purpose of this study is to determine the effects a plant-based diet has on the cholesterol profile of young adults in comparison to the standard American diet.

Literature Review

Developing a strategy for the prevention and or reduction of cardiovascular disease by initiating lifestyle modifications has been researched at length. Current literature states that efforts should be aimed at primary prevention to both prevent and treat further complications of CVD. Of the stated cardiovascular risk factors, cholesterol levels have a large impact on the progression and or prevention of the disease. In general, dietary fat intake plays a major role in controlling cholesterol; specifically the type of fat consumed. Studies have demonstrated that populations that consume a plant-based diet typically have a significantly lower serum concentration of total cholesterol and LDL, along with correspondingly lower rates of coronary artery disease in comparison to the general population. Plans for therapeutic lifestyle changes call for the restriction of total and saturated fats and dietary cholesterol, along with the inclusion of plant sterols, soy proteins, viscous fibers, and nuts as the initial intervention when trying to reduce cholesterol.

Several studies have been conducted to investigate the effects of consuming a primarily plant-based diet on the components of serum cholesterol levels. The literature seems to suggest that the long- and short-term effects of consuming a plant-based diet will result in a lower total cholesterol. Ferdowsian & Barnard (2009) conducted meta-analysis of 27 randomized

controlled and observational trials. Thirteen observational studies were included, ten of which were cross sectional studies, and the remaining three were case controlled studies. A total of 4,772 participants from several countries provided a population that was quite diverse in age, gender, racial, and ethnic compositions. Nine of the cross-sectional and two of the case-controlled studies demonstrated a significant reduction in the total cholesterol and LDL levels of the participants who consumed a plant-based diet versus those who consumed a standard diet. In addition, those participants consuming diets which consisted of lean-meat and ovolactovegetarian components displayed reduced total cholesterol and LDL concentrations. In a cross sectional analysis conducted by Bradbury et al. (2014), the serum concentrations of total cholesterol, apolipoprotein, and non-HDL cholesterol of 1694 participants were measured. The participants consisted of 424 meat-eaters, 425 fish-eaters, 423 vegetarians, and 422 vegans. The total serum cholesterol and non-HDL cholesterol concentrations were lower in both male and female vegans than any other group. Vegetarians had lower total cholesterol concentrations than both the fish-eaters and meat-eaters.

In comparison, De Biase, Carrocha Fernandes, Gianini, & Garcia Duarte (2005) conducted a cross-sectional study comparing the cholesterol and triglyceride levels of 76 individuals. Of those 76 individuals, 22 were omnivores; the remaining 54 participants consisted of lacto-ovo vegetarians, lacto vegetarians, and vegetarians. The evidence suggested that vegetarians reported the lowest levels of total cholesterol, LDL, and triglycerides.

When 47 overweight hyperlipidemic men and women were observed in a parallel study conducted by Jenkins et al., (2009); they were asked to consume either a low-carbohydrate vegetarian diet, or a high-carbohydrate lacto-ova vegetarian diet for four weeks. Evidence suggested the participants consuming the low-carbohydrate vegetarian diet displayed lower total

cholesterol and triglyceride levels as well. Kim, Cho, & Park (2012) conducted a study consisting of 45 vegetarians and 30 omnivores to evaluate the health status of individuals who have maintained a vegetarian diet for more than ten years. The evidence displayed a significant difference in the total cholesterol of the vegetarians (173.73±31.42 mg/dl), and the omnivores (193.17±37.89mg/dl). Congruent with the theme of the previous studies, the vegetarians also had lower LDL cholesterol (101.36 mg/dl) than the omnivores at (120.60mg/dl). Jenkins et al. (2014) investigated the long term effects of a diet that was both low-carbohydrate and plant-based on low-density lipoprotein cholesterol levels and weight loss. A parallel design was used to observe 39 men and women whom were overweight and hyperlipidemic. The intervention included advising the individuals to consume a diet that was a low-carbohydrate vegan diet compared to a high-carbohydrate lacto-ovo vegetarian diet for a six month period. At the end of the six month observation, the participants who consumed the low-carbohydrate diet showed a significant reduction in LDL, total cholesterol, and triglycerides.

High Density Lipoproteins. In a recent study conducted by Haung et al. (2014), 2397 premenopausal and 1154 postmenopausal women were recruited to participate in a cross-sectional study, comparing the lipid profiles among dietary clusters. The three diet clusters consisted of vegan, ovo-lacto vegetarian, and an organic diet. Participants chosen had maintained the selected diet for a minimum of one whole year. Vegans and ovo-lacto vegetarians were found to have significantly lower HDL cholesterol than omnivores. Similar results were found in the previously mentioned study conducted by Bradbury et al. (2014), which documented a lower mean HDL cholesterol level in the women assigned to the vegan diet when compared to the fish and meat eaters. There were some variability in the results pertaining to measured HDL levels among the literature. Jenkins et al. (2009) and (2014) documented there

was no difference noted in the HDL cholesterol level of its participants from either of the two diet interventions. Likewise, there was no evidence of a significant difference in the HDL cholesterol in the omnivore versus the vegetarian groups of participants in the Kim et al. (2012) study. Ultimately, De Biase et al. (2005) also documented no differences in HDL levels reported between the samples; however, there was a significantly higher HDL to total cholesterol ratio noted in the vegan participants.

The evidence suggests that HDL levels in individuals that consume a primarily plant based diet, tend to be lower than those that consume a non-vegetarian diet. In instances where low-fat diets utilize carbohydrates to replace fats, the literature suggest there to be a decrease in the HDL cholesterol levels. It has been suggested that the lower apolipoprotein production rates have been a contributing factor. Several previous studies have documented the consumption of both soy and nuts, to increase HDL concentrations when included in a low-fat diet. Overall, the evidence remains inconclusive as to whether or not consuming a primarily plant-based diet will ultimately lower serum HDL levels significantly

Low Density Lipoproteins. When analyzing the mean non HDL or (LDL) cholesterol in both males and females, Bradbury et al. (2014) found vegans to have lower levels when compared to meat-eaters, fish-eaters, and vegetarians. In both studies conducted by Jenkins et al. (2009) and (2014), the results demonstrated a greater reduction in LDL cholesterol level of the low-carbohydrate, high vegetable protein plant-based diet group over the high-carbohydrate lavto-ovo vegetarian diet group. In the 2009 leg of the study, the measurements were taken after one month of intervention; the second leg of the study followed the same intervention for an additional six months until completion. When comparing vegans, lacto vegetarians, lacto-ovo vegetarians, and omnivores, De Biase et al. (2005) documented serum LDL cholesterol levels

which decreased as the consumption of animal products was restricted based on dietary allowances. The vegan participants reported the lowest documented levels. Similar to the previously mentioned studies, Kim et al. (2012) documented a significant difference in the LDL cholesterol levels of omnivores (120.60 mg/dl) and vegetarians (101.36 mg/dl). The study conducted by Haung et al. (2014), was unable to document a significant difference in the LDL cholesterol levels between the dietary groups. The use of contraception and or hormone therapy was found to be related to the elevated LDL cholesterol levels, and may have accounted for this difference.

It can be concluded, based on the combined result of these studies that vegetarians display a lower level of LDL cholesterol as a result of decreased intake of saturated fatty acids, and a higher consumption of vegetable proteins and oils. It is believed that the reduction in LDL cholesterol in vegetarian diets may also be the result of the cholesterol-lowering properties of soy protein and nuts, which has been displayed in previous studies. There is a definitive correlation between the significant negative linear trend in serum LDL cholesterol levels and the increased proportion of raw food consumed in the diet.

Triglycerides. When serum triglyceride levels were measured in the participants of the De Biase et al. (2005) study, a significant difference was reported. Omnivores were reported to have the highest levels, with the numbers decreasing as the consumption of animal products decreased. Jenkins et al. (2009) and (2014), both documented a significantly greater reduction in the triglyceride level of the participants in the low-carbohydrate versus the high-carbohydrate intervention groups. In comparing omnivores to vegetarians, Kim et al. (2012) was not able to document a significant difference in the serum triglyceride levels. In a similar fashion, there were also no significant differences documented in the triglyceride levels of participants assigned

to dietary clusters in the study conducted by Haung et al. (2014). The use of oral contraception and or hormone therapy was associated with the increased levels of triglycerides in participants.

Total Cholesterol. In the study conducted by Haung et al. (2014), the vegan participants were found to have an overall lower total cholesterol than the omnivores in both groups of women. However, the study had no significant differences in total cholesterol documented between any of the dietary groups. Kim et al. (2012) documented a significant difference in the total cholesterol between vegetarians (173.73 ± 31.42) and the omnivores (193.17 ± 37.89). The participants of the Jenkins et al. (2009) study displayed a significant reduction in the total cholesterol levels of the low-carbohydrate intervention group when compared to the high carbohydrate group. All three groups of vegetarians participating in the De Biase et al. (2005) study reported a significantly lower total cholesterol level; the vegan group reported total cholesterol levels of (141.06 ± 30.56). Of the participants, the omnivores reported the highest levels of total cholesterol with mean levels of (208.09 ± 49.09).

Summary. Individuals who abide by a plant-based diets tend to have lower plasma cholesterol concentrations, which manifest in various ways. One mechanism by which cholesterol is reduced, is the result of a decrease in the dietary intake of total fat, saturated fat, and cholesterol. In addition to a reduction in these macronutrients, a plant-based diet contributes to a decreased serum cholesterol by including compounds such as dietary fiber, carotenoids, saponins, phenolics, and flavonoids, which are derived primarily from fruits and vegetables, whole grains, and legumes. The information provided suggests that a portion of the difference in concentration of serum cholesterol in between the diet groups, may be a result of the difference in nutrient composition. Consumption of foods that are found to be rich in nuts and soy have been known to reduce serum lipid concentrations and are also associated with lowering CHD risk

factors. In addition the consumption of viscous fiber in low starch vegetables and the β-glucan in oats and barley, may been a contributing factor in the overall cholesterol-lowering effect of the diet. It should also be noted that evidence suggested total cholesterol levels increased as the consumption of meat increased. The decreased HDL levels associated with the consumption of a plant-based diet is not associated with poor cardiovascular health. It is the ratio of HDL to LDL, and the HDL to total cholesterol levels that bear significance to one risk for cardiovascular heart disease.

Limitations. Some limitations of the studies included were the failure to include a homogenous vegetarian diet group. In some instances, dietary intake was measured utilizing a food frequency questionnaire (FFQ), which relied heavily on the participant's ability to self-report adequate intake. To date, there are very few studies available documenting the cause and effect relationship between the initiation of a plant-based diet and cholesterol profiles in young adults. Further investigation is required to determine the benefit of initiating a plant-based diet as a young adult in an attempt to prevent cardiovascular risk factors such as elevated cholesterol. With the primary goal of healthcare today being prevention, targeting young adults to initiate lifestyle modifications in an effort to combat preventable diseases is the key.

Methodology

Research Design. The research design chosen for the Zoe transformation research study was a Pre-test/Post-test design. In this study, participants were volunteers of the student body who agreed to participate in the dietary challenge, along with volunteer participants who made up the control group. The participants were divided into the intervention and the control groups. The volunteers assigned to the control group did not participate in the dietary challenge, but did participate in baseline and outcome measurements.

Population/Sample. The Zoe project was conducted on students at Southern Adventist University, who agreed to participate in the Zoe Transformation Challenge between the dates of March 17 – April 13 of 2014. There was also a control group which was also recruited from Southern Adventist University, who did not participate in the dietary or spiritual challenges to compare baseline and outcome measurements. The recruitment for participants included both an email solicitation and a verbal presentation by FNP student researchers on March 16th during a lunch program at the Hulsey Wellness Center with recruitment and consent form completion. The participants were not responsible for any cost, nor provided with any compensation or class credit for their participation in the study. Those participants who completed the study were offered a $10.00 gift card as a means of recruitment.

Intervention. The intervention group participated in a dietary challenge of whole foods. The participants were allowed to eat as libitum, as long as the food choices fell within the guidelines provided. The guidelines stipulated that no added sugars or refined sweeteners were to be allowed. The participants were to use water as the primary beverage daily; however, 100% whole fruit juices and unsweetened soy/nut milk products were also allowed. The guidelines also stipulated that tofu and 100% whole grain bread was allowed. The participants received daily emails and encouraging Bible scriptures, and were provided with the book *Christ's Way to Pray* for spiritual and emotional support. The participants were also encouraged to participate in weekly worship meeting to offer encouragement and support to one another, and to utilize the readings for discussion. The participants were offered weekly challenge activities to help them achieve their weekly prayer goals.

Procedures. All of the students participating in the research study were required to complete an informed consent prior to participating. The participants each completed surveys

related to diet, stress, physical activity levels, and spiritual experience before and after participation in the study. In addition, participants had their blood drawn by the school of nursing on March 17, 2014 and again after the challenge on April 14, 2014. Upon completion of the challenge, some of participants participated in a recorded and taped interview to discuss their spiritual experience.

Measurements/Data Collection. Pre and post data were collected on biometric data (height, weight, BMI, body fat percentage, and blood pressure), fasting blood levels, RMR (resting metabolic rate). The participant's RMR was performed at Southern Adventist University's Human Performance Lab, using the Parvo Medics TrueOne 2400 metabolic measuring system. In addition fasting blood samples included plasma cortisol levels, C-reactive protein, lipids, PLAC test, and IL-6 levels. The questionnaires completed by participants included the Dietary Screener (information on the individuals consumption and physical activity), Perceived Stress Scale (assesses the individual stress to specific stressors), Daily Spiritual Experience Scale (measures individuals daily spiritual experiences), and the Spiritual Experience Reflection questionnaire which was provided at the conclusion of the study to explore the spiritual experience of the participants in the study.

Analysis. The statistical analysis plan for this research study included double entry of all data which were gathered and then imported into the SPSS system for analysis. Interval/ratio data were analyzed to test assumptions of normal distribution and homogeneity of variance prior to hypothesis testing. As a result of the non-random sampling of the participants, the intervention and control group demographics and biometric parameters were compared at baseline (chi square, Fischer's exact test or independent t-test) to determine if the two groups were statistically different based on demographic, biometric, or questionnaire characteristics; the

parameters with significant differences were used as covariates. A paired sampling t-testing method was used to compare pre and post intervention measurements of the primary biometrics outcomes, and analyses of covariance was used to compare interval/ratio data from the two groups, controlling for pre-intervention covariates. Multiple regression analysis was then uses to evaluate various models for other quantitative predictors (stress, physical activity, and spiritual experience) of biometric outcomes.

Ethical Considerations. The Zoe project underwent a review by the Southern Adventist University's IRB (Institutional Review Board) in which the physical, psychological, social, and spiritual risks were examined. After the review, it was deemed by the IRB that the risks of the research study were minimal to all participants, and it was approved to commence. All individuals were provided with an informed consent form for the study. No minors were included in the study. Based on the fact that spirituality and prayer are personal and sensitive issues based on an individual's belief systems, participants were given the option to participate in this portion of the program, or to decline.

Results and Discussion

My contribution to the Zoe project as a research assistant included data entry, data analysis, and the collection of supporting data to validate findings of the study. The entry of data was divided into several sections which included the pre and post data related to dietary intake, biometric data, stress, and spiritual aspects. The aspect of data entry that I was responsible for was the pre dietary questionnaire. I must admit, I was unprepared for the detail with which the entry of this data into SPSS would require. Each component of data entry was required to be entered by two separate individuals from separate copies of the data to validate its accuracy.

This proved to be a very meticulous process due to very minor differences in the format in which the data were entered. In addition to data entry, each research assistant was also responsible for analysis of the subsets of data. It is beyond the scope of this paper to present any findings of this study. At this time, no conclusions about the dietary habits of young adult college students can be drawn from this study. In addition, no conclusions about the effects of dietary or other changes can be made for the short-term or long-term impact of these changes on cardiovascular risk factors. Based on the current available literature, it would be expected that if these changes were implemented, there would be a decrease in the incidence of cardiovascular disease within this population.

Evaluation

My learning experience as a result of participation in this research project has been focused primarily on the time and attention to detail with which the collection of data, organization of information, and analysis of the data consumes. Previously I have underestimated the efforts placed on cultivating good research material. It can most definitely be said that conducting a research project, requires an extensive amount of man power, time, and financial backing to complete. After participating as a research assistant, I owe a great deal of respect to those individuals who take on research on a full time basis. As my participation in the Zoe research project comes to a close, the analysis of data has not yet been completed. I am intrigued to learn the completed results of analysis, including the potential sub studies that may result from the Zoe project in the future. I am honored to say that my very miniscule contribution to the research project may lead to potential changes in the methods of prevention and or treatment of patients in the future to come.

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Appendix A

The Neuman Systems Model. (Original diagram copyright © 1970 by Betty Neuman.)

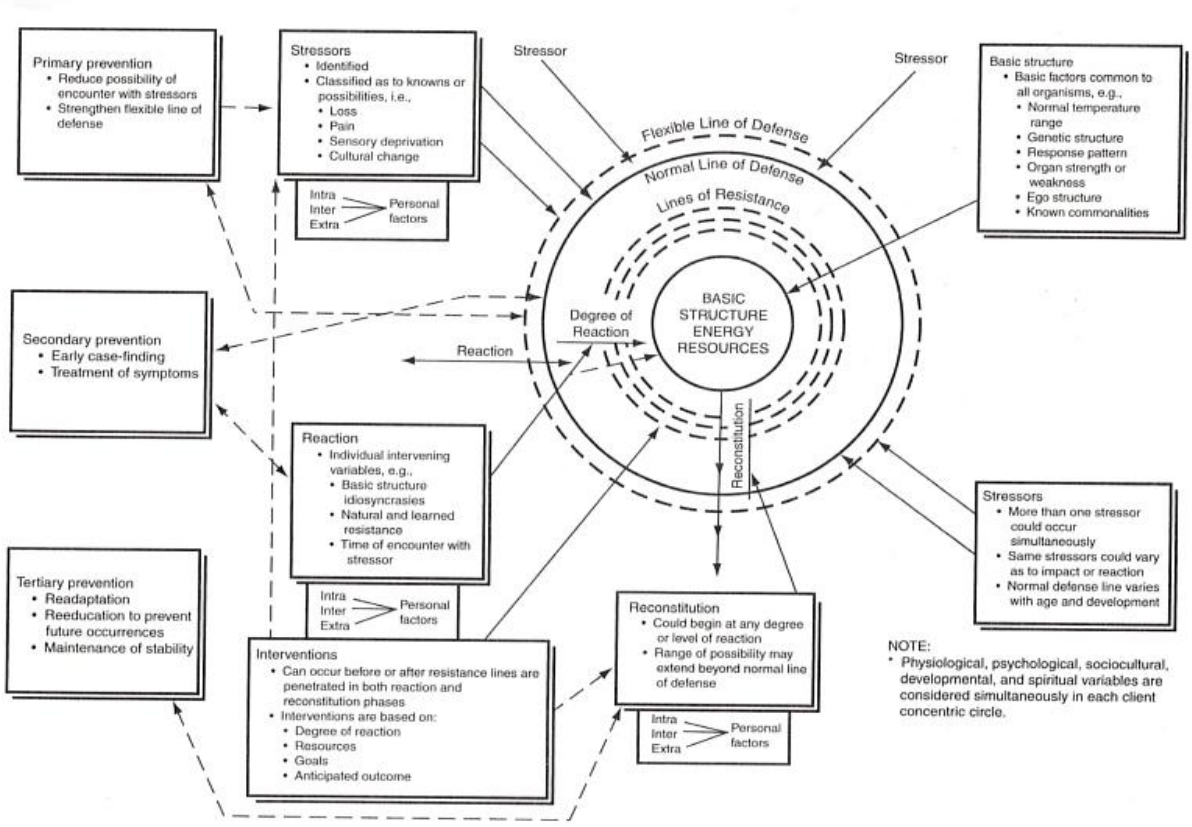

FIGURE 1-3. The Neuman Systems Model. *(Original diagram copyright © 1970 by Betty Neuman.)*

Appendix B

NRSG 594 - Capstone Research Activity Log

Name: Terriest V. Haire

Date	Time Spent	Activity	Place
8/26/2014	1 hour	Research assistant meeting	School
9/16/2014	1 hour	Research assistant meeting	School
9/23/2014	35mins	Meeting	FHH
9/25/2014	2 hours	IRB, Participant log, spreadsheet	Home
9/27/2014	1.5 hours	Researching Zoe study	School
9/29/2014	2.5 hours	Organization of data	Home
10/1/2014	4 hours	Data Entry	Home
10/15/2015	1 hour	Data Entry	Home
10/17/2014	2 hours	Data Entry	Home
10/19/2014	4 hours	Data Entry/Corrections	Home
10/26/2014	3 hours	Data Entry/ Corrections	Home
10/29/2014	40 minutes	Dr. Gates webcast	Home
10/30+A35/2014	3.5 hours	Corrections	Work
10/31/2014	2 hours	Correction/Comparison	Home
11/1/2014	4 hours	Researching FFQ studies	Home
11/4/2014	1.5 hours	Comparison of data entry	Home
11/10/2014	1 hour	Correction	Home
11/11/2014	4 hours	Reviewing Articles per Dr. Gates	Library
11/14/2014	2 hours	Phone comparison Tara	Home
11/16/2014	2 hours	Phone comparison Tara	School
11/19/2014	2 hours	Phone comparison Tara, Joan	Home
11/23/2014	2 hours	Computer crash, SPSS	Home
11/24/2014	3.5 hours	Downloading programs	Home
11/25/2014	1 hour	Dr. Gates webcast	Home

11/25/2014	1.5 hours	Youtube videos SPSS	Home

Median(Interquartile Range)			

11/30/2014	3.5 hours	SPSS analysis	Home
12/2/2014	2 hours	SPSS word document	Home
12/3/2014	2 hours	SPSS Tables	Home

	Experimental Group	Control Group	p-value
Pre-DSQ Q3 - Cereal Frequency	4.0(3)	4.0(3)	
Pre-DSQ Q6 - Milk	2.0(5)	3.0(4)	
Pre-DSQ Q7 - Milk Type	4.0(1)	4.0(2)	
Pre-DSQ Q8 - Sweetened Soda	1.5(2)	1.0(2)	
Pre-DSQ Q9 - 100% Juice	3.5(3)	2.0(3)	
Pre-DSQ Q10 - Sweetened Coffee/Tea	2.0(4)	2.0(3)	
Pre-DSQ Q11 - Sweetened Drinks	2.0(4)	2.0(2)	
Pre-DSQ Q12 - Fruit	6.0(3)	6.0(3)	
Pre-DSQ Q13 - Green Leafy Salad	5.0(2)	5.0(3)	
Pre-DSQ Q14 - Fried Potatoes	2.0(2)	3.0(2)	
Pre-DSQ Q15 - Other Potatoes	3.0(2)	3.0(2)	
Pre-DSQ Q16 - Beans	4.0(3)	3.0(2)	
Pre-DSQ Q17 - Cooked Whole Grains	4.0(3)	2.0(3)	
Pre-DSQ Q18 - Other Vegetables	5.0(4)	4.5(2)	
Pre-DSQ Q19 - Salsa	2.0(3)	2.0(2)	
Pre-DSQ Q20 - Pizza	2.0(2)	2.0(1)	
Pre-DSQ Q21 - Tomato Sauce	2.0(2)	3.0(2)	
Pre-DSQ Q22 - Cheese	4.0(3)	3.5(3)	
Pre-DSQ Q23 - Red Meat	.00(1)	2.0(2)	
Pre-DSQ Q24 - Processed Meat	.00(1)	1.0(2)	
Pre-DSQ Q25 - Whole Grain Bread	4.5(3)	3.0(3)	
Pre-DSQ Q26 - Chocolate or Candy	4.0(3)	3.0(2)	
Pre-DSQ Q27 - Breakfast Sweet Breads	2.0(4)	2.0(3)	
Pre-DSQ Q28 - Cookies, Cake, Pie, Brownies	3.0(2)	2.5(2)	
Pre-DSQ Q29 - Ice Cream or Frozen Desserts	2.0(3)	2.0(2)	
Pre-DSQ Q30 - Popcorn	1.0(1)	1.0(1)	

Appendix C