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ABSTRACT

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PURPOSE: The purpose of this study was to compare cardiovascular disease risk among university employees (N = 47) with the general public as per National Health and Nutrition Examination Survey (NHANES) data and American College of Sports Medicine (ACSM) recommendations. **METHODS:** Health and wellness assessments were performed on public university employees comprised of body compositional analysis, blood lipid and glucose panels, dietary recalls, and blood pressure and then compared with the results of current NHANES data and ACSM recommendations using a one-way t-test and descriptive analysis. A three day dietary recall was also performed and compared with the U.S Department of Agriculture's recommendations. **RESULTS:** Descriptive results indicated that the sample's means were above recommended values for male age, body fat percentage, low density lipoprotein cholesterol, and a diet too high in sodium and too low in calcium, fiber, and vitamin D. A one-way t-test indicated that the sample also had significantly higher diastolic blood pressure ($p = .0008$) and High Density Lipoprotein ($p = .0005$) and significantly lower blood glucose ($p = .00001$) than the national average. **CONCLUSION:** These results indicate that the university employees were at significant risk for some cardiovascular disease risk factors and dietary choices, which indicates that they would benefit from health promotion programs that target those specific risk factors.

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CHAPTER I

INTRODUCTION

Cardiovascular disease is on the rise in the United States of America and around the world^{1, 2}. Approximately 1 in 4 deaths in the United States are caused by some form of cardiovascular disease^{1, 2}. In fact, cardiovascular disease is the number one cause of death in the United States^{1,2} and around the world³. Cardiovascular disease is extremely dangerous due to its often sudden onset and high mortality rate. One of the main reasons that cardiovascular disease is on the rise is because many of the risk factors for the disease are on the rise as well. Some risk factors are outside of one's control, such as age, gender, and genetics. However, many risk factors for the disease can be modified through lifestyle changes and medical intervention. Modifiable risk factors include physical activity level, hypertension, prediabetes, dyslipidemia, diet, and obesity.

It has been found that people of different socioeconomic classes, races, education levels, and geographic locations have different risks of cardiovascular disease². Some research has been done to determine if there are differences in cardiovascular disease by occupation, however many of these studies are epidemiological and have only looked at overall mortality or determined how many people in certain occupations have been diagnosed with the disease. The majority of studies do not delve into rates of specific risk factors among occupations. Additionally, most studies focus on high risk or high stress occupations such as firefighters, police officers, laborers, etc. There are a lack of studies focusing on

cardiovascular disease risk factors among jobs that are considered to be “white collar.”

White collar jobs are generally considered to be ones where the employees spend the majority of their day in an office or cubicle environment. While it may seem obvious that sedentary jobs such as these may cause an increase in cardiovascular disease risk due to their physically inactive nature, it is unclear if this is actually the case. Research has shown that an educational level often has an inverse relationship with cardiovascular disease risk⁴. Many of the “white collar” jobs generally require a high education level. This leads to questions regarding if the benefits of having a higher education level outweigh the risks of having a sedentary job. Most of the research done today is performed in a university setting; this makes the selection of university employees ideal due to their white collar nature and their easy accessibility to researchers.

Since many common risk factors can be alleviated through lifestyle modification, it is important to first determine which risk factors are most apparent in a population. Once it is identified which specific risk factors are common, risk factor modification and prevention programs can be designed in order to help decrease risk the most. While many health promotion and risk factor modification programs are centered around diet and exercise, programs should still be even more customized to include education based on specific risk factors in order to help the population to more fully understand their conditions and how to fix them. One of the largest benefits for an employer to initiate a health promotion program is not only the health and happiness of their employees but also to increase their

employees work capacity and decrease costs of absenteeism, medical costs, and work related injuries. Alkhatib's 2013 study concluded that sedentary risk factors are prevalent within university employees regardless of job roll. This conclusion is paramount in the discussion of university setting health promotion⁵. In 2015 Alkhatib published a follow up on this study and found that these sedentary risk factors can be significantly minimized by the implication of a work place health promotion program involving exercise⁶. Unfortunately, according to Falck and Kilcoyne, health promotion programs in university settings are scarce and employees in this field are frequently overlooked when it comes to health promotion⁷.

Statement of the Problem

The purpose of this study was to examine cardiovascular disease risk factors among university employees, and to compare these results with standardized norms based on age and gender. In addition, this study will also be used to help guide programmatic offerings in health and wellness within the university. The following risk factors of cardiovascular disease were studied:

- 1) Age
- 2) Gender
- 3) Body composition
- 4) Blood pressure
- 5) Blood glucose
- 6) Blood lipids
- 7) Diet

Hypothesis

There is significant risk of cardiovascular disease among university faculty and staff. There is a significant difference of cardiovascular risk between university employees and those of the general population.

1. There is no significant risk based on age or gender among the sample.
There is no significant difference between the general public and sample on age or gender.
2. There is a significant risk of obesity among the sample. There is no significant difference between the general public and sample on obesity.
3. There is significant risk of hypertension among the sample population.
There is no significant difference between the general public and sample based on hypertension.
4. There is significant risk of dyslipidemia among the sample population.
There is no significant difference between the general public and sample based on dyslipidemia.
5. There is no significant risk of prediabetes among the sample population.
There is a significant difference between the general public and sample based on fasting blood glucose.
6. There is significant risk of adverse dietary factors of the sample population.

Significance of the Study

This investigation is significant because cardiovascular disease rate is on the rise in the United States of America and the disease causes a significant increase in mortality among the population⁸. Comparing faculty and staff of a regional Midwestern university with other occupations will be helpful in planning future health and wellness initiatives in the university setting. The results of this study may also prove effective in helping the subjects to gain a better understanding of their health levels and augment their lifestyles accordingly to improve health.

This study is relatively groundbreaking because there is little research done on this type of career as most occupational health studies focus on physically demanding jobs such as fire fighters, medical providers, and law enforcement.

Delimitations of the Study

The following delimitations were identified in the study:

1. The sample population was limited to employees and staff of the University of Wisconsin-River Falls in River Falls, Wisconsin, United States of America. (N = 47)
2. A Cholestech LDX machine was used to measure blood lipids and glucose.
3. A Cosmed Bod Pod was used to measure body composition.
4. In order to ensure fasting blood lipids and glucose were measured, participants were instructed to consume nothing but water for the 12 hours prior to the tests being administered.

Limitations of the Study

The following limitations were recognized in the study:

1. The sample population in this study was selected based on participant willingness.
2. Variability may be skewed due the fact that the participants volunteered and were not chosen at random. Behaviors and attitudes participants may have already possessed may have influenced their decision to volunteer.
3. Diet was self-reported by participants causing reliability and validity to be restricted to the accuracy of participants' responses.
4. The sample was limited in quantity.

Definition of Terms

Atherosclerosis: Hardening of the arteries due to damage to the blood vessel.

Contributing factor to many cases of cardiovascular disease.

Blood Lipids: Blood-borne fats, such as triglycerides and cholesterol.

Body Composition: The chemical composition of the body. The model generally used considers two components: fat free mass (muscle, bone, etc) and fat mass. This measure is often written as "percent body fat."

Body Mass Index (BMI): A measurement of body overweightness or obesity determined by dividing weight (in kilograms) by height (in meters) squared. BMI is highly correlated with body composition and risk of disease.

Cardiovascular Disease (CVD): A class of diseases of the circulatory system including the heart and blood vessels.

Cardioprotectant: A substance or condition that promotes the safety of the cardiovascular system and guards against its destruction.

Diabetes Mellitus Type I: An autoimmune condition which results in the destruction of the beta cells of the pancreas leading to a decrease in insulin production, which causes the body to not be able to properly process glucose.

Diabetes Mellitus Type II: A condition where the cells of the body become insulin resistant and fail to respond to insulin as they previously did. This leads to an improper level of blood glucose. Research has shown that this type of diabetes has a genetic component but also is heavily influenced by excess body weight, poor diet, and lack of exercise.

Dyslipidemia: Blood lipid levels outside of the healthy range. LDL cholesterol greater than or equal to 130 mg per deciliter, or HDL less than 40 mg per deciliter, or total cholesterol greater than or equal to 200 mg per deciliter⁹.

High Density Lipoprotein (HDL): A cholesterol carrier regarded as a scavenger; theorized to remove cholesterol from the arterial wall and transport it to the liver to be metabolized.

Hypertension: Chronically abnormally high blood pressure. In adults, hypertension is usually defined as a systolic blood pressure of 140 mmHg or higher and a diastolic pressure of 90 mmHg or higher.

Ischemia- A restriction of blood flow to the tissues causing of lack of oxygen and glucose needed for cellular metabolism.

Low Density Lipoprotein (LDL): A cholesterol carrier theorized to be responsible for depositing cholesterol in the arterial walls.

Obesity: A excessive amount of body fat, generally defined as more than 22% in men and 32% in women, a Body Mass Index of 30 kg/m^2 in either gender, or a waist girth of more than 102 cm (40 inches) in men or 88 cm (35 inches) in women⁹.

Prediabetes: A fasting glucose level greater than or equal to 100 mg/dL and less than or equal to 125 mg/dL confirmed by measurement on at least two occasions.

Total Cholesterol Ratio/High Density Lipoprotein (TC/HDL): Ratio of total cholesterol to HDL which is used to predict risk of heart disease. Optimal ratio is 4-5 to 1, depending on gender.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this study was to examine cardiovascular disease risk factors among university employees, and to compare these results with standardized norms based on age and gender. In addition, this study will also be used to help guide programmatic offerings in health and wellness within the university.

The aim of this review of literature was to examine the following factors relationship with cardiovascular disease: age, gender, diet, prediabetes, dyslipidemia, hypertension, and obesity. Since the majority of these issues are interconnected and are often associated with each other, it is important to study them together rather than solely as individual issues. This chapter will help to determine the cause and effect of these risk factors on contributing to cardiovascular disease, but also the effect on cardiovascular disease when these risk factors are eliminated or resolved. This review of literature also investigates differences in cardiovascular disease among different types of occupations.

Age and Gender

Research⁹ has found that age and gender have a significant impact on the risk of cardiovascular disease. While, unfortunately, these are unmodifiable risk factors, knowing the demographic of the population one is working with can have a significant impact on the planning, programing, and implementation of health promotion.

The American College of Sports Medicine has stratified risk for age as a cardiovascular disease risk factor. Their stance is that age becomes a risk factor for men ages 45 and older and women ages 55 and older⁹. Their stand on this is solidified from a statement made by the American College of Cardiology and American Heart Association in 2002¹⁰.

As seen in the American College of Sports Medicine's stance on age, gender comes into play. Age becomes a risk factor for men when they are 10 years younger than women. According to research by Rossouw, women develop heart disease around 10-15 years later than men¹¹. It is hypothesized this is because of the cardioprotectant effect of estrogen¹². Research by Epstein et al. found that estrogen appears to have a positive effect on cholesterol levels and the blood vessels in general. They found that estrogen acted as a vasodilator and its properties have an antiatherosclerotic effect on the vascular system¹³. Because men have lower levels of estrogen than women¹⁴ it is theorized that their bodies naturally have less protection against atherosclerosis. When women reach menopause and their estrogen levels drop, they also lose some of their bodies' natural antiatherosclerotic properties¹⁵. Additionally, being female has been found to decrease mortality rate from those whom already have heart failure¹⁶. However, it is hypothesized that after menopause a man and woman's risk for heart disease equalizes due to the decrease in estrogen levels of post-menopausal women¹⁴.

Body Composition

Obesity is a major contributing factor to the development not only of cardiovascular disease itself but also of the other risk factors associated with cardiovascular disease. Obesity is also an epidemic in the population of the United States. Per research by Flegal et al., 2 in 3 adults in the United States are considered to be overweight or obese. This research was done as part of a national survey entitled the National Health and Nutrition Examination Survey (NHANES) between 2008 and 2010¹⁷.

In 1997, the American Heart Association came out with a statement regarding the relationship between obesity and cardiovascular disease. Prior to this statement, and the research associated with it, the thought was that obesity had an indirect relationship with cardiovascular disease and that the link between heart disease and obesity was due to various other factors associated with obesity such as hypertension, dyslipidemia, and impaired fasting glucose. However, the American Heart Association changed their stance due to the fact that more research was coming out and finding that obesity was a direct predictor of heart disease¹⁸.

The American Heart Association cited research from multiple longitudinal studies in their statement¹⁸. One of these studies was drawn from The Framingham Study. The Framingham Study is a groundbreaking, long term, longitudinal study that has been ongoing since 1948. The study began with 5,209 adult subjects in Framingham, Massachusetts and sought to discover long term factors associated with cardiovascular disease, diet, exercise, and various other health related factors and is now on its third generation of subjects¹⁹. One study done from the

Framingham study was extremely useful in the American Heart Association's statement. Garrison and Castelli studied men from the Framingham Study for 30 years and found that men who were greater than 110% of their desired body weight suffered from a mortality rate 3.9 times higher than men of desirable weights (100% -109%)²⁰.

Another integral study that the American Heart Association based their statement on was from Rabkin et al. These researchers from the University of Manitoba studied nearly 4000 men for 26 years and compared their Body Mass Index (BMI) with cases of heart disease in the cohort. They found that a high BMI was significantly associated with the development of myocardial infarction (heart attack), coronary insufficiency, and sudden death. Researchers also adjusted for age and blood pressure in univariate and multivariate analysis to further conclude their findings were sound²¹.

Hypertension

Chronic and prolonged high blood pressure, called hypertension, is associated with the development of cardiovascular disease due to the stress it places on the blood vessels and cardiovascular muscles. Hypertension is defined by the American College of Sports Medicine as a Systolic Blood Pressure (SBP) greater than 140 mmHg or a Diastolic Blood Pressure (DBP) greater than 90 mmHG. Hypertension is also divided into two categories based on severity. Stage 1 hypertension is defined as a SBP between 140 and 159 mmHg or a DBP between 90 and 99 mmHg. Stage 2 Hypertension is defined as a SBP of 160 mmHg or more or a

DBP of 100 mmHg or more. Prehypertension is a dangerous predecessor to hypertension. Prehypertension is defined as a SBP between 120 and 139 mmHg and a DBP between 80 and 89 mmHg⁹.

When blood pressure is chronically high it is believed to cause microscopic tears in the vessels, the tears then become scar tissue. This scar tissue provides a place for cholesterol, fat, and plaque in the blood to lodge itself. When this happens, the blood vessels become narrower and less flexible over time. This can lead to organ damage, myocardial ischemia, and stroke because of inadequate blood flow²². This narrowing can also lead to blood clots that can cause such conditions as strokes or Deep Vein Thromboses (DVTs)²³.

The relationship of blood pressure and increases in cardiovascular disease is believed to be curvilinear. Rapsomaniki et al. studied 1.25 million individuals' blood pressures and risk of cardiovascular disease over a 13-year period. They found that those with a SBP between 90 and 114 mmHg and a DBP between 60 and 74 mmHg had the lowest risk of cardiovascular disease. They found as SBP and DBP increased above these values, cardiovascular disease risk increased as well. Additionally, they found that there was no J-shaped curve at values below a SBP of 90 and DBP below 60²⁴.

Hypertension is known as the silent killer due to its general lack of signs and symptoms. Many people do not know they even have it at all. About 1 in 3 people in the United States have hypertension and only 52% of these people have their blood pressure under control²⁵. However, with frequent monitoring hypertension can be easily detected and treated with medical or lifestyle intervention. The American

College of Sports Medicine indicated that prehypertensive patients should be treated with lifestyle intervention alone unless they have a compelling indication to include medication. They also stated that those who are in Stage 1 or 2 hypertension should include lifestyle changes and medication in their intervention program⁹.

Diabetes and Prediabetes

Diabetes is a rising problem in our society. Over the last 35 years the number of new cases of diabetes has ballooned from 493,000 new cases per year in 1980 to 1,437,000 cases per year in 2014²⁶. Research has found that being diabetic or prediabetic has a significant effect on the risk of cardiovascular disease²⁷. However, a 2002 survey study found that only 68% of diabetic patients surveyed in the United States believed they were at risk for cardiovascular disease²⁸. Additionally, Haffner et al. found that cardiovascular disease accounts for more than 80% of deaths in persons with Type II Diabetes²⁹.

There are two main types of diabetes, diabetes mellitus type I and diabetes mellitus type II. Diabetes mellitus type I, or juvenile onset diabetes, is an autoimmune condition where the body's own immune system causes destruction of the insulin producing beta cells located in the pancreas. This causes the body to not be able to process glucose properly, leading to an increase in blood and urine glucose concentration. There is no known cure for this form of diabetes. This type of diabetes accounts for about 5% of cases of diabetes in the United States³⁰. This form of diabetes must be treated with pharmacological intervention. The other major type of diabetes, diabetes mellitus type II, is caused by a combination of lifestyle and

genetic factors. Lifestyle modification methods such as an increase in exercise and change in diet are generally recognized as the best options in treating diabetes mellitus type II and in some extreme cases pharmacological intervention is necessary.

In research by Ford et al., researchers found that there was an association with hyperglycemia and cardiovascular disease. Due to this, diabetics and prediabetics, especially those who are undiagnosed, have an increased risk for cardiovascular disease²⁷. A review study by Ripsin et al. found lifestyle intervention was significantly more effective than pharmacological intervention alone³¹. This being said, those who are at risk for the development of diabetes mellitus type II may benefit positively from increased health and wellness promotions in order to decrease both their risk of developing diabetes and cardiovascular disease.

Dyslipidemia

Having abnormal blood lipids levels is also a serious risk factor for cardiovascular disease. Like hypertension, dyslipidemia is often unaccompanied by signs and symptoms and can often go undiagnosed unless routinely checked by a medical professional³². In addition to the lack of signs and symptoms, dyslipidemia is also very dangerous because blood lipids are more difficult and invasive to measure than other risk factors such as hypertension and obesity and thus people do not get them measured very frequently.

When blood lipids are measured they are often divided into three sub groups: Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), and

Triglycerides. A ratio of HDL to total cholesterol is often given. Having a lower ratio of HDL to total cholesterol denotes a lower risk for cardiovascular disease. LDL cholesterol is also known as “bad cholesterol”, LDL is responsible for depositing cholesterol on the artery walls, worsening atherosclerosis. HDL cholesterol is also known as “good cholesterol.” It is responsible for scavenging cholesterol that is in the artery, lessening the atherosclerotic effect. Triglycerides are a measure of the amount of fat in the blood.

Having dyslipidemia is a major contributing factor to heart disease and the atherosclerotic process. It is hypothesized that having too low HDL cholesterol and too high LDL cholesterol and triglycerides causes the atherosclerotic process to be expedited³³. In an article by Kannel and Vasan, researchers reviewed multiple scholarly articles concerning triglycerides’ roll in atherosclerosis. They found that elevated triglycerides were positively related to cardiovascular disease risk. They also found that even in participants with low LDL cholesterol, risk was still high if they possessed high triglycerides³⁴.

Another valuable number to look at when determining risk for cardiovascular disease risk based on serum lipid levels is the ratio of Total Cholesterol to HDL cholesterol (TC/HDL). Lemieux et al. found that men who have lower TC/HDL are more likely to experience ischemic heart disease and are more likely to experience high LDL levels as compared to men with higher TC/HDL. Additionally, these researchers found that TC/HDL ratio was more predictive of ischemic heart disease than Total Cholesterol to LDL cholesterol ratio (TC/LDL)³⁵. Based off of an analysis of previous studies done by Millán et al., a male’s TC/HDL

level should be less than 4.5 and a woman's should be less than 4.0³⁶. The Mayo Clinic also states similar numbers and believes that the TC/HDL ratio should be less than 5 for both men and women³⁷.

Diet

While the American College of Sports Medicine does not consider one's diet to be a specific risk factor for the development of cardiovascular disease, diet can have a significant impact on the development of the disease. Additionally, there is some research that has shown specific attributes of one's diet may influence their rate of developing the disease. Diet has also been found to have a significant impact on the development of other risk factors for cardiovascular disease such as obesity, dyslipidemia, prediabetes, and hypertension⁹.

A major dietary contributing factor to risk of cardiovascular disease is an unbalanced total caloric intake. When one consumes excess calories as compared to the amount that he or she is burning off through a combination of acts of daily living (ADLs) and exercise, the extra is stored as fat in the body. Over time, this extra fat can build up in the body and lead to obesity³⁸. As previously mentioned, obesity is a major contributing factor to cardiovascular disease.

Research regarding the consumption of fat and its relationship with cardiovascular disease is clear. Consuming unsaturated fatty acids is a cardioprotectant activity and can help lower LDL cholesterol and triglyceride levels, can positively affect platelet function, and can decrease blood pressure in those with hypertension. In contrast, research has shown that saturated fats can cause adverse

effects such as an atherosclerotic effect on the blood vessels. Furthermore, the American Heart Association has concluded that trans fats have a more negative effect on the body and should be fully eliminated from the diet³⁹.

Dietary fiber may also have an association with the risk of cardiovascular disease. In a study by Ludwig et al., researchers studied data from the Coronary Artery Risk Development in Young Adults (CARDIA) Study (a longitudinal cohort study that examined change in cardiovascular disease risk factors in young adults over a ten-year period). They found that fiber intake showed a strong, inverse linear association with body weight, waist to hip ratio, and fasting blood insulin. Additionally, they found an association between fiber intake and blood pressure, HDL and LDL cholesterol, and triglyceride levels⁴⁰.

A longitudinal study by Bazzano et al. followed up on participants of the National Health and Nutrition Examination Survey between 1971 and 1975. Researchers compared adults who consumed fruit or vegetables 3 or more times a day with adults who consumed them less than once per day at baseline. When research was completed in 2001, researchers found that those who consumed 3 or more servings per day had a 27% lower risk of stroke, 42% lower stroke mortality, 24% lower ischemic disease mortality, and a 27% lower cardiovascular disease mortality⁴¹.

Additionally, many vitamin and mineral deficiencies are related with the development of cardiovascular disease and many of the other contributing factors, such as obesity. Wang et al. used data from the Framingham Heart Study and found that individuals who had vitamin D deficiency (<15 mg/mL in blood) were 1.62

times more times likely to have a cardiac event 5.4 years later⁴². Furthermore, there has been some research correlating magnesium with decreased risk of cardiovascular disease⁴³. There has not been significant research shown on the relationship of other types of vitamin and mineral deficiency and risk of cardiovascular disease, however, vitamin and mineral deficiencies are often linked many other types of disease. It is extremely important to recognize these deficiencies in populations in order to best address dietary changes in order to promote overall health.

However, there is a major link between increased dietary sodium consumption and risk of cardiovascular disease and hypertension. A meta-analysis by Strazzullo et al. found that those who had habitual higher salt intake were ~1.23 times more likely to suffer a stroke and ~1.14 times more likely to develop cardiovascular disease⁴⁴. Excess sodium consumption may also be linked to an increase in blood pressure. Graudal et al. studied high sodium and low sodium diets in different blood pressure categories (normotensives, hypertensives). They found that reduction of sodium consumption resulted in significant decreases in blood pressure: a 1% decrease in the blood pressure of normotensives and a 3.5% reduction in hypertensives⁴⁵.

Work Place

There has been some research to describe the effect of occupation on cardiovascular disease risk. However, many of these studies generally focus on highly physically taxing jobs or jobs considered to be “blue collar.” There are many

studies focusing on cardiovascular disease and different types of occupational hazards one may face in blue collar jobs such as carbon monoxide exposure or shift work⁴⁶. While these studies are very valuable, it is also incredibly important to investigate “white collar” employees risk for cardiovascular disease, as white collar jobs are on the rise and blue collar jobs are on the downswing⁴⁷. If we are able to gain more research in this area, we may be able to help reduce cardiovascular risk in these populations and the population as a whole. Many studies found generally related to sedentary behaviors such as those found in white collar jobs and not specific jobs or types of jobs in general. However, these studies can be related back to white collar jobs because white collar jobs are generally sedentary ⁴⁸.

Gu et al. studied data in the National Health Interview Survey. They found that white collar workers had a significant increase in obesity rates between 2004-2007 and 2008-2011 while blue collar workers did not⁴⁹. Since obesity is becoming more prevalent in white collar workers as compared to blue collar workers, it is important to examine cardiovascular disease risk even more in white collar workers to develop plans to help them reduce this risk.

Within the category of white collar jobs, there are many different types of jobs. Some of these jobs are more active, such as teaching, and some are more sedentary, such as receptionist type work. The same is true within the category of university employees. There are many different types of jobs within university settings, which begs to ask if there are differences in risk factors and behaviors between different types of jobs. Alkhatib’s 2013 study concluded that sedentary risk factors are prevalent within university employees regardless of job role. In this

study, Alkhatib also found that employees, regardless of age and gender, on average, had higher than recommended blood glucose, percent body fat, and BMI⁵.

We can now see the need for health promotion programs in a university setting to help reduce the risk of cardiovascular disease. Unfortunately, according to Falck and Kilcoyne, health promotion programs in university settings are scarce and employees in this field are frequently overlooked when it comes to health promotion⁷.

Summary of Literature

While research has shown positive relationships between age, gender, diet, dyslipidemia, body composition, hypertension, and work place environment, it is important to consider that patients are individuals and all of their situations are unique. When utilizing studies to determine risk factors for cardiovascular disease, it is important to remember the whole picture. Extensive research has been done in many areas, but in the realm of white collar employee risk and health, there is much more to be done; specifically, in the realm of the university employee. There are about 1.55 million people in the United States employed in higher education; because this is considerable amount of the work force, it is vital to determine risk of disease in order to learn more about this population and to help them to combat heart disease and its risk factors⁵⁰.

CHAPTER III

METHODOLOGY

The purpose of this study was to determine the relationship between cardiovascular disease risk factors among university employees and compare these results with standardized norms based on age and gender in order to aid in offering more specific health promotion options for this type of white collar employee.

The focus of this chapter is to communicate information about preliminary procedures, selection of the subjects, assessments, data collection/procedures, and data treatment.

Preliminary Procedures

Research for this study was collected using various online journal databases (PubMed, Google Scholar, Ebsco, etc.), various recent textbooks, and government website (Center for Disease Control, National Institute of Health, U.S. Department of Health and Human Services, etc.). Research between 1977 and 2016 was utilized for the purpose of this study, with the majority of research used being less than 15 years old. Chapters 1-3 were submitted to the thesis committee chair and were approved. The Institutional Review Board (IRB) Application was accepted by the review board at the University of Wisconsin- River Falls (See Appendix A). Preceding any data collection, subjects were given an informed consent and signed once they had all details explained to them (See Appendix B).

Selection of Participants

In this study there were 47 participants, 14 males and 33 females, ranging in age from 26 to 65 years. All participants were employed by the University of

Wisconsin-River Falls in River Falls, Wisconsin, United States of America and volunteered for participation in the study to gain a better understanding of their personal health. Volunteers filled out a 3-day dietary recall and had resting blood pressure, body composition, fasting blood lipids, and fasting blood glucose measured. Fourteen volunteers failed to return their three-day dietary recall leaving 33 subjects available for dietary analysis.

Assessments

The following assessments were taken during this study:

Dietary Recall

Following the physiologic data collection, subjects were asked to compose a three-day dietary recall. Subjects were asked to write down all the foods and beverages and amounts for three nonconsecutive or consecutive days, depending on the subjects choosing. Subjects were instructed that when they recorded the amounts it would be best to have the actual size of the items such as “1 cup” but it would also be acceptable to put the relative size such as “size of a deck of cards.” One day had to be a weekend day and two days had to be weekdays. Subjects were instructed to select days that were typical for them, this excludes days that they believe were atypical such as days where they consumed holiday meals or were sick and did not have their normal appetite. Subjects were given a standardized form for recording their dietary recall (Note Appendix B). Subjects were instructed to return the recall within 30 calendar days.

Body Composition & Body Mass Index (BMI)

During the review of literature, researchers found that most studies used Body Mass Index (BMI) to measure obesity, however BMI is less effective at measuring obesity because it only takes height and weight into account and not ratio of lean muscle mass to fat mass. BMI is easier to measure as it requires no complex machines measurement (only a scale and length measuring device)⁵¹. However, researchers desired a more accurate measure of obesity for this study. For this reason, body composition using the Cosmed BodPod was used and BMI was also measured because it is often easier to compare this data with national statistics.

Subjects were instructed to bring tight fitting attire to wear for the body composition and body mass index measures, specifically spandex shorts, sports bras, swimming suits, compression shorts, etc. Before the measures were taken, subjects were given privacy to change into this attire and were instructed to remove all jewelry, glasses, socks, shoes, etc. and place a swim cap on their head, fully covering and encapsulating their hair. This was to ensure no excess weight or air was trapped around the body when measures were taken. Subjects were then asked if they knew their height, if they did not, researchers measured their height at this time.

Then, subjects stood on a Doran Scales Inc Model DS5100 scale (Doran Scales Inc., Batavia, IL) and height was inputted manually. The scale then automatically computed BMI per the equation kilograms of body weight divided by height in meters squared. Next the Cosmed Bod Pod (COSMED, Rome, Italy) was calibrated following their step-by-step procedure via their software. Subjects were then

weighed on the scale attached to the Bod Pod and were instructed to stay as still as possible and breathe regularly. Next, subjects were asked to enter the Bod Pod, sit in a manner comfortable for them and told to limit movement but maintain normal breathing. Then, the Bod Pod was started and took two or three measurements depending on if the subject had too much movement. Following this, subjects were asked to change back into their street attire and their data was retrieved from the Bod Pod.

Resting Blood Pressure

Subjects' blood pressures were measured using the guidelines established by the American College of Sports Medicine in 2013⁹. Blood pressure was taken using a standard sphygmomanometer and stethoscope and then recorded. Prior to the measurement of the subjects' blood pressure subjects were required to sit in a peaceful and still manner in a chair with back support for at least 5 minutes. Subjects were instructed to sit with their feet flat on the floor and their right arm on a table in front of them. When this time had passed the researcher placed a standard size blood pressure cuff around the subject's upper right arm, aligned with the brachial artery, at a height level with the subject's heart. The chest piece of the stethoscope was placed in the antecubital space over the brachial artery. The cuff was then quickly inflated to 20 mmHg above the first Korotkoff sound. The cuff was then slowly released at a rate of 2-5 mmHg per second. The systolic blood pressure was recorded when the first Korotkoff sound was heard, denoting the resumption of blood flow to the brachial artery. The diastolic blood pressure was recorded when there was a complete disappearance of sound.

Blood Lipids & Glucose Profile

Blood lipid and glucose profiles were measured using a Cholestech LDX machine. Quality control for the machine was run on a regular basis to maintain valid and reliable results. To further maintain accuracy in the results, subjects were required to fast 12 hours prior to administration of the test, but were instructed to consume ample water in order to maintain hydration.

Subjects blood was drawn via a finger prick. Then, blood was drawn using a capillary tube and placed into the Cholestech LDX cassette and analyzed by the machine. Researchers wore non-latex gloves at all times and all materials were disposed of in a biohazard receptacle.

Data Collection/Procedures

The data for this study was collected from University of Wisconsin-River Falls employees from January 20th, 2015 to November 17th, 2015 at the University of Wisconsin-River Falls Human Performance Lab (Rodli Hall, 512 S. 6th Street, River Falls, Wisconsin, United States of America, 54022).

This study used data collected after subjects signed an informed consent form. Prior to each testing session, subjects were instructed to fast for at least 12 hours prior to the testing and consume nothing but water during those 12 hours. The following testing protocol was conducted: subjects were instructed to sit quietly and ask any questions they had while the researchers explained the purpose of the study, informed consent (Appendix A), and dietary recall (Appendix B). Once the subjects had been sitting for at least 5 minutes, their resting blood pressure was measured. Following this, subjects had a finger prick performed to obtain a small

blood sample gathered with a capillary tube which was then transferred to the Cholestech LDX machine and analyzed. While waiting for the blood analysis, subjects were asked to change into their spandex or swim suit, remove any jewelry or glasses, and place a swim cap on their head. Then, body weight and height were measured with a Doran Scales DS5100 scale and BMI was calculated automatically. Subjects were then instructed to enter the Bod Pod for the body composition measurement. After this, subjects changed back into their street clothes and had the results of their BMI, Body Composition, blood lipid and glucose profiles, and resting blood pressure explained to them and compared to ACSM guidelines.

Each test was performed in the morning to noontime between the hours of 7:30 A.M. and 12:00 P.M, depending on the schedule of the subjects. One subject was tested per day. Each session lasted approximately 25 minutes. At this time the subjects were instructed on how to fill out their dietary recall and to send it back via campus mail or email within 30 calendar days. All data collected was recorded on one form for the researchers (Appendix B) and one form for the subjects (Appendix B). The subjects' forms contained additional educational materials to further their understanding of their results.

The National Health and Nutrition Examination Survey (NHANES) 2013-2014 data was used for comparing the university employee sample data to that of the general public. This was the most recent data set available at the time of data collection. The files used were those for non-Hispanic males and females between the ages of 25 and 65 years of age⁵². Means and standard deviations were produced for the purpose of comparing the two data pools.

For purposes of defining healthy levels of the variables, the American College of Sports Medicines (ACSM) recommendations were used for age, body composition, blood cholesterol, blood glucose, blood pressure, and body composition were used⁹. The ACSM recommendations were selected because of their highly researched and widely accepted values for these numbers. For the dietary recommendations, the US Department of Health and Human Services and US Department of Agriculture's Dietary Guidelines for Americans 2015-2020 was used due to their widely accepted research and history of accuracy⁵³.

Treatment of Data

The investigation was a descriptive study where mean and standard deviation values for male and female cardiovascular disease risk factors were assessed. These data points were then compared with national age and gender specific standardized norms and recommendations using a one-way t-test. Statistical Package for the Social Sciences (SPSS) (IBM Corporation, Armonk, New York, United States) version 24.0 was used for statistical analysis. An alpha value of .05 was used to determine significance. NutritionistPro (Axxya Systems LLC, Redmond, Washington, United States) was used to analyze dietary recalls.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to examine cardiovascular disease risk factors among university employees, and to compare these results with standardized norms based on age and gender. In addition, this study will also be used to help guide programmatic offerings in health and wellness within the university. For the purpose of this study, seven different measures were taken to evaluate cardiovascular disease risk (1) age, (2) gender, (3) body composition, (4) blood pressure, (5) blood lipids, (6) blood glucose, and (7) diet. This data will be compared to national statistics gathered from the National Health and Nutrition Examination Survey (NHANES) from 2013 to 2014⁵².

Results

Participants

A sample of university employees was used for the purpose of this study. The sample consisted of 47 participants, 14 males (29.7%) and 33 females (70.3%), ranging in age from 26 to 65 years of age with a mean age of 46.15 ± 11.17 . All participants were employed by the University of Wisconsin-River Falls (UWRF) in River Falls, Wisconsin, United States of America. Out of the 47 subjects, 33 subjects turned in the dietary recall.

Age and Gender

Table 1 shows the age and gender of participants as well as a comparison of the cardiovascular disease risk factor age as stratified by the American College of Sports Medicine (ACSM). This table also compares the sample's means with those of the general population as described in NHANES 2013-2014. The sample of female UWRF employees had an average age of 46.12 years $\pm$ 11.97 years, thus not meeting the risk factor classification range for cardiovascular disease. However, 11 out of 33 (33.33%) of the subjects were 55 years of age or older, putting them at an increased risk for cardiovascular disease⁹. These numbers were highly comparable to the national average (44.65 $\pm$ 11.46). There was no significant difference between female UWRF employees and the national average ($p = .76$). The sample of male UWRF employees had an average age of 46.21 years $\pm$ 9.42 years, classifying them as within the risk factor range for cardiovascular disease. Additionally, 7 out of 14 (50%) of the subjects were 45 years of age or older, putting them at an increased risk for cardiovascular disease⁹. These numbers were very comparable to the national average (45.47 $\pm$ 11.83). There was no significant difference between male UWRF employees and the national average ($p = .62$).

Table 1.

Sex	Age	ACSM risk factor	National Average	t
Male (n = 14)	46.21 $\pm$ 9.42	≥ 45	44.65 $\pm$ 11.46	0.50
Female (n = 33)	46.12 $\pm$ 11.97	≥ 55	45.47 $\pm$ 11.83	0.30

Note. All values are listed in years of age and Mean $\pm$ Standard Deviation when applicable. $p < .05$ ⁹

Body Composition

Table 2 shows the mean body fat percentage values for male and female participants. Table 3 shows the mean Body Mass Index (BMI) values for participants. The participants must be divided between male and female for these measurements because the ACSM recommends different values for male and female populations. This table also compares the sample's means with the recommendations of the ACSM and those of the general population as described in NHANES 2013-2014. The sample of female UWRf employees had an average body fat percentage of $33.18 \pm 8.85\%$. This was greater than the ACSM recommendation of 20-32% fat⁹. Out of the 32 female individuals, 15 (46.88%) were over 32% fat. Additionally, 1 of the individuals (3.125%) was underfat (<20% body fat). The sample of male UWRf employees had an average body fat percentage 24.18 ± 7.14 . This was greater than the ACSM recommendation of 10-22%⁹. Out of the 14 male subjects, 9 were over 22% fat (64.29%). Additionally, 1 individual (7.14%) was underfat (< 10% fat). Because there was no national data available in the NHANES data set for body fat, there is no statistically significant data available.

Table 2.

Sex	%Fat	ACSM recommendation	National Average
Male (n = 14)	24.18 ± 7.14	10-22%	-
Female (n = 32)	33.18 ± 8.85	20-32%	-

Note. All values are described as Mean $\pm$ Standard Deviation. %Fat = Body Fat⁹. NHANES data unavailable for body fat percentage.

The sample of female UWRF employees had an average BMI of 25.75 ± 5.67 which did not put them in the risk factor range for cardiovascular disease. Only 4 out of the 32 (12.5%) subjects had a BMI of greater than 30 kg/m^2 . This was less than the national average (30.41 ± 8.95). However, there was no statistically significant difference between the sample and the national data ($p = .054$). The sample of male UWRF employees had an average BMI of 27.60 ± 3.83 which did not put them at risk for cardiovascular disease. However, 3 out of the 14 (21.43%) subjects had a BMI of greater than 30 kg/m^2 . This was less than the national average 29.30 ± 6.73 . Yet, there was no significant difference between the sample and the national data ($p = .35$).

Table 3.

Sex	BMI	ACSM recommendation	National Average	t
Male (n = 14)	27.60 ± 3.83	≤ 30	29.30 ± 6.73	0.94
Female (n = 32)	25.75 ± 5.67	≤ 30	30.41 ± 8.95	-1.93
All (n = 46)	26.31 ± 5.21	≤ 30		

Note. All values are described as Mean $\pm$ Standard Deviation. BMI = Body Mass Index. All measures are described as body weight in kilograms/ height in m^2 . $p < .05^{*9}$.

Resting Blood Pressure

Table 4 shows the mean systolic and diastolic blood pressure of the sample population. This table also compares the systolic and diastolic blood pressure values with ACSM recommendations and with those of the general population as described in NHANES 2013-2014.

The average systolic blood pressure (SBP) of the sample was $114.21 \text{ mmHg} \pm 10.29 \text{ mmHg}$. This was less than the ACSM recommendation of less than 120 mmHg⁹. Of the 47 participants, 13 (27.66%) had a SBP in the pre-hypertensive range of 120-39 mmHg. The male sample had 8 participants (57.14%) in this range. The female population had 5 participants (15.15%) in this range. The national average was 118.51 ± 14.89 . While the national average was more than the UWRF sample, it was not significantly different ($p = 0.0518$).

The average diastolic blood pressure (DBP) of the sample was $76.30 \text{ mmHg} \pm 7.01 \text{ mmHg}$. This was less than the ACSM recommendation of less than 80 mmHg⁹. While this was in the healthy range, it was still significantly more than the national average of 71.10 ± 10.44 ($p = .0008$). There were 7 males (50%) and 10 females (30.3%) in the prehypertensive range (DBP between 80 – 89 mmHg). Additionally, there was one male (7.14%) in the stage one hypertension range (DBP between 90-99 mmHg).

Table 4.

	Sample	ACSM Rec.	National Average	t
SBP	114.21±10.29	< 120	118.51±14.89	-1.95
DBP	76.30±7.01	< 80	71.10±10.44	3.36*

Note. All values are described as Mean $\pm$ Standard Deviation. ACSM rec = American College of Sports Medicine recommendations. SBP = Systolic Blood Pressure. DBP = Diastolic Blood Pressure. All measures are described in millimeters of mercury. $p < .05^{*9}$.

Blood Lipids

Table 5 shows the mean values of Total Cholesterol (TC), High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Triglycerides, and Total Cholesterol/High Density Lipoprotein ratio (TC/HDL). The table also compares these numbers with recommendations made by the ACSM and with those of the general population as described in NHANES 2013-2014.

The UWRF sample had a mean TC of $187.74 \text{ mg/dl} \pm 30.27 \text{ mg/dl}$. This was in the ACSM recommended value of $<200^9$. This was less than the national average of $192.03 \pm 40.75 \text{ mg/dl}$. However, it was not significantly less ($p = 0.48$). There were 3 men out of 14 (21.4%) and 13 women (39.39) who had a total cholesterol over 200 mg/dl.

The UWRF sample had a mean HDL value of $61.24 \pm 18.18 \text{ mg/dl}$. This was significantly higher than the national average of $52.09 \text{ mg/dl} \pm 17.25 \text{ mg/dl}$ ($p = .0005$). It was also higher than the ACSM recommendation value of 60 mg/dl⁹ or greater.

The UWRF sample had a mean LDL value of $107 \text{ mg/dl} \pm 27.61 \text{ mg/dl}$. This is lower than the ACSM recommendation value of $<130 \text{ mg/dl}^9$ and it is not significantly different than the national average of $114.09 \pm 35.28 \text{ mg/dl}$ ($p = 0.21$). There were 3 men (21.43%) and 7 women (21.875%) of the sample that were above the ACSM risk factor value of 130 mg/dl.

The UWRF sample had a mean triglyceride level of $133.41 \pm 122.56 \text{ mg/dl}$. This was less than the ACSM risk factor value of $<150 \text{ mg/dl}^9$. The sample was very

comparable with the national average ($134.50 \text{ mg/dl} \pm 124.79 \text{ mg/dl}$). The groups were not significantly different ($p = .95$).

The UWRF male sample had a mean of 4.46 ± 1.47 for their TC/HDL ratio. The female UWRF sample had a mean of 2.86 ± 0.65 for their TC/HDL ratio. This was below the Mayo Clinic's recommended value of less than 5 for both men and women³⁷. There was no national data available for this information and so there is no statistically significant analysis available for this data.

Table 5.

	Sample (n = 46)	Rec.	National Average	t
TC	187.74 ± 30.27	<200	192.03 ± 40.75	-0.70
HDL	61.24 ± 18.18	≥ 60	52.09 ± 17.25	3.48*
LDL	107.89 ± 27.61	< 100	114.09 ± 35.28	-1.24
TRG	133.41 ± 122.56	<150	134.50 ± 124.79	-0.06
TC/HDL				
Male	4.46 ± 1.47	<5		
Female	2.86 ± 0.65	<5		

Note. All values are described as Mean $\pm$ Standard Deviation. TC = Total Cholesterol. HDL = High Density Lipoprotein. LDL = Low Density Lipoprotein. TRG = Triglycerides. TC/HDL = Total Cholesterol/High Density Lipoprotein ratio. Rec. = Recommendation. Recommendations for TC, HDL, LDL, and TRG made by the American College of Sports Medicine. Recommendation for TC/HDL by the Mayo Clinic. * $p < .05$ ^{9, 37}.

Blood Glucose

Table 6 shows the mean values of fasting blood glucose of the population and compares them to the ACSM recommended values and the national average.

The mean fasting blood glucose of the sample was $91.70 \pm 9.43 \text{ mg} \bullet \text{dL}^{-1}$, which was significantly less than the national average of $105.53 \pm 32.50 \text{ mg} \bullet \text{dL}^{-1}$ ($p = 0.0001$). This was less than the ACSM recommendation of less than $100 \text{ mg} \bullet \text{dL}^{-1}$ ⁹. A blood glucose screening of a fasting blood glucose reading of $100 \text{ mg} \bullet \text{dL}^{-1}$ or more and $125 \text{ mg} \bullet \text{dL}^{-1}$ or less denotes possible prediabetes⁹. Four out of the 14 men (28.57%) and 5 out of the 33 women (15.15%) had a blood glucose greater than $100 \text{ mg} \bullet \text{dL}^{-1}$.

Table 6.

	Sample (n = 47)	ACSM Rec.	National Average	t
BG	91.70±9.43	<100	105.53±32.50	-7.59*

Note. All values are described as Mean $\pm$ Standard Deviation. BG = Blood Glucose. ACSM Rec. = American College of Sports Medicine Recommendation. All values are in $\text{mg} \bullet \text{dL}^{-1}$ ⁹.

Diet

Table 7 shows the mean values of the subjects' dietary recalls. Subjects recorded all food consumed for three days and the means were taken of these three days. Data is being compared to recommendations made by U.S Department of Health and Human Services and U.S Department of Agriculture (USDA)⁵³. There were no data available from the NHANES data set and so there was no point of comparison to national averages. Additionally, the USDA has made recommendations for consuming dietary cholesterol and fat. They have stated that the public should consume as little cholesterol as possible, thus in Tables 8 - 12 the recommended cholesterol will be listed as "< " and in Table 7 in the mean percent achieved category, cholesterol values will be listed in mean amount consumed. The USDA has also recommended that 20 – 35% of the total calories consumed should come from fat sources. Because there is a range for this nutrient, mean percent of fat achieved will be listed instead of mean percent achieved of recommended.

Tables 8 - 12 shows the mean values of subjects' dietary recalls into the age and gender groups that the UUSDA uses when making nutrient intake recommendations. Table 8 represents data collected from females 19 – 30 years of age. Table 9 represents data collected from females 31 – 50 years of age. Table 10 represents data collected from males 31 – 50 years of age. Table 11 represents data collected from females 51 or more years of age. Table 12 represents data collected from males 51 or more years of age. Note, there were no females less than 19 years of age and no males less than 31 years of age.

Table 7.	Sample (n = 33)	Mean%ofRecAchieved	SD
	Calories	100.96	39.28
	Protein	170.28	63.80
	Fat	35.81	8.32
	Carbohydrate	160.99	71.52
	Cholesterol	278.06	143.50
	Calcium	88.94	54.92
	Iron	143.94	102.11
	Thiamin	145.06	78.58
	Riboflavin	196.44	96.04
	Fiber	81.84	32.04
	Vitamin C	101.64	70.63
	Vitamin D	32.5	35.19
	Sodium	133.01	77.43

Note. Mean%ofRecAchieved = The mean percent of recommended values achieved by the participants based on age and gender recommendations made by the US Dept. of Health and Human Services and the U.S. Dept. of Agriculture⁵³. SD = Standard Deviation. Fat is described in % of overall calories consumed. Cholesterol is described in milligrams (mg).

Table 8.	Sample (n = 3)	Recommended	Achieved
Calories		2000.00	1462.33 ± 132.52
Protein		46.00	71.00 ± 8.00
Fat		20-35%	27.33 ± 2.08
Carbohydrate		130.00	177.00 ± 33.41
Cholesterol		<	243.00 ± 34.70
Calcium		1000.00	804.00 ± 94.98
Iron		18.00	12.33 ± 1.15
Thiamin		1.10	1.13 ± 0.06
Riboflavin		1.10	1.73 ± 0.25
Fiber		28.00	16.67 ± 5.13
Vitamin C		75.00	69.67 ± 58.79
Vitamin D		15.00	5.00 ± 4.58
Sodium		<2300.00	2385.33 ± 401.13

Note. Achieved values are described as Mean ± Standard Deviation. Calories, protein, and fiber are described in grams (g). Fat is described in percent of overall calories per consumed per day. Calcium, iron, thiamin, riboflavin, sodium, cholesterol, and vitamin C are described in milligrams (mg). Vitamin D is described in micrograms (µg). Recommendations made by US Dept. of Health and Human Services and the U.S. Dept. of Agriculture⁵³.

Table 9.	Sample (n = 12)	Recommended	Achieved
	Calories	1800.00	1853.42 ± 911.20
	Protein	46.00	86.00 ± 41.31
	Fat	20-35%	41.08 ± 9.24
	Carbohydrate	130.00	194.72 ± 127.48
	Cholesterol	<	271.42 ± 146.38
	Calcium	1000.00	1009.09 ± 721.28
	Iron	18.00	19.09 ± 18.50
	Thiamin	1.10	1.87 ± 1.06
	Riboflavin	1.10	2.47 ± 1.61
	Fiber	25.20	20.22 ± 7.68
	Vitamin C	75.00	82.18 ± 55.44
	Vitamin D	15.00	4.27 ± 7.66
	Sodium	<2300.00	2822.63 ± 1546.99

Note. Achieved values are described as Mean ± Standard Deviation. Calories, protein, and fiber are described in grams (g). Fat is described in percent of overall calories per consumed per day. Calcium, iron, thiamin, riboflavin, sodium, cholesterol, and vitamin C are described in milligrams (mg). Vitamin D is described in micrograms (µg). Recommendations made by US Dept. of Health and Human Services and the U.S. Dept. of Agriculture⁵³.

Table 10.	Sample (n = 4)	Recommended	Achieved
	Calories	2200.00	2423.75 ± 344.01
	Protein	56.00	112.00 ± 14.26
	Fat	20-35%	34.50 ± 4.65
	Carbohydrate	130.00	276.50 ± 56.72
	Cholesterol	<	354.50 ± 177.51
	Calcium	1000.00	1287.00 ± 716.10
	Iron	8.00	23.75 ± 6.18
	Thiamin	1.20	2.48 ± 1.02
	Riboflavin	1.30	2.90 ± 0.80
	Fiber	30.80	22.25 ± 5.32
	Vitamin C	90.00	65.50 ± 62.76
	Vitamin D	15.00	5.75 ± 3.69
	Sodium	<2300.00	4064.25 ± 433.50

Note. Achieved values are described as Mean ± Standard Deviation. Calories, protein, and fiber are described in grams (g). Fat is described in percent of overall calories per consumed per day. Calcium, iron, thiamin, riboflavin, sodium, cholesterol, and vitamin C are described in milligrams (mg). Vitamin D is described in micrograms (µg). Recommendations made by US Dept. of Health and Human Services and the U.S. Dept. of Agriculture⁵³.

Table 11.	Sample (n = 11)	Recommended	Achieved
	Calories	1600.00	1754.54 ± 596.73
	Protein	46.00	72.00 ± 22.52
	Fat	20-35%	33.18 ± 6.71
	Carbohydrate	130.00	207.27 ± 74.51
	Cholesterol	<	275.45 ± 168.46
	Calcium	1200.00	835.64 ± 307.28
	Iron	8.00	12.00 ± 5.29
	Thiamin	1.10	1.36 ± 0.60
	Riboflavin	1.10	1.87 ± 0.47
	Fiber	22.40	22.45 ± 8.13
	Vitamin C	75.00	85.00 ± 47.37
	Vitamin D	15.00	5.09 ± 4.16
	Sodium	<2300.00	3109.63 ± 2610.43

Note. Achieved values are described as Mean ± Standard Deviation. Calories, protein, and fiber are described in grams (g). Fat is described in percent of overall calories per consumed per day. Calcium, iron, thiamin, riboflavin, sodium, cholesterol, and vitamin C are described in milligrams (mg). Vitamin D is described in micrograms (µg). Recommendations made by US Dept. of Health and Human Services and the U.S. Dept. of Agriculture⁵³.

Table 12.	Sample (n = 3)	Recommended	Achieved
Calories		2000.00	1782.67 ± 400.55
Protein		56.00	73.00 ± 9.17
Fat		20-35%	34.67 ± 7.57
Carbohydrate		130.00	217.67 ± 56.90
Cholesterol		<	247.33 ± 77.49
Calcium		1000.00	1011.00 ± 397.84
Iron		8.00	15.33 ± 4.04
Thiamin		1.20	1.67 ± 0.15
Riboflavin		1.30	2.40 ± 0.66
Fiber		28.00	15.67 ± 3.21
Vitamin C		90.00	99.67 ± 94.13
Vitamin D		15.00	5.00 ± 2.65
Sodium		<2300.00	3156.00 ± 25.12

Note. Achieved values are described as Mean ± Standard Deviation. Calories, protein, and fiber are described in grams (g). Fat is described in percent of overall calories per consumed per day. Calcium, iron, thiamin, riboflavin, sodium, cholesterol, and vitamin C are described in milligrams (mg). Vitamin D is described in micrograms (µg). Recommendations made by US Dept. of Health and Human Services and the U.S. Dept. of Agriculture⁵³.

Discussion

The purpose of this study was to examine cardiovascular disease risk factors among university employees, and to compare these results with standardized norms based on age and gender. In addition, this study will also be used to help guide programmatic offerings in health and wellness within the university.

This section will describe more in depth statistical analysis of the data and explain the results. This portion will also be extremely helpful to programs who seek to decrease cardiovascular disease risk thorough target specific risk factors and those who are most likely to face them.

Age and Gender

The age range found in this study is similar to that of a 2007 study where researchers completed health intervention on university employees in the United Kingdom⁵⁴. They had 58 women with a mean age of 42 ± 10 years and 6 men with a mean age of 40 ± 11 years⁵⁴. Additionally, Alkhatib's 2015 study had 56 subjects with a mean age of 50.7 ± 2 years⁶. In a previous study by Alkhatib's 2013 study, there were 34 subjects with a mean age of 47.8 ± 11.9 years⁵. While Gilson et al. had mean values less than our study, Alkhatib (2015) had mean values greater than those found in our study, and Alkhatib (2013) had values very comparable to those found in our study. This shows that there is possibly some variability in employee age from university to university. A greater sample size in all of these studies would have been helpful in determining if our sample had a similar mean age to comparable studies. However, we do know that our population was about 2 years older than the national average as determined by National Health and Nutrition

Examination Survey (NHANES) data. This data is extremely valuable because the American College of Sports Medicine (ACSM)⁹ states that there is an increased risk for higher body fat percentage, blood pressure, and many other physiologic variables with an increased age.

The mean ages for males in our group was 46.21 ± 9.42 years and 46.12 ± 11.97 years for females. This is only slightly higher than the national average of ages in the pool of NHANES data utilized and not significantly different. A possible reason for this may be due to an increased education level generally found in university employees. Many jobs at this level require a bachelor's degree, master's degree, and/or doctoral degree. Because these degrees take time to finish, it may be possible that the employees did not start their career until slightly later in life, compared to their counterparts. Additionally, the United States Census found in 2015, 32.5% of Americans over the age of 25 had a bachelor's degree and 12% had some form of education completed at the graduate level⁵⁵. All subjects reported either masters or doctoral degrees as their terminal degree. It is possible our mean ages are higher than the national average due to the subjects being in a different pool than their peers because of higher education level. In future studies, it may be helpful to ask education level and years working at the university in order to help make the demographic clearer for comparison purposes and aiding in health promotion targeting.

Body Composition

Many ancillary studies^{5,6,49} have chosen to use Body Mass Index (BMI) as a measure of body composition because it is significantly easier to measure, requires

less skilled personnel, and less equipment than measuring body fat percentage. Thus, most comparative studies that are applicable here will be compared to our information on BMI and not body fat percentage. Additionally, the NHANES study does not have any data on body fat percentage and so there is no comparison point to national data. However, this does not make the body fat percentage data less meaningful. Body fat percentage is a true value of the amount of fat comprises person's body while BMI is the ratio of weight and height in the body. BMI does not distinguish between fat and fat free mass in the body. Because of this, body fat percentage is an extremely valuable measure because of the increased risk for cardiovascular disease (and other conditions) that is caused by excess body fat⁵⁶.

While we found that the majority of our sample was within normal limits for BMI, they were above of recommended limits for body fat percentage. This may be due to the fact that some of the participants maybe have had a normal body weight for their height but a high percentage of fat. This is likely because BMI is a measure that does not differentiate between muscle mass and fat mass. It was found to be extremely helpful to measure both BMI and body fat in this study in order to learn of the obesity status of individuals and to see that it may be possible in other studies that they may have had similar results if they would have measured body fat as well. It is likely that many of our participants who were found to have normal BMI but above recommended percent fat have normal body weights but less muscle mass than recommended. This information is highly helpful because it can help us to determine that future health promotions at the university level should incorporate

resistance training exercises (weight lifting, resistance training, plyometrics, etc.) into their program in order to increase amount of muscle mass.

Due to the sedentary nature of white collar jobs⁴⁸, these results were not unexpected. Body fat percentage that is above recommended values can be caused by a variety of factors including, but not limited to, sedentary lifestyle, poor diet (above recommended consuming of calories and other nutrients or below recommended amounts of some nutrients), genetics, and certain medications. In the future it would be extremely helpful to additionally study physical activity trends in the sample to help determine the causes of these rates of obesity. Some of the groups (when divided between age and gender) exhibited above normal calorie consumption (see page 56), which may have contributed to this trend.

Body Mass Index

Gu et al. studied obesity rates in different types of occupations using BMI. They found that 16.8% of male employees measured who were employed as post-secondary educators were classified as obese⁴⁹. This is 5% less than what we saw in our sample, however this is most likely due to small sample size. For females, 16.1% were classified as obese. This is higher than what we found by 4%. This is also likely due to our small sample size limitation. In Gu et al., there were 465 males and 470 females⁴⁹. In our study, there were 32 females and 14 males. Alkhatib (2013) found that his 34 subjects had a mean BMI of $25.1 \pm 4.3 \text{ kg/m}^2$ ⁵. Our sample had a mean BMI of 26.31 ± 5.21 , slightly higher than that of Alkhatib (2013). These numbers are close, however, and both are within the ACSM's recommendation of less than or equal to 30 kg/m^2 ⁹.

Body Fat

Alkhatib (2013) found that their 15 male subjects had a mean body fat percentage of 26.2 ± 5.0 and their 19 females had a mean of 32.4 ± 6.8 %. Our male subjects had body fat percentages of 24.18 ± 7.14 , 2% lower than Alkhatib's subjects. Conversely, our female subjects had a mean value of 33.18 ± 8.85 , 1% higher than Alkhatib's subjects. Although these values were 1 and 2 percent different between the two studies, they were both above the ACSM's recommended values. Because this study was performed in England, it is entirely possible that our differences are due differences in culture, environment, or genetics.

It is concerning that our sample was found to be over the recommended percent body fat range because, as previously state in the literature review, having a high percent fat can be a contributing factor for many diseases, not just cardiovascular disease¹⁸. Overall, about 52% of our sample was considered to be overweight or obese by body fat percentage. While this is less than the believed rate of obesity and overweightness in the US (two thirds of those living in the US are considered overweight or obese¹⁷), it is still incredibly disconcerting because this put half of our sample to be at an increased risk for cardiovascular disease. This is a shocking amount of risk. It would be incredibly prudent to create support for faculty and staff to help them overcome this modifiable risk factor. It is also possible that many don't know the exact dangers of being overweight or obese and so educational sessions may also help those effected to have a greater desire to lose the weight.

Resting Blood Pressure

When surveyed, one out of 47 employees reported being on blood pressure lowering medication. This number was very small, only 2% of subjects. For this reason, we do not believe that these blood pressure lowering medications had a significant effect on our data. However, it was found to be extremely useful to obtain this information from subjects in order to fully grasp their current blood pressure status.

Systolic Blood Pressure

When Alkhatib's 2013 study researched sedentary risk factors in university employees, he found that the subjects had an average systolic blood pressure of $115.2 \text{ mmHg} \pm 18.9 \text{ mmHg}^5$. This mean was very comparable to our sample of university employees ($114.21 \text{ mmHg} \pm 10.29 \text{ mmHg}$). Both studies' populations were within the ACSM's guidelines for systolic blood pressure of less than 120 mmHg⁹. These results are very encouraging. The ACSM reports that systolic blood pressure greater than 120 mmHg results in an increased risk for cardiovascular disease⁹.

Diastolic Blood Pressure

Alkhatib (2013) found an average diastolic blood pressure of $72.1 \text{ mmHg} \pm 10.6 \text{ mmHg}$ in his 34 coed subjects⁵. This was about 4 mmHg lower than the employees in our study ($76.30 \text{ mmHg} \pm 7.01 \text{ mmHg}$). Both studies' diastolic blood pressures were within the ACSM recommended value range of less than 80 mmHg⁹. It is very interesting that our sample's mean diastolic blood pressure was about 5 mmHg above the national average and about 4 mmHg above data collected by

Alkhatib (2013). This may be due to a variety of factors such as increased sodium consumption by our sample (the average person consumed 133.01% of their recommended amount of sodium) or increased body fat percentage. Research has indicated that increased sodium consumption can result in an increase in blood pressure⁵⁷. While still within the ACSM recommendation, it is somewhat concerning that our numbers were significantly higher than the national average ($p < .05$). Rapsomaniki et al. found that diastolic blood pressure between 60 and 74 mmHg was linked with the lowest incidence of cardiovascular disease. As diastolic blood pressure rose from this point, there was a curvilinear increase in incidence of cardiovascular disease²⁴. While our mean value was slightly higher than this point, it would be highly advantageous in targeting blood pressure reduction in university employee populations in order to decrease risk of cardiovascular disease.

Blood Lipids

Other studies that focused on faculty and staff of universities did not include data on all cholesterol levels. The studies that did provide information on cholesterol mainly focused on total cholesterol⁵. This may have been due to a variety of factors such as a lack of equipment that was required, funding for supplies and equipment needed, or lack of trained staff. Because other studies did not give a reason why they did not measure cholesterol data, these reasons are only speculative. Because of this, it is difficult to draw conclusions based on comparison points found in other studies. No subjects reported taking any sort of blood lipid control medications.

The UWRF sample had a mean total cholesterol of 187.74 ± 30.27 mg/dl. This was in the ACSM recommended value of <200 mg/dl⁹. This was less than the national average of 192.03 ± 40.75 mg/dl. However, it was not significantly less ($p = 0.48$). One study did provide information on total cholesterol but did not provide High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), or Triglyceride levels. Alkhatib (2013) found that his subjects had a mean total cholesterol level of 189.48 ± 27.07 mg/dl⁵. These numbers were extremely close to what we found in our subjects. These healthy cholesterol levels are extremely encouraging to see because dyslipidemia is often referred to as a silent killer due to its negative health effects, lack of symptoms, and infrequent checking by health professionals³². Healthy mean total cholesterol can be determined by a variety of factors including health diet, regular physical exercise, and genetic factors.

The UWRF sample had a mean HDL value of 61.24 ± 18.18 mg/dl. This was significantly higher than the national average of 52.09 ± 17.25 mg/dl ($p = 0.0005$). It was also higher than the ACSM recommendation value of 60 mg/dl⁹. Our sample may have had a higher mean HDL level due to the higher number of women in the sample than men. According to the American Heart Association, women frequently have higher HDL levels than their male counterparts due to their higher levels of estrogen (the female sex hormone that can raise HDL¹²). This was extremely exciting to see because HDL cholesterol is linked to a lower rate of cardiovascular disease when kept over 60 mg/dl⁹. Having a high HDL level is extremely important for cardiovascular health. It would be important to promote this among faculty and staff so that they are more aware.

The UWRF sample had a mean LDL value of 107 ± 27.61 mg/dl. This is lower than the ACSM recommended value of <130 mg/dl⁹ and it is not significantly different than the national average of 114.09 mg/dl ($p = 0.21$). The UWRF sample had a mean triglyceride level of 133.41 ± 122.56 mg/dl. This was less than the ACSM risk factor value of <150 mg/dl⁹. The sample's population was very comparable with the national average (134.50 mg/dl $\pm$ 124.79 mg/dl). The groups were not significantly different ($p = 0.95$). The UWRF male sample had a mean of 4.46 ± 1.47 for their Total Cholesterol/High Density Lipoprotein (TC/HDL) ratio. The female UWRF sample had a mean of 2.86 ± 0.65 for their TC/HDL ratio. These mean ratio values are within the Mayo Clinic's recommended value of less than five³⁷. There was no national data available for this information and so there is no statistically significant analysis available for this data.

Blood Glucose

No subjects reported having diabetes mellitus of any type or taking any sort of diabetes control medication. The mean fasting blood glucose of the sample was 91.70 ± 9.43 mg • dL⁻¹, which was significantly less than the national average of 105.53 mg • dL⁻¹ $\pm$ 32.50 mg • dL⁻¹ ($p < 0.0001$). It was also within the ACSM recommendation of less than 100 mg • dL⁻¹⁹. Interestingly, it was also lower than mean values for blood sugar found by Alkhatib (2013). His sample of university employees had a mean blood glucose value of 117 mg • dL⁻¹⁵. However, it was unclear whether Alkhatib (2013) measured fasting blood glucose or not, it was only stated that participants rest for 5 minutes prior to measurement⁵. It is unclear what may have caused the mean blood glucose of our sample to be lower than the

national average and previous study. It may be due to a variety of factors including ethnicity, geography, genetics, diet, body composition, and physical activity level. While unclear why mean blood glucose was lower than other samples, this is highly encouraging data for this population. It is estimated that as many as 29.1 million Americans suffer from type II diabetes and as many as 8.1 million of those are undiagnosed⁵⁸. Type II diabetes is often discovered through measurement of fasting blood glucose and finding the results to be impaired. It is encouraging that our subjects were found to have a mean fasting blood glucose in the healthy range because it may note a lack of large amount of type II diabetes in this population.

Diet

In the dietary recall portion of the study only 33 out of the 47 (70.2%) total participants returned their diet information, this may have been due to many factors including but not limited to time availability, memory issues, desire to complete, motivation level, and embarrassment. However, we were not able to survey individuals about their reasons for not completing so the aforementioned plausible reasons are speculative by the researchers. In the future, it may be helpful to incentivize the dietary recall portion of the study by offering follow up appointments to go over the results of the subjects' recalls and suggest possible dietary modifications. Subjects may have felt that they were getting nothing out of the dietary recall because they did not have an appointment like this and that may have caused some of the subjects not to turn them in. When dividing the subjects into groups by age and gender necessitated by the U.S. Departments of Health and Human Services and Agriculture, the groups become very small (between 3 and 11

subjects per group) to the point where there could possibly be error. This is to be considered when reviewing these results. In the future it would be helpful to have a larger number of subjects so that these groups could be larger and less error prone.

Macronutrients

While the mean amount of calories consumed for all subject was $100.96 \pm 39.28\%$ of the recommended amount for age and gender, two groups were on average above the recommended amount and two groups were on average below the recommended amount. Males from ages 31 to 50 consumed about 200 more calories on average than recommended and females over age 51 consumed about 150 calories more calories on average than their recommended amount. Generally consuming excess calories is due to overeating in the diet. Females ages 19 – 30 consumed about 550 calories per day less than recommended on average. This was not unexpected because these are commonly ages where women feel pressure to have a slim build and these young women may have been intentionally eating less in order to keep their weight down. This is not known in certainty and is speculative. Additionally, men over the age of 51 consumed around 250 calories too little for their dietary needs on average. Under consuming calories can be caused by a variety of factors such as misinformation about the body's caloric needs or caloric content of foods as well as desire to lose weight.

All groups consumed the recommended amount of fat per day (between 20 - 35% of total calories) on average except for females, ages 31 to 50. They consumed a mean amount of $41.08 \pm 9.24\%$ per day. All groups also consumed more protein on average per day than necessary. This may be due to excess consumption of meat or

confusion about the amount of protein their bodies actually need. Additionally, all groups consumed more grams of carbs per day than recommended. However, U.S. Departments of Health and Human Services and Agriculture also state that it is healthy to consume 45 – 65% of total calories as carbohydrates⁵³. When means were computed from grams to calories, all groups consumed between 42 and 48% of their calories from carbs, putting them in the recommended value for carbohydrate nutritional needs.

Micronutrients

In the dietary recall portion of this study, there were many variables in which the subjects obtained adequate amounts of the nutrients they required. Overall, subjects consumed adequate amounts of iron, thiamin, riboflavin, and vitamin C. The only major exceptions for these nutrients include the following. Women between the ages of 19 and 30 years required 18 mg of iron per day and only consumed 12.33 ± 1.15 mg on average. Women this age are recommended to consume extra iron because they are of childbearing age. The amount may be difficult for them to consume in adequate amounts due to many factors including dietary preferences, lack of knowledge of iron containing foods, and not knowing that they even require that much in their diet. This was disappointing to see as women require this much iron to maintain proper bodily function. Decreased dietary consumption can lead to symptoms such as lethargy and anemia. Men between the ages of 31 and 50 lacked in consuming adequate amounts of vitamin C. They required 90mg per day and only consumed a mean amount of 65.50 ± 62.76 mg. This may also be caused by a lack of knowledge, desire to consume vitamin C containing foods, or a possible error due to

the small sample size ($n = 4$). This is concerning because the body needs adequate vitamin C in order to sustain immune and other important functions.

Other micronutrients where age and gender groups did not consume adequate amounts were calcium, fiber, and vitamin D. The reasons for not consuming these in adequate amounts are speculative, as we did not survey individuals on their food choices or follow up with individuals about food knowledge and preferences. All gender and age groups did not consume the recommended amount of vitamin D per day ($15\ \mu\text{g}$), however, our body is also capable of obtaining vitamin D through the sun quickly so it is possible that the subjects did actually get the adequate amount of vitamin D they needed. However, this cannot be assumed. This would be important to learn more about in the future by asking subjects about their sun exposure during different seasons. Because the university is located in Wisconsin, the winters have short days often with minimal sun. Some of the subjects had their data collection sessions in the winter months and so it is concerning that they most likely did not get adequate calcium due to lack of sun exposure during these months. This may cause vitamin D deficiency in the subjects. This is also concerning because vitamin D and calcium are synergists and help each other to absorb in the body. Because the groups did not consume adequate vitamin D, it may cause a lack of absorption of calcium in the body (an essential nutrient for bone growth and development).

Females between the ages of 19 and 30 years and those more than 51 years old also did not consume adequate amounts of calcium. Women between the ages of 19 and 30 consumed, on average about 200 mg less than the recommended amount

of 1000 mg while women more than 51 years of age consumed on average almost 400 mg less than their recommended amount of 1200mg. This is concerning because women are more likely to get osteoporosis than men and thus need more calcium⁵⁹. It would be heavily favorable to encourage increased calcium consumption in these female populations. All age and gender groups' mean values, except for women more than 51 years of age, were in adequate in their fiber intake. This may be due to dietary choice such as a lack of choosing whole grain foods (the USDA recommends that Americans consume half of their grains in as whole grains⁵³). This may also be due to lack of knowledge of what constitutes a whole grain.

Additionally, there were some micronutrients where many age and gender groups consumed excessive amounts of micronutrients: sodium and cholesterol. All groups consumed excess sodium. However, males between the ages of 31 and 50 consumed sodium the most excessively. They averaged 4064.25 ± 433.50 mg on average. The recommended amount for all groups was less than 2300 mg per day. Between all groups, the average sodium consumption was 133.01% of recommended or about 3059.23 grams per day. This may be due to consuming processed foods, adding salt, or fast food/restaurant food. Research has found that high sodium diets are linked to an increased risk for cardiovascular disease⁴⁴.

The U.S. Department of Agriculture and Department of Health and Human Services recommend that dietary cholesterol be consumed in as little amounts as possible⁵³. Men between the ages of 31 and 50 years consumed the most dietary cholesterol (354.50 ± 177.51 mg), followed by women over the age of 51 ($247.33 \pm$

77.49 mg), females between the ages of 31 and 50 (271.42 ± 146.38 mg), males over the age of 51 (247.33 ± 77.49 mg), and females between the ages of 19 and 30 (243.00 ± 34.70 mg). The previous recommendation for dietary cholesterol was less than 300 mg a day⁵³. If we were currently going by this standard, then all groups except men between the ages of 31 and 50 years would fall into the acceptable range. Dietary cholesterol comes from animal products and thus the consumption of dietary cholesterol in excess may be due to excess consumption of animal products in these groups.

CHAPTER V

SUMMARY, CONCLUSION, and RECOMMENDATIONS

Summary

The purpose of this study was to identify cardiovascular disease risk factors in University of Wisconsin-River Falls (UWRF) faculty and staff and compare this data with age and gender specific national data provided by the National Health and Nutrition Examination Survey (NHANES) 2013- 2014 data.

In this study, there were 47 participants (14 males and 33 females) with a mean age of 46.15 ± 11.17 years. Subjects volunteered for this study in order to gain a better understanding of their own health. Before subjects were tested, they were asked to fast for 12 hours and complete a medical history form. Subjects were explained informed consent and instructed to sign. Subjects then had their resting blood pressure, body composition, and fasting blood glucose and lipids measured. Subjects were then instructed to fill out their three-day dietary recall and return promptly by mail or email.

A descriptive analysis of age, body fat percentage, body mass index, systolic and diastolic blood pressure, serum total cholesterol, high density lipoprotein, low density lipoprotein, triglycerides, and fasting blood glucose was assessed using means and standard deviations. These values were compared to recommendations made by the American College of Sports Medicine (ACSM)⁹ and the Mayo Clinic³⁷. These values were then compared with age and gender specific NHANES data where available.

Additionally, descriptive analysis was also completed of the dietary recall data. Mean amounts consumed per day and standard deviations were calculated of the following: calories, protein, fat, carbohydrates, cholesterol, calcium, iron, thiamin, riboflavin, fiber, vitamin C, vitamin D, and sodium. These results were then compared with recommendations made by the US Department of Health and Human Services and the Department of Agriculture⁵³.

Briefly, the sample had a significantly higher diastolic blood pressure and high density lipoprotein levels and significantly lower fasting blood glucose compared to the national average. Having significantly lower fasting blood glucose and higher high density lipoprotein levels are positive health indicators. Additionally, the samples' mean values were above recommended for body fat percentage, male age, and low density lipoprotein. In the dietary recall portion of the study the mean values obtained for all subjects were higher than recommended in calories, protein, carbohydrate, fat, iron, thiamin, riboflavin, sodium, and vitamin C intake and lower than recommended in calcium, fiber, and vitamin D intake.

Conclusions

Based on the results of analysis of data obtained during this study, the following conclusions are warranted:

Age & Gender

1. Mean male UWRF employee age (46.21 ± 9.42 years) appears to be slightly above the ACSM risk factor for cardiovascular disease (45 years of age⁹), but not significantly different than the national average age for adult men ($p = 0.62$).

2. Mean female UWRF employee age (46.12 ± 11.97) appears to be below the ACSM risk factor for cardiovascular disease (55 years of age⁹) and not significantly different than the national average age for adult women ($p = 0.76$).

Body Composition

1. Both male and female UWRF employees appear to be, on average, within the ACSM recommended Body Mass Index (BMI) range of 30 kg/m² or less⁹ (mean BMI = 26.31 ± 5.21). There was no significant difference between either gender and the national data available (male = $p = .35$). However female BMI was trending towards being significantly lower than the national data average ($p = 0.054$).
2. Both male and female UWRF employees appeared to have mean body fat percentages above the ACSM recommendations of males having between 10 and 22% fat and females having between 20 and 32% fat⁹. Males were on average 2.18% above recommended and females were on average 1.18% above recommended. Both genders had a large percent of their subjects tested as being above recommended values (males = 64.29% of subjects, females = 46.88% of subjects).

Resting Blood Pressure

1. UWRF employee mean systolic blood pressure (114 ± 10.29 mmHg) was within the ACSM recommended value of less than 120 mmHg⁹ and was not significantly different than national mean data.

2. UWRF employee mean diastolic blood pressure (76.30 ± 7.01 mmHg) was within the ACSM recommended value of less than 80 mmHg⁹ and was significantly higher than the national mean data ($p = 0.0008$).

Blood Lipids

1. UWRF employees appeared to have mean total cholesterol (187.74 ± 30.27 mg/dl) within the ACSM recommendation of less than 200 mg/dl⁹. These values were not significantly different than national data ($p = 0.48$).
2. UWRF employees appear to have mean High Density Lipoprotein (HDL) (61.24 ± 18.18 mg/dl) within the ACSM recommendation of more than 60 mg/dl⁹. They also had HDL significantly greater than the national average ($p = 0.0005$).
3. UWRF employees appear to have mean Low Density Lipoprotein (LDL) (107.89 ± 27.61 mg/dl) above the ACSM recommendations of less than 100 mg/dl⁹. These values were not significantly different than the national average ($p = 0.21$).
4. UWRF employees appear to have mean triglyceride levels (133.41 ± 122.56 mg/dl) within the ACSM recommendation of less than 150 mg/dl⁹. There was no significant difference between these values and the national average ($p = 0.95$).

Blood Glucose

1. UWRF employees appeared to have mean fasting blood glucose (91.70 ± 9.43 mg • dL⁻¹) within the ACSM recommended value of less than 100 mg • dL⁻¹ ⁹, which was significantly lower than the national average ($p = 0.0001$).

Diet

1. Men between the ages of 31 and 50 consumed a mean amount of 200 calories and females over age 51 consumed a mean amount of 150 calories per day more than recommended. Females between ages 19 and 30 consumed a mean amount of 550 calories and males over age 51 consumed a mean amount of 250 calories per day less than recommended.
2. The majority of subjects grouped by age and gender consumed adequate amounts of macronutrients with the exception of the following:
  - a. Females between the ages of 31 and 50 consumed 6% more calories from fat per day than recommended.
3. Micronutrients consumed in adequate amounts by all groups were iron, thiamin, riboflavin, and vitamin C with the exception of the following:
  - a. Women between the ages of 19 and 30 consumed less iron on average (12.33 ± 1.15 mg) than the recommended amount (18 mg).
4. All groups did not consume adequate amounts of vitamin D. The mean of all participants was only $32.5 \pm 35.19\%$ of recommended daily intake.
5. Females between the ages of 19 and 30 and those more than 51 years of age did not consume adequate amounts of calcium. The recommended value consumed per day for this group is 1200 mg per day and they consumed a mean amount of 835.64 ± 307.28 mg per day.

6. All groups did not consume adequate amounts of fiber with the exception of women more than 51 years of age. The mean amount of fiber consumed between all groups was $81.84 \pm 32.04\%$ of recommended.
7. All groups consumed excess sodium. The mean sodium intake between all groups was $133.01\% \pm 77.43\%$ of recommended.
8. Mean dietary cholesterol intake was 278.06 ± 143.50 mg. The recommendation by the U.S. Department of Agriculture and U.S. Department of Health and Human Services is to consume as little as possible.

Recommendations

Based on the conclusions drawn from this study, the following recommendations can be given for further study:

1. A replication of this study with increased sample size and more equal distribution of male and female participants.
2. An incentive to complete dietary recall such as a follow up appointment to discuss current diet and recommendations.
3. An investigation to include all current variables and add the other cardiovascular disease risk factors made by the ACSM including family history, smoking history, and physical activity in order to divide subjects into risk categories made by the ACSM. It may also be prudent to survey participants' health beliefs as related to these risk factors.

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APPENDICIES

APPENDIX A
INFORMED CONSENT FORM

INFORMED CONSENT FORM

Project Title:

Occupational Health and the Risk of Cardiovascular Diseases in University Employees

Principal Investigators:

Lead Investigator:

Dr. Kenneth Ecker, FACSM, Professor, Department of Health and Human Performance

Co-Investigators:

Dr. Jodee Schaben, Assistant Professor, Department of Health and Human Performance

Dr. Stacy Furness, Assistant Professor, Department of Health and Human Performance

Ms. Laura Dobler, Graduate student in Clinical Exercise Physiology (CEP), Department of Health and Human Performance

Mr. Gustavo Mendoza, Graduate student in Clinical Exercise Physiology (CEP), Department of Health and Human Performance

Purpose and Explanation:

The purpose of this investigation will be to examine the relationship of cardiovascular disease risk factors and blood lipid profiles among university employees, and to compare these results with standardized norms based on age and gender. In addition, this investigation will also compare the health status of university employees with other occupations in an attempt to identify those to be at greater risk or benefit from a health perspective. In addition, this investigation will also be used to help guide programmatic offerings in health and wellness at UWRF.

Methods:

This investigation will examine overall health-risk using the following assessments. Assessments will be made during the spring, summer and fall semesters of 2015.

Assessments:

Blood Lipid/Glucose Profile - will be measured after a 12-hour fast by a Cholestech LDX instrument. Total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol, total cholesterol/ high density lipoprotein ratio, triglycerides and glucose will be evaluated.

Body Composition – will be assessed using the Bod Pod System. This unit is based on air displacement plethysmography technology.

Resting Heart Rate/Blood Pressure – will also be measured. Heart rate will be measured on a 30-second reading. Blood pressure will be measured using a standard sphygmomanometer and stethoscope.

Physical Activity – will be assessed using the International Physical Activity Questionnaire (IPAQ). All participants will complete this inventory.

SF-36 inventory – quality of life index will be monitored using this standard form.

Risks:

Extremely low occurrence of a sore finger from the cholesterol screen. Every effort will be made to conduct the testing session (s) in a manner that will minimize any possible risk to the subject.

Benefits:

The benefits of participating in this study are increased awareness of your health-risk profile, physical activity level, as well as the health advantages of participating in a consistent exercise program.

Confidentiality and Use of Information:

I have been informed that the information obtained from this study will be treated as privileged and confidential, and will subsequently not be released or revealed to any person without express written consent. I do however, agree to the use of any information for research and/or statistical purposes. In no way will my name be used in connection with the data.

I have had the opportunity to ask certain questions about this investigation. I acknowledge that I have read and understand this document in its entirety. I have given my consent to use the information provided.

If you have any questions or concerns with regard to this investigation, you may contact Dr. Kenneth Ecker, Department of Health and Human Performance, University of Wisconsin, River Falls (UWRF) at 715-425-0635, or Molly Van Wagner, Director of Grants and Research at 715-425-3195.

I have read the foregoing information and understand it. Any questions which may have occurred to me have been answered to my satisfaction.

Signature of Client _____ Date _____

Signature of Investigator _____ Date _____

APPENDIX B

DATA FORMS

DIETARY RECALL

Three-Day Dietary Record

Name: _____ Date: _____

It is important that this record be both accurate and representative of your normal dietary intake. Thus it is essential that you do not alter your normal eating habits in any way and that you record as precisely as possible every single item that you consume (this includes water, vitamins, condiments, etc.). To do so, you must follow a few simple instructions (listed below). The purpose here is to correctly record and quantify your normal intake, not to judge it. If you change your eating habits in any way, then we cannot accurately analyze your typical diet. The procedure may seem somewhat cumbersome, but remember, it is only three days.

INSTRUCTIONS

Keep a pen and paper with you at all times to record your intake including food item, quantity, and notes. This is imperative as snacks are typically consumed unpredictably and, as a result, it is impossible to record them accurately unless your recording forms are nearby.

Use a small food scale if you have one, or use standard measuring devices (e.g., measuring cups, measuring spoons) to record the quantities consumed as accurately as possible. If you do not eat all of the item (for instance a portion of an apparently delicious hastily prepared casserole or leftovers that turned out to be not so delicious),

re-measure what's left and record the difference.

Record combination foods separately (e.g., hot dog, bun, and condiments) and include brand names of food items (list contents of homemade items) whenever possible.

For packaged items, use labels to determine quantities.

Record three days that are representative of your normal intake. Therefore if your weekdays are different from your weekends, pick two weekdays and one weekend. Likewise, if your M, W, and F are different from your T and Th and all three days are different from your Sat and Sun, you should pick one day to represent each unique schedule.

EXAMPLE: DIETARY RECORD: DAY 1

FOOD ITEM	QUANTITY	NOTES
Breakfast		
2 pieces of toast	2 pc	
Margarine	1 T	
Orange Juice	6 oz	
Lunch		
Small pizza	400 g	Pepperoni, mushroom, cheese
Dinner		
Chicken	6 oz	
Baked potato	6 oz	
Mixed vegetables	1 c	Peas, carrots, corn

DIETARY RECORD: DAY 1

FOOD ITEM (Include brand names)	QUANTITY (g, ml, tablespoons (T), teaspoons (t), cups (c), etc.)	NOTES (Include ingredients & amounts of homemade items)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		

DIETARY RECORD: DAY 2

FOOD ITEM (include brand names)	QUANTITY (g, mL, tablespoons [T], teaspoons [t], cups [c], etc.)	NOTES (include ingredients & amounts of homemade items)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		

DIETARY RECORD: DAY 3

FOOD ITEM (Include brand names)	QUANTITY (g, mL, tablespoons [T], teaspoons [t], cups [c], etc.)	NOTES (Include ingredients & amounts of homemade items)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		

PHYSIOLOGIC DATA FORM

FACULTY GRANT DATA COLLECTION WORKSHEET

Participant's name: _____ Date: _____

Gender: _____ Age: _____ Ht (in.): _____ Weight (lbs.): _____

BMI: _____

Resting HR Measurements:

10-sec count: _____ x 6 = _____ BPM

Rating: _____

Resting BP Measurements:

BP reading: _____/_____

Rating: _____

Body Composition (Bod Pod):

Male: Trial 1

% Fat: _____

LBM: _____

FFM: _____

Rating: _____

Female: Trial 1

% Fat: _____

LBM: _____

FFM: _____

Rating: _____

Blood Lipid Analyses:**Male:**   **Trial 1**

TC: _____

HDL: _____

TC/HDL ratio: _____

LDL: _____

Trig: _____

Glu: _____

Female: **Trial 1**

TC: _____

HDL: _____

TC/HDL ratio: _____

LDL: _____

Trig: _____

Glu: _____

FITNESS/WELLNESS CENTER
Medical Questionnaire

All information will remain strictly confidential- please fill out completely.
PERSONAL INFORMATION

Name: Last	First	M.I.	Date of Birth	Sex
Current Address: (Street #)			City	State Zip
Department Location			Office Phone	Title
Social Security Number			Date of last physical exam?	
Please list any serious or chronic illness you are aware of:				
Please list any allergies to medications, foods, substances:				
Please list any medication you have been on or presently take:				
Type of Medication	Dosage & Frequency	How Long	Reason	

*****

MEDICAL HISTORY

ILLNESS

Please check if any of the following pertain to you:

Illness	Present	Past	Dates	Illness	Present	Past	Dates
Heart Attack	☐	☐	☐	Gout	☐	☐	☐
Anemia	☐	☐	☐	Diabetes	☐	☐	☐
Asthma	☐	☐	☐	Hypoglycemia	☐	☐	☐
Epilepsy/convulsions	☐	☐	☐	Rheumatic Fever	☐	☐	☐
Heart Murmur	☐	☐	☐	Hernia	☐	☐	☐
Lung Disease	☐	☐	☐	Back or Disk	☐	☐	☐
Stroke	☐	☐	☐	Condition	☐	☐	☐

If yes, how long is illness controlled?

Symptoms:

During the last twelve months, have you experienced:

	Yes	No		Yes	No
High Blood Pressure	☐	☐	Shortness of Breath	☐	☐
Swelling of Hands/Feet	☐	☐	Unusual Fatigue/Dizziness	☐	☐
Pain or Cramps in Legs	☐	☐	Significant Weight Fluctuation	☐	☐
EKG Abnormalities	☐	☐	High Triglycerides	☐	☐
Blurred Vision	☐	☐	High Cholesterol	☐	☐
Skipped Beats/Palpitations	☐	☐	Chest Pain/Pressure	☐	☐
Numbness/Tingling in Arms, Hands, Legs or Face	☐	☐			
Hospitalizations	☐	☐			

List the dates and the reasons for hospitalizations for any significant illness (Women: do not list pregnancies)

FAMILY HISTORY

	Yes	No		
Is your father living?	_____	_____	If not, age and cause of death:	_____
If your mother living?	_____	_____	If not, age and cause of death:	_____
Has your father, mother, grandparents, or siblings had:				
High Blood Pressure	Yes _____	No _____	Who _____	
Stroke	_____	_____	_____	Heart Attack (over 50) Yes _____ No _____ Who _____
Heart Attack	_____	_____	_____	Diabetes _____
(50 years or younger)	_____	_____	_____	Cardiovascular Disease _____
			Other _____	_____

HEALTH HISTORY HABITS

NUTRITION/WEIGHT

What do you think is your "best" weight? _____ lbs.
 List your weight: _____ Now: _____ One year ago: _____ At age 21: _____
 Do you regard yourself as overweight/underweight? Yes _____ No _____ Not Sure _____
 If overweight, which of the following contributes most: _____
 Large meals _____ Snacks _____ Business Lunches _____ Entertainment _____ Other _____
 Are you presently following any diet? Yes _____ No _____ Type _____ Calories/day _____
 Indicate the number of times per week you usually eat:
 Fruit & Vegetables _____ Beef _____ Whole Grains _____ Fried Foods _____
 Dairy Products _____ Fowl _____ Desserts _____ Other _____
 Approximate your daily intake of:
 12 oz Caffeine Sodas _____ Cups of Coffee _____ Cups of Tea _____
 Glasses of Wine _____ Bottles of Beer _____ Ounces of Liquor _____

SMOKING

Did you ever smoke cigarettes? Yes _____ No _____ If yes, how many packs per day? _____
 Do you currently smoke cigarettes? Yes _____ No _____ If yes, how many packs per day? _____
 If you have stopped smoking, what was the approximate date? _____
 Do you smoke cigars or a pipe? Yes _____ No _____ If yes, how many per day? _____

TENSION/ANXIETY

How would you describe your level of tension most of the time?
 No tension, very relaxed _____ Slight tension _____ Moderate Tension _____
 High Tension _____ Very tense _____
 Do you practice any relaxation skills to eliminate tension? Yes _____ No _____
 Describe: _____

PHYSICAL ACTIVITY

Are you currently involved in any fitness activity? Yes _____ No _____
 If no, how long has it been since you participated in any fitness activity? _____
 If yes, do you: Yes _____ No _____ Time spent each workout Yes _____ No _____ Time spent each workout _____
 Perform calisthenics _____ Swim _____
 Cycle _____ Jog _____
 Walk _____ Other _____
 Approximately how many days per week do you exercise?
 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____

What fitness or sports activity would you be interested in learning more about? _____

Do you consider yourself in better physical condition than others your age? Yes _____ No _____

How much physical activity do you get during a typical work day?

Walking _____ Amount of blocks _____
 Stairs _____ Amount of steps _____
 Other _____ Amount _____

MUSCULAR-SKELETAL HISTORY

Do you have injuries (past/present) or limitations that may affect full participation in a physical fitness program? Yes _____ No _____

OBJECTIVES

List the objectives you would like to achieve from a physical fitness program: (examples: lose weight, firm body, prevent heart attack)
 _____
 _____
 _____

FACULTY GRANT DATA COLLECTION WORKSHEET

Participant's name: _____ Date: _____

Gender: _____ Age: _____ Ht (in.): _____ Weight (lbs.): _____

BMI: _____

Resting HR Measurements:

10-sec count: _____ x 6 = _____ BPM

Rating: _____

Resting BP Measurements:

BP reading: _____ / _____

Rating: _____

Body Composition (Bod Pod):

Male: Trial 1

% Fat: _____

LBM: _____

FFM: _____

Rating: _____

Female: Trial 1

% Fat: _____

LBM: _____

FFM: _____

Rating: _____

Blood Lipid Analyses:

Male: Trial 1

TC: _____

HDL: _____

TC/HDL ratio: _____

LDL: _____

Trig: _____

Glu: _____

Female: Trial 1

TC: _____

HDL: _____

TC/HDL ratio: _____

LDL: _____

Trig: _____

Glu: _____

TOTAL CHOLESTEROL				LDL (bad) CHOLESTEROL				HDL (good) CHOLESTEROL				TRIGLYCERIDES			
2004				2006				2008				2011			
Color Key	Very Bad	380	380	320	320	130	130	625	625	Very High	150	150	150	150	
		370	370	310	310	125	125	600	600						
		360	360	290	290	120	120	575	575						
		350	350	280	280	115	115	550	550						
		340	340	270	270	110	110	525	525						
330	330	260	260	105	105	500	500	High	140	140	140	140			
320	320	250	250	100	100	475	475								
310	310	240	240	95	95	450	450								
300	300	230	230	90	90	425	425								
290	290	220	220	85	85	400	400								
Yellow is Bad	High	280	280	210	210	80	80	375	375	Hgh	130	130	130	130	
		270	270	200	200	75	75	350	350						
		260	260	190	190	70	70	325	325						
		250	250	180	180	65	65	300	300						
		240	240	170	170	60	60	275	275						
White = Borderline		230	230	160	160	55	55	250	250		120	120	120	120	
		220	220	150	150	50	50	225	225						
		210	210	140	140	45	45	200	200						
		190	190	130	130	40	40	175	175						
		180	180	120	120	35	35	150	150						
Green is Good	Good	170	170	110	110	30	30	125	125	Normal	110	110	110	110	
		160	160	100	100	25	25	100	100						
		150	150	90	90	20	20	75	75						
		140	140	80	80	15	15	50	50						
		130	130	70	70	10	10	25	25						
Very Good	Very Good	120	120	60	60	5	5	0	0	Very Good	10	10	10	10	
		110	110	50	50	0	0	0	0						
		100	100	40	40	0	0	0	0						
		90	90	30	30	0	0	0	0						
		80	80	20	20	0	0	0	0						
Very Good	Very Good	70	70	10	10	0	0	0	0	Very Good	0	0	0	0	
		60	60	0	0	0	0	0	0						
		50	50	0	0	0	0	0	0						
		40	40	0	0	0	0	0	0						
		30	30	0	0	0	0	0	0						

These are my personal cholesterol readings over 7 years. Not too bad. I have been taking atorvastatin recently. My 2014 readings should prove interesting, regarding artery improvement.

TOTAL/HDL Cholesterol Ratio	
7.5	Very High
7.0	
6.5	
6.0	High
5.5	
5.0	
4.5	Good
4.0	
3.5	
3.0	
2.5	
2.0	
1.5	Fair
1.0	
0.5	
0.0	Poor

BP Range Notes		
Normal Blood Pressure		
BP Readings Range		
Systolic (mm Hg)	Diastolic (mm Hg)	HIGH B. P. Symptoms Stressed, Sedentary, Bloated, Weak, Failing
210- 240+	125- 140+	Stage 4 High B. P. Stage 3 High B. P. Stage 2 High B. P. Stage 1 High B. P.
180 - 210 160 - 180 140 - 160	110 - 125 100 - 110 90 - 100	
140 130 120 110 100	90 85 80 70 65	BORDERLINE HIGH BP High Normal NORMAL B. P. Low Normal Low Blood Pressure
90 80 70 60 50	60 55 45 35 30	90 - 60 - Very Low BP 80 - 55 - Extremely Low BP 70 - 45 - Danger 60 - 40 - Danger 50 - 30 - DANGER LOW
		LOW Blood Pressure Symptoms - Weak, Tired, Dizzy, Fainting, Coma

Body Mass Index (BMI) Charts

<http://www.vertex42.com/ExcelTemplates/bmi-chart.html>

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