AN ASSESSMENT OF CARDIOVASCULAR RISK FACTORS
AND DIETARY INTAKE IN FIREFIGHTERS

A thesis submitted to the
Kent State University College and Graduate School
of Education, Health and Human Services
in partial fulfillment of the requirements
for the degree of Masters of Science

By
Elizabeth A. Kitchen
May 2012
The purpose of this study was to determine if on-duty dietary intake of firefighters was different from off-duty dietary intake and to provide descriptive data of firefighters’ dietary habits related to cardiovascular disease.

Fifty-eight full-time firefighters were recruited. Comparative data were based on two 24 hour dietary recalls, one on-duty, one off-duty. Nutrients analyzed include carbohydrates, proteins, total fat, saturated fat, monounsaturated fatty acids, polyunsaturated fatty acids and trans fat, cholesterol, sodium, potassium, fiber and total kilocalories. Descriptive data was collected by means of a questionnaire and anthropometric measurements. Statistical procedures included a paired sample t-test for nutrient analysis with a p-value < 0.05. Means, standard deviations and frequencies were reported for descriptive data.

Dietary nutrients comparing on-duty and off-duty intakes displayed no statically significant difference for micro or macronutrients. Lunch and dinner were consumed more frequently on-duty compared to off-duty (p = 0.001, p = 0.006).

Overall, it was determined that firefighters on-duty and off-duty dietary intakes do not vary. However, nutrient analysis determined an overconsumption in nutrients (i.e.: total fat, saturated fat, cholesterol, sodium) directly correlated to increasing CVD risk.
ACKNOWLEDGEMENTS

Dr. Karen Lowry Gordon- Thank you for your endless hours of reading, corrections, and assistance in helping me complete this thesis. Your time and dedication has allowed this thesis to take great shape.

Dr. Natalie Caine-Bish- If it were not for your strict deadlines in Techniques in Research I would still be working on my literature review. Thank you for also being another set of eyes and offering great feedback!

Dr. John Staley- Your wealth of knowledge in this area of research has impacted my thesis into something that I am very proud of. The suggestions and tips for researching this population, has been very beneficial, thank you!

My Family- Thank you for your continuous encouragement, support, and positivity. It is because of you that I have had the opportunity to do great things.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>3</td>
</tr>
<tr>
<td>Purpose</td>
<td>4</td>
</tr>
<tr>
<td>Hypothesis</td>
<td>4</td>
</tr>
<tr>
<td>Operational Definitions</td>
<td>4</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>6</td>
</tr>
<tr>
<td>Cardiovascular Disease</td>
<td>6</td>
</tr>
<tr>
<td>Overview of Cardiovascular Disease</td>
<td>6</td>
</tr>
<tr>
<td>Atherosclerosis</td>
<td>6</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>7</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>7</td>
</tr>
<tr>
<td>Stroke</td>
<td>8</td>
</tr>
<tr>
<td>Heart attack</td>
<td>8</td>
</tr>
<tr>
<td>Risk Factors of Cardiovascular Disease</td>
<td>9</td>
</tr>
<tr>
<td>Modifiable Risk Factors</td>
<td>9</td>
</tr>
<tr>
<td>Smoking and tobacco</td>
<td>9</td>
</tr>
<tr>
<td>Physical activity</td>
<td>10</td>
</tr>
<tr>
<td>Alcohol</td>
<td>10</td>
</tr>
<tr>
<td>Weight</td>
<td>11</td>
</tr>
<tr>
<td>Hypertension</td>
<td>12</td>
</tr>
<tr>
<td>Diabetes</td>
<td>13</td>
</tr>
<tr>
<td>Diet</td>
<td>14</td>
</tr>
<tr>
<td>Total fat</td>
<td>14</td>
</tr>
<tr>
<td>Saturated fat</td>
<td>15</td>
</tr>
<tr>
<td>Trans fatty acids</td>
<td>17</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>17</td>
</tr>
<tr>
<td>Non-modifiable Risk Factors</td>
<td>18</td>
</tr>
<tr>
<td>Age and gender</td>
<td>18</td>
</tr>
<tr>
<td>Family history/ethnicity</td>
<td>19</td>
</tr>
</tbody>
</table>
II. METHODOLOGY

Data Analysis

Prevention of Cardiovascular Disease

Cardiovascular Disease and Firefighters

Lifestyle Modifications

Diet

Monounsaturated fatty acids

Polyunsaturated fatty acids

Fiber

Protein

Sodium

Potassium

Caffeine

Firefighters

Employment Requirements

Work Environment

On-duty meal habits

Fatalities and On the Job Injuries

Cardiovascular Disease and Firefighters

Prevalence of Cardiovascular Disease in Firefighters

Cause of Increased Risk of Cardiovascular Disease in Firefighters

Physical activity

Work stressors and environment

Diet

Weight/BMI

Prevention of Cardiovascular Disease in Firefighters

Medical Examinations

Diet Education

Cardiovascular Dietary Patterns

III. METHODOLOGY

Purpose

Research Hypothesis

Participants

Survey Design

Consent form (Appendix A)

Firefighter’s questionnaire (Appendix B)

Anthropometric measurements (Appendix C)

Two day 24 hour recall (Appendix D)

Procedure

Data Analysis

Dietary Analysis

Statistical Analysis
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nutrient Composition of the TLC Dietary Pattern</td>
<td>40</td>
</tr>
<tr>
<td>2. Daily Food Group Servings for TLC Dietary Pattern at 2,000 kcal</td>
<td>41</td>
</tr>
<tr>
<td>3. Nutrient Composition of the DASH Dietary Plan at 2,100 kcal</td>
<td>42</td>
</tr>
<tr>
<td>4. Daily Food Group Servings of DASH Dietary Pattern</td>
<td>43</td>
</tr>
<tr>
<td>5. Subject Characteristics of Firefighters (x ± SD)</td>
<td>54</td>
</tr>
<tr>
<td>6. Frequency of Meals Eaten On-Duty and Off-Duty by Firefighters (%) (n=58)a</td>
<td>55</td>
</tr>
<tr>
<td>7. Days Out of 10 of Firefighters Eating Alone or in a Groupa (x ± SD) (n=58)</td>
<td>55</td>
</tr>
<tr>
<td>8. Dietary Intakes of Firefighter On and Off-Duty (n=50)a</td>
<td>59</td>
</tr>
<tr>
<td>9. Researched Anthropometric Measures Compared to Current Study Findings</td>
<td>61</td>
</tr>
</tbody>
</table>
CHAPTER I  
INTRODUCTION

In the United States (U.S.), cardiovascular disease (CVD) is the leading cause of death accounting for more deaths than all other causes combined (Coulston, Rock & Monsen, 2001). Coronary heart disease (CHD) accounts for 53% of CVD related deaths while 17% are from stroke (Mahan & Escott-Stump, 2008). Precipitating a cost exceeding $403 billion in 2006, the effects of CVD cause it to be a major public health concern (Mahan & Escott-Stump, 2008).

While a major health concern for the public, CVD is also a major concern for firefighters. Cardiovascular death among firefighters accounts for 39-45% of fatalities (Fahy, 2005, Kales et al., 2003, 2007). Much of those fatalities can be linked to firefighters’ work environment and/or modifiable and non-modifiable risk factors.

A firefighters job is to protect the public and its property resulting in specific duties that are very physically and mentally demanding. Duties may include operating pumps, positioning ladders, fighting fires, rescuing victims and administering medical care (“Fatalities,” 1999). Each day at the fire station is often and unpredictable.

Studies have addressed that the work environment of firefighters increases CVD risk. These studies identify the following factors: the effect of fire smoke, carbon monoxide and hydrogen cyanide on the cardiovascular system (Department of Health and Human Services (DHHS), 2007), increased heart rate, catecholamine, and heart attack risks with heavy physical exertion (Barnard & Duncan, 1975), electrolyte change through fire suppression (Rossi, 2003), working at maximum cardiac stress for a prolonged period...
of time (Drew-Nord et al., 2009; Kales et al., 2007; Manning & Griggs, 1983) and the effects of fire proof clothing on heat loss and heart rate (Kales, Soteriades, Christoudias & Christiani, 2003).

Modifiable and non-modifiable risk factors are also associated with CVD in firefighters. Modifiable risk factors are risks that can be changed to decrease the prevalence of CVD. They are responsible for approximately 80% of cases related to CVD and stroke (“Cardiovascular diseases,” 2009). Modifiable risk factors include smoking, physical inactivity, alcohol, obesity, hypertension (HTN), diabetes and poor diet. Non-modifiable risks are factors that can not be altered. Non-modifiable risk factors include age, gender and family history. Both modifiable and non-modifiable risk factors do not cause CVD but have a positive association with acquiring the disease. CVD may not develop if a risk factor is present but it has been shown that the presence of multiple risk factors does increase the chance of developing CVD (“Cardiovascular disease risk factors,” 2010).

Research has also shown that there is a lack of physical activity requirement for on-duty firefighters. At the national or city level there are no physical activity requirements for firefighters (Byczek, Walton, Conrad, Reichelt & Same, 2004) and no requirements for periodical medical examinations (Kales, Soteriades, Christophi & Christiani, 2007).

The effects both a firefighter’s work environment and the presence of modifiable and non-modifiable risk factors can correlate to an increase in CVD related deaths. Although fire suppression represents only about 1-5% of firefighters professional time
each year, it accounts for 32% of CVD related deaths. As a result, fire suppression was associated with a risk of death that was approximately 10 to 100 times as high as the risk associated with non-emergency duties (Kales et al., 2007). Stress and exertion during fire suppression also accounted for 56% of fatalities relating to heart attack, stroke, pulmonary embolism, heat exhaustion, and heart valve damage (U.S. Fire Administration, 2010).

Because firefighters work environment is not applicable to change with relation to cardiovascular risk, it is important to consider what can be changed (i.e.; modifiable risk factors). Although a majority of modifiable risk factors have been closely studied in relationship to CVD risk in firefighters, dietary intake and CVD has very limited research. Many firefighters are not aware that what they consume on a daily basis, whether on-duty or off, affect how they perform during an emergency. Evaluating firefighters dietary intake may provide useful information into decreasing firefighters risk for CVD by drawing awareness to their dietary habits and providing a means for change.

**Statement of the Problem**

Firefighters experience more occupational fatalities due to CVD than persons in any other profession (Kay, Lund, Taylor & Herbold, 2001). Of the approximately 100 firefighter casualties per year, 45% of those deaths are caused by CVD (Scanlon & Ablah, 2008). CVD is precipitated by modifiable risk factors such as tobacco and alcohol use, lack of exercise, and poor diet (“Cardiovascular Diseases,” 2009). Poor diet is also a modifiable risk factor that can have an impact on firefighter’s cardiovascular health. Research has shown high cholesterol (Mahan & Escott-Stump, 2008), high blood
pressure (Kennel, 1996), and obesity (Hertz, Unger, McDonald, Lustik & Biddulph-Krentar, 2004) can lead to a decrease in cardiovascular health. Likewise, high cholesterol, high blood pressure and obesity are also strongly correlated to dietary habits (Mahan & Escott-Stump, 2008).

Due to the correlation between poor diet and cardiovascular health, it is important to consider on-duty and off-duty dietary intake with regards to CVD risk in firefighters. Firefighters work 24 hours on-duty and therefore consume all of their meals at the station. While much research has been placed on firefighter risk factors involving blood pressure, exercise, diabetes and weight, very few studies have investigated on-duty and off-duty dietary habits related to those topics. As a result, it is necessary to investigate on-duty and off-duty dietary habits seeing as they are a strong indicator of cardiovascular risks alone and in conjunction with other modifiable risk factors.

**Purpose**

The purpose of this study was to determine if on-duty dietary intake of firefighters was different from off-duty dietary intake and to provide descriptive data of firefighters’ dietary habits related to cardiovascular risks.

**Hypothesis**

1. Firefighters on-duty dietary intake will be different from their off-duty dietary intake

**Operational Definitions**

1. Firefighters- Male firefighters employed by a fire department who work full time, consisting of 24 hours on-duty followed by 48 hours off-duty.
2. **On-duty** - A period of 24 hours to which a firefighter is responsible for the safety of the surrounding community

3. **Off-duty** - A period of time to which a firefighter is not at work (not on-duty)

4. **Dietary Intake** - Nutrients (carbohydrates, proteins, total fat, saturated fat, monounsaturated fatty acids, polyunsaturated fatty acids and trans fat, cholesterol, sodium, potassium, fiber and total kilocalories) consumed during time on and off-duty based on 24 hour recall
CHAPTER II
REVIEW OF LITERATURE

Cardiovascular Disease

Overview of Cardiovascular Disease

The leading cause of death in the United States (U.S.) is cardiovascular disease (CVD), accounting for more deaths than all other causes combined (Coulston, Rock & Monsen, 2001). Of these CVD related deaths, 53% are from Coronary Heart Disease (CHD) and 17% are from stroke (Mahan & Escott-Stump, 2008). The prevalence of CVD causes it to be a major public health concern, resulting in costs exceeding $403 billion in 2006 (Mahan & Escott-Stump, 2008). CVD can precipitate through a variety of causes including atherosclerosis, CHD, congestive heart failure (CHF), stroke and heart attack.

Atherosclerosis. Atherosclerosis is the most common contributing factor to the development of CVD (Mahan & Escott-Stump, 2008). Atherosclerosis develops when plaque builds up in the artery walls from low-density lipoproteins (LDL) ("What is cardiovascular disease," 2010). The thickening and narrowing of the arterial wall is caused by the accumulation of cholesterol, smooth muscle cells, and fibroblasts causing plaque formation. With enough plaque accumulation, blood circulation is slowed or blocked altogether. Before plaque formation, endothelial dysfunction occurs causing blood vessels to become constricted. Some of the factors that contribute to endothelial dysfunction are dyslipidemia (abnormality in any lipoprotein, especially LDL), hypertension (HTN), smoking, diabetes, obesity, and diets high in saturated fat and
cholesterol (Mahan & Escott-Stump, 2008). Occlusion of arteries can have detrimental effects depending on its location. In the coronary arteries atherosclerosis can cause angina, myocardial infarction (MI) or sudden death. A cerebral arterial occlusion can cause strokes, ischemic attacks, blood clots, and gangrene.

**Coronary heart disease.** Impaired blood flow to the coronary artery is classified as CHD. The incidence of CHD is high; 700,000 Americans had a new coronary attack and 500,000 had a recurrent attack in 2000 (Mahan & Escott-Stump, 2008). CHD is described as a MI or ischemia of at least one coronary artery. With the occurrence of either, heart tissue is damaged often leading to heart disease and potential death. Symptoms of CHD may or may not be detected. If symptoms are present, they include chest pain and discomfort from the heart not receiving enough oxygen, shortness of breath and fatigue with exertion (Coronary Heart Disease, 2010). With enough impaired blood flow to the coronary arteries, caused by plaque accumulation, angina, myocardial infarction and sudden death can result.

**Congestive heart failure.** Improved treatment of cardiovascular disorders such as MI, HTN and valvular heart disease, is projected to increase the occurrence of heart failure (Coulston et al., 2001). CHF is a sign and symptom resulting from impairment of systolic and/or diastolic functioning of the myocardium or can also be described as inefficient heart pumping. Those individuals with CHF often experience shortness of breath, chest discomfort, exercise capacity limitations, peripheral edema, anorexia and can become fatigued easily (Coulston et al., 2001). Risk factors of CHF include but are not limited to HTN, obesity, diabetes, atherosclerosis, CHD and dyslipidemia along with
excess sodium intake (Mahan & Escott-Stump, 2008). Physiologically, CHF occurs similar to atherosclerosis where there is an asymptomatic phase when damage is occurring unbeknownst to the individual. Damage can be caused by an acute MI or by volume overloading on the heart (Mahan & Escott-Stump, 2008). The occurrence of damage changes the function and shape of the heart’s left ventricle producing left ventricular hypertrophy to compensate for the lack of blood flow. Due to an enlarged left ventricle and the compensating overuse of the system, further damage is done, allowing for CHF to further progress.

**Stroke.** The two most common forms of CVD are heart attack and stroke (“Cardiovascular Diseases, ” 2009). In the U.S., stroke is the third leading cause of death, killing about 137,000 people each year, and is a leading cause of serious long term adult disability (“What is a heart attack ”, 2008). A stroke transpires when cerebral arteries to the brain become blocked or burst often resulting in the death of brain cells (“What is cardiovascular disease,” 2010). Blockage occurs from the collection of lipoproteins on the arterial walls. High blood pressure, diabetes, smoking, and obesity can predispose an individual for a stroke.

**Heart attack.** Each year, about 1.1 million people in the U.S. have heart attacks, and almost half of them die. CHD, which often results in a heart attack, is the leading killer of both men and women in the U.S. (“Coronary Heart Disease”, 2010). A heart attack occurs by either a block in the coronary artery with can be triggered by heavy physical exertion due to an increase in heart rate and blood pressure or a decrease in arterial circumference as a result of atherosclerotic plaque. Chest and upper body
discomfort in the arms, neck and back, shortness of breath, nausea, vomiting, lightheadedness, fainting, or breaking out in a cold sweat are symptoms of a heart attack and should elicit help to decrease damage to the heart (“Coronary Heart Disease”, 2010). Heart attack prevention is linked to diet, exercise and stress factors, all of which can be modified.

**Risk Factors of Cardiovascular Disease**

There are many risk factors associated with CVD. Modifiable risk factors are risks that can be changed to decrease the prevalence of CVD, while non-modifiable risks are factors that can not be altered. These risk factors do not cause CVD but have a positive association with acquiring the disease. CVD may not develop if a risk factor is present but it has been shown that the presence of multiple risk factors does increase the chance of developing CVD (“Cardiovascular disease risk factors,” 2010).

**Modifiable Risk Factors**

Modifiable risk factors are responsible for approximately 80% of CVD and strokes (“Cardiovascular diseases,” 2009). These factors include smoking, physical inactivity, alcohol, weight, HTN, diabetes and poor diet.

**Smoking and tobacco.** Smoking and tobacco has been recognized for more than 40 years as an increased risk for CVD (Mahan & Escott-Stump, 2008). The cardiovascular risk imposed by both, smoking and tobacco, is magnified by the coexistence of several other coronary risk factors. However, when another risk factor is present in a smoker (i.e.; HTN, high cholesterol) the risk of CVD is further increased (Prasad, Kabir, Dash & Dab, 2009). Use of any tobacco product also promotes
atherosclerosis and fibrinogen, a blood clotting agent (“Heart disease behaviors, ” 2009). Acute coronary events including thrombus formation, plaque instability and arrhythmias are influenced by tobacco use as well (Mahan & Escott-Stump, 2008). Cigarette smoking is associated with increase levels of inflammatory markers. Inflammatory markers, such as C-reactive protein, have been shown to be both prognostic and predictive of future cardiovascular events in several populations (Bakrhu & Erlinger 2005). Second-hand smoke exposure may also increase the risk of CVD in those who are non-smokers.

**Physical activity.** Low level of fitness (i.e.; physical inactivity) is an independent risk factor for CVD (Mahan & Escott-Stump, 2008). It has been shown to increase the risk of heart disease and stroke by 50% (“Cardiovascular disease risk factors, ” 2010). Without exercise, atherogenesis can occur rapidly forming plaque in the arterial walls and decrease the vascularity of the myocardium. Physical inactivity also has an impact on other risk factors including HTN, triglycerides, high density lipoproteins (HDL), diabetes and obesity which when combined with lack of exercise can increase the risk of CVD (“Cardiovascular disease risk factors, ” 2010; Hubert, Feinleib & McNamara, 1983; Kannel, 1996).

**Alcohol.** Alcohol consumption has been associated with a lower risk of CVD in individuals who are light to moderate drinkers (Mukamal, Chen, Rao & Breslow, 2010). By consuming two drinks a day for men and one drink a day for women, there is a significant decrease in cardiovascular risk due to alcohols ability to raise HDL and reduce fibrinogen (Mahan & Escott-Stump, 2008). Heavy drinkers, more than two drinks for
men and one drink for women, have an increased risk for HTN because alcohol raises blood pressure and total triglycerides (Beulens et al., 2007).

**Weight.** Obesity has been shown to be an important long term predictor of CVD incidence among individuals. Obesity is a prevalent CVD risk, 65% of adults are overweight (Body Mass Index (BMI) 25-29.9) and 31% are obese (BMI>30) (Hedley et al., 2004). In a study conducted by Hubert et al., CHF increase 2.5 to 3 fold from leanest to heaviest subjects, signifying that those who are overweight have a higher risk when compared to leaner individuals. In addition to weight, waist to height ratio is strongly correlated with cardiovascular risk (Gruson et al., 2009). For men, a ratio between 53 and 58 predicts for an increased CVD risk. For women the ratio is 49 to 54. Android fat distribution, where weight is centered around the midsection, have a greater chance of CVD than those who carry weight around the hips (gynoid fat distribution) (Mahan & Escott-Stump, 2008). Excess adipose tissue has been associated with HTN, dyslipidemia, glucose intolerance, and endothelial dysfunction, all of which effect heart function (Hertz, Unger, McDonald, Lustik & Biddulph-Krentar, 2004). It has been argued that obesity does not convey an increased risk of CVD unless it is accompanied by elevations in such characteristics as blood pressure or blood lipids (Hubert, Feinleib & McNamara, 1983).

Weight loss can affect CVD. In a study conducted by Pascual et. al. (2009) metabolic syndrome participants who lost weight during the trial decreased systolic and diastolic blood pressures as well as LDL cholesterol. Further observations concluded that
the impact of weight loss changes the rate of cardiovascular risk factors and reinforces the necessity to be proactive in achieving weight reduction. (Pascual et al., 2009).

**Hypertension.** HTN is a prevalent and powerful contributor to CVD (Kennel, 1996). HTN is classified as having an average blood pressure higher than 140 mmHg systolic or 90 mmHg diastolic. Having high blood pressure predisposes to all cardiovascular diseases including cardiac failure, coronary artery disease, and peripheral artery disease due to an increased stress on the heart and arteries (Kennel, 1996). Stress on the arteries causes microscopic tears that when healed create scar tissue that attracts plaque. Plaque formation in the arteries then eventually leads to atherosclerosis. In response to high blood pressure and an increased workload secondary to obesity, the left ventricle of the heart grows in size (Mahan & Escott-Stump, 2008). Left ventricular growth is classified as left ventricular hypertrophy, and is found to be a strong risk factor for CVD, heart failure (HF) and sudden death (Mahan & Escott-Stump, 2008).

HTN is a public health problem in developed countries. HTN is defined as persistently high arterial blood pressure. It is often referred to as the “silent killer” because individuals with HTN can be asymptomatic for years and then have a fatal stroke or heart attack. There is no cure for HTN however, it is easily detected and can be managed through proper diet, exercise and medications. HTN is caused by multiple factors including a combination of environmental and genetic components (Mahan & Escott-Stump, 2008). Environmental factors including the increase in BMI may contribute to the increase in prevalence of HTN.
Race and age also play a part. Black adults have a higher age-adjusted prevalence of HTN (37% of men; 39% of women) than non-Hispanic whites (24% of men, 23% of women) (Mahan & Escott-Stump, 2008). Older individuals have a higher prevalence of HTN. Prior to age 55 men have an increased risk of HTN greater than women, but after 55 women have the increased risk over men, regardless of race (Mahan & Escott-Stump, 2008). An increase in blood pressure is consistent with the increased risk for CVD. The higher the blood pressure, the greater the chance of left ventricular hypertrophy, CHF, stroke and kidney disease (Mahan & Escott-Stump, 2008).

**Diabetes.** With improvements in the management of diabetes and CVD, evidence still suggests that CVD is the leading cause of morbidity and mortality in people with diabetes (Diabetes Mellitus, 1999). The Framingham Study demonstrated that diabetes mellitus is associated with a two to five fold increase in CVD and related death (Kannel & McGee, 1979). Individuals with diabetes lack the ability to make insulin or can not facilitate their own insulin production and glucose becomes abundant in the blood (“Heart disease conditions,” 2009). The abundance of glucose results from defects in insulin secretion from the β- cells or insulin action/resistance. With glucose build up, arteries become damaged perpetuating CVD. Some of the increased risk for CVD seen in diabetic individuals is attributable to the concurrent presence of other risk factors such as dyslipidemia, HTN, and obesity (American Heart Association (AHA), 2002). Management of these risk factors has been shown to effectively reduce the incidence of major coronary events in persons with diabetes (AHA, 2002). Additionally, due to dyslipidemia as a risk factor, LDL cholesterol in a diabetic individual needs to be at 70
mg/dL (Pearson et al., 2003). With regards to drug treatment, lowering of glucose by medications has not produced a reduction in cardiovascular events, suggesting that elevated glucose may indicate proximal pathology related to adipocyte stress and dysfunction (Mozaffarian, Wilson & Kannel, 2008).

**Diet.** Dietary intake high in fat and cholesterol is strongly related to an increased risk for CVD, but more specifically to the proliferation of other risk factors such as obesity, HTN and diabetes. Evidence from prospective studies have shown that dietary patterns are associated with risk and, specifically, that dietary patterns high in saturated fatty acids, cholesterol, and animal fat increase LDL cholesterol levels (Van Horn et al., 2008).

**Total fat.** Total fat, while necessary in the diet, is often consumed in large amounts in the typical American diet. Total fat intake for adults 19 years of age and older is 20-35% of kilocalories. These ranges are associated with a reduced risk of CVD while providing adequate intake of essential nutrients (U.S. Department of Agriculture, 2010). However, according to National Health and Nutrition Examination Survey (NHANES), the average American between the ages of 20-70 years old consumes 35% of their calories from fat. High fat diets increase postprandial lipidemia and chylomicron remnants, both of which are associated with increased risk of CVD (Mahan & Escott-Stump, 2008). Hu et al., determined in his study of dietary patterns and risk of CVD in men that those individuals who consumed high intakes of red and processed meats, refined grains, sweets, desserts, French fries and high fat dairy had an increased risk for CVD, when compared to those who consumed a high intake of vegetables, fruit,
legumes, whole grains, fish and poultry. As a whole, the study demonstrated strong evidence that a diet high in vegetables, fruit, legumes, whole grains, fish and poultry and low in red and processed meats, refined grains, sweets, desserts, French fries and high fat dairy may reduce the risk of CVD (Hu et al., 2000). Focusing on dairy, diets containing high fat dairy may also be linked to an increase in blood pressure and CVD. Consumption of high fat dairy products such as cheeses and whole milk may increase systolic blood pressure (Alonso, Zozaya, Vazquez, Martinez & Martinez-Gonalez, 2009). In the same study, high fat dairy was also shown to increase body weight compared to low fat dairy consumption. Research has also determined that there is very little evidence from prospective epidemiological studies suggesting that total fat intake, independently of dietary fat quality increases the risk of CVD (Erkkila, deMello, Riserus & Laaksonen, 2008). U.S. Dietary Guideline for Americans 2010 has stated that while a recommendation is made for percent of total fat, the type of fatty acids consumed are more important in influencing CVD than the total amount of fat in the diet.

**Saturated fat.** Saturated fat has a close relationship to CVD and more specifically to its effects with cholesterol and LDL. A strong body of evidence indicates that higher intake of saturated fatty acids (SFA) are associated with higher levels of blood total cholesterol and LDL cholesterol indicating risk factors for CVD (Dietary Guidelines, 2010). SFA are found mostly in animal foods and contain three different types. SFA include myristic acid (butterfat, coconut and palm kernel oil), lauric acid (palm kernel and coconut oils), and palmitic acid. Palmitic acid is the most abundant SFA in the diet accounting for 60% of the total SFA intake of Americans (Mahan &
According to the Dietary Guidelines for American 2010, consuming less than 10% of calories from SFAs and replacing them with monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) is associated with low blood cholesterol levels and therefore a lower risk for CVD (Dietary Guidelines, 2010). Further reduction of CVD risk can be done by decreasing the percentage of calories from saturated fat from 10% to 7% (Dietary Guidelines, 2010). A significant correlation between SFA intake, total cholesterol and death was found in the Seven Countries Study. Death rates were positively associated with the percentage of dietary energy from SFA. A 5% change in SFA elicited a 4.7% change in age adjusted all cause mortality rate (Keys et al., 1986). Saturated fat intake (as percent of calories) was also positively correlated with serum cholesterol levels as well as with a five year incidence of CVD (Coulston et al., 2001). In an epidemiological study by Gordon (1995), the evidence that lowering serum cholesterol levels by decreasing intake of saturated fatty acids reduced the risk for CVD. The analysis included six dietary trials and demonstrated that lowering serum cholesterol levels by reducing the intake of saturated fatty acids significantly decreased the incidence of CVD by 24%, a 21% decrease in coronary mortality and a 6% decrease in total mortality (Gordon, 2005). Additional research performed by the National Cholesterol Education Program (NCEP) states that for every 1% increase in kilocalories from SFA as a percent of total energy, the LDL cholesterol increases approximately 2%. Conversely, a 1% reduction in SFA will reduce cholesterol by about 2% (AHA, 2002).
**Trans fatty acids.** Trans fatty acids (TFA) are fats that contain a double bond in the trans configuration. TFA are produced through oil hydrogenation that allows hardening of the oil, but some TFA are found naturally in animal fats (AHA, 2002). Solid fat including TFA are abundant in the American diet and can lead to excess caloric intake. Solid fats account for on average 19% of total calories in the American diet (Dietary Guidelines, 2010). However, TFA are not classified as saturated fatty acids, and therefore need to be consumed in small or no quantities.

Similar to SFA, TFA are shown to modify blood cholesterol levels. TFA lower HDL cholesterol resulting in a worsening of total cholesterol to HDL ratio and LDL to HDL ratios, which in turn increases CVD risk (Mensinky & Katan, 1990). TFA also raises LDL cholesterol levels by increases plasma levels of lipoprotein and triglycerides while reducing endothelial function by impairing dilation (Hu & Willett, 2002). In addition, TFA adversely affect essential fatty acid metabolism and prostaglandin balance by inhibiting enzyme function (Hu & Willett, 2002). Due to TFA having a large negative impact on cholesterol and CVD, research has shown that by substituting MUFAs and PUFAs for SFA and TFA total cholesterol can be lowered (Griel & Kris-Etherton, 2006).

**Cholesterol.** Cholesterol can either be made in the body or consumed through food intake. Regardless of where cholesterol comes from, its purpose is for physiological and structural functions. Therefore, it is not necessary to consume dietary cholesterol (Dietary Guidelines, 2010). With that said, the average cholesterol consumption is 256mg per day with men consuming 331mg and one-third of coming from egg intake.
Even though cholesterol can be made in the body there are recommendations to consume less than 300mg per day due to its large impact on LDL and HDL and thus CVD (Dietary Guidelines, 2010).

Dietary cholesterol has been shown to raise total cholesterol and LDL cholesterol. Diets high in saturated fat and cholesterol elevate LDL by down-regulating the LDL receptors in the liver (Mahan & Escott-Stump, 2008). With down-regulation, receptors are repressed causing less LDL to be cleared from the plasma. The abundance of LDL in the plasma allows for oxidation in the arterial walls leading to atherosclerosis. This process of LDL oxidation caused by cholesterol can vary from person to person depending on genetic factors. Cholesterol also affects total to HDL cholesterol ratio. In a meta-analysis study by Weggeman and colleagues it was determined that dietary cholesterol raises the ratio of total to HDL cholesterol adversely affecting serum cholesterol (Weggeman, Zock & Katan, 2001).

**Non-modifiable Risk Factors**

**Age and gender.** Non-modifiable risk factors include age, gender and family history. In both men and women, as age increases there is an increase in CVD mortality rates, leading to not only gender but age as a risk factor for cardiovascular risks. The incidence of premature CVD in men age 35 to 44 is three times as high as the incidence of women of the same age (Mahan & Escott-Stump, 2008). Therefore, the increase in absolute risk with aging becomes clinically significant for men in their mid 40’s and women at about the same time as menopause (AHA, 2002). As gender plays a risk factor
role, The Framingham Heart Study has shown that the differences in absolute CVD risk between genders can not be explained by standard risk factors.

**Family history/ethnicity.** Family history of CVD is a non-modifiable risk factor. A family history is considered to be positive when a MI or sudden death occurs before the age of 55 years in a male first degree relative or the age of 65 in a first degree female relative (Mahan & Escott-Stump, 2008). The risk for CVD can greatly increase when heredity is combined with unhealthy lifestyle choices such as smoking, physical inactivity and consuming a poor diet (“Heart disease heredity,” 2009).

Ethnicity may play a role as a non-modifiable risk factor. In a study conducted by Thomas et al., focusing on ethnicity, income and CVD, black men had lower cholesterol levels and high blood pressure than white men. Fewer black men were also classified as being at low or intermediate risk for CVD compared to white men but, more black men were classified as high or very high risk for CVD. In summary, the study determined black men have a greater tendency to develop CVD risk factors versus white men over time.

**Prevalence of Cardiovascular Disease**

With the combination of modifiable and non-modifiable risk factors, CVD is the leading cause of death in the U.S. accounting for more deaths than all other causes combined (Coulston, et al., 2001). Data from NHANES 2003-2006 indicated that 33.6% of the US adults age 20 and older have HTN. As for smoking, 23.1% of men and 18.3% of women age 18 and older are smokers. The percentage of the non-smoking population
with detectable serum cotinine (indicating secondhand smoke) was 46.5% in 1999-2004 (AHA, 2009).

In 2006, approximately 7.7% of the adult population had a diagnosis of diabetes while 29% were pre-diabetic with abnormal fasting blood glucose (AHA, 2009). Prevalence of overweight and obesity in U.S. adults age 20 years old and older is 66.3% (AHA, 2009). Of those, 32.9% of U.S. adults have a BMI greater than or equal to 30, which is classified as obese.

Due to the large percentage of individuals who have at least one risk factor, it is estimated that 61.8 million individuals in the general population have CVD. Although most CVD deaths occur in persons older than 65 years of age, one third of deaths occur before average life expectancy is reached (Mahan & Escott-Stump, 2008). From 1996-2006, death rates from CVD have declined 29.2% but it is still the leading cause of death. Mortality data for 2006 showed that CVD accounted for 1 out of every 2.9 deaths in the U.S. and on average 1 death every 38 seconds is from CVD (AHA, 2009). CVD caused approximately 1 out of every 6 deaths in the U.S. in 2006 (AHA, 2009). Roughly every 25 seconds an American will have a coronary event and approximately every minute someone will die from it. Americans are also affected by strokes. Mortality data from 2006 indicates that stroke accounted for approximately 1 of every 18 deaths in the U.S. (AHA, 2009). On average every 40 seconds someone in the U.S. has a stroke. As with CVD rates, stroke rate have also fallen 18.4% from 1996 to 2006, but they still remain a concern.
Prevention of Cardiovascular Disease

Lifestyle Modifications

Altering risk factors associated with CVD can prevent onset of the disease. To achieve an increase in CVD prevention, lifestyle modification is necessary. The AHA has defined a construct of ideal cardiovascular health, which is defined as (1) the simultaneous presence of four favorable health behaviors (absence from smoking within the last year, ideal BMI, physical activity and consumption of a dietary pattern that promotes cardiovascular health); (2) the simultaneous presence of four favorable health factors (absence from smoking within the last year, untreated total cholesterol <200 mg/dL, untreated blood pressure ≤ 120/≤ 80 mmHg and the absence of diabetes mellitus); and (3) the absence of clinical CVD (including CHD, stroke, and heart failure). Given the importance of abstinence from smoking and smoking cessation to health promotion, smoking appears in both lists of health factors and health behaviors. To meet ideal cardiovascular health, all of the constructs need to be satisfied.

Diet. A large preventative measure in CVD is diet. Many foods and food compounds can have a direct impact on CVD contributors such as HTN and artherosclerosis. Without correct dietary habits and lifestyle modifications CVD is inevitable.

Monounsaturated fatty acids. MUFAs are fatty acids that have only one double bond present making it an unsaturated fatty acid. Sources of MUFAs include olive oil, canola oil, peanut oil and tree nuts. Recommendations from the Dietary Guidelines for Healthy Americans 2010 states that SFA should be replaced with MUFA and PUFA in
order to decrease CVD risk as well as lower blood LDL and triglycerides (Dietary Guidelines, 2010; Mahan & Escott-Stump, 2008; Pearson et. al., 2002).

With replacement of SFA with MUFA, evidence has been shown that MUFA intake has an inverse association with death from CVD (Lunn & Theobald, 2006). Similarly, de Lorgeri et al. reported that subjects who consumed a Mediterranean type diet high in MUFAs had a significant reduction in the risk of death from CVD cause or non-fatal acute MI, as well as cardiac mortality and total mortality (deLorgeril et al., 1995). Diets high in MUFAs and total fat do not show a beneficial effect with CVD. When total fat and MUFA consumption is high, HDL cholesterol has not been shown to change thus, hindering the cholesterol lowering effects of HDL (Coulston et al., 2001).

**Polyunsaturated fatty acids.** Just like MUFAs, PUFAs need to have a double bond in the fatty acid chain but PUFAs must contain more than one double bond. There are two forms of PUFAs: Omega-6 polyunsaturated fatty acid (linoleic acid) and Omega-3 polyunsaturated fatty acid (linolenic acid), both of which are essential fatty acids. Omega-6 PUFAs are found mainly in flaxseed, canola oil, hemp oil, pumpkin seeds, sunflower seeds, and meats. Omega-3 PUFAs are traditionally found in cold water fish and nut oils. Both Omega-6 and Omega-3 have been shown to have beneficial effects with regards to CVD. In the Nurses Health Study, consumption of fish was associated with a decreased risk of cardiovascular events and death from CVD (Hu et al., 2002). Omega-3 PUFA consumption was also linked to an inverse effect on blood pressure. Thirty-one controlled trials showed that intakes of Omega-3 higher than three grams of fish oil per day were needed in order to observe a significant reduction in blood
pressure (3.0 mmHg systolic and 1.5 mmHg diastolic) in HTN individuals (Morris, Sacks, & Rosner 1993). Protection from CVD through fish consumption has been linked to docosanhexaneoic acid (DHA) and eicosapentaenoic acid (EPA). DHA and EPA are made in the body with the presence of Omega-3 and are needed for developmental growth and may be a preventative in the areas of heart disease, rheumatoid arthritis and hypertension (Harris, 1997). The mechanism behind PUFA protective qualities are not known with confidence but may be related to an antithrombogenic effect, retarding the growth of atherosclerotic plaque, an anti-inflammatory effect, and being mildly hypotensive. (Kris-Etherton, Harris & Appel, 2002).

**Fiber.** Fiber has been shown to decrease CVD. Dietary fiber is found in fruits, vegetables, whole grains and legumes. Research has shown that dietary fiber (from cereal) is associated with a reduced risk of fatal and non-fatal MI (Rimm et al., 1996). Soluble fiber, including oat bran, psyllium, guar gum and pectin has been shown to reduce CVD risk though its action on lipids, lipoprotein and glucose metabolism (Coulston et al., 2001). Likewise, fiber has also demonstrated an effect on lowering glucose and insulin levels in non-diabetics and increasing insulin sensitivity in those with diabetes (Coulston et al., 2001). Fiber has also been shown to decrease cholesterol by binding to bile acid, which lowers serum cholesterol, as it depletes the bile acid pool (Mahan & Escott-Stump, 2008). When bound, bacteria in the colon ferment the fiber and produce acetate, propionate and butyrate, which inhibit cholesterol synthesis (Mahan & Escott-Stump, 2008). Comparing soluble fiber to insoluble fiber, soluble fiber may have a greater effect on blood pressure than insoluble fiber (Lazarou & Kouta, 2008). In a
population of type two diabetics, soluble plant fibers were added to a diet recommended by the AHA for individuals at high risk or those who have been diagnosed with CVD. When following the diet, those who consumed the soluble fibers decreased their systolic blood pressure by 9.4 mmHg (6.9%) when compared to the control group who received wheat plant fibers (Vuksan et al., 1999). C-reactive protein, which is a sensitive marker for inflammation, is an independent predictor of future CVD. In a study conducted by North, Venter and Jerling, weight loss, modified saturated fat, MUFA and PUFA intake and an increase in fiber consumption significantly lowered C-reactive protein concentrations (25-54%). For the benefit of fiber recommendations are 25 to 30 grams per day with six to ten grams being soluble fiber.

**Protein.** Protein foods include animal (seafood, meat, poultry, eggs) and plant based sources (beans, peas, nuts, seeds). Milk and milk products also contain protein. Fat is prevalent with protein foods. Fat found in meat, poultry and eggs are considered saturated fat and have been shown to increase CVD risk. Fat found in nuts and seeds are considered oils and contain MUFA and PUFA, which have been proven to be beneficial in decreasing CVD risk. NHANES data suggests that on average men between the ages of 20-29 consume 105.3 grams of protein per day, 30-39 years old, 101.6 grams per day, 40-49 years old, 104.7 grams per day and for 50-59, 101.1 grams per day (U.S. Department of Agriculture, 2010). According to Dietary Guidelines for Americans, protein consumption should be 56 grams per day for males ages 19 to 51 and older (Dietary Guidelines, 2010). As for proteins effect on CVD, NCEP states that it has little effect on serum LDL cholesterol level or other lipoproteins (AHA, 2002). Further
research indicates an increased consumption of protein or MUFA decreases blood pressure when linked to other multiple dietary factors such as fruit, vegetable, and low fat dairy products (Appel, 2001). Much research has also been conducted in the area of CVD and plant protein sources. Soy protein compromising more than half of daily protein intake has been shown to lower LDL cholesterol levels by a few percentage point when it replaces dairy protein or a mixture of animal protein (Lichtenstein et al., 2002). Findings have therefore indicated that plant protein sources have decreased levels of saturated and trans fat, while an increase in fiber the LDL lowering PUFA which may decrease CVD risk.

**Sodium.** Sodium is consumed in abundance in the average American diet. New sodium guidelines placed by the Dietary Guidelines for Americans recommend less than 2,300 mg per day for men ages 19-51 and older (Dietary Guidelines, 2010). On average men between 20-59 years of age consume 4,254 mg of sodium per day (U.S. Department of Agriculture, 2010). Much sodium is found in prepackaged convenience food and meals, to which a large majority of Americans are purchasing and eating. Abiding by the new guidelines may be difficult due to the abundant availability of high-sodium foods and the currently high levels of sodium consumption however, advocating for lower sodium foods and abstaining from convenience meals is advisable (Lichtenstein et al., 2002).

Consuming high qualities of sodium has been shown to increase blood pressure and potentially cause HTN (Mahan & Escott-Stump, 2008). Over consumption of
sodium allows for fluid retention in the body, placing added pressure on the arterial walls increasing both systolic and diastolic pressure.

Strong evidence has linked CVD risk and sodium consumption. In a study following the benefits of the Dietary Approaches to Stop Hypertension (DASH) diet subjects were placed in three sodium level categories high, moderate and low (Sacks et al., 2001). Subjects followed the DASH diet in addition to their prescribed sodium amounts. Results determined that reducing sodium from the high to moderate group reduced systolic blood pressure by 1.3 mmHg. Moderate to low sodium reduction further decreased systolic pressure to 1.7 mmHg. Results were observed in both those with and without preexisting high blood pressure. Subjects who also followed the DASH diet were associated with a significantly lower systolic blood pressure (Sacks et al., 2001).

A reduced sodium intake can also prevent hypertension in non-hypertensive individuals, can lower blood pressure in the setting of antihypertensive medication, and can facilitate hypertension control (Lichtenstein et al., 2002). Overall, research has demonstrated a decreased sodium intake related to blood pressure was greater in African Americans, middle and older-aged individuals, and those with HTN, diabetes, or chronic kidney disease (Coulston et al., 2001; Lichtenstein et al., 2002).

**Potassium.** The evidence for a role of potassium in lowering blood pressure is consistent across study types and is biologically plausible (Coulston, Rock & Monsen, 2001). Potassium is found in numerous fruits and vegetables including: bananas, cantaloupe, avocados, potatoes, tomatoes and spinach. Recommendations from the Dietary Guidelines for Americans state that potassium consumptions should be 4,700
27

mg/day for men 19 to 51 and older (Dietary Guidelines, 2010). On average however, men are not receiving the recommendations. Men ages 20-29 are consuming 2,939 mg per day, 30-39 years old increase to 3,080, 40-49 are at 3,162 and men 50-59 years old intake 3,169 mg per day, much lower than the recommended (U.S. Department of Agriculture, 2010). Would it be possible to state that men are at an increased risk for CVD due low potassium intake? Recent studies have determined the inverse relationship between high potassium intakes and low blood pressures. In a study by Appel (2001), administration of 60–120 mmol/day of potassium supplements decreased, systolic and diastolic pressure at 4.4 and 2.5 mmHg in individuals with high blood pressure. Individuals without high blood pressure decreased by 1.8 and 1.0 mmHg (Appel, 2001). Consistent results were found in further studies providing support to use potassium as a reduction and prevention of high blood pressure and thus a decrease in CVD.

**Caffeine.** Caffeine is consumed through a wide variety of beverages such as coffee, tea, pop and energy drinks or though oral supplements such as those taken to increase energy prior to intense physical activity. Biomechanically caffeine works as a central nervous stimulant, diuretic and vasodilator. If consumed prior to exercise it has been shown to increase endurance in strenuous aerobic exercise and improve intensity of shorter duration exercise performance (McArdle, Katch & Katch, 2007). Between the ages of 20 and 59, men consume on average 139.6 – 273.4 mg of caffeine daily (U.S. Department of Agriculture, 2010). Recommendations for caffeine consumption vary depending on the individual, but studies suggest 100-200 mg/day (Food & Drug Administration, 2007). Caffeine with relation to blood pressure and CVD has displayed
conflicting results due to individual’s tolerance (Coulston, Rock & Monsen, 2001). Kellawan and colleagues looked at caffeine’s effect during fire combat. The study demonstrated that caffeine increases physiological strain as a result of increased gastrointestinal temperature during exercise conditions such as firefighting. An increase in physiological strain increases the need for air but due to the caffeine intake rate of perceived exertion was decreased. As a result, caffeine could increase body temperature, increasing risk for heat related injuries (Kellawan, Stewart-Hill, & Petersen, 2009). Caffeine has also shown an effect on blood pressure in individuals with pre-existing hypertension. When consuming 200-300 mg of caffeine an increase in both systolic and diastolic blood pressure may result (Mesas, Leon-Munoz, Rodriguez-Artalejo, & Lopez-Garcia, 2011).

Firefighters

Employment Requirements

Firefighting is considered one of the most dangerous professions. Many men and women put their lives on the line in order to protect their community and minimize property destruction (“Fatalities,” 1999). Every day at the station is unpredictable in nature.

Approximately 310,000 jobs are held by firefighters, and 55,200 by upper management (Chief, Lieutenant or Captain). As for the fire station it is considered a “home away from home.” Many fire stations contain facilities for cooking, dining, relaxing, exercising and sleeping. Depending on the size of the station, individual shifts are composed of four to eight firemen (Elliot et al., 2004). Hours at the fire station are
much different from a typical job. Many firefighters are on-duty for 24 hours and then off-duty for 48 hours, receiving an additional day off at intervals ("U.S. Bureau of Labor Statistics- Fire Fighters," 2009). Extra hours at emergencies or working holidays occur as well. Many firemen work 50 or more hours per week.

Due to the amount of time spent together and the dependability placed each other in the line of duty, just as they would with their own family, habits an tend to be similar. Family is also reflected with the way firefighters prepare and consume their meals. It is accustom for firefighters to cook and dine as a group.

Firefighters are required to respond to emergencies 24 hours day. Numerous alarms sound at various times of the day or night and the firefighters must be quick to assist. The uncertainty of the alarm can not only lead to an increase in stress but irregular sleeping and unhealthy dietary habits.

**Work Environment**

On-duty firefighters must perform specific duties. Duties are physically and mentally demanding, and require great agility and stamina. While battling building fires, firefighters’ duties may include connecting hose lines to hydrants, operating pumps or positioning ladders but they must also rescue victims, administer medical care and salvage the contents of the building ("Fatalities," 1999). Firefighters not only fight fires but are also required to administer medical care to victims of minor accidents at home or in a car. Rescue operations may also be necessary in the event of a natural disaster. As with firefighters scope of practice, the variety of duties change with the given situation and changes need to be made quickly. Work environments also vary by seconds or
hours. Firefighters can potentially be exposed to poisonous, flammable or explosive
gasses, chemicals, radioactive material, blood, bodily fluids and foreign matter. While
breathing apparatuses are used, smoke inhalation and chemical exposure, including
carbon dioxide occur. During a call, protective fireproof clothing must be worn along
with a helmet and steel toe boots. The protective equipment weighs approximately fifty
pounds and retains a great deal of heat (Kales, Soteriades, Christoudias & Christiani,
2003). When combining fire and medical duties, exposures, uniform, rescue efforts of
others as well as their own, firefighters are required to work under maximal amount of
stress. When firefighters are not working under maximal amounts of stress, time is spent
at the station. At the station firefighters may clean and maintain equipment, hone old
skills and develop new ones, exercise and eat.

**On-duty meal habits.** Due to the nature of the job and the uncertainty of the next
meal, dietary habits may be poor. Portions are large. Many firemen consume large
portions because it is unknown if that will be the only meal that they eat in the day
therefore, it needs to be sustaining for the duration of their shift (Spittler, 2009).
Firefighters also tend to be fast eaters. The habit of eating fast has developed at fire
stations because firefighters anticipate have their meals interrupted by emergencies.
Eating fast can result in reduced awareness of the quantity eaten and ingesting amounts
that exceed the amount necessary for satiety (Gerace and George, 1996).

**Fatalities and On the Job Injuries**

About two million fires are reported each year in the U.S. and fire departments
responds to a fire every 18 seconds (“Fatalities,” 1999). Due to the high demand and
dangerous work conditions, firefighters have one of the highest occupational fatality rates. Average workplace fatality rate for 1992-1997 was approximately 17 firefighters per 100,000 employed compared to five per 100,000 employed for all workers (‘Fatalities,” 1999). Therefore, the index of relative risk shows that firefighters are three times more likely to be fatally injured on the job when compared to the average worker. During 2008, for every 100,000 fires, 3.86 firefighter deaths occurred while on-duty. In 2009, 36 deaths took place to career firefighters, while volunteer firefighters had 54, totaling 90 deaths (U.S. Fire Administration, 2010). Of those 90 fatalities, 57 occurred while responding to an emergency situation. Non-emergency situations including training and administrative activities took 33 lives. While in an emergency situation, there are numerous issues that may arise causing death. During 2009, 79.6% of deaths occurred while fighting fires (U.S. Fire Administration, 2010).

**Cardiovascular Disease and Firefighters**

**Prevalence of Cardiovascular Disease in Firefighters**

Cardiovascular events, largely due to CVD, account for 45% of deaths among on-duty firefighters (Fahy, 2005). CVD has consistently been the leading cause of “on-duty deaths” or fatalities resulting from injury or illness occurring during fire department duties (Kales et al., 2003). Between January 1, 1994 and December 31, 2004 1,144 firefighter deaths were reported to the U.S. Fire Administration. Eour hundred and forty-nine of the 1,144 or 39% were due to CVD (Kales, Soteriades, Christophi & Christiani, 2007). CVD deaths were classified into duty at time of death. Thirty-two percent of deaths from CVD occurred during fire suppression, 31% during alarm
response and 37 during other duties (Kales, Soteriades, Christophi & Christiani, 2007). Because fire suppression represents only about one to five percent of firefighters professional time each year but accounted for 32% of deaths from CVD, it was associated with a risk of death that was approximately 10 to 100 times as high as the risk associated with non-emergency duties (Kales et al., 2007).

The same can be said for the year 2009. According to the U.S. Fire Administration, a total of 90 firefighter fatalities occurred. Stress and exertion accounted for roughly 56% of fatalities, the highest among all other categories (U.S. Fire Administration, 2010). The stress and exertion category includes all cardiac or cerebrovascular deaths such as heart attack, stroke, and events relating to extreme climatic thermal exposure. Of those 50 stress and exertion deaths, 39 were a result of a heart attack, eight were due to stroke, and one death each from a pulmonary embolism, heat exhaustion, and damage to a heart valve from extreme physical exertion (U.S. Fire Administration, 2010).

**Cause of Increased Risk of Cardiovascular Disease in Firefighters**

The risk of CVD related to firefighters may increase due to the lack of adequate physical fitness, job-related stressors such as working under extreme conditions, and poor diet, which when combined with inadequate physical fitness can precipitate other issues pertaining to weight, HTN, and diabetes (Byczek, Walton, Conrad, Reichelt & Same, 2004; Elliot et al., 2004; Kales et al., 2007).

**Physical activity.** Inadequate physical activity places firefighters at an increase risk for CVD (Scanlon & Ablah, 2008). There is no national mandatory fitness standard
for firefighters (Byczek, Walton, Conrad, Reichelt & Same, 2004). Most fire departments do not require firefighters to exercise regularly, undergo periodic medical examinations or have a return to work evaluation (Kales et al., 2007). Additionally, while mental and physical qualifications are required to be hired as a firefighter, those qualifications do not need to be maintained throughout the firefighter’s career. In a study comparing physical fitness of younger firefighters (age 20 to 29) to older (age 50 to 59), VO$_2$ max (a measurement of maximal oxygen consumption) decreased in the older group by 27.7%; sit-ups by 40%; push-ups by 45.6% and flexibility by 9.7% (Drew-Nord, Hong & Froelicher, 2009). Scanlon and Ablan surveyed firefighters in New York, and reported that only 45% of firefighters were exercising. Because of no national or city fitness standards, exercise is not mandatory even though findings state that intense physical activity is a strong triggering factor for CVD among physically inactive individuals (Kales et al., 2007). Firefighters need a high level of cardiorespiratory fitness to respond to the job’s intense emergency situations, but without a high level of fitness, firefighters are an increased risk for CVD.

**Work stressors and environment.** Firefighters work in a stressful environment encompassing extreme temperatures, heavy physical exertion, smoke, chemical and noise exposure and sudden alarms. As a result, firefighters are at an increased risk when responding to alarms and fighting fires.

Heat stress can occur during fire suppression. Extreme heat given off from the fire in conjunction with the fire retardant uniform increases body temperature (Guidotti, 2002). As the body reacts to an increase in temperature, perspiration and fluid loss occur,
resulting in electrolyte change. If electrolytes are not replaced a decrease in stroke volume and cardiac outputs have been shown to occur (Rossi, 2003).

Heavy physical exertion, while a day to day activity, also has been shown to have a large implication on cardiac stress. Firefighters have a job that requires physical activity to begin instantly, with long bouts of rest or light work. During times of extreme physical activity, firefighters heart rate increases due to a surge of catecholamine in the sympathetic nervous system (Barnard & Duncan, 1975). A study comparing heart rates with varying weights of self-contained breathing apparatuses found that heart rate increased 70 to 80% of maximum within the first minute of exercise regardless of the breathing apparatus weight. Heart rate then continued to increase 90 to 100% of predicted until the fire was extinguished (Manning & Griggs, 1983). Fireproof uniforms are also found to increase cardiac stress on firefighters. Uniforms weighing 50 pounds significantly increase heart rate, oxygen consumption and water loss (Kales, Soteriades, Christoudias & Christiani, 2003).

Smoke and chemical inhalation directly affects CVD. Fire smoke is a complex mixture of heated gases, vapor and particulate matter with a majority of the composition being made up of carbon monoxide, hydrogen cyanide and particulate matter. If inhaled, both carbon monoxide and hydrogen cyanide disrupt the blood transport and intercellular use of oxygen resulting in hypoxia and eventually myocardial injury (Satran et al., 2005). Studies of significant particulate matter exposure has been linked to CVD. Long term repeated particulate exposure is associated with cardiovascular mortality and the initiation and/or progression of atherosclerosis (Dockery et al., 1993). Short term
exposure has resulted in triggering heart attacks among firefighters with pre-existing heart disease (Peters, Dockery, Muller & Mittleman, 2001).

Reactions to alarms also increase heart rate. Kales et al (2007) determined that heart rate in firefighters increased in alarm response increasing CVD risk roughly five fold during an alarm. Blood pressure also increases during an alarm and when exposed to fire truck sirens during the alarm response.

Circadian distribution of CVD can occur when cardiac stressors happen on a regular basis (Kales et al., 2003). According to Drew-Nord et al., (2009) firefighters most often have cardiac death between noon and midnight, whereas the general population frequently dies of cardiovascular events between six a.m. and midnight. The time of firefighter’s death corresponds to the period of high intensity emergency dispatches at most fire departments, linking the increased risk of cardiovascular with fire suppression.

**Diet.** Diet has a direct effect on CVD in firefighters, and may be linked to obesity, hypertension and diabetes. Looking at the efficacy of worksite health promotion in fire stations, the Promoting Healthy Lifestyles: Alternative Models’ Effects (PHLAME) firefighter’s study determined that fruits and vegetable consumption was approximately six servings daily (Elliot et al., 2004). Post diet and exercise intervention, firefighter’s daily intake of fruits and vegetables did not increase. With regards to dietary fat intake, healthy levels post interventions were not met. Lifestyle choices of heavy drinking and smoking were prevalent in firefighters (Nagaya, Yoshida, Takahashi & Kawai, 2006).
Gerace and George (1996) focused on whether a firefighter’s diet might predict subsequent changes in weight. No correlation was found between number of alcoholic beverages consumed per week and weight change after seven years. Intake of fats or fruits and vegetables combined did not correlate to weight change. Eating speed did show a relationship. Firefighters who said they ate “faster” at the station gained 9.9 pounds, compared to those who said that their pace did not differ by location and increased their weight by 6.8 pounds. Those firefighters who “nibbled throughout the day” gained 10.6 pounds compared to those who did not nibble increased by 6.9 pounds.

**Weight/BMI.** Obesity may jeopardize firefighters performance and cause serious issues relating to HTN and diabetes. Obesity is associated with HTN, low HDL, high triglycerides and LDL and high plasma glucose levels. Obese firefighters are more likely to have HTN compared to overweight or normal weight firefighters in addition to developing job disability over time (Soteriades, Hauser, Kawachi, Christiani & Kales, 2008). Soteriades et al., (2008) examined the association between obesity and risk of job disability among firefighters. The average BMI of firefighters was 29.0 ±4. Twenty-seven percent of firefighters had class I obesity, 7% class II and .6% class III, extreme obesity. The result showed a one unit increase in BMI was associated with 5% increase in the risk of job disability.

A study by Byczek et al (2004) determined mean BMI of suburban firefighters to be 29, categorizing them as overweight. BMI values ranged from 19.5 to 54.3 with 44% of firefighters classified as overweight and 30% classified as obese. Within the study, it was determined that male firefighters had a higher prevalence of obesity (≥ 30), low HDL
(<40 mg/dL), high total cholesterol ($\geq 240$ mg/dL), and high LDL ($\geq 160$ d/dL) when compared to US adult men. HTN ($\geq 140/90$ mmHg) and diabetes (Fasting plasma glucose $\geq 126$ mg/dL) was lower compared to U.S. adult men. Likewise, Nagaya et al., (2006) determined that a BMI over 30 is a strong risk factor for diabetes and cardiovascular risk factors.

Large samples of firefighters are overweight based on BMI (Hsiao, Long & Snyder, 2002). A BMI value does not distinguish between an individual’s muscle or fat mass. As such, an individual having a high BMI value may either have increased muscle or increased fat. Given this limitation there are a higher proportion of obese firefighters compared to the general population, signifying the inability for BMI to truly depict between fat and muscle. When compared to all occupations, those in protective service occupations have the tallest standing height, highest weight, largest buttock and thigh circumference and bi-acromial breadth (Hsiao, Long & Snyder, 2002).

**Prevention of Cardiovascular Disease in Firefighters**

**Medical Examinations**

The risk of CVD events during fire suppression may be increased. Many firefighters lack adequate physical fitness, have underlying cardiovascular risk factors and have subclinical or clinical CHD (Kales et al., 2007). In further prevention of cardiovascular impairments, many studies support the start of a worksite diet and exercise program along with routine medical examinations. Major cardiovascular risks factors are detectable at routine examinations and mostly modifiable. Yet 75% of firefighters who die from on-duty cardiovascular related deaths have not had a recent medical examination
(Kales et al., 2007). Fitness promotion, medical screening and improved medical management could prevent many of these premature deaths and should be promoted and provided by fire service authorities (Kales, 2003).

**Diet Education**

Because diet is a modifiable risk factor it may be important to institute diet education into fire stations. Like the general public, firefighters deem proper nutrition a daunting task. With appropriate nutrition education, addressing barriers to change and convincing firefighters that healthful dietary changes could be made without sacrificing enjoyment of the eating experience, CVD risk may decrease (Kay et al., 2001).

Many firefighters are willing to take a step forward in diet and physical activity. At least 90% of respondents in the Scanlon and Ablah (2008) study favored fire departments taking a more active role in informing its members about the increased medical risk associated with their jobs, would attend a department-organized lecture regarding proper diet and exercise and reduction of their risks of heart attack, and were interested in participating in a department sponsored fitness program.

**Cardiovascular Dietary Patterns**

Proper nutrition in conjunction with exercise and potential weight loss has been determined as the primary intervention for those who are at risk or have been diagnosed with CVD (Mahan & Escott-Stump, 2008). Recommended by both the AHA and NCEP, the Therapeutic Lifestyle Changes (TLC) and DASH diet has been shown to decrease risk for CVD.
Focusing on decreasing CVD risk, the TLC approach is designated to reduce intakes on saturated fat and cholesterol while increasing the option for LDL lowering plant sterols/stanols and fiber in addition to promoting weight reduction and an increase in physical activity (AHA, 2002). The cornerstone of the TLC diet is reduction in LDL cholesterol. SFA and cholesterol have been shown to increase LDL, thus it is core component to the diet. Dietary modifications are necessary to reduce LDL cholesterol. Shown in Table 1 are the nutrient component changes essential for CHD risk reduction. Saturated fat is recommended at less that 7%, while PUFA and MUFA are 10% and 20% respectively. Cholesterol recommendations are less than 200mg/day with a suggestion to consume no more than two egg yolks per week (AHA, 2002). No food group is omitted in the TLC diet. Table 2 details the suggested food groups and servings. Breads, cereals, pasta, whole grains, dry bean and peas are recommended at six or more servings per week due to their complexity in carbohydrates, an ample amount of protein and low in SFA. Fruits and vegetables provide an abundance of Vitamins C, E, A, Beta-carotene, fiber and other various vitamins and minerals and should be consumed between 4-5 servings a day for each. Eat free and/or low fat dairy is recommended due to its reduced saturated fat content and is recommended for consumption 2-3 servings a day. Animal products are high in cholesterol and fat. Recommendations of removing any visible fat and consuming less than 5 ounces a day of lean meat applies to the TLC diet. Nuts and seeds are high in fat but with most containing unsaturated fat they can be eaten in moderation.
Table 1

*Nutrient Composition of the TLC Dietary Pattern*

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommended Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated Fat</td>
<td>Less than 7% of total kilocalories</td>
</tr>
<tr>
<td>Polyunsaturated Fat</td>
<td>Up to 10% of total kilocalories</td>
</tr>
<tr>
<td>Monounsaturated Fat</td>
<td>Up to 20% of total kilocalories</td>
</tr>
<tr>
<td>Total Fat</td>
<td>25-35% of total kilocalories</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>50-60% of total kilocalories</td>
</tr>
<tr>
<td>Fiber</td>
<td>25-30 grams/day</td>
</tr>
<tr>
<td>Protein</td>
<td>Approximately 15% of total kilocalories</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 200 mg/day</td>
</tr>
<tr>
<td>Total Calories</td>
<td>Intake/expenditure based on weight maintenance/loss.</td>
</tr>
</tbody>
</table>


In following the TLC diet, research has shown it to be successful in reducing LDL cholesterol. In a study by Lichtenstein et al. (2002) on middle aged men and women with elevated LDL cholesterol, BMI and moderate hypercholesterolemia, LDL cholesterol was reduced by 11%. HDL decreased by 7% and no change of cholesterol to HDL ratio was found (Lichtenstein et al., 2002). Findings also state that those individuals with borderline high LDL may stall the use of lipid lowering medication with TLC diet (Lichtenstein et al., 2002).
Table 2

*Daily Food Group Servings for TLC Dietary Pattern at 2,000 kcal*

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains</td>
<td>7 servings/day</td>
</tr>
<tr>
<td>Vegetables</td>
<td>5 servings/day</td>
</tr>
<tr>
<td>Fruits</td>
<td>4 servings/day</td>
</tr>
<tr>
<td>Fat Free/ Low Fat Dairy</td>
<td>2-3 servings/day</td>
</tr>
<tr>
<td>Lean Meats, Poultry and Fish</td>
<td>≤ 5 oz/ day</td>
</tr>
<tr>
<td>Nuts, Seeds and Legumes</td>
<td>Counted in vegetable serving</td>
</tr>
<tr>
<td>Fats and Oils</td>
<td>Depends on daily calorie needs</td>
</tr>
</tbody>
</table>


The DASH diet, which is a diet proven effective in the control of high blood pressure, emphasizes fruits, vegetables, and dairy with low fat content. It includes whole grain, poultry, fish and dry fruits. It has small quantities of red meat, sweets, and sugar and is low in cholesterol and saturated fat and aims at controlling the body weight (Coulston, Rock & Monsen, 2001; Sacks et al., 2001). Shown in Table 3, are the nutrient components for the DASH dietary plan. The difference between TLC and DASH can be noted for protein and cholesterol. DASH contains recommendations for sodium, potassium, calcium, and magnesium. Similar to TLC, DASH does not omit any food groups. Table 4 lists the suggested food groups and recommended servings. Differentiating between DASH and TLC is the addition of nuts, seeds and legumes and sweets/added sugars as a separate grouping. Lean meat, fish and poultry is greater in DASH when compared to TLC (<6 ounces per day versus <5 ounces per day).
Table 3

*Nutrient Composition of the DASH Dietary Plan at 2100 kcal*

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommended Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>27% of total kilocalories</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>6% of total kilocalories</td>
</tr>
<tr>
<td>Protein</td>
<td>18% of total kilocalories</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>55% of total kilocalories</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>150 mg/day</td>
</tr>
<tr>
<td>Sodium</td>
<td>1500-2300 mg/day</td>
</tr>
<tr>
<td>Potassium</td>
<td>4700 mg/day</td>
</tr>
<tr>
<td>Calcium</td>
<td>1250 mg/day</td>
</tr>
<tr>
<td>Magnesium</td>
<td>500 mg/day</td>
</tr>
<tr>
<td>Fiber</td>
<td>30 grams/day</td>
</tr>
</tbody>
</table>


DASH research has also been proven to decrease HTN and blood pressure. After a six week DASH trial, effects on blood lipid were shown to change. Abiding by the DASH diet significantly decreased LDL cholesterol by 7.3%, HDL cholesterol by 9% and total cholesterol by 7.5% (Obarzanek et al., 2001). As a side note, more research was said to be completed on the decrease of HDL because it is beneficial to decreasing CVD risk. Similarly, in a study by Sacks and colleagues levels of dietary sodium in tandem with the DASH diet was used as a means for decreasing blood pressure in subjects with and without HTN. Results proved that with sodium reduction and DASH, systolic blood pressure could be reduced. Mean systolic blood pressure decreased 7.1 mmHg in subjects without HTN and 11.5 mmHg in those with HTN (Sacks et al., 2001).
In conjunction with positive results from both dietary patterns, it may be possible to implement these lifestyle modifications into fire stations depending on the ability of firefighters to make a long lasting change and their awareness of dietary habits.

Table 4

*Daily Food Group Servings of DASH Dietary Pattern*

<table>
<thead>
<tr>
<th>Food Groups</th>
<th>Servings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains</td>
<td>6-8 servings/day</td>
</tr>
<tr>
<td>Vegetables</td>
<td>4-5 servings/day</td>
</tr>
<tr>
<td>Fruits</td>
<td>4-5 servings/day</td>
</tr>
<tr>
<td>Fat Free/ Low Fat Dairy</td>
<td>2-3 servings/day</td>
</tr>
<tr>
<td>Lean Meats, Poultry and Fish</td>
<td>&lt; 6 oz/day</td>
</tr>
<tr>
<td>Nuts, Seeds and Legumes</td>
<td>4-5 servings/week</td>
</tr>
<tr>
<td>Fats and Oils</td>
<td>2-3 servings/day</td>
</tr>
<tr>
<td>Sweets and Added Sugars</td>
<td>≤ 5 servings/week</td>
</tr>
</tbody>
</table>

CHAPTER III

METHODOLOGY

Purpose

The purpose of this study was to determine if on-duty dietary intake of firefighters was different from off-duty dietary intake and to provide descriptive data of firefighters’ dietary habits related to cardiovascular risks.

Research Hypothesis

Firefighters’ on-duty dietary intake will be different from their off-duty dietary intake. Work status (on-duty/off-duty) is the independent variable and dietary intake is the dependent variable.

Participants

This comparative descriptive evaluation was conducted in the Northeast Ohio area between September and October 2011. A total of 58 participants were recruited through convenience sampling at Brimfield Township, Cleveland, Hopkins International Airport, Kent and Willoughby fire stations. Participants were limited to male, full time firefighters, consisting of 24 hours on-duty and 48 hours off-duty, who had been employed for at least a year in the department. Female firefighters were excluded due to their low population. Kitchen facilities at the fire station were required as means to prepare meals, if chosen. The ethical committee of the Institutional Review Board (IRB) at Kent State University approved this study and informed written consent was obtained from all participants.
Survey Design

Firefighters willing to participate were required to complete four sections of the data collection instrument. The instrument consisted of an IRB approved consent form, a questionnaire pertaining to habits on-duty and off-duty, anthropometric measurements and 24 hour dietary recall. The researcher was present throughout data collection.

Consent form (Appendix A). The IRB approved consent form was required from all firefighters willing to participate. The consent form described the purpose of the research, procedures that would be taking place, benefits of the study, any possible risks and discomforts that might occur, how the participant’s information would be kept private and confidential, along with participants’ contact information. Confidentiality was kept by the use of an identification code. The code was based on the last four digits of the participants’ phone number. Identification codes correlated to each participant data collection instrument. The researcher was the only person with access to the key.

Firefighters’ questionnaire (Appendix B). The questionnaire consisted of 12 pages. General characteristic questions addressed age, length of employment, gender, and employee status (full/ part time). Breakfast, lunch and dinner questions, asking for a numerical response, detailed how many days per week meals were eaten and whether those meals were consumed alone or in a group. Eive point Likert scale questions pertained to how often meals were consumed and the prevalence of feeling pressure to eat in a group. General physical activity participation on-duty and off-duty was questioned along with type frequency and duration. Shopping and cooking habits were addressed for on-duty and off-duty as was consumption of take out or fast food. Questions pertaining to
cardiovascular risks and yearly physicals were also asked. Participants were required to list any medication, supplementation and herbal use. Detailed questions about alcohol and caffeine containing beverages were included in addition to potential ideas for nutrition education.

**Anthropometric measurements** (Appendix C). Height, weight, hip and waist circumference and blood pressure were the anthropometric measurements collected on the participants. Weight was measured using the provided station scale. Participants were fully clothed in appropriate station uniform. Walkie-Talkies, wallets and sweatshirts were removed, if applicable. Shoes remained on. Weight was measured to the nearest hundredth of a kilogram. Again, using a station provided stadiometer, height was measured in the standing position to the nearest hundredth of a centimeter. Shoes remained on. With the use of a cloth tape measure, the researcher measured hip and waist circumferences. Hip circumference was measured at the largest part of the gluteus maximus and waist was taken at the umbilical region. Both measurements were recorded to the nearest hundredth of a centimeter. The researcher, using either a LifePack machine or a cuff and stethoscope, provided by the station, took systolic and diastolic blood pressures on each participant. Participants were required to sit while having blood pressure taken.

**Two day 24 hour dietary recall** (Appendix D). Participants were asked to fill out a 24 hour dietary recall for one on-duty and one off-duty day. Fill in columns consisted of time of consumption, identification as a meal or snack, food item consumed,
amount, preparation style, brand name if applicable, and location consumed. A detailed example was also attached as a means for specificity.

**Procedure**

Personal contact was made by the researcher at each station by contacting the supervisor. During initial communication, a date and time was determined for the researcher to arrive at the station to recruit participants. With station arrival, all interested participants were asked to report to a central location. The researcher provided a brief five minute overview of the study detailing each section. At that time any questions were addressed. Those who were willing to participate were required to fill out the consent form prior to completion of any other sections. Consent forms were then collected and the questionnaire was passed out. As participants finished the questionnaire, the 24 hour dietary recalls were given. Participants were instructed to include any and all beverages (i.e.; water, coffee, juice, beer, wine, pop) in addition to protein powder and its mixers in this section. After the questionnaire and dietary recalls were finished, the anthropometric measurement form was next. Heights and weights were taken first in the weight room at each facility. Blood pressure and hip/waist circumference, measured by the researcher and recorded by the participant, were collected.

In the event of an emergency call, data collected was postponed until arrival back at the station. All data collection instruments were to be completed with the researcher present. Without any emergency calls, the average time of completion was 30-45 minutes.
Post data analysis, participants who requested study results (Appendix E) and/or dietary analysis results (Appendix F) received requested information along with two CVD risk factor handouts from the American Heart Association pertaining to monitoring cholesterol, blood pressure and weight and the significance of high blood pressure (Appendix G and H). Participants’ information and handouts were placed in a sealed envelope with their four digit identification number written on the front for easy recognition. Envelopes were delivered to each station along with a note thanking the station for their willingness to participate (Appendix I).

**Data Analysis**

**Dietary Analysis**

Completed on-duty and off-duty dietary recalls from participants were analyzed for nutrient components including carbohydrates, proteins, fats (total fat, saturated fat, monounsaturated fatty acids, polyunsaturated fatty acids, omega 3, omega 6 and trans fat), cholesterol, fiber, alcohol, potassium and sodium along with total kilocalories using Diet Analysis Plus (10th Edition, Cenegage Learning, Independence, KY).

**Statistical Analysis**

The researcher conducted descriptive data analysis of the completed questionnaire and anthropometric information. Means, standard deviations and/or frequencies were determined for age, length of employment, dining, physical activity, shopping and cooking habits, cardiovascular diagnoses, medication, supplement and herbal use, alcohol, caffeine and tobacco use, potential nutrition education, height, weight, waist and hip circumference and blood pressure. Nutrient components were evaluated by a paired
sample t-test comparing nutrient intake of on-duty versus off-duty. Total kilocalories were also evaluated using a paired sample t-test. All partial responses were used. Statistical significance was set at $p < 0.05$. Data was analyzed using SPSS for Windows (Version18, SPSS Inc, Chicago, IL).
CHAPTER IV
JOURNAL ARTICLE

Introduction

Firefighters experience more occupational fatalities due to cardiovascular disease (CVD) than persons in any other profession (Kay, Lund, Taylor & Herbold, 2001). Of the approximately 100 firefighter casualties per year, 45% of those deaths are caused by CVD (Scanlon & Ablah, 2008). CVD can be precipitated by modifiable risk factors such as tobacco and alcohol use, lack of exercise, and poor diet (“Cardiovascular Diseases,” 2009). Research demonstrates high cholesterol (Mahan & Escott-Stump, 2008), high blood pressure (Kennel, 1996), and obesity (Hertz, Unger, McDonald, Lustik & Biddulph-Krentar, 2004) can lead to a decrease in cardiovascular health; high cholesterol, high blood pressure and obesity are also strongly correlated to poor dietary habits (Mahan & Escott-Stump, 2008).

While much research has been conducted on firefighter CVD risk factors involving blood pressure, exercise, diabetes and weight, very few studies have investigated dietary habits related to those topics. Therefore, due to the relationship between poor diet and cardiovascular health, it is important to consider dietary intake with regards to CVD risk in firefighters.

Purpose

The purpose of this study was to determine if on-duty dietary intake of firefighters was different from off-duty dietary intake and to provide descriptive data of firefighters’ dietary habits related to cardiovascular risks.
Methods

A two 24-hour dietary recall was used to compare on-duty and off-duty nutrient intake. Descriptive data evaluating meal frequency, cardiovascular risk factors, medication/supplement use, alcohol/tobacco use, potential nutrition education topics and anthropometric measurements were also evaluated. The researcher was present throughout the duration of data collection.

Participants

This comparative descriptive evaluation was conducted in the Northeast Ohio area between September and October 2011. A total of 58 participants were recruited through convenience sampling at Brimfield Township, Cleveland, Hopkins International Airport, Kent City and Willoughby fire stations. Participants were limited to male, full time firefighters, consisting of a 24 hour on-duty shift and 48 hours off-duty shift, who had been employed for at least a year in the department. A kitchen facility at the station was also required.

Data Collection Instruments

Firefighters willing to participate were required to complete four sections of the data collection instrument. The instrument consisted of an Institutional Review Board (IRB) approved consent form, a questionnaire consisting of questions pertaining to demographics, shopping/cooking habits, and cardiovascular risk factors, anthropometric measurements and two 24-hour dietary recall (one for on-duty intake and another for off-duty intake).
Section two, the questionnaire, required both numerical and five point Likert scale responses pertaining to demographics, shopping and cooking habits, cardiovascular risk factors and as feedback for potential nutrition education.

The researcher collected anthropometric measurements including height, weight, hip and waist circumference and blood pressure (section three). Height and weight were assessed with the provided station scale and stadiometer. Using a cloth tape measure, hip circumference was taken at the largest part of the gluteus maximums and waist at the umbilical region. The researcher, using either a LifePack machine or a provided station blood pressure cuff and stethoscope, collected systolic and diastolic blood pressures.

Section four, the twenty-four hour recalls (one on-duty and one off-duty day), was the last part of the instrument. Participants filled out seven columns consisting of time, meals/snack, food item, amount, how prepared, brand name, and home cooking or dining out for the required two days. The researcher addressed the importance of including all liquid beverages (i.e.; water, coffee, juice, beer, wine, pop) in addition to powder supplements and its mixer. An example page was also attached as a means for specificity. Depending on emergency runs, survey completion varied from 30 to 120 minutes.

**Statistical Analysis**

The researcher conducted descriptive data analysis of the completed questionnaire and anthropometric information. Frequencies were calculated for meals, group dining pressure, shopping/cooking habits, physical activity, cardiovascular risk factors, and nutrition education. Anthropometric measures, demographic information, dining habits,
meal consumption and meals eaten as take out were evaluated for means and standard deviations.

Completed on-duty and off-duty dietary recalls from participants were analyzed for nutrient components including carbohydrates, proteins, fats (total fat, saturated fat, monounsaturated fatty acids, polyunsaturated fatty acids, omega 3, omega 6 and trans fat), cholesterol, fiber, alcohol, potassium and sodium along with total kilocalories using Diet Analysis Plus (10th Edition, Cenegage Learning, Independence, KY). Nutrient components were evaluated by a paired sample t-test comparing nutrient intake of on-duty versus off-duty. Total kilocalories were also evaluated using a paired sample t-test. A chi-square measured the relationship of nutrition education and the request of study results and/or dietary analysis results. All partial responses were used. Statistical significance was set at p < 0.05. Data was analyzed using SPSS for Windows (Version 18, SPSS Inc, Chicago, IL).

**Results**

The purpose of this study was to determine if dietary intake varied for firefighters based on on-duty and off-duty diets. Subject characteristics are summarized in Table 5. The average participant was 38.7 ± 10.1 years old and had worked as a firefighter for 13.9 ± 10.1 years. Height and weight measurements were used to calculate, a body mass index (BMI) of 28.5 ± 3.6. Blood pressure averaged 124 ± 10.3/79 ± 7.5 for participants.
Anthropometrics

Table 5

Subject Characteristics of Firefighters ($\bar{x} \pm SD$)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>$\bar{x}$</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>58</td>
<td>38.7</td>
<td>± 10.1</td>
</tr>
<tr>
<td>Length of Employment (years)</td>
<td>58</td>
<td>13.9</td>
<td>± 10.1</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>56</td>
<td>180.7</td>
<td>± 5.9</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>56</td>
<td>93.9</td>
<td>± 11.4</td>
</tr>
<tr>
<td>BMI</td>
<td>56</td>
<td>28.5</td>
<td>± 3.6</td>
</tr>
<tr>
<td>Hip Circumference (cm)</td>
<td>52</td>
<td>107.1</td>
<td>± 10.2</td>
</tr>
<tr>
<td>Waist Circumference (cm)</td>
<td>56</td>
<td>99.1</td>
<td>± 10.7</td>
</tr>
<tr>
<td>Waist to Hip Ratio</td>
<td>54</td>
<td>0.95</td>
<td>± 0.10</td>
</tr>
<tr>
<td>Systolic Blood Pressure (mmHg)</td>
<td>56</td>
<td>124</td>
<td>± 10.3</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mmHg)</td>
<td>56</td>
<td>79</td>
<td>± 7.5</td>
</tr>
</tbody>
</table>

Dining Habits

Dining habits consisted of on-duty and off-duty meals, snacks and beverage consumption. Out of seven days, overall breakfast was consumed the least at (n=57) 5.12 ± 2.25 days of the week followed by 5.95 ± 1.48 for lunch and 6.79 ± 0.64 for dinner.

For on-duty and off-duty habits, results were based on a five point Likert scale of always, usually, sometimes, rarely, and never. Out of ten days, breakfast was always eaten off-duty 44.8% of the time versus 37.9% while on-duty (Table 6). Lunch was consumed on-duty more frequently than off-duty (p = 0.001). Similarly, dinner was consumed off-duty more frequently as well (p = 0.006).
Table 6

*Frequency of Meals Eaten On-Duty and Off-Duty by Firefighters (%) (n=58)*

<table>
<thead>
<tr>
<th></th>
<th>Always</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
<th>p value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast- Off</td>
<td>44.8</td>
<td>20.7</td>
<td>15.5</td>
<td>12.1</td>
<td>6.90</td>
<td>0.542</td>
</tr>
<tr>
<td>Breakfast- On</td>
<td>37.9</td>
<td>20.7</td>
<td>20.7</td>
<td>17.2</td>
<td>3.40</td>
<td></td>
</tr>
<tr>
<td>Lunch- Off</td>
<td>37.9</td>
<td>31.0</td>
<td>24.1</td>
<td>6.90</td>
<td>0.00</td>
<td>0.001*</td>
</tr>
<tr>
<td>Lunch- On</td>
<td>96.6</td>
<td>3.40</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Dinner- Off</td>
<td>82.8</td>
<td>12.1</td>
<td>5.20</td>
<td>0.00</td>
<td>0.00</td>
<td>0.006*</td>
</tr>
<tr>
<td>Dinner- On</td>
<td>98.3</td>
<td>1.70</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Results were based on paired sample t-test

<sup>b</sup> Statistical significance was set at p < 0.05

*<sup>*</sup> Significant difference between on-duty and off-duty

Table 7 details the number of days out of 10 that participants either eat alone or as a group. On-duty a majority of firefighters ate lunch and dinner as a group, but breakfast varied. Off-duty does not demonstrate a pattern of alone or group eating based on meals.

Table 7

*Days Out of 10 of Firefighters Eating Alone or in a Group<sup>a</sup> (x ± SD) (n=58)*

<table>
<thead>
<tr>
<th></th>
<th>On-Duty</th>
<th></th>
<th>Off-Duty</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alone</td>
<td>Group</td>
<td>Alone</td>
<td>Group</td>
</tr>
<tr>
<td>Breakfast</td>
<td>4.09 ± 3.82</td>
<td>3.79 ± 3.71</td>
<td>4.6 ± 3.54</td>
<td>3.62 ± 3.40</td>
</tr>
<tr>
<td>Lunch</td>
<td>1.50 ± 2.74</td>
<td>8.19 ± 2.99</td>
<td>5.97 ± 2.72</td>
<td>3.00 ± 2.19</td>
</tr>
<tr>
<td>Dinner</td>
<td>0.57 ± 1.44</td>
<td>9.14 ± 2.05</td>
<td>2.98 ± 3.27</td>
<td>6.47 ± 3.49</td>
</tr>
</tbody>
</table>

While at the station 53% of firefighters never felt pressure to eat as a group for breakfast, 39.7% at lunch and 36.2% at dinner. At home, 62% did not feel pressure to eat as a group for breakfast compared to 69% at lunch and 43% at dinner.
Physical Activity

Physical activity is very important to firefighters’ jobs. While at the station, 81% of firefighters reported participating in physical activity. Of those 81% who participated, 62.07% weight trained, 56.90% used the treadmill, 10.34% rode a stationary bike and 8.62% participated in Cross Fit. Out of 10 workdays, average physical activity was performed 6.8 ± 3.81 days for 57.22 ± 27.11 minutes. At home 82.8% of firefighters stated that they were physically active. Dissecting physical activity, 39% weight trained, 44% used the treadmill, 21% ran outside, 14% biked, and 7% participated in Cross Fit or play sports while off-duty. Out of 10 days at home, 6.12 ± 2.78 days included physical activity for an average of 65.29 ± 29.77 minutes per day. No statistical significance was determined between days and length of physical activity between on-duty and off-duty.

Shopping and Cooking

While on-duty, 55% of firefighters stated that grocery shopping was completed by a variety of people. As for meal preparation, 62.1% participants stated meals were made by several firefighters. Out of 10 workdays 1.46 ± 2.13 days contained meals prepared outside of the station.

At home, 34.5% of firefighters stated that their significant other purchases the groceries while 31.6% shop themselves. Meal preparation at home consisted of 39.7% of participants stating that they cook together or take turns, while 32.2% cook themselves, and 20.7% said their significant other does the cooking. Out of 10 days at home 2.33 ± 1.65 days also contained meals prepared outside of the home. Statistical significance
(p = .001) was determined between meals prepared outside of the station and the home, with more firefighters consuming meals prepared outside of the home.

**Cardiovascular Diseases**

Tobacco was being used by firefighters in this study. Based on firefighter responses, 96.6% do not smoke. Smokeless tobacco was used by 13.8% using $.875 \pm .567$ cans per day. Overall, tobacco use was seen in 15.79% of firefighters surveyed.

Potential CVD risk factors were analyzed. One firefighter had been previously diagnosed as being diabetic and was managing his symptoms through medication and diet. Diagnosis of high blood pressure in firefighters was 17.2% (n=10). Of those who were diagnosed, 12.1% (n=7) treated their diagnosis and 5.2% (n=3) remain untreated. Treatment consisted of medication and diet.

Thirty-seven firefighters stated that they knew their blood pressure; however, only 70% were within 5 mmHg for their actual systolic blood pressure and 65% for diastolic. Only 49% of firefighters were within 5 mmHg for both their combined systolic and diastolic blood pressure.

High cholesterol was assessed. Based on responses, 74.1% (n=43) of firefighters were never diagnosed with high cholesterol. Of the 24.1% (n=14) who were diagnosed, 19.0% (n=11) were treating high cholesterol through medication and/or diet. Cholesterol levels were known by 32.8% of participants. Average cholesterol level was $178.5 \pm 39.7$. Cholesterol levels were based only on reported values as no cholesterol was taken during this study. High triglyceride diagnosis was also calculated. It was determined that 8.6%
(n=5) of the participants had been diagnosed as having high triglycerides with only 60% (n=3) treating it through medication and/or diet. As for awareness of triglyceride numbers, none of the firefighters were able to state their number. Additionally, out of all the firefighters participating in the study, no one had ever been diagnosed with CVD.

**Medication/Supplement Use**

Yearly physicals are not mandatory with any Northeast Ohio Fire Department. However, 86.2% of surveyed firefighters had a check up or physical with their physician within the past year. Prescribed prescription drugs were used by 41.4% (n=24) of participants. With regards to medication types, 42% were cholesterol lowering, 25% were blood pressure lowering, 13% acid reflux, in addition to a small minority of antidepressants, thyroid, arthritis, and ADHD medications.

Supplement, vitamin, and mineral use by surveyed firefighters were 62.1% (n=36). Multivitamins were the most widely used at 58%, followed by fish oil at 42%, Vitamin D and Protein at 14%, and creatine and flax seed oil at 11%.

**Alcohol/Caffeine Use**

Alcohol use was prevalent among firefighters. Of firefighters surveyed, 82.8% (n=48) consumed alcohol, with 36.2% (n=21) consuming it 2-4 times per week. During those times, consumption would average 36.13 ± 20.13 ounces, which is approximately three, 12 ounce cans of beer. A majority, 73%, preferred beer with 13% choosing wine and 15% liquor.

Caffeine containing beverage consumption was also high. Based on firefighter responses, 86% (n=50) consumed caffeine containing beverages. Firefighters stated
43.1% (n=25) consumed caffeine containing beverages greater than one time a day averaging 17.3 ± 14.70 ounces. A majority of caffeine intake was dependent on coffee (78%) followed by pop (34%), tea (18%) and energy drinks (12%).

**Dietary Intake**

Table 8 lists the intakes of the firefighters dietary intake for an on-duty and off-duty day. No significant differences in dietary intake among on-duty and off-duty days were determined except for alcohol (p = 0.001), which demonstrated that firefighters were not consuming alcohol while on the job.

Table 8

*Dietary Intakes of Firefighters On and Off-Duty (n=50)*

| Dietary Intake               | On-Duty               | Off-Duty              | p-value
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilocalories</td>
<td>2078.97 ± 117.72</td>
<td>2104.69 ± 90.40</td>
<td>0.832</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>112.33 ± 8.41</td>
<td>102.19 ± 6.12</td>
<td>0.221</td>
</tr>
<tr>
<td>Carbohydrates (g)</td>
<td>210.32 ± 11.98</td>
<td>224.8 ± 13.29</td>
<td>0.288</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>88.63 ± 6.75</td>
<td>80.61 ± 5.42</td>
<td>0.277</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>29.72 ± 2.69</td>
<td>27.7 ± 2.33</td>
<td>0.492</td>
</tr>
<tr>
<td>Monounsaturated Fat (g)</td>
<td>26.24 ± 2.33</td>
<td>22.58 ± 2.10</td>
<td>0.193</td>
</tr>
<tr>
<td>Polyunsaturated Fat (g)</td>
<td>12.85 ± 1.54</td>
<td>11.22 ± 1.12</td>
<td>0.396</td>
</tr>
<tr>
<td>Trans Fat (g)</td>
<td>0.8 ± 0.21</td>
<td>0.92 ± 0.32</td>
<td>0.752</td>
</tr>
<tr>
<td>Omega 6 Linoleic (g)</td>
<td>9.62 ± 1.29</td>
<td>8.27 ± .84</td>
<td>0.388</td>
</tr>
<tr>
<td>Omega 3 Linolenic (g)</td>
<td>0.96 ± 0.15</td>
<td>0.92 ± 0.11</td>
<td>0.836</td>
</tr>
<tr>
<td>Cholesterol (g)</td>
<td>385.46 ± 34.04</td>
<td>343.27 ± 37.86</td>
<td>0.374</td>
</tr>
<tr>
<td>Fiber (g)</td>
<td>19.29 ± 1.46</td>
<td>18.41 ± 1.75</td>
<td>0.588</td>
</tr>
<tr>
<td>Alcohol (g)</td>
<td>0 ± 0.01</td>
<td>14.47 ± 3.72</td>
<td>0.001*</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>2828.46 ± 234.19</td>
<td>2393.19 ± 183.69</td>
<td>0.069</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>3656.94 ± 265.49</td>
<td>3636.78 ± 251.85</td>
<td>0.952</td>
</tr>
</tbody>
</table>

*a Results were based on paired sample t-test
b Statistical significance was set at p < 0.05
* Significant difference between on-duty and off-duty
Nutrition Education Opportunities

Firefighters were asked if there would be any interest in nutrition education. Of those who responded, 58.6% stated, yes, they would be interested in some form of nutrition education. A majority (91%) would find healthy eating information helpful followed by healthy cooking (47%), weight loss (38%), portion control (26%) and cardiovascular disease management (24%). With regards to study results and diet analysis, 69% preferred to have the results of the study and 40.7% wanted the diet analysis results. In comparing nutrition education interest to receiving the study results and/or the diet analysis, there was a statistically significant relationship (p = .015). Those firefighters who were interested in receiving nutrition education were also more likely to request the results of the study and the diet analysis.

Discussion

The purpose of this study was to determine if on-duty and off-duty dietary intakes varied among firefighters. With the information obtained, intent was to provide statistics for future research with regards to dietary habits, CVD risks and appropriate nutrition education. After complete analysis it was determined that the research hypothesis was rejected, resulting in a similarity between firefighters’ on-duty and off-duty dietary intakes.

Cardiovascular Related Risk Factors

Firefighters have shown to be the tallest and heaviest amongst all areas in the protective service occupations (Hsiao, Long, Snyder, 2002). As seen in Table 9, Hsiao’s
data mirrors the current findings. According to the World Health Organization (WHO) recommendation for BMI, firefighters in the current study are classified as overweight (≥ 25). However, BMI does not take into account muscle mass and current study results indicate that a large majority of firefighters weight train. The area of most concern in the current study was waist circumference and hip to waist ratio (WHR). Both measurements are correlated to an increase in cardiovascular events. A WHR ≥ 0.9 and a waist circumference ≥102 centimeters is not only a strong indicator of cardiovascular risk but is a better predictor when compared to BMI (Schneider et al., 2006).

Table 9

| Research Anthropometric Measures Compared to Current Study Findings |
|---------------------------|---------------------------|
| **Research Findings**     | **Current Findings**      |
| Height (cm)               | 177.7ᵃ                   | 180.7 ± 5.9 |
| Weight (kg)               | 88.8ᵃ                   | 93.9 ± 11.4 |
| BMI                       | 28.1ᵃ                   | 28.5 ± 3.60 |
| Waist Circumference (cm)  | 97.5ᵃ                   | 99.1 ± 10.7 |
| Waist to Hip Ratio        | ≥ .90ᵇ                    | 0.95 ± 0.10 |

b Based on World Health Organization standard of ≥.90 increases CVD risk

Abdominal fat, as seen in the current study, has been shown to be an independent risk factor for diabetes, coronary artery disease, stroke, and hypertension (HTN) (Hu, Jousilahti, Antikainen, Katzmarzyk, & Toomilehto, 2010; Schneider et al., 2006).

Continuously firefighters are placing themselves at risk on a daily basis for others; however, they themselves are at risk for increased cardiovascular complications as a result of borderline or higher than normal anthropometric measurements predicting CVD.
Other risk factors besides anthropometrics are smoking, diabetes, blood pressure, cholesterol and triglycerides. These factors correlate with a higher prevalence of CVD.

For more than 40 years tobacco has been recognized as an increased risk for CVD (Mahan & Escott-Stump, 2008). The risk imposed by tobacco may be magnified if other cardiovascular risks are present. In this study, tobacco was being used by 15.79% of participants in the form of cigarettes or smokeless tobacco. Being the health care field, firefighters are well aware of the risk of using tobacco and the stressors that it places on the heart and lungs. In conjunction with anthropometric measurements predicting CVD risk, tobacco use can further increase firefighters risk.

HTN continues to be a common and powerful contributor to CVD (Kennel, 1996). HTN is classified as having an average blood pressure higher than 140 mmHg systolic or 90 mmHg diastolic (Mahan & Escott-Stump, 2008). Outcomes from this study indicated firefighters, on average, do not have high blood pressure as determined by a systolic and diastolic blood pressure of 124 ± 10.3 and 49 ± 7.5. However, results may not be an accurate representation, as 25% of firefighters were prescribed blood pressure lowering medication.

Diagnosis of high cholesterol and participant’s cholesterol number was assessed. On average, 24.1% of firefighters were diagnosed with high cholesterol. In conjunction, mean reported cholesterol averaged 178.55 ± 39.69. Numerically, >200 indicates a diagnosis of high cholesterol. While the average cholesterol was lower than 200, 42% of firefighters taking medication were on a cholesterol lowering prescription. Dietary cholesterol was also above the recommended intake, both indicating a need for education
on cholesterol management through proper food choices seeing as an increase in blood cholesterol can result in a positive risk factor for CVD.

High triglyceride diagnosis (> 150 ml/dL) was found in 8.6% of firefighters. The current study determined that no participants were aware of their triglyceride number. Even with a low diagnosis, overall education in knowing personal CVD numbers such as blood pressure, cholesterol, and triglycerides may increase CVD awareness among firefighters, and lower risk for future complications.

Low level of fitness (i.e., physical inactivity) is not only a risk factor for CVD but it has been shown to increase the risk of heart disease and stroke by 50% (“Cardiovascular disease risk factors,” 2010, Mahan & Escott-Stump, 2008). With regards to this study, data indicated 81% of participants were physically active at the station and 82.8% at home. Physical activity was well within American College of Sports Medicine (ACSM) recommendations of moderate-intensity cardiorespiratory exercise for at least five days a week or greater than 30 minutes adding up to a total greater than 150 minutes per week; as indicated by an average of 6.8 ± 3.81 days of physical activity on-duty and 6.0 ±2.78 days off-duty. Minutes per day are also following ACSM recommendations, as on-duty physical activity duration was 57.22 minutes ± 27.11 and 65.29 ± 29.77 minutes for off-duty. Because physical inactivity has an impact on other risk factors including HTN, triglycerides, high density lipoproteins (HDL), diabetes and obesity, it is very important for firefighters to maintain their high levels of activity because it will not only benefit CVD risk factors but improve the body’s

**Dietary Habits**

Uncertainty of a firefighters next meal, due to the nature of their job, may cause poor dietary habits. Portions are large as a result of not knowing if that will be the only meal consumed during the day (Spittler, 2009). Comparing on-duty and off-duty lunch and dinner frequencies out of ten days, more meals were typically consumed on-duty versus off-duty displaying statistically significant results. Thirty-one million consumers skip breakfast each day and firefighters are no different (“Morning Mealscape”, 2011). Breakfast, which is deemed as the most important meal of the day, is essential in boosting metabolism after an overnight fast and in replenishing nutrient stores that were used during the night (“The Proven Benefits of Breakfast,” 2007). When breakfast is skipped, much as it is with firefighters (consumed only 5.2 days of the week), blood glucose levels drop causing fatigue and poor concentration, all of which are very important when safety is on the line. The decrease in breakfast consumption may be a result of the time of day reporting to work. Stations require early morning roll call, which places an added stressor on where to eat breakfast, at home or at the station. If breakfast was to be consumed at the station emergency runs may interfere with meal plans. According to the current study, both lunch and dinner meals were consumed more regularly. Lunch was eaten 5.95 days out of the week and dinner at 6.79 days. Increases in lunch and dinner may be a result of skipping breakfast or meal consistency.
Dining Habits

Firefighters spend a large majority of their time together. Closeness at the fire station results in a camaraderie among firefighters (Staley, 2009). Firefighter camaraderie is often a result of dependency on one another in the line of duty. The same can be said for their dining habits. Eating meals in a group at an average of $8.19 \pm 2.99$ workdays out of 10 for lunch and $9.14 \pm 2.05$ for dinner, demonstrates firefighters closeness. Relationship development and sense of community have been shown to occur with group eating, which may be directly correlated with the brotherly bond of firefighters (“Research on the Benefits of Family Eating,” 2011).

Shopping and Cooking Habits

Firefighters are known nationwide for being great cooks (McKay, 2011). Pride and at times competitiveness occurs from wanting to be known as the fire station with the best meals (McKay, 2011). This ability to cook great meals may translate to a lower than typical take out/ fast food consumption; however, it may actually be higher than the average. In a recent study by the United States Department of Agriculture (USDA), 75% of individuals typically ate out at least once per week (USDA, 2006). Correlating with those statistics, firefighters typically prepared meals outside of the station $1.46 \pm 2.13$ times every ten days. Off-duty consuming meals prepared outside of the home were more frequent with $2.33 \pm 1.65$ times every ten days. Eating meals prepared from an outside source may lead to an increase in caloric intake and excess sodium and fat consumption. Dietary intake with regards to sodium and fat are already exceeding
recommendations which indicate further education to address selecting proper portion sizes and healthier dining out options, in order to decrease cardiovascular risk.

**Health Awareness**

Many fire departments do not have requirements for periodical medical examinations (Kales, Soteriades, Christophi & Christiani, 2007). However as displayed in the current study, 86.2% of firefighters were receiving an annual physical or check up. Awareness of blood pressure numbers were also common. Sixty-three percent of firefighters stated that they knew their blood pressure and 49% of responses were within 5 mmHg for both systolic and diastolic measurements. Availability of blood pressure tools may have caused a high accuracy rate or it could be due to the 17.2% who have been diagnosed with high blood pressure and their awareness of personal blood pressure. Through this study a majority of firefighters were consuming vitamins, minerals and herbs. Approximately 61.1% of participants took a vitamin, mineral or herb, with over 50% taking multivitamin and/or fish oil. Multivitamins have been recommended for those lacking nutrient intake, while fish oil has been shown to lower triglycerides, the risk of heart attack and strokes in those with CVD and to slow the build up of atherosclerotic plaque (deLorgeril et al., 1995). Overall, it appears that participants in this study were taking medication and supplements that are related to CVD; however, they were over consuming nutrients that have been linked to increasing cardiovascular complications.

**Dietary Intake**

While no significance was found between on-duty and off-duty dietary intakes there were still major concerns with firefighters dietary habits.
According to Dietary Guidelines for Americans, protein consumption should be approximately 56 grams per day for males ages 19 to 51 and older (Dietary Guidelines, 2010). Based on average intake of all participants protein intake was 102.19 grams ±43.28 for off-duty and 112.33 grams ±59.49 for on-duty, both well over the recommended amount. Increased protein consumption was positively correlated to strength training, which was seen in 69% of on-duty firefighters who were physically active and 32% of off-duty physically active firefighters. Many firefighters were also supplementing with protein while on-duty and off-duty. While the increase in protein may help with strength training and muscle mass, excess protein in the urine correlates with an increased risk for heart disease and stroke (Wake Forest, 2010).

According to the DASH diet, 55% of kilocalories is recommended for carbohydrate consumption. With 2104.69 ± 639.25 kilocalories being consumed off-duty and 2078.96 ± 59.49 on-duty, recommended carbohydrate intake is approximately 289.39 grams off-duty and 285.86 grams on-duty. Both on and off-duty intakes were fairly low at 224.80 ± 93.98 (off) and 210.32 ± 84.72 (on). The decrease in carbohydrates may be influenced by the larger than recommended intake of protein as a result of strength training. When a firefighter is only taking in a general amount of calories and those calories are divided among carbohydrates, fats, and protein, and protein and fats are already high in calories, carbohydrate calories will be low. If carbohydrates were to be increased, consumption should include high fiber and whole grain products, as they may be beneficial in decreasing CVD risk by lowering cholesterol and blood pressure.
Total fat is often consumed in large amounts in the typical American diet and firefighters were no different. Total fat intake for adults 19 years of age and older is 20-35% of kilocalories. This recommendation would be approximately 58 grams of total fat based on kilocalorie intake of 2104.69 ± 639.25 (off) and 2078.96 ± 59.49(on). Firefighters in this study were well above the mark at 80.62 ± 38.37 (off) and 88.63 ± 47.76 (on). Similarly, saturated fat slightly exceeded the recommendation of < 10% of kilocalories from saturated fat. Recommendations were 31.1 grams (off) and 23.89 (on) compared to 27.70 ± 16.53 (off) and 29.73 (on). Trans fat was also consumed in excess. Recommendations are to consume none if not minute quantities and firefighters intakes were approximately 1 gram. The increase in overall fat consumption may be associated with firefighters’ large protein intake. Based on the 24 hour recalls, firefighters were often consuming large quantities of high fat protein foods such as ground beef, pot roast, and sausage. As a result of the large amount of fat consumption and its known impact on CVD, it may be beneficial to decrease fat intake, by selecting lower fat protein sources, or modifying the types of fat to more “heart healthy” varieties such as mono and polyunsaturated fatty acids which have been proven to decrease low density lipoprotein cholesterol (LDL) preventing further cardiac events (deLorgeril et al., 1995; Hu et al., 2002).

Dietary cholesterol consumed above 200 mg/day places individuals at risk for precipitating cardiovascular risks (Mahan & Escott-Stump, 2008). According to this study, firefighters were consuming above and beyond the daily recommendations.
On-duty cholesterol intake was calculated at 385.46 ± 34.04 and off-duty at 343.27 ± 37.86. As previously stated, high blood cholesterol prevalence was low among participants; however, of firefighters taking prescription drugs, 42% are taking cholesterol lowering medication. Both forms of cholesterol need to be stressed with the implementation of nutrition education. Awareness of blood cholesterol as well as dietary cholesterol levels may decrease intake of high cholesterol foods thus potentially decreasing cardiovascular risk.

Increasing fiber consumption is shown to decrease cholesterol by binding to bile acid, which lowers serum cholesterol, in addition to lowering blood pressure (Mahan & Escott-Stump, 2008; Vuksan et al., 1999). This study found fiber consumption to average 18.41 ± 12.35 grams for off-duty and 19.29 ± 10.33 grams for on-duty, much below the recommendation of 25-30 grams per day (Dietary Guidelines, 2010). Benefits to increase fiber through the consumption of whole grains, legumes, fruits and vegetable may benefit not only cardiovascular risks but also regularity and feelings of satiety to decrease overall kilocalorie consumption.

Alcohol consumption calculated from the 24 hour recalls placed firefighters on track for the recommended two drinks a day to decrease CVD risk, based on the average 14.7 ± 26.34 grams (Beulens et al., 2007). However, according to the questionnaire, intake was approximately 36.2 ± 20.13 ounces and consumption was 2-4 times per week. The average beer is 12 ounces, which was what a majority (73%) consumed, placing the total to three beers. While beer is considered the drink of choice, firefighters might consider switching to red wine for its heart healthy benefits. Red wine seems to have
even more heart-healthy benefits than other types of alcohol due to the antioxidant derivative resveratrol ("Red Wine and Resveratrol," 2011). Resveratrol has been shown to not only protect arterial linings but to decrease LDL cholesterol and prevent blood clots ("Red Wine and Resveratrol," 2011). Because of red wine’s heart healthy properties, switching from beer does not increase the recommendations for alcohol consumption. Regardless the type, consumption still needs to be no more than 2 drinks a day to ensure regulation of blood pressure and total triglycerides (Beulens et al., 2007).

With regards to sodium, intake was well above the recommended 2,300 mg a day as with most Americans. (Dietary Guidelines, 2010). Average intake on-duty was 3636.78 mg ± 1780.88 and 3656.94 mg ±1877.26. In reviewing firefighter’s 24 hour dietary recalls, high sodium is not a result of using table salt but of consuming large amounts of lunch meats, cheeses, bacon, sausage and potato chips. As high blood pressure was found in 17.2% of firefighters and 25% of medication being prescribed was antihypertensive, it is thought that sodium consumption would be within normal limits as a way of treatment. However, this was not the case. Major concern needs to be placed on sodium intake as a result of increased quantities, a large diagnosis of high blood pressure, and use of antihypertensive drugs. If firefighters continue sodium intake as is, it may lead to an increase in blood pressure and precipitate other cardiovascular risks.

Potassium, while conflicting in the data with regards to CVD causes, remains low in consumption (Mahan & Escott-Stump, 2008). Recommendations for potassium are 4,700 mg according to U.S. Dietary Guidelines (Dietary Guidelines, 2010). Intake
off-duty was 2393.19 ±1289.91 and 2828.26 ±1655.97 for on-duty. Increasing potassium rich foods such as fruits and vegetables may assist in increasing overall potassium intake.

In general, while this study did not find any statistically significant data between on-duty and off-duty dietary intakes, it did find major concerns with firefighters overall nutrient intakes. Many nutrients correlated with an increased risk of CVD were consumed in higher than recommended amounts. Awareness of these increased amounts can benefit future nutrition education, by focusing on lowering nutrients prevalent to cardiovascular risks.

Limitations

Several of the study limitations are noted. The total number of participants recruited was 58 generating a relatively small sample size. Selection may also have been biased, as firefighters willing to participate could have been more health conscience than non-participants, leading to an underestimation of cardiovascular implications. Location was subject to only Northeast Ohio, resulting in variance of statistics if study is performed elsewhere. The study was also based on full time firefighters and may not speak for part time. Survey information was completed in a group setting. Influencing of responses may have been a factor. Calibration of station provided anthropometric equipment (stadiometer, scale, blood pressure cuff and LifePack machine) was unknown to the researcher, and may have skewed measurements. Blood pressure comparison percentage of known to actual may have been elevated due to some firefighters taking blood pressure prior to completing the questionnaire. Additionally, dietary intakes may have been less than accurate based on lack of experience in determining proper portion
sizes and brand names. Similarly, meals were often prepared at home/station and food selection choices often did not give home cooked options.

**Application**

As study results indicate, nutrition education is a must in the area of fire service. Firefighters put their lives at risk everyday for others, but they themselves are the ones at risk. The need for nutrition education can be seen throughout this study. Firefighters were overweight, based on BMI and WHR, smokers and drinkers who were taking blood pressure and cholesterol lowering medication and were consuming excess amounts of fat, cholesterol and sodium. Adding those modifiable risks to the job stressors of increased heart rate, smoke inhalation, heat stress, and intense physical activity firefighters lives were greatly in danger of cardiovascular events. Even with the large prevalence of cardiovascular risks occurring for this group, only 24% of those wanting nutrition education were interested in cardiovascular disease management.

However, there is a positive in working with such a unique group. In a study by Staley, Weiner, and Linnan (2011) firefighters stated that they were greatly influenced by personal motivation and personal motivation was reinforced when combined with a strong interpersonal influence such as a chief or lieutenant. The same study also found that those individuals in charge (chief or lieutenant) greatly influenced other firefighters (Staley, Weiner & Linnan, 2011). This camaraderie among firefighters plays an important role in nutrition education and dietary change due to the fact of peer influence. Based on Staley, Weiner, and Linnan’s results, when spearheading nutrition education it
may be important to have those in charge “on board” as to influence others and make the education successful.

According to the desire for nutrition education, roughly 58.6% of firefighters stated that they would be interested in future nutrition education. Due to not only the large demand for education, but the need for it as well, health educators should be focusing on this high risk population. As the results of the study indicated, separate modification of on-duty and off-duty diets would not be necessary as intake is similar. Dietary intakes however, would need to be modified for this unique group of individuals. Overall, both past findings and this current study indicate an increased risk of CVD for firefighters. Therefore, it is imperative that health educators do their best to educate this population. With a lack of public policy surrounding cardiovascular risks and firefighting, nutrition education may be the only means to decreasing cardiovascular risk.

Conclusion

Outcomes from this study indicate a great demand for nutrition education based on firefighter’s anthropometrics, dietary habits, cardiovascular risks and dietary intake. Additionally, while no significance was determined between on-duty and off-duty dietary intakes, it is important to further investigate nutrient consumption and cardiovascular risks. Future research focusing on eating habits, dietary intake and group influence may be necessary to broaden the literature on CVD risks and firefighters, and potentially lead to the development of a firefighter wellness policy.
APPENDICES
APPENDIX A

LETTER OF CONSENT
Appendix A
Letter of Consent

Informed Consent to Participate in a Research Study

**Study Title:** Firefighters and Cardiovascular Disease: An Assessment of Cardiovascular Risk Factors and Dietary Intake

**Principle Investigator:** Liz Kitchen

You are being invited to participate in a research study. This consent form will provide you with information on the research project, what you will need to do, and the associated risks and benefits of the research. Your participation is voluntary. Please read this form carefully. It is important that you ask questions and fully understand the research in order to make an informed decision. You will receive a copy of this document to take with you.

**Purpose**
To determine the dietary intake of firefighters on-duty versus off-duty along with providing dietary feedback for future research with regards to firefighters, dietary habits and CVD, and determining what appropriate dietary interventions, if any, would be applicable to this population.

**Procedures**
Participants will be asked to fill out a questionnaire with regards to their eating and exercise habits along with their diet at the station and at home. A 2-day food record will also be completed for a workday at the station and a day at home. Measurements including blood pressure, height, weight, waist circumference and total cholesterol will be taken as well.

**Benefits**
Potential benefits of participating in this study will include knowing height, weight, waist circumference, total cholesterol and blood pressure which may lead to awareness with respect to cardiovascular disease risk. Benefits will also include diet intake awareness.

**Risks and Discomforts**
There are no anticipated risks beyond those encountered in everyday life.
Privacy and Confidentiality
All participants will be required to use a 4 digit identification number (last 4 digits of their phone number) to ensure confidentiality. Your study related information will be kept confidential within the limits of the law. Any identifying information will be kept in a secure location and only the researcher will have access to the data. Research participants will not be identified in any publication or presentation of research results; only aggregate data will be used.

Voluntary Participation
Taking part in this research study is entirely up to you. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. You will be informed of any new, relevant information that may affect your health, welfare, or willingness to continue your study participation.

Contact Information
If you have any questions or concerns about this research, you may contact Liz Kitchen at (440) 223-9918 or Dr. Karen Gordon at (330) 672-2248. The Kent State University Institutional Review Board has approved this project. If you have any questions about your rights as a research participant or complaints about the research, you may call the IRB at (330) 672-2704.

Consent Statement and Signature
I have read this consent form and have had the opportunity to have my questions answered to my satisfaction. I voluntarily agree to participate in this study. I understand that a copy of this consent will be provided to me for future reference.

_________________________________________  ________________
Participant Signature                              Date

_____________________________  __________________  _____________
Address

      City                                      State                                     Zip

ID # (Last 4 Digits of Phone Number)
APPENDIX B

FIREFIGHTER’S QUESTIONNAIRE
Appendix B  
Firefighter’s Questionnaire  

An Assessment of Cardiovascular Risk Factors in Firefighters 
Firefighter Questionnaire

Thank you for taking part in this study focusing on Firefighter’s dietary habits and cardiovascular disease risk. Please complete the information below as accurately as possible.

I.D.# (Last 4 Digits of Telephone Number): ________________________________

Employee Status (please circle): Full Time Part Time

Gender (please circle): Male Female

Age (in years): __________________________

Length of Employment (in years): ________________________________

The following questions pertain to your **BREAKFAST** habits

1. How many days per week do you typically eat breakfast? (please circle)

   1  2  3  4  5  6  7

   While on shift, how often do you eat breakfast? (please circle)

   Always Usually Sometimes Rarely Never

   While at home, how often do you eat breakfast? (please circle)

   Always Usually Sometimes Rarely Never

   Out of 10 workdays, how many times do you eat breakfast alone or in a group?

   Alone _____________________ Group _____________________
When eating breakfast at the station how often do you feel pressure to eat in a group? (please circle)

Always               Usually    Sometimes    Rarely    Never

Out of 10 days at home, how many times do you eat breakfast alone or with someone?

Alone _____________________    Someone _______________________

When eating breakfast at home how often do you feel pressure to eat with someone? (please circle)

Always               Usually    Sometimes    Rarely    Never

The following questions pertain to your LUNCH habits

2. How many days per week do you typically eat lunch? (please circle)

1                  2                  3                  4                  5                  6                  7

While on shift, how often do you eat lunch? (please circle)

Always               Usually    Sometimes    Rarely    Never

While at home, how often do you eat lunch? (please circle)

Always               Usually    Sometimes    Rarely    Never

Out of 10 workdays, how many times do you eat lunch alone or in a group?

Alone _____________________    Group _______________________

When eating lunch at the station how often do you feel pressure to eat in a group? (please circle)

Always               Usually    Sometimes    Rarely    Never
Out of 10 days at home, how many times do you eat lunch alone or with someone?

Alone _____________________  Someone _____________________

When eating lunch at home how often do you feel pressure to eat with someone? (please circle)

Always  Usually  Sometimes  Rarely  Never

The following questions pertain to your DINNER habits

3. How many days per week do you typically eat dinner? (please circle)

1  2  3  4  5  6  7

While on shift, how often do you eat dinner? (please circle)

Always  Usually  Sometimes  Rarely  Never

While at home, how often do you eat dinner? (please circle)

Always  Usually  Sometimes  Rarely  Never

Out of 10 workdays, how many times do you eat dinner alone or in a group?

Alone _____________________  Group _____________________

When eating dinner at the station how often do you feel pressure to eat in a group? (please circle)

Always  Usually  Sometimes  Rarely  Never

Out of 10 days at home, how many times do you eat dinner alone or with someone?

Alone _____________________  Someone _____________________
When eating dinner at home how often do you feel pressure to eat with someone? (please circle)

Always       Usually       Sometimes       Rarely       Never

The following question pertains to **PHYSICAL ACTIVITY**

4. At the station do you participate in physical activity? (please circle)

   YES       NO

   If YES, what type of physical activity? (please circle ALL that apply)

   Weight Training       Treadmill/Elliptical       Stationary Bike       Other____________

   Out of 10 workdays how many times do you participate in physical activity?

      # of times ________________________

      Typically for how long?

5. At home do you participate in physical activity? (please circle)

   YES       NO

   If YES, what type of physical activity? (please circle ALL that apply)

   Weight Training       Treadmill/Elliptical       Stationary Bike       Other____________

   Out of 10 days at home, how many times do you participate in physical activity?

      # of times ________________________

      Typically for how long?
The following questions pertain to habits AT THE STATION

6. At the station who does the grocery shopping? (please circle)

   No One Specific  A Designated Person
   - I am the Designated Person

   Several Firefighters  Individual Shopping

7. At the station who does the cooking? (please circle)

   No One Specific  A Designated Person
   - I am the Designated Person

   Several Firefighters  Individual Shopping

8. At the station, out of 10 workdays how many times do you typically eat take out?
   # of times ________________________

The following questions pertain to habits AT HOME

9. At home who does the primary grocery shopping? (please circle)

   Myself  Significant Other  Both/Take Turns  Other__________

10. At home who does the cooking? (please circle)

    Myself  Significant Other  Both/Take Turns  Other__________

11. At home, out of 10 days how many times do you typically eat take out?

    # of times ________________________
The following questions pertain to **EVERYDAY HABITS**

12. Do you smoke? (please circle):

   YES    NO

   If YES, how many cigarettes do you smoke per day?

   # of cigarettes ________________________

13. Do you use smokeless tobacco? (please circle):

   YES    NO

   If YES, how many cans do you go through per day?

   # of cans ________________________

14. Have you been diagnosed by your Doctor as being Diabetic? (please circle)

   YES    NO

   If YES, is it being treated? (please circle)

   YES    NO

   If YES, how is it being treated? (please circle ALL that apply)

   Medication    Diet    Other _________________

15. Have you been diagnosed by your Doctor as having high blood pressure? (please circle)

   YES    NO

   If YES, is it being treated? (please circle)

   YES    NO

   If YES, how is it being treated? (please circle ALL that apply)

   Medication    Diet    Other _________________
16. Do you know what your blood pressure reading is (please circle)?

YES      NO

If YES, list the reading

17. Have you been diagnosed by your Doctor as having high cholesterol? (please circle)

YES      NO

If YES, is it being treated?

YES      NO

If YES, how is it being treated? (please circle ALL that apply)

Medication      Diet      Other ____________________

18. Do you know what your cholesterol number is?

YES      NO

If YES, list the number

19. Have you been diagnosed by your Doctor as having high triglycerides? (please circle)

YES      NO

If YES, is it being treated? (please circle)

YES      NO

If YES, how is it being treated? (please circle all that apply)

Medication      Diet      Other ____________________

20. Do you know what your total triglyceride number is? (please circle)

YES      NO

If YES, list the number
21. Have you been diagnosed by your Doctor as having any cardiovascular diseases? (please circle)

YES  NO

If YES, is it being treated? (please circle)

YES  NO

If YES, how is it being treated? (please circle ALL that apply)

Medication  Diet  Other __________________

22. In the past year, have you had a check-up/ physical with your Doctor? (please circle)

YES  NO

23. Are you currently taking any prescription medications? (please circle)

YES  NO

If YES, what medications are you taking?

24. During the past year have you taken any vitamins, minerals or other supplements? (please circle)

YES  NO

If YES, please list the vitamin, mineral and/or supplement and the amount you take/ took per day (mg/day)

25. Do you typically consume alcoholic beverages? (please circle)

YES  NO

If YES, how often (please circle)

<1x/ month  1-3x/month  1x/week  2-4x/week  5-6x/week  1x/day  >1x/day

How many ounces per sitting? _________________________________
What type of alcohol do you typically consume? (please circle ALL that apply)

Beer  Wine  Liquor

26. Do you typically consume caffeine containing beverages? (please circle)

YES  NO

If YES, how often (please circle)

<1x/ month  1-3x/month  1x/week  2-4x/week  5-6x/week  1x/day  >1x/day

How many ounces per sitting? ________________________________

What type of caffeine do you typically consume? (please circle ALL that apply)

Coffee  Tea  Pop  Energy Drinks

27. Would you be interested in nutrition education if it were available? (please circle)

YES  NO

If YES, what type would you be interested in? (please circle ALL that apply)

Healthy Eating  Healthy Cooking  Weight Loss  Diabetes Management

Cardiovascular Management  Portion Control  Label Reading

Grocery Store Tour  Other ________________________________

Would you like to receive the results of the study? (please mark box)

YES ☐  NO ☐

Would you like to receive your diet analysis results? (please mark box)

YES ☐  NO ☐

THANK YOU FOR TAKING TIME TO FILL OUT THE SURVEY!
APPENDIX C

ANTHROPOMETRIC MEASUREMENTS
Appendix C
Anthropometric Measurements

An Assessment of Cardiovascular Risk Factors in Firefighters: Anthropometric Data

ID #______________________________

♥ Height (cm): ____________________________

♥ Weight (kg): ____________________________

♥ Hip Circumference (cm): __________________

♥ Waist Circumference (cm): __________________

♥ Blood Pressure (mmHg): ____________________________
APPENDIX D

TWO DAY 24 HOUR DIETARY RECALL
Appendix D
Two Day 24 Hour Dietary Recall

Firefighters and Cardiovascular Disease:
An Assessment of Cardiovascular Risk Factors and Dietary Intake

Directions
24 Hour Dietary Recall

- Choose a *typical station workday and one off-duty day* to record your food and beverage consumption. Each day should be one continuous 24-hour time period.

- Write down *everything*, you eat, the time you ate it at and if it is a snack or a meal on the form provided. This includes food, beverages and ingredients from mixed dishes. Include alcohol consumption. When in doubt, write it down! Be certain to fully describe each food item (e.g. % milk, whole wheat bread, lite beer, medium egg, lean ground beef, etc.).

- Record the amount of each item you consumed on the intake record. (i.e.: Cups, tablespoons, teaspoons, ounces, grams, pieces etc.)

- Record the preparation method where appropriate. Items can be prepared in a variety of ways, such as grilled, fried, steamed or baked.

- Record a brand name/ off brand if known (e.g. Kellogg’s Raisin Bran, Pepsi, etc).

- Record where you consumed the meal or snack. If you ate it at the station just put station, if it was at home list home. For those meals consumed out of the home (i.e.: restaurant) please list the restaurant name.

- For meals eaten at a restaurant please approximate serving sizes and what was included in the meal. For example if you at Subway, please list what size sub, what kind of bread, cheese, meat, and then what toppings you put on your sub along with any dressing. Do not forget beverages!

- Try to record your food intake after every meal and snack. If you wait until the end of the day to record these items, you will likely forget to write something down and it will be difficult to capture the detail required. Multiple forms may be necessary.
Please Refer To The Attached Example

2 Day Diet Recall

ID#_______EXAMPLE__________________

DATE _______________________________

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal/ Snack</th>
<th>Food Item</th>
<th>Amount</th>
<th>How Prepared</th>
<th>Brand Name</th>
<th>Home Cooking or Dining Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 AM</td>
<td>MEAL</td>
<td>EGGS- LARGE</td>
<td>2 EGGS</td>
<td>FRIED</td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BUTTER</td>
<td>1 TBL</td>
<td>USED TO COOK</td>
<td>LAND O’ LAKES</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAUSAGE LINKS</td>
<td>4 LINKS</td>
<td>SKILLET</td>
<td>BOB EVANS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>WHOLE WHEAT BREAD</td>
<td>2 SLICES</td>
<td>TOASTED</td>
<td>BROWN BURY</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SKIM MILK</td>
<td>16 OZ</td>
<td></td>
<td></td>
<td>DARYMENS</td>
</tr>
<tr>
<td>1:00PM</td>
<td>SNACK</td>
<td>TORTILLA CHIPS-</td>
<td>2 OZ</td>
<td></td>
<td>TOSTITOS</td>
<td>STATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SALSA- MILD</td>
<td>1 C</td>
<td></td>
<td>CHI CHI’S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>WATER</td>
<td>16 OZ</td>
<td></td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td>3:00 PM</td>
<td>SNACK</td>
<td>APPLE- GALA</td>
<td>1 APPLE</td>
<td></td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td>5:00PM</td>
<td>MEAL</td>
<td>CHICKEN BREAST (W/ SKIN)</td>
<td>6 OZ</td>
<td>GRILLED</td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SALT</td>
<td>1 TSP</td>
<td></td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PEPPER</td>
<td>1 TBP</td>
<td></td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PEROGIES- POTATO/ONION</td>
<td>4 PEROGIES</td>
<td>BOILED</td>
<td>MRS. T’S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BROCOLLI- FRESH</td>
<td>2 C</td>
<td>STEAMED</td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WATER</td>
<td>20 OZ</td>
<td></td>
<td></td>
<td>STATION</td>
</tr>
<tr>
<td>8:00</td>
<td>SNACK</td>
<td>ICE CREAM- STRAWBERRY</td>
<td>1.5 C</td>
<td></td>
<td>PIERRE’S</td>
<td>STATION</td>
</tr>
</tbody>
</table>
## ON-DUTY
2 Day Diet Recall

ID# ________________________________

DATE ________________________________

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal/ Snack</th>
<th>Food Item</th>
<th>Amount</th>
<th>How Prepared</th>
<th>Brand Name</th>
<th>Home Cooking or Dining Out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## OFF-DUTY
2 Day Diet Recall

| ID #_______________________________ |
| DATE ______________________________ |

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal/ Snack</th>
<th>Food Item</th>
<th>Amount</th>
<th>How Prepared</th>
<th>Brand Name</th>
<th>Home Cooking or Dining Out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

FEEDBACK OF STUDY RESULTS
Appendix E
Feedback of Study Results

Study Results

Average Characteristics of Firefighters
- Age: 38.74 years
- Length of Employment: 13.90 years
- Height: 180.71 cm / 5’ 9”
- Weight: 93.96 kg / 206.7 lb
- Hip Circumference: 107.12 cm / 42 in
- Waist Circumference: 99.05 cm / 38.99 in
- Systolic Blood Pressure: 123.82 mmHg
- Diastolic Blood Pressure: 79.13

General Meal Habits
- Average number of days breakfast is eaten: 5.12
- Average number of days lunch is eaten: 5.95
- Average number of days dinner is eaten: 6.79

On-Duty Meal/Shopping Habits
- 37.9% always eat breakfast
- 96.6% always eat lunch
- 98.3% always eat dinner

- Meals eaten alone out of 10 workdays:
  - Breakfast: 4.09 days
  - Lunch: 1.50 days
  - Dinner: 0.57 days

- Meals eaten in a group out of 10 workdays:
  - Breakfast: 3.79 days
  - Lunch: 8.10 days
  - Dinner: 9.14 days

- Pressure to eat in a group:
  - Breakfast: 53% said never
  - Lunch: 39.7% said never
  - Dinner: 36.2% said never

- Out of 10 workdays, meals consumed as “take out”: 1.46
• At the station a majority (55.2%) said that no one specific does the shopping

• At the station a majority (62.1%) said several firefighters prepare meals

**Off-Duty Meal/Shopping Habits**

• 44.8% always eat breakfast

• 37.9% always eat lunch

• 82.8% always eat dinner

• Meals eaten alone out of 10 days at home:
  o Breakfast: 4.60 days
  o Lunch: 5.97 days
  o Dinner: 2.98 days

• Meals eaten with someone out of 10 days at home:
  o Breakfast: 3.62 days
  o Lunch: 3.00 days
  o Dinner: 6.47

• Pressure to eat with someone:
  o Breakfast: 62% said never
  o Lunch: 69% said never
  o Dinner: 43% said never

• Out of 10 days at home, meals consumed as “take out”: 2.33

• At home 34.5% said their significant other does the grocery shopping and 31.6% shop themselves

• At home 39.7% cook together or take turns cooking, 32.2% do the cooking themselves, and 20.7% said their significant other cooks

**Physical Activity**

• On-duty 81% participated in physical activity
  o Physical activity out of 10 workdays: 6.8
  o Duration of physical activity: 57.22 minutes
o Physical activity preference:
  ▪ Weight Train: 62.07%
  ▪ Treadmill: 56.9%
  ▪ Stationary Bike: 10.34
  ▪ Cross Fit: 8.62%
  ▪ Other: 5%

• Off-duty 82.8% participated in physical activity
  o Physical activity out of 10 days at home: 6.12
  o Duration of physical activity: 65.29 minutes
  o Physical activity preference:
    ▪ Weight Train: 39%
    ▪ Treadmill: 44%
    ▪ Run Outside: 21%
    ▪ Bike: 14%
    ▪ Cross Fit, Sports: 7%

**Cardiovascular Risks**
• 96.6% have not smoked

• 84.5% have not used smokeless tobacco

• 96.6% have never been diagnosed with diabetes

• 81.0% have never been diagnosed with high blood pressure
  o 17.2% have high blood pressure and 70% are treating it through either diet and/or medication

• 63% knew what their blood pressure was
  o Only 16% were within 5 mmHg for both systolic and diastolic

• 74.1% have never been diagnosed with high cholesterol
  o 24.1 have high cholesterol and 78.6% are treating it though either diet and/or medication

• 32.8% knew what their cholesterol was
  o Average cholesterol was 187.5 but this is only based on reported values

• 89.7% have never been diagnosed with high triglycerides
  o 8.6% have high triglycerides and 60% are treating it through diet and/or medication

• No one knew their triglyceride number

• No one has ever been diagnosed with cardiovascular disease
• 86.2% have had a physical with a physician in the past year

Medication/Supplements
• 41.4% took prescription drugs
  o Cholesterol: 42%
  o Blood Pressure 25%
  o Acid Reflux: 13%
  o Antidepressant, Thyroid, Arthritis, ADHD: 8%
  o Diabetic: 4%

• 62.1% took vitamins, minerals or supplements
  o Multivitamin: 58%
  o Fish Oil: 42%
  o Vitamin D, Protein: 14%
  o Creatine, Flax Seed: 11%
  o Vitamin C, Sports Supplements: 8%
  o Other: 33%

Alcohol/Caffeine
• 82.5% consumed alcohol
• 36% consumed alcohol 2-4 times per week
• Average alcohol consumption: 36.13 ounces
• Alcohol preferences
  o Beer: 73%
  o Wine: 13%
  o Liquor: 15%

• 86.2% consumed caffeine containing beverages
• 43.1% consumed caffeine containing beverages more than 1 time a day
• Average caffeine containing beverage consumption: 17.38 ounces
• Caffeine containing beverage preferences
  o Coffee: 78%
  o Tea: 18%
  o Pop: 34%
  o Energy Drinks: 12%

Nutrition Education
• 58.6% were interested in nutrition education
  o Healthy Eating: 91%
  o Healthy Cooking: 47%
  o Weight Loss: 38%
  o Portion Control: 36%
- Cardiovascular Disease Management: 24%
- Label Reading: 9%
- Grocery Store Tour: 6%

### Dietary Intake

<table>
<thead>
<tr>
<th>Dietary Intake</th>
<th>Off-Duty</th>
<th>On-Duty</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilocalories</td>
<td>2,104.69</td>
<td>2078.97</td>
<td>25-28 g/kgBW</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>102.19</td>
<td>112.33</td>
<td>56 g</td>
</tr>
<tr>
<td>Carbohydrates (g)</td>
<td>224.8</td>
<td>210.32</td>
<td>285.4-285.8 g</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>80.61</td>
<td>88.63</td>
<td>58 g</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>27.7</td>
<td>29.72</td>
<td>23.98-31.1 g</td>
</tr>
<tr>
<td>Monounsaturated Fat (g)</td>
<td>22.58</td>
<td>26.24</td>
<td>up to 20% kcal</td>
</tr>
<tr>
<td>Polyunsaturated Fat (g)</td>
<td>11.22</td>
<td>12.85</td>
<td>up to 10% kcal</td>
</tr>
<tr>
<td>Trans Fat (g)</td>
<td>0.92</td>
<td>0.8</td>
<td>&lt; 1 g</td>
</tr>
<tr>
<td>Omega 6 Linoleic (g)</td>
<td>8.27</td>
<td>9.62</td>
<td>14-17 g/day</td>
</tr>
<tr>
<td>Omega 3 Linolenic (g)</td>
<td>0.92</td>
<td>0.96</td>
<td>1.6 g/day</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>343.27</td>
<td>385.46</td>
<td>&lt; 200 mg</td>
</tr>
<tr>
<td>Fiber (g)</td>
<td>18.41</td>
<td>19.29</td>
<td>25-30 g</td>
</tr>
<tr>
<td>Alcohol (g)</td>
<td>14.47</td>
<td>0.00</td>
<td>&lt; 2 drinks/day</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>2393.19</td>
<td>2828.46</td>
<td>4,700 mg</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>3636.78</td>
<td>3656.94</td>
<td>2,300 mg</td>
</tr>
</tbody>
</table>
APPENDIX F

DIETARY ANALYSIS RESULTS
## Dietary Analysis Results

Oct 22, 2011  
Liz Kitchen, kitchen ea@gmail.com  

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>DRI</th>
<th>Intake</th>
<th>0%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kilocalories</td>
<td>2591 kcal</td>
<td>2,299.12 kcal</td>
<td>69%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>61.69 g</td>
<td>146.03 g</td>
<td>237%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>281.0 - 406.0 g</td>
<td>188.18 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat, Total</td>
<td>55.0 - 97.0 g</td>
<td>106.03 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>&lt; 25 g</td>
<td>35.31 g</td>
<td>141%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monounsaturated Fat</td>
<td>*</td>
<td>60.09 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyunsaturated Fat</td>
<td>*</td>
<td>8.80 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trans Fatty Acid</td>
<td>*</td>
<td>0.0 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholesterol</td>
<td>&lt; 300 mg</td>
<td>454.33 mg</td>
<td>151%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Essential Fatty Acids</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omega-6 Linolenic</td>
<td>17 g</td>
<td>2.19 g</td>
<td>12%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omega-3 Linolenic</td>
<td>1.6 g</td>
<td>0.16 g</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carbohydrates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dietary Fiber, Total</td>
<td>9.8 g</td>
<td>12.58 g</td>
<td>59%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar, Total</td>
<td>*</td>
<td>7.67 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>2.7 L</td>
<td>2.52 L</td>
<td>68%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>*</td>
<td>0 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vitamins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiamin</td>
<td>1.2 mg</td>
<td>1.41 mg</td>
<td>118%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riboflavin</td>
<td>1.3 mg</td>
<td>2.01 mg</td>
<td>155%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niacin</td>
<td>16 mg</td>
<td>30.72 mg</td>
<td>192%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>1.3 mg</td>
<td>2.14 mg</td>
<td>165%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D12</td>
<td>2.4 µg</td>
<td>17.09 µg</td>
<td>712%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folate (DFE)</td>
<td>400 µg</td>
<td>292.13 µg</td>
<td>73%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin C</td>
<td>90 mg</td>
<td>51.38 mg</td>
<td>57%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D (IU)</td>
<td>4 µg</td>
<td>9.79 µg</td>
<td>66%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A (RAE)</td>
<td>500 µg</td>
<td>2,179.51 µg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A (IU)</td>
<td>*</td>
<td>43,607.98 IU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>alpha-Tocopherol (Vit E)</td>
<td>16 mg</td>
<td>3.61 mg</td>
<td>24%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minerals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>1000 mg</td>
<td>400.8 mg</td>
<td>40%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>8 mg</td>
<td>21.36 mg</td>
<td>967%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>400 mg</td>
<td>244.47 mg</td>
<td>61%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>4700 mg</td>
<td>3281.93 mg</td>
<td>70%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>11 mg</td>
<td>35.49 mg</td>
<td>323%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>1500 mg</td>
<td>2,087.45 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DA Plus 10 Page: 1
APPENDIX G

CHOLESTEROL, BLOOD PRESSURE AND WEIGHT HANDOUT
Appendix G
Cholesterol, Blood Pressure and Weight Handout

How Can I Monitor My Cholesterol, Blood Pressure and Weight?

High cholesterol, high blood pressure and being overweight or obese are major risk factors for heart disease and stroke. You should be tested regularly to know if you have high blood cholesterol or high blood pressure. That's because elevated cholesterol and blood pressure have no warning signs.

And you should talk to your doctor about a healthy weight for you.

<table>
<thead>
<tr>
<th>Goal</th>
<th>Today’s Date</th>
<th>Today’s Date</th>
<th>Today’s Date</th>
<th>Today’s Date</th>
<th>Today’s Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure (mm Hg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDL Cholesterol (mg/dL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDL Cholesterol (mg/dL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (pounds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What can I do to lower my cholesterol and blood pressure?

- Eat a nutritious, well-balanced diet low in saturated fats, trans fats and cholesterol that includes lots of fruits, vegetables and fat-free dairy products.
- Eat no more than 8 ounces per day of cooked meat, seafood or poultry.
- Choose lean cuts of meat, trim all visible fat and throw away the fat that cooks out of the meat.
- Substitute meatless or “low-meat” main dishes for regular entrees.
- Use a minimal amount of fats and oils, usually no more than 2 to 3 servings a day depending on your caloric needs.
- Use less salt. Limit the amount of salty foods you eat.
- Limit the amount of alcohol you drink. If you’re a woman, don’t drink more than one drink a day. If you’re a man, have no more than two drinks a day.
- Do at least 30 minutes of physical activity on most or all days of the week.
- Take your medicines as prescribed.
How Can I Monitor My Cholesterol, Blood Pressure and Weight? (continued)

How can I manage my weight?

Even modest weight loss (5 to 10 percent of your body weight) can help lower your risk for heart disease and stroke. Check with your doctor before starting a program.

- Reduce the number of calories you eat. Excess calories add excess weight.
- Do at least 30 minutes of moderate-intensity physical activity on most (preferably all days of the week). Building up to one hour or more of daily moderate-intensity physical activity can have a significant effect on weight control.

How can I learn more?

1. Talk to your doctor, nurse or other health-care professionals. If you have heart disease or have had a stroke, members of your family also may be at higher risk. It’s very important for them to make changes now to lower their risk.
2. Call 1-800-AHA-USA (1-800-242-8721) or visit americanheart.org to learn more about heart disease.
3. For information on stroke, call 1-888-4-STROKE (1-888-478-7653) or visit StrokeAssociation.org.

We have many other fact sheets and educational booklets to help you make healthier choices to reduce your risk, manage disease or care for a loved one.

Knowledge is power, so Learn and Live!

What are the warning signs of heart attack and stroke?

**Warning Signs of Heart Attack**

Some heart attacks are sudden and intense, but most of them start slowly with mild pain or discomfort with one or more of these symptoms:

- Chest discomfort
- Discomfort in other areas of the upper body
- Shortness of breath with or without chest discomfort
- Other signs including breaking out in a cold sweat, nausea or lightheadedness

**Warning Signs of Stroke**

- Sudden weakness or numbness of the face, arm or leg, especially on one side of the body
- Sudden confusion, trouble speaking or understanding
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, loss of balance or coordination
- Sudden, severe headache with no known cause

Learn to recognize a stroke. Time lost is brain lost.

Call 9-1-1 ... Get to a hospital immediately if you experience signs of a heart attack or stroke!

Do you have questions or comments for your doctor or nurse?

Take a few minutes to write your own questions for the next time you see your healthcare provider. For example:

- What kind of physical activity would be good for me?
- How can I know what my weight should be?
- What’s the most important change I can make?
APPENDIX H

HIGH BLOOD PRESSURE HANDOUT
Appendix H
High Blood Pressure Handout

What Is High Blood Pressure?

Another name for high blood pressure (HBP) is hypertension (hi-par-TEN-shun).

High blood pressure means the pressure in your arteries is elevated. Blood pressure is the force of blood pushing against blood vessel walls. It’s written as two numbers, such as 112/78 mm Hg. The top, systolic, number is the pressure when the heart beats. The bottom, diastolic, number is the pressure when the heart rests between beats. Normal blood pressure is below 120/80 mm Hg. If you’re an adult and your systolic pressure is “20 to 130, or your diastolic pressure is 60 to 89 (or both),” then you have “prehypertension.” High blood pressure is a pressure of 140 systolic or higher and/or 90 diastolic or higher that stays high over time.

No one knows exactly what causes most cases of high blood pressure. It usually can’t be cured, but it can be controlled. High blood pressure usually has no symptoms. It is truly a “Silent Killer.” About 72 million Americans and 1 in 3 adults have it, and many don’t even know they have it. Not treating high blood pressure is dangerous. High blood pressure increases the risk of heart attack and stroke. You can live a healthier life if you treat and control it.

Who is at higher risk?

- People with close blood relatives who have HBP
- African Americans
- People over age 30
- Overweight people
- People who aren’t physically active
- People who consume too much salt
- People who drink too much alcohol

- People with diabetes, gout or kidney disease
- Pregnant women
- Women who take birth control pills, who are overweight, had HBP during pregnancy, have a family history of HBP or have mild kidney disease

High blood pressure usually doesn’t have any signs — that’s why it’s so dangerous. Make sure you get it checked regularly and treat it the way your doctor indicates.
What Is High Blood Pressure? (continued)

How can I tell I have it?
You usually can't tell! Many people have it and don't know it. The only way to know if your blood pressure is high is to get it checked regularly by your doctor.

What can untreated high blood pressure lead to?
- Stroke
- Heart attack, angina or both
- Heart failure
- Kidney failure
- Peripheral arterial disease (PAD)

What can I do about it?
- Lose weight if you're overweight.
- Eat healthy meals: low in saturated fat, trans fat, cholesterol and salt.
- Limit alcohol to no more than one drink per day for women or two drinks a day for men.
- Be more physically active. Exercise at least 30 minutes on most or all days of the week.
- Take medicine the way your doctor tells you.
- Know what your blood pressure should be and work to keep it at that level.

How can medicine help?
Some medicines, such as vasodilators, help relax and open up your blood vessels so blood can flow through better. A diuretic (di-uh-RET-ik) can help keep your body from holding too much water and salt. Other medicines help your heart beat more slowly and with less force.

How can I learn more?
1. Talk to your doctor, nurse or other health-care professionals. If you have heart disease or have had a stroke, members of your family also may be at higher risk. It's very important for them to make changes now to lower their risk.
2. Call 1-800-AHA-USA1 (1-800-242-8721) or visit americanheart.org to learn more about heart disease.
3. For information on stroke, call 1-888-4-STROKE (1-888-478-7653) or visit StrokeAssociation.org.
   We have many other fact sheets and educational booklets to help you make healthier choices to reduce your risk, manage disease or care for a loved one.
   Knowledge is power, so Learn and Live!

Do you have questions or comments for your doctor?
Take a few minutes to write your own questions for the next time you see your healthcare provider. For example:

Will I always have to take medicine?
What should my blood pressure be?
APPENDIX I

THANK YOU NOTE
Appendix I
Thank You Note

Dear ________________________________,

I would like to say thank you for your participation in my research study *An Assessment of Cardiovascular Risk Factors and Dietary Intake in Firefighters*. With your help I was able to obtain a great deal of information for not only my research but hopefully for future research as well. Your contribution is greatly appreciated!

For those of you who requested feedback from the results of the study and/or dietary analysis results you can find the study results attached and the dietary results enclosed in an envelope. All envelopes are coded according to the last 4 digits of your telephone number that you listed at the time of the study. With regards to the dietary analysis, please keep in mind the information provided is only as accurate as the completed dietary recall. If serving sizes were approximated results will be too. Also, please note the areas of concern are highlighted.

If you have any further questions about the study or interpreting your dietary analysis please feel free to contact me at (440) 223-9918 or ekitchen@kent.edu. Again, thanks so much for your help!

Sincerely,

Liz Kitchen
REFERENCES


Diabetes Mellitus: A Major Risk Factor for Cardiovascular Disease : A Joint Editorial Statement by the American Diabetes Association; the National Heart, Lung, and


Morning Mealscape. (2011, October 11). Retrieved November 15, 2011, from https://www.npd.com/wps/portal/npd/us/news/pressreleases/pr_111011b/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3g3b1NTS98QY0N3H39za09LQzcTt7BAr2BzY_1I_SjjeBc3Sw8PN28TQ4sgSw5sD1d_QxfPoAAjC0sj_YLsQEUA15hcQQ!!/


Nagaya, T., Yoshida, H., Takahashi, H., Kawai, M. (2006). Policemen and firefighters have increased risk for type 2 diabetes mellitus probably due to their large


professionals from the Centers for Disease Control and Prevention and the American Heart Association. *Circulation*, 107, 499-511. doi: 10.1161.01.CIR.0000052939.59093.45


