Adherence of Collegiate Level, Recreational/Intramural and Non-Athlete College Students to the Mediterranean Diet

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Adherence of Collegiate Level, Recreational/Intramural and Non-Athlete College Students to the Mediterranean Diet

An Honors Thesis submitted in partial fulfillment of the requirements for Honors in the Department of Health Sciences and Kinesiology

By 
Amber Ezinne Ugbo

Under the mentorship of Dr. Joelle E. Romanchik-Cerpovicz

ABSTRACT

The Mediterranean Diet, which is rich in complex carbohydrates and plant-based foods, may be beneficial to athletic performance. To date, no one has examined adherence of collegiate athletes to a Mediterranean Diet. This study compared how closely collegiate, recreational/intramural, and non-athletes in college followed a Mediterranean Diet. Surveys and validated Mediterranean Diet score questionnaires were completed by 933 undergraduates in HLTH 1520: Healthful Living at Georgia Southern University. Participants self-reported following various diets including decreased or increased carbohydrate, increased protein, and increased water intake. No one specifically reported following a Mediterranean Diet and total calculated Mediterranean Diet scores were low and did not differ among groups. However, scores for individual Mediterranean Diet components varied. Male athletes, regardless of athletic classification, consumed more complex carbohydrates such as potatoes and more lean protein such as poultry and fish than female athletes. However, in contrast to a Mediterranean-type Diet, male athletes consumed larger amounts of red meat. Athletes also generally consumed significantly more complex carbohydrates than non-athletes and specifically, female athletes consumed significantly more vegetables than non-athlete females. These data suggest that while athletes consume more complex carbohydrates than non-athletes, males and females obtain these carbohydrates from different sources. It is possible that consumption of these components of the Mediterranean Diet may be determined in part by what specific sports males and females are participating in. Future studies may examine this possibility. These results are relevant to nutrition professionals as they develop appropriate educational programs on the Mediterranean Diet for athletes in college.

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<tbody>
<tr>
<td>ACSM</td>
<td>American College of Sport Medicine</td>
</tr>
<tr>
<td>ACSN</td>
<td>American College of Sport Nutrition</td>
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<tr>
<td>AMDR</td>
<td>Acceptable Macronutrient Distribution Range</td>
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<tr>
<td>ATP</td>
<td>Adenosine Triphosphate</td>
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<tr>
<td>BW</td>
<td>Body Weight</td>
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<tr>
<td>DRI</td>
<td>Daily Recommended Intake</td>
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<td>FFQ</td>
<td>Food Frequency Questionnaire</td>
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<tr>
<td>g</td>
<td>Gram</td>
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<tr>
<td>HEI</td>
<td>Healthy Eating Index</td>
</tr>
<tr>
<td>HLTH</td>
<td>Health</td>
</tr>
<tr>
<td>IOC</td>
<td>International Olympic Committee</td>
</tr>
<tr>
<td>IRB</td>
<td>Institutional Review Board</td>
</tr>
<tr>
<td>ISSN</td>
<td>International Society of Sports Nutrition</td>
</tr>
<tr>
<td>Kcal</td>
<td>Kilocalories</td>
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<tr>
<td>Kg</td>
<td>Kilogram</td>
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<tr>
<td>L</td>
<td>Liter</td>
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<tr>
<td>mg</td>
<td>Milligram</td>
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<tr>
<td>N</td>
<td>Population Size</td>
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<tr>
<td>NCAA</td>
<td>National Collegiate Athletic Association</td>
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<tr>
<td>n.d.</td>
<td>No Date</td>
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<tr>
<td>RDA</td>
<td>Recommended Daily Allowance</td>
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Rec/Intra  Recreational/Intramural
S/R/N  Sometimes/Rarely/Never
p  Probability Value
USDA  United States Department of Agriculture
µg  microgram
Chapter One: Introduction and Literature Review

1.1 Definition of an Athlete

An athlete can be defined as an individual involved in any athletic event that requires physical skill, strength, or endurance (Oxford English Dictionary, 2013). Individuals can be divided into numerous classifications of athletes including recreational athletes and competitive athletes, such as collegiate and elite athletes (Laquele, 2009).

1.1.1 Recreational

The term recreation refers to an action that entertains an individual through an activity (Oxford English Dictionaries, 2009). Recreational athletes are individuals who do not train for competition at a similar level as a competitive athlete but still remain physically active (Laquele, 2009). They typically practice improving their skills, train and follow nutritional recommendations to remain in good physical condition and follow the rules of the sport in competitions (Bureau of Labor Statistics, U.S. Department of Labor, 2016).

1.1.2 Collegiate

College athletics involve institutions of education such as colleges and universities that regulate and fund sports and athletic competition (Zumerchik, 1997). These colleges and universities sponsor college athletes who are students enrolled in their institution and who compete in their athletic programs (Zumerchik, 1997). College athletic sports can range from, but are not limited to men’s baseball, men’s and women’s basketball, women’s field hockey, men’s football, men’s and women's gymnastics, men’s
ice hockey, men’s and women’s lacrosse, men’s and women’s soccer, women’s softball, women’s volleyball, and men’s wrestling (Hootman et al, 2007).

The National Collegiate Athletic Association (NCAA) is an organization in the United States that oversees both regional and national intercollegiate athletics and is organized into three divisions that each represents a different level of competition (Encyclopedia Britannica, 2013). Research administered by NCAA Research showed that with more than 460,000 athletes competing in the association, only a few athletes in each sport progress to compete at the elite or Olympic level.

1.1.3 Elite

Elite athletes are considered dominant when compared to others competing in sports (Cambridge Dictionaries, 2016). Several variables such as anthropometric and physiologic characteristics, balance, the presence of the athlete on the team, duration of training, form of performance training, development of skills and maturation, and physical performance contribute to the definition of the elite athlete (Lorenz et al, 2013).

A classification system developed by Swann et al (2014) categorizes four types of elite athletes: semi-elite, whose highest level of presence is below the standard in their sport; competitive elite, which are athletes that regularly compete at the highest level in their field of sport; successful-elite athletes, who have competed at the highest level and have experienced some level of success as defined by the sport; and world-class elite athletes, who experience a constant amount of success at the highest level, by repeatedly producing wins over a long period of time (Swann et al, 2014).
1.2 Types of Sports

1.2.1 Aerobic Activities

An essential framework of an athlete’s success in sports includes aerobic and anaerobic power (Gholamhasan et al., 2013). When an organism is aerobic, it is living in the presence of oxygen (Zumerchik, 1997). Aerobic activity can be referred to as a structure of exercises that are formed to improve the supply and use of oxygen in the body and increase the heart’s capacity to pump blood and distribute oxygen throughout the body (Zumerchik, 1997). This increase in the body’s demand for oxygen causes a brief increase in respiration and heart rate (Millward et al., 2014). The development of aerobic power and capacity typically comes from the incorporation of training that is of low intensity and long duration (Pyne & Sharp, 2014). Common aerobic sports include, but are not limited to, running, walking, cycling, and dancing (Zumerchik, 1997). All of these sports require oxygen in order to produce adenosine triphosphate (ATP) – the fuel for the human body’s cells (Whitney & Rolfes, 2011).

1.2.2 Anaerobic Activities

When an organism is anaerobic, it is able to live and grow when oxygen is not present (U.S. Environmental Protection Agency). Anaerobic activity is referred to as any physical activity that is generally of high intensity and short duration, in which the muscles need for oxygen, exceeds the body’s capacity to supply it (Oxford English Dictionary, 2008). Common anaerobic sports include, but are not limited to, weightlifting and sprinting in various sports such as running, swimming, and cycling (Zumerchik, 1997).
1.3 Nutrition and Athletic Performance

1.3.1 Nutrients

The growth, repair, and maintenance functions of body tissues are dependent on energy and nutrients (Whitney & Rolfes, 2011). Nutrients are chemical substances found in food that the body uses for health and growth (Brown et al, 2013). The body can make certain nutrients in small amounts, but essential nutrients must be obtained from food (Roth, 2010) in levels adequate for growth and sustenance of life (Encyclopedia Britannica, 2016).

The six classes of nutrients include the energy yielding nutrients, carbohydrates, lipids, and proteins also referred to as macronutrients because they are required in gram (g) quantities. The essential nutrients that do not provide energy are vitamins, minerals, and water (Whitney & Rolfes, 2011). Of these nutrients, vitamins and minerals are referred to as micronutrients because they are required in milligram (mg) quantities. The six nutrients are also categorized into whether they are organic nutrients or inorganic nutrients (Roth, 2010). Organic nutrients include carbohydrates, lipids, protein, and vitamins (Encyclopedia Britannica, 2016). Organic nutrients are the fundamental building blocks of different cell components (Encyclopedia Britannica, 2016). Inorganic nutrients include minerals and water and are also required for human growth (Roth, 2010). The act of consuming these nutrients and the process of supplying nourishment or food is called nutrition and is a branch of science that works with nutrition and nutrients in individuals (Oxford English Dictionary, 2004).

Nutrient requirements for athletes depend on the type of sport and the various stages of training including preparation, competition, off-season, and the shifts between
these stages (Houtkooper et al, 2007). Athletes usually go through regular training and preparation that includes several hours of high-intensity activity at persistent periods of time (Pyne & Sharp, 2014). The difficulty of training that athletes often exhibit can result in energy expenditures two to three times larger than that of untrained individuals (Clark et al, 2003). Therefore, athletes must sustain an adequate amount of energy and nutrient intake mainly during times of intense training, in order to avoid injuries, illnesses, and exhaustion (Melin et al, 2015). Diets rich in various nutrients are essential to managing the immune system with enough capacity to meet an athlete’s demands of training and competition (Pyne & Sharp, 2014). Athletes must meet energy requirements and time the consumption of nutrients such as carbohydrates, protein, and fluids before, during, and after physical activity to support the maintenance, repair, and growth of muscle, reach protein synthesis and turnover requirements and to remain sufficiently hydrated (Houtkooper et al, 2007).

1.3.1.1 Macronutrients

Macronutrients again, are also the only nutrients that yield energy for use in the body’s tissues according to Whitney & Rolfes, 2011, and are needed in order to maintain various functions of the body including respiration, circulation, physical work, and maintenance of core body temperature.

Optimal energy is important for athletes and active individuals who partake in physical fitness (Genton et al, 2010). A negative energy balance, which results when more energy is used than taken in, is commonly associated with athletes involved in aerobic sports like running and cycling and sports with dietary restrictions such as
gymnastics and wrestling (Potgieter, 2013). All athletes can meet their energy needs from carbohydrates, protein, and fat (lipids), the energy-yielding macronutrients (Whitney & Rolfes, 2011).

The macronutrient, carbohydrates, is a compound that consists of the elements carbon, oxygen, and hydrogen arranged as monosaccharides or multiples of monosaccharides such as disaccharides and polysaccharides (Whitney & Rolfes, 2011). The main characteristics of carbohydrates are that they supply the major source of energy to cells in the body (Whitney & Rolfes, 2011), as such; carbohydrates can be measured in terms of either g or Kilocalories (Kcal) (Zumerchik, 1997) providing four Kcal per g. Complex carbohydrates include starches and fibers with the main sources of carbohydrates being found in vegetables, fruits, whole grains, and milk products (Slavin & Carlson, 2014).

Carbohydrates are one of the two main sources of fuel oxidized by skeletal muscle tissue during extended endurance exercise (Cermak & Van Loon, 2013). According to Potgieter (2013), an athlete’s daily recommendation for carbohydrates varies depending on the amount and intensity of exercise. However, the athlete should include complex carbohydrates of low-moderate glycemic index into their diets (Potgieter, 2013). This can help support exercise such as high-intensity intermittent physical activity which has been shown to rely on muscle glycogen stores in order to support demanding exercise (Raman et al, 2014).

The essential macronutrient protein (Roth, 2010) is composed of amino acids, which form the links in the protein chains (Whitney & Rolfes, 2011). Protein is the main functional and constitutional component of the cells in the body including enzymes,
membrane carriers, blood transport molecules, intracellular matrices, hair, fingernails, 
serum albumin, keratin, and collagen, hormones, and significant parts of membranes 
(Whitney & Rolfes). Meats, eggs, and milk are all excellent sources of protein in addition 
to some plant-based foods such as beans, peas, and lentils (Breen et al, 2012). The current 
Daily Recommended Intake (DRI) of protein generally for adults ranges between 0.8-0.9 
g protein/kg/day (Phillips, 2012).

In general, athletes and physically active individuals have increased protein needs. 
However, athletes that are involved in anaerobic activities such as strength and power 
athletics have protein needs that exceed that of endurance athletes that are involved in 
aerobic activities (Hoffman et al, 2009). Increased intake of protein and amino acids to 
prevent in muscle impairment is controversial (Genton et al, 2010). The International 
Society of Sports Nutrition (ISSN) recommends protein intake to range from 1.0 g/kg to 
2.0 g/kg per day of body weight (BW) depending on intensity of exercise (Kersick et al, 
2008). Individuals involved in resistance training generally need to consume 1.2 -2.0 g/kg 
of BW daily which is substantially higher than the current Recommended Daily 
Allowance (RDA) for individuals not involved in resistance training with the intent to 
gain muscle mass (Stark et al, 2012). The recommended protein intake for endurance 
athletes ranges from 1.2-1.4 g/kg/BW in order to support nitrogen balance (Thomas et al, 
2016).

Lipids, the final group of macronutrients, are stored in the body as triglycerides 
(Zumercchik, 1997). Lipids are an essential part of an individual’s diet and provide 
energy, important structured components of cell membranes, and nutrients such as 
vitamins A, D, and E (Thomas et al, 2016). Since lipids are one of the macronutrients that
supply energy, they contain nine kilocalories of energy per gram, which is the most out of all the macronutrients (Zumerchik, 1997). The Acceptable Macronutrient Distribution Range (AMDR) for lipids is 20 to 35% of energy intake (Thomas et al, 2016). The U.S. Department of Health and Human Services and U.S. Department of Agriculture recommends that 10% of lipids in the diet are saturated, 10% is polyunsaturated, and 10% is monounsaturated fat (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015).

Lipids are also one of the two main sources of fuel that is oxidized by skeletal muscle tissue during activities such as extended endurance exercise (Cermak & Van Loon, 2013). Lipids are a source of energy for all athletes and active individuals and provide fat-soluble vitamins and essential fatty acids. The general recommendations for fat are the same for athletes, which is 20%-35% of fat in their total energy intake (Potgieter, 2013).

1.3.1.2 Micronutrients

Vitamins and minerals are considered micronutrients because they are required in mg or microgram (µg) quantities compared to macronutrients required in g amounts (Whitney & Rolfes, 2011). Vitamins are organic chemical compounds with no caloric value and are essential to health because they are important for tissue growth, maintenance, and repair (Zumerchik, 1997). Currently, 14 vitamins have been discovered and can be classified as either fat-soluble or water-soluble vitamins (Brown et al, 2013). Fat-soluble vitamins are vitamins that are soluble in fats and oils and insoluble in water including vitamins A, D, E, and K (Whitney & Rolfes, 2011). Water-soluble vitamins are
Vitamins that are soluble in water including the B complex vitamins and vitamin C (Brown et al, 2013). Fat-soluble vitamins are able to be stored in large amounts in the body, which can result in toxicity, so it is recommended that intake of fat-soluble vitamins from food and supplementation should be carefully watched (Zumerchik, 1997).

Minerals are inorganic compounds with no caloric value that naturally come from Earth’s crust and are essential to human health (Zumerchik, 1997). Minerals can be divided into two categories including major minerals and trace minerals (Nix & Williams, 2009). Major minerals are essential nutrients that the human body requires in amounts that are greater than 100 mg per day and trace minerals are essential nutrients that the human body requires in amounts less than 100 mg per day (Whitney & Rolfes, 2011).

Vitamins and minerals play an important role in body processes such as energy production, hemoglobin synthesis, maintenance of bone health, immune function, and protection against oxidative damage (Thomas et al, 2016). Vitamins each have their own separate individual task but in general the functions of vitamins include being components of enzymes, antioxidants, hormones that affect gene expressions, and a component of the cell membranes (Nix & Williams, 2009). Vitamins also help with the facilitation of the release of carbohydrates, protein, and fat (Whitney & Rolfes, 2011). In addition, some vitamins are important because they can act as antioxidants which are compounds that prevent the effects of free radicals that take electrons from cell walls and through this damage, can result in chronic diseases, such as cardiovascular disease and cancer (Zumerchik, 1997). Vitamins that act as antioxidants include vitamins C, E, and beta-carotene which is a precursor to vitamin A (Landete, 2013). Minerals aid in a variety
of metabolic tasks in the body including being involved in building tissue and activating, regulating, transmitting, and controlling metabolic processes (Nix & Williams, 2009). Although, recommended intakes vary between vitamins and minerals, the ISSN recommends that consumption of a sufficient nutrient-rich diet consisting of a variety of foods should provide an adequate amounts of micronutrients (Potgieter, 2013).

Athletes may choose to consume micronutrients in the form of whole foods or supplements in order to enhance their athletic performance. However, at this time, the ergogenic effect of most vitamins and minerals is still unclear and in need of further research (Potgier, 2013). It is important to note that athletes involved in dietary restricting sports, such as wrestling and gymnastics are at risk for micronutrient deficiencies according to Thomas et al, 2016. As such, athletes are recommended to consume at least the RDA for all micronutrients (Thomas et al, 2016). It is also possible that athletes require greater amounts of micronutrients in order to meet the increased need of building, repairing, and maintaining lean body mass (Thomas et al, 2016).

With regard to specific micronutrients, it is important to mention that calcium is important for forming and maintaining healthy bone tissue in athletes and non-athletes alike (Burke et al, 2010). The main food sources of calcium include milk and milk products (Whitney & Rolfes, 2011). Magnesium is also important and plays many roles in cellular metabolism including protein metabolism (Thomas et al, 2016). In order to make up for the metabolic needs of athletic performance, magnesium must be redistributed throughout the body because studies have shown that magnesium deficiencies can have negative impacts with strenuous exercise (Neilson & Lukaski, 2006). The main food sources of magnesium include vegetables, fish, nuts, and whole
grains (Burke et al, 2011). Zinc also plays a vital role in the growth and repair of muscle tissue as well as energy production, which is important for athletic performance (Thomas et al, 2016). The main food sources of zinc include foods high in protein such as meats, fish, poultry, milk and cheese (Whitney & Rolfes, 2011). Iron is a mineral needed for the development of oxygen-carrying proteins, hemoglobin and myoglobin, and for the enzymes that participate in energy production (Thomas et al, 2016). Iron is an important micronutrient for athletic performance since it is an important component in oxygen transportation and energy production (Alaunyte et al, 2015). A deficiency in the mineral iron could result in weakened muscle function and limited work capacity (Thomas et al, 2016). The main food sources for iron include meat sources such as meat and poultry for heme iron and plant sources such as leafy greens, lentils, and beans for non-heme iron (Whitney & Rolfes, 2011).

There has been somewhat inconsistent evidence on the antioxidant effects of Vitamins C and E as well as the action of vitamin D and their roles as ergogenic aids (Connolly et al, 2006). It has been argued that antioxidants are able to lower the amount of reactive oxygen species that forms as a result of demanding exercise (Potgieter, 2013). Research on vitamin C has shown that when it is consumed in amounts of about 250 mg/day through fruits and vegetables, it may cause a reduction in oxidative stress without compromising training adaptations (Braakhuis & Hopkins, 2015). It is believed that vitamin E is the most active antioxidant throughout the cell lipid phases (Stepanyan et al, 2014). As a result of vitamin E playing an important role in cell protection from free radicals brought on by oxidative stress from exercise, it is supported that vitamin E could aid biological preparation for athletes engaging in endurance exercises (Stepanyan et al,
However, because there is insufficient evidence to support that a vitamin D deficiency limits performance, it is proposed that the vitamin may play a significant role in muscle structure and function (Hamilton, 2011).

1.3.1.3 Water

Water is essential for life, makes up 75% of body weight in infants and 55% in elderly, and is important for cellular homeostasis (Popkin et al, 2010). Although water contains no caloric value, it remains an essential nutrient and is vital for human life (Zumerchik, 1997). Water can be lost from the body in several ways including sweat, urine, and exhalation and must be replaced by the consumption of fluids from drink and through water content of various foods (Zumerchik, 1997). It is important to maintain a balance of about 0.5-2 L per hour in order to maintain hydration levels especially in the athlete (Potgieter, 2013).

Hydration levels are an important component of exercise performance (Kraft et al, 2012). Athletes tend to lose 6-10% of their body weight in sweat loss as a result of strenuous physical activities which can lead to dehydration (Popkin et al, 2010). Dehydration is referred to as a loss of water in the body from normal levels (Murray, 2007). Rehydration can reverse the effects of dehydration and it turn can prevent oxidative stress produced from physical activity (Popkin et al, 2010). It is recommended that the body weight of athletes be measured before and after exercise to ensure that fluid balance is being maintained (Potgieter, 2013). This need is discussed further a later section of Chapter One.
1.3.2 Ergogenic Aids, Supplements, and Other Dietary Compounds

Nutritional ergogenic aids are training techniques or nutritional practices that one might utilize in order to improve the efficiency of exercise performance (Krieder, 2010). When considering ergogenic aids, athletes should always be counseled because aids need to be checked for safety and efficacy (Potgieter, 2013). A few ergogenic aids for athletic performance included in current research include foods that contain antioxidants, creatine, bicarbonate, and caffeine (Abbey & Rankin, 2011). This thesis will focus further on antioxidants as ergogenic aids.

Many athletes begin consuming antioxidants and taking antioxidant supplements as an ergogenic aid in order to prevent free radical damage and muscular fatigue that results from exercise (Burke et al, 2009). Several studies for various whole food ergogenic aids include the study of flavonols, including quercitin on oxidative stress in the body. Oxidative stress refers to an imbalance between the making of reactive oxygen species and a sufficient amount of antioxidant defenses, which is a detrimental condition involved in several physiopathological states including exercise (Pingitore et al, 2015). Evidence supports that supplementation with natural antioxidants could aid in the recovery of oxidative damage brought on by free radicals and prevent tissue injury in athletes from exercise (Sadowska-Krepa et al, 2015). Although, there is some research regarding antioxidants as ergogenic aids have been controversial (Potgieter, 2013).

There are a variety of different plant polyphenols that are categorized into groups based on their chemical structure with phenolics and flavonoids being two types (Myburgh, 2014). An antioxidant called quercitin is classified as a flavonol, which is one of the six subclasses of flavonoid compounds (Kelly, 2011). Flavonoid compounds are
polyphenolic compounds that are found in many fruit and vegetable sources (Pelletier et al, 2013). Quercitin is one of the main natural flavonoids that can be found in the skin of fruits and vegetables, and in leafy vegetables and berries (Askari et al, 2012). They can specifically be found in red onions, tomatoes, blueberries, apples, black tea, and purple grapes and their juice (Reid, 2013).

It is estimated that the intake of flavonols in Western populations is estimated to be around 20-50 mg/day with about 13.82 mg/day being in the form of quercetin-type flavonols (Kelly, 2011). This could be due to quercitin being the most naturally occurring flavonoid (Casuso et al, 2013). Human and animal studies have been conducted with quercitin to see if it has an effect on oxidative stress, inflammation, blood pressure, and the improvement of the endothelial function (Pelletier et al, 2013). Studies on quercitin supplementation show an improvement in the running to fatigue time in mice, however, this study was not conducted on humans so the use of quercitin as an ergogenic aid is still being researched (Casuso et al, 2013). Previous studies with humans currently show that quercitin, when consumed alone, does not affect body composition and performance (Askari et al, 2012). However, quercitin is an antioxidant, so it appears to demonstrate potential beneficial effects on health (Kelly, 2011). This includes beneficial effects on cardiovascular disease, endothelial dysfunction, and atherosclerosis (Askari et al, 2012).

The use of raw and/or processed foods as ergogenic aids by athletes has been reported in several studies (Toscano et al, 2015). Anthocyanin, a phytochemical that is an antioxidant found in red and purple fruits and vegetables, has shown evidence to reduce inflammation, oxidative stress, and signs of muscle damage during exercise (Reid, 2013). Juices containing tart cherries have high amounts of antioxidants and anti-inflammatory
compounds and can prove to be beneficial in reducing the symptoms of muscle pain after exercise among athletes training for endurance events (Kuehl et al, 2010). When consumed before, during, and after endurance exercise, tart cherry juice has been found to reduce recovery time, oxidative stress, and inflammation (Howatson et al, 2010). Purple grapes have been shown to have a very high amount of antioxidant and anti-inflammatory activity and consumption of purple grape juice is purposed to have possible ergogenic effects in athletes (Toscano et al, 2015). Also, a reduction in resting blood pressure and oxygen demand of submaximal exercise has been seen in athletes who supplement with nitrate-rich beetroot juice (Muggeridge et al, 2014). A six-week consumption of an acai-berry based juice was shown to have no effect on sprint performance but did show a reduction in the amount of exercise-induced muscle damage (Sadowska-Krępa et al, 2015).

1.3.3 Dietary Differences Based Upon Gender and Type of Sport

Leech et al, 2015 defines diet quality as the overall dietary intake of an individual and how closely it is related to the national guidelines. Studies use various indices such as the Healthy Eating Index (HEI) based on recommendations of the United States Food Guide Pyramid and the United States Department of Agriculture (USDA) national dietary guidelines (Wirt & Collins, 2009). A study led by Webber et al (2015) on the diet quality of collegiate athletes showed that although female athletes are at risk for eating disorders and low caloric levels, they had a higher overall diet quality than the males. Similarly, a study investigating the nutrition knowledge and attitudes of collegiate athletes found that females tested higher than males in nutrition knowledge (Dunn et al, 2008). The
questions in the questionnaire included recommendations for the intake of various food groups, food choice, and the connection between diet and disease (Dunn et al, 2008).

A study that investigated the relationship between physical activity, diet quality, and weight status by Pate et al (2015) concluded that the relationship between diet quality and regular day-to-day physical activity has yet to be explored in depth. In a review investigating nutrition in team sports, results also indicated that the dietary quality of athletes involved in team sports have not been studied as well as individual athletes have (Mujika & Burke, 2010). This suggests that more research be done on individuals participating in individual sports such as track and field. However, Webber et al (2015) conducted a study on the diet quality of collegiate athletes using a Food Frequency Questionnaire (FFQ) and comparing it to the HEI. The researchers found that males that participated in sports involving a ball, including soccer, basketball, and volleyball, reported a higher overall diet quality than individuals in sports that require a leaner build, such as gymnastics, swimmers, and divers (Webber et al, 2015). More research needs to be done in this area on the diet qualities of sports with various levels of athletic performance including recreational, collegiate, and elite athletes while comparing males versus females.

1.3.4 Timing of Nutrition

The amount and timing of intake of nutrition, in particular that of carbohydrates and protein for exercise, is critical to athletic performance (Potgieter, 2013). The study of nutrient timing in sports and physical activity has become a valuable and attractive aspect of sports nutrition and the training, performance, and recovery components of sports
Nutrient timing involves the consumption of nutrients, specifically carbohydrates, protein and water, before, during, and after an exercise session (Aaragon & Schoenfeld, 2013). It is generally proposed that nutrient timing strategies may be effective at enhancing training and performance athletes (Nystrom et al, 2015). The nutritional recommendations before, during, and after physical activity can differ between endurance and resistance exercise. However, due to the impact, each activity results in different signaling mechanisms in the skeletal muscle (Millard-Stafford et al, 2008), as such, many recommendations offer ergogenic effects that apply to both endurance and resistance trained athletes (Phillips, 2012). The current nutrient timing recommendations for athletes and active individuals are as follows:

1.3.4.1 Pre-Exercise

Several studies have supported the idea that consumption of carbohydrates and protein prior to exercise is an effective method for enhancing performance during training and decreasing muscle damage associated with exercise (Kerksick et al, 2008). Research shows positive effects of starting exercise with a lower than normal body weight beginning exercise in a hydrated state with attention paid to the sensation of thirst before, during, and after exercise (Goulet, 2012). In order to avoid dehydration, several studies recommend the consumption of fluids before, during, and after exercise in order to decrease the risk of heat injuries such as a heat stroke (Thomas et al, 2016). Recommendations for carbohydrate, protein, and fluid intake before exercise are as follows:
During moderate to high intensity exercise, glycogen stores in the body will only last for approximately ninety minutes to three hours. This limit requires that athletes consume some form of carbohydrates before any exercise lasting longer than ninety minutes (Potgieter, 2013). Nutrient timing methods such as carbohydrate loading prior to exercise have been found to increase endurance and exercise performance in athletes (Burke et al., 2011). Carbohydrate loading refers to a nutritional strategy used to elevate muscle glycogen stores before any exercise lasting longer than 90 minutes by delaying fatigue (Raman et al., 2014). Typically, meals high in carbohydrates that are consumed two to four hours prior to exercise have been shown to benefit athletes by promoting muscle and liver glycogen stores and supporting blood glucose (Genton et al., 2010).

When fueling for an event, the International Olympic Committee (IOC) generally recommends 7-12g/kg of BW every 24 hours leading up to an event lasting longer than 90 minutes and 1-4g/kg BW consumed 1-4 hours before exercise lasting longer than 60 minutes (Maughan & Burke, 2012). However, carbohydrate recommendations may change as factors such as exercise intensity changes and exercise intensity can dictate the amount of glycogen stores that remain after exercise, which in turn determines how many carbohydrates, are needed beforehand (Millard-Stafford et al., 2008).

Studies have exhibited that the short term effect of consuming protein close to a workout including, either immediately prior to or within an hour afterwards, greatly increases the rate of protein synthesis in the muscles and protein accretion when compared to delayed consumption of proteins after exercise (Hoffman et al., 2009). In general, it has been shown that the consumption of protein before and after a workout can improve physical performance, training session recovery, lean body mass, muscle
hypertrophy, and strength (Stark et al, 2012). Specifically, protein that is consumed prior to exercise can provide amino acids for building and repairing of muscle tissue during exercise (Thomas et al, 2016). There is no definite protein intake requirement set prior to exercise, but the American College of Sports Nutrition (ACSN) recommends that a moderate amount of protein ranging between 0.15-0.25 g/kg BW be added to a pre-exercise meal (Potgieter, 2013).

Research advises that athletes begin exercise in a hydrated state (Goulet, 2012). The purpose of the recommendation is so that an individual begins the activity with a normal state of body water content (Sawka et al, 2007). When athletes fall under that normal state of body water content during exercise, they risk a decrease in performance, and serious medical conditions such as heat exhaustion and heat stroke can occur (Von Duvillard et al, 2004). By taking in fluids, athletes are able to maintain hydration and body temperature, and prevent dehydration (Von Duvillard et al, 2004). Sweat rates for athletes will depend on the type of exercise, temperature, humidity, body weight, genetics, heat acclimatization state, and metabolic efficiency (Thomas et al, 2016).

However, the American College of Sports Medicine (ACSM) recommends that athletes consume around 5-7 mL/kg-1 BW of either water or a sports drink at least four hours before exercise in order to maintain hydration (Sawka et al, 2007).

1.3.4.2 During Exercise

Recommendations for carbohydrate, protein, and fluid intake during exercise are well known:
Since performance in activities such as endurance exercise is largely based on carbohydrate availability, carbohydrate consumption during exercise may be necessary (Cermak & Van Loon, 2013). An increase in liver and muscle glycogen stores and proper fluid intake is recommended during exercise in order to combat muscle fatigue and hypoglycemia as a result of low muscle glycogen stores (Potgieter, 2013). During exercise lasting less than 60 minutes, the ISSN recommends that athletes consume 30-60 g of carbohydrates per hour (Potgieter, 2013). These recommendations are especially advised in the case that no pre-exercise meal has been consumed or the exercise is being done in hot or humid conditions (Sawka et al, 2007).

Recently studies have shown that consuming protein during exercise is beneficial for increasing muscle protein synthesis rates for resistance and endurance exercises but that does not have an effect on improving exercise performance (Van Loon, 2014). The IOC does not provide any recommendations for protein intake before or during physical activity due to the association with maximal stimulation of muscle protein synthesis after exercise although the addition of carbohydrates to protein in a ratio of 3-4:1 during exercise is showing some promise (Potgier, 2013).

As the type, intensity, and duration of exercise, and environmental factors change, the need for fluids and electrolytes during exercise changes (Rodriguez et al, 2009). In order to avoid a water deficit in excess of 2% of body weight, an athlete must hydrate and drink fluid during exercise (Thomas et al, 2016). Beverages that contain 6% to 8% of carbohydrates are recommended for exercise that lasts longer than 60 minutes so that liver and muscle glycogens stores may be replenished and individuals may stay hydrated during and exercise session (Sawka et al, 2007).
1.3.4.3 Post-Exercise (Recovery)

The ACSN recommends the main goals of recovery should be to provide the athletes with adequate fluid, electrolytes, energy, and protein to supply amino acids for the maintenance and repair of muscle protein, and carbohydrates to replace muscle glycogen stores and aid recovery (Potgieter, 2013). Recovery involves the rehabilitation of an individual back to a healthy and or normal state (Oxford English Dictionary, 2009). Intense or prolonged physical activity and competition can increase the risk for injury and illness, limiting an athlete’s ability to improve performance, which requires recovery to decrease that risk (Pyne & Sharp, 2014). The duration after exercise is considered the most demanding component of nutrient timing due to the reduction of a large part of stored fuels such as glycogen and amino acids and the damage caused to muscle fibers after an intensive resistance training workout (Aragon & Schoenfeld, 2013). After demanding physical activity, recovery involves a variety of methods that are determined by timing and quantity of the consumption of nutrients (Potgieter, 2013). Various nutritional recovery strategies include water and electrolyte intake for rehydration and rebuilding carbohydrate stores and protein consumption for recovery of muscles (Kovacs et al, 2014). The development of a recovery strategy, which involves the application of techniques to quicken the time of recovery, could possibly reduce the risk of injury in athletes following exercise (Nédélec et al, 2013). Recommendations for carbohydrate, protein, and fluid intake after exercise are as follows:

 Consumption of carbohydrates after exercise could result in increased glycogen levels and could affect glycogen syntheses in the short run (Thomas et al, 2016). As such, the ASCN, the IOC and the ISSN recommends 1.0-1.5g/kg BW of carbohydrates during
the first 30 minutes following an exercise session and again every two hours following
the exercise session (Potgieter, 2013). For aerobic exercises, it has been shown that
consuming carbohydrates in conjunction with smaller amounts of protein within the first
few hours following an endurance event, has been shown to increase muscle glycogen
resynthesis rate (Millard-Stafford et al, 2008). The ISSN recommends having a
carbohydrate to protein ratio of 3:1 to 4:1 or by adding 0.2-0.5 g/kg of BW of protein to a
recovery meal along with carbohydrates, which can result in increased muscle protein
synthesis and improved performance (Potgieter, 2013).

Glycogen synthesis rates have been found to be similar when both carbohydrates
and protein are available following endurance and resistance exercise (Thomas et al,
2016). Protein that is included in meals after exercise could also provide amino acids
needed for muscle protein repair in the body (Thomas et al, 2016). The IOC recommends
a total of 20-25 g of protein be consumed following resistance exercise and the ACSM,
the ISSN, and the IOC all agree that approximately 20 g of protein within 30 minutes
after is sufficient after any exercise to obtain a positive effect (Potgieter, 2013).

If athletes do not consume adequate amounts of fluid during exercise to balance
fluid losses, they may finish their exercise period dehydrated (Thomas et al, 2016).
Dehydration refers to a reduction in the amount of water in the body and can be harmful
to the health of an individual (Oxford English Dictionary, 1993). For example,
dehydration can lead to increases in core temperature, fatigue, headaches, vomiting,
diarrhea, and muscle cramps (Von Duvillard et al, 2004). Hydration status can be restored
by replacing fluids and electrolytes lost during exercise with the intake of meals and
beverages (Thomas et al, 2016). When accelerated recovery is needed, 1.5 L of fluid per
kg of BW lost during exercise should be consumed in the form of beverages, snacks, and meals (Potgieter, 2013).

1.3.5 The Mediterranean Diet

The Mediterranean Diet was first defined as a general food consumption pattern observed in individuals living in countries surrounding the Mediterranean Sea during the early 1950’s through the late 1960’s (Lopez-Garcia et al, 2014). The Mediterranean Diet earned its appreciation in the 1990’s due to the characteristics of the diet showing to make improvements in health and has continued to expand and increase in popularity with the general public and in research communities (Piscopo, 2009).

1.3.5.1 Characteristics

The diet is characterized by a high intake of plant foods including vegetables, fruits, whole grains, legumes, nuts, and herbs and spices (Hoffman et al, 2015). The diet also consists of moderate amounts of dairy products and low amounts of red meat, processed meats, sweets. In addition, the diet includes the consumption of moderate amounts of fish and poultry at meals (Estruch et al, 2013).

The two most common attributes of the Mediterranean Diet are the consumption of wine and olive oil (Hoffman et al, 2015). Wine, almost exclusively red wine, is consumed in moderate amounts usually with meals (Chrysohoou et al, 2004). According to Buckland & Gonzalez (2015), olive oil is an essential part of the diet as it is the primary source of dietary fat, supplying a third to two-thirds of total vegetable fat. Olive
oil is used in almost all meals in the Mediterranean Diet for cooking and in salad dressings (Hoffman et al, 2015).

1.3.5.2 Role in Inflammation

Inflammation is now being recognized as a key factor in chronic diseases such as atherosclerosis and cardiovascular disease (Richard et al, 2013). Several studies have shown that increasing adherence to the Mediterranean Diet is beneficial to one’s health including the prevention of cardiovascular disease (Estruch et al, 2013). In a study with 1,003 individuals from European regions that survived myocardial infarctions exhibited an inverse relationship between a Mediterranean Diet Score and the development of a pro-inflammatory state (Panagiotakos et al, 2009). In addition, a study done with patients diagnosed with metabolic syndrome saw an increased relationship between the consumption of the Mediterranean Diet and markers of systemic vascular inflammation (Esposito et al, 2004). When the Mediterranean Diet is combined with weight loss this causes a reduction in plasma C-reactive protein concentrations, which is an inflammatory biomarker, associated with metabolic syndrome (Richard et al, 2013).

There is also sufficient scientific evidence that supports characteristics of the Mediterranean Diet’s benefit to health due to the results of pro-inflammatory factors and various biological components (Ginter & Simko, 2015). As a result, the Mediterranean Diet could possibly be used as a remedial approach for chronic inflammation diseases (Gotsis et al, 2015).
1.3.5.3 Role in Disease Prevention

The Mediterranean Diet has been persistent in exhibiting its positive influence on health (Sofi et al, 2014). Research on the diet from countries surrounding the Mediterranean Sea greatly support the positive impacts it makes on human health and cardiovascular disease due to its antioxidant and anti-inflammatory effects (Chrysohoou et al, 2004). Individuals living in countries surrounding the Mediterranean Sea have been shown in research to benefit from increased life expectancy, decreased rates of morbidity from chronic disease and protection against heart attacks, certain cancers, diabetes, and other diseases associated with oxidative stress (Serra-Majem et al, 2004).

An increase in the adherence to the Mediterranean Diet has consistently been associated with a decreased risk of cardiovascular diseases in both observational group studies and prevention trials (Estruch et al, 2013). Recent epidemiological evidence suggests that high intake of olive oil in the Mediterranean Diet is associated with a reduced risk of several chronic disease, with cardiovascular disease being the primary disease (Buckland & Gonzalez, 2015). In addition, a Spanish study on the effects of the Mediterranean Diet on the primary prevention of cardiovascular diseases examined the effects of the Mediterranean Diet on disease prevention by randomly selecting subjects who had either Type 2 diabetes or at least three other major risk factors and asking them to follow a Mediterranean Diet. This study showed that both individuals in both Mediterranean diet groups had a 30% decreased prevalence of major cardiovascular events (Robson, 2014).

According to Whayne (2014), the Mediterranean Diet may also impact the prevalence of various other diseases such as various forms of cancer, Parkinson’s disease,
and Alzheimer’s disease with past research showing that the Mediterranean Diet could play a significant role in the prevention of these diseases (Otaegui-Arrazola et al, 2014). For example, research has shown that individuals strictly following the Mediterranean Diet have been linked to a decrease in cognitive decline (Gotsis et al, 2015). In addition, several studies show a link between individuals with a high adherence to the Mediterranean Diet and a reduced risk from the occurrence of breast cancer, prostate cancer, and cancer mortality (Schwingshackl & Hoffmann, 2014). Furthermore, an inverse correlation exists between the Mediterranean Diet and the consumption of omega-6 and omega-3 essential fatty acids, high intakes of fiber, and antioxidants in the polyphenols such as quercetin and lycopene that are commonly found in foods related to the Mediterranean Diet such as tomatoes, olives, grapes (Ginter & Simko, 2015).

1.3.5.4. Role in Athletics

Many characteristics of the Mediterranean Diet, including high consumptions of whole grains, vegetables, and fruits, have generally been recommended for athletes to include in their diet in order to maintain and improve performance (Potgieter, 2013). There are also other aspects of the Mediterranean Diet such as the consumption of olive oil and antioxidants that could be beneficial to athletes and used as an ergogenic effect (Ginter & Simko, 2015). Omega-3 fatty acids present in olive oil and fish oil are absorbed into heart and muscle skeletal membranes which has been shown to reduce oxygen consumption in animals (Peoples et al, 2008). For example, a study performed on rat skeletal muscle demonstrated that extra-virgin olive oil improved the adaptive response of the body to conditions of oxidative stress due to physical activity.
(Castrogiovanni et al, 2014). In addition, a study on sixteen men concluded that fish oil supplementation lowered heart rate, whole-body oxygen consumption, and rate pressure product during demanding workouts (Peoples et al, 2008).

Although there has been a somewhat inconsistent result regarding the ability of antioxidants to lower the amount of reactive oxygen species that form as a result of demanding exercise, it is possible that this major characteristic of the Mediterranean Diet could be beneficial if utilized by athletes (Potgieter, 2013). A study conducted on recreational marathon runners and tart cherry juice, which contains large amounts antioxidants, improved individual’s recovery after physical activity (Brouner et al, 2010).

The results of these recent studies display not only health benefits to the general population, but also the potential to be used as an ergogenic aid during exercise or athletic performance (Cermak & Van Loon, 2013). Though these individual foods commonly found in the Mediterranean Diet have been studied in various populations, no one to date has examined its use by an athletic population of varying genders and athletic performance levels. It may be beneficial to conduct further research on the Mediterranean Diet as whole in order to see its effect on athletic performance.

1.3.6 Goals of This Project

The principle goal of this project was to determine whether recreational and collegiate athletes adhere to a Mediterranean-type Diet. The hypothesis of this study was less than 50% of college athletes enrolled in a Healthful Living course (HLTH 1520) at Georgia Southern University adhere to a Mediterranean-type Diet, that collegiate athletes adhere to the Mediterranean Diet more often than college athletes involved in recreational
athletics, and that female athletes, both recreational and collegiate, adhere to the Mediterranean Diet more often than male recreational and collegiate athletes. The specific aims of this study were:

Aim 1
To determine collegiate, recreational/intramural (rec/inta), and non-athletes adherence to a Mediterranean-type diet based on the frequency of foods common in the Mediterranean Diet they consume.

Aim 2
To compare the number of recreational, collegiate athletes, and non-athletes that adhere to the Mediterranean Diet.

Aim 3
To compare the number of female and male recreational, collegiate, and non-athletes that adhere to a Mediterranean-type Diet.
Chapter Two - Materials and Methods

2.1 Subjects/Demographics

Demographic data was collected about participants at the start of the study. The subjects of this study were male and female underclassmen enrolled in the Healthful Living (HLTH 1520) course at Georgia Southern University. To be considered underclassmen, this population had to have completed less than 60 college credit hours. Participants of the study were asked to complete a demographic sheet prior to taking the survey where were asked their age, gender, class in school (freshman, sophomore, junior, senior).

Additional questions included whether participants lived on campus, had a meal plan, and whether or not they had a prior nutrition class. Participants were also asked how often they bought and prepared their own meals. Choices included "often" (more than ten times a month), "sometimes" (5-10 times a month), "rarely" (less than 5 times a month), or "never". Furthermore, participants were asked the sports in which they participated, if any, and if so, at what level was their participation. Choices included recreational or collegiate level. Lastly, if participants played a sport, they were asked if they had ever followed a specific diet to improve athletic performance. Choices ranged from yes to no and if yes, participants indicated which diet(s) were followed.

2.2 Instrumentation

The instrument used in this study was a survey derived from the 11-item survey by Martinez-Gonzalez et al. (2004). Food items included non-refined cereals (whole grain bread, pasta, rice, etc.), potatoes, fruits, vegetables, legumes, olive oil, fish, poultry, red meat and products, full-fat dairy products, and alcohol intake which were also
summarized to provide a total Mediterranean Diet Score for each participant. The demographic sheet and survey instrument appear in Appendix A.

2.3 Procedures

Students (N = 933) completed the survey before they received the nutrition lecture in the HLTH 1520 course. This approach was used so that the data from the study would be collected without influence from a nutrition lecture in the course. Surveys were given to three sections of the Healthful Living courses at Georgia Southern University at the beginning of the class period. The survey was given in an auditorium where the students had access to their own desk. The students were given the option to either take the survey or decline participation. There was no penalty if a student chose not to participate in the survey and students also had the right to refuse to continue participation at any time during the administration of the survey. The length of time provided for the survey was approximately ten minutes which was determined before the study was conducted to be sufficient for participants to complete the survey.

2.4 Calculation of Mediterranean Diet Scores

Consistent with other studies, scores of less than or equal to 26 represent a lower Mediterranean Diet score and scores of greater than or equal to 27 represented a higher Mediterranean Diet score. The total Mediterranean Diet score was obtained by totaling individual components of the Mediterranean Diet score including consumption of non-refined cereals, potatoes, fruits, vegetables, legumes, fish, red meat and products, poultry, full-fat dairy products, olive oil, alcohol.
Individual scores for non-refined cereals, potatoes, fruits, vegetables, legumes, fish, full-fat dairy products, and olive oil increase as the servings per week increase. However, individual scores for red meat and products, poultry, and alcohol decrease as the servings per week increase as the consumption of these components are characteristically low in the Mediterranean Diet.

2.5 Approval

Approval for this study was granted by the Institutional Review Board (IRB) at Georgia Southern University. A copy of the IRB approval appears in Appendix B.

2.6 Analysis of the Data

Frequency of adherence to the Mediterranean Diet was analyzed for significance using Fisher’s Exact Test within VassarStats (For a 2x2 Contingency Table:. (n.d.). Retrieved from http://vassarstats.net/tab2x2.html).
Chapter Three - Results

3.1 Demographics

Demographics of all of the participants are presented in Tables 1 and 2. Table 1 shows that of the participants, approximately 5% of males and females were collegiate athletes. Of the remaining participants, a significantly higher proportion of men (63.5%) reported being recreational/intramural athletes than females (36.5%) (p <0.0001) (Table 1). The majority of the participants were freshmen (78%) with an even distribution of males and females (N=372, 39.8% females, N=357, 38.2% males). The remaining were sophomores (22%) with a similar even distribution by gender (N=98, 10.5% females, N=107, 11.4% males). In addition, there was a significant difference in the number of individuals who participated in sports at any level when comparing males and females. Male underclassmen participated significantly more in either level of sports than females (p <0.0001) (Table 1).

The majority of all students lived on campus and participated in a meal plan. Regardless of sex, significantly more collegiate athletes participated in a meal plan than non-athletes (p=0.03) (Table 2). This observation may be due to scholarships being awarded to collegiate athletes by a university scholarship which include meal plan expenses. Based upon this observation, it is not surprising then, that the majority of participants in all categories selected the "sometimes", "rarely", and "never" option when asked how often their meals were bought after preparation at home. These selections would be expected due to the observed high participation rate in meal plans on campus by participants.
Table 1: Demographics of Athletes and Non-Athletes

<table>
<thead>
<tr>
<th></th>
<th>Males (N=463)</th>
<th>Females (N=470)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (N)</td>
<td>% (N)</td>
</tr>
<tr>
<td>Collegiate Athletes a</td>
<td>5.8 (27)</td>
<td>4.7 (22)</td>
</tr>
<tr>
<td>Rec/Intra Athletes a</td>
<td>57.2 (265)</td>
<td>32.3 (152)</td>
</tr>
<tr>
<td>Non-Athletes a</td>
<td>37.0 (171)</td>
<td>63.0 (296)</td>
</tr>
</tbody>
</table>

*p <0.0001 – Significant difference: Male and Female Collegiate/Recreational/Intramural Athletes vs. Male and Female Non-Athletes
Table 2: Demographics of Collegiate Athletes, Recreational/Intramural Athletes, and Non-Athletes by Gender

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Collegiate Male</th>
<th>Female</th>
<th>Rec/Intra Male</th>
<th>Female</th>
<th>Non-Athletes Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (N)</td>
<td></td>
<td>% (N)</td>
<td></td>
<td>% (N)</td>
<td></td>
</tr>
<tr>
<td>Class in School</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>66.7 (18)</td>
<td>81.8 (18)</td>
<td>79.6 (211)</td>
<td>81.6 (124)</td>
<td>74.3 (127)</td>
<td>77.7 (230)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>33.3 (9)</td>
<td>18.2 (4)</td>
<td>20.4 (54)</td>
<td>18.4 (28)</td>
<td>25.7 (44)</td>
<td>22.3 (66)</td>
</tr>
<tr>
<td>Live on Campus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>74.1 (20)</td>
<td>77.3 (17)</td>
<td>79.2 (210)</td>
<td>86.2 (131)</td>
<td>74.3 (127)</td>
<td>80.1 (237)</td>
</tr>
<tr>
<td>No</td>
<td>25.9 (7)</td>
<td>22.7 (5)</td>
<td>20.8 (55)</td>
<td>13.8 (21)</td>
<td>25.7 (44)</td>
<td>19.9 (59)</td>
</tr>
<tr>
<td>Meal Plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>81.5 (22)</td>
<td>81.8 (18)</td>
<td>79.6 (211)</td>
<td>82.2 (125)</td>
<td>71.9 (123)</td>
<td>76.4 (226)</td>
</tr>
<tr>
<td>No</td>
<td>18.5 (5)</td>
<td>18.2 (4)</td>
<td>20.4 (54)</td>
<td>17.8 (27)</td>
<td>28.1 (48)</td>
<td>23.6 (70)</td>
</tr>
<tr>
<td>Buying/Preparation of Own Meals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Often</td>
<td>33.3 (9)</td>
<td>40.9 (9)</td>
<td>27.5 (73)</td>
<td>33.6 (51)</td>
<td>35.1 (60)</td>
<td>32.4 (96)</td>
</tr>
<tr>
<td>S/R/N</td>
<td>66.7 (18)</td>
<td>59.1 (13)</td>
<td>72.5 (192)</td>
<td>66.4 (101)</td>
<td>64.9 (111)</td>
<td>67.6 (200)</td>
</tr>
<tr>
<td>Prior Nutrition Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>85 (17)</td>
<td>86.7 (13)</td>
<td>88.3 (174)</td>
<td>86.4 (108)</td>
<td>88.5 (108)</td>
<td>85.4 (204)</td>
</tr>
<tr>
<td>College</td>
<td>15 (3)</td>
<td>13.3 (2)</td>
<td>11.7 (23)</td>
<td>13.6 (17)</td>
<td>11.5 (14)</td>
<td>14.6 (35)</td>
</tr>
</tbody>
</table>

*Prior nutrition education does not add up to the total because some people selected both and some people did not have prior nutrition education.

a – p = 0.03 Comparison between total athletes and total non-athletes of both genders.
The majority of students in all categories also had prior nutrition education in high school (86.9%). There were also no significant observed differences found between collegiate, recreational/intramural, and non-athlete types in regards to when their prior nutrition education was completed. As well as no significant differences in the extent of nutrition education between athlete types, non-athletes, or by gender regarding their class in school, living on campus, buying and preparation of own meals, and prior nutrition education.

### 3.2 Survey Data

As shown in [Tables 3](#), the sport played most by collegiate male athletes was football (28%), while the sport collegiate female athletes participated in most was marching band and majorettes (20.8%). The next most played sports for collegiate male athletes were marching band/majorettes (28.0%), lacrosse (8.0%), soccer (8.0%), and track and field (8.0%), while the next most played sports for collegiate females athletes were cheerleading (12.5%), dance (12.5%), and swimming and/or diving (12.5%).

Regarding participation in recreational or intramural sports by gender, ([Table 4](#)), male collegiate athletes, males participated most in basketball (20.2%), followed by flag football (20.0%), and soccer (14.9%). The recreational/intramural sports participated in most by females were soccer (19.8%) volleyball (19.4%), and flag football (15.2%).

When asked if they ever followed a specific diet to improve their athletic performance ([Table 5](#)), significantly more male recreational/intramural athletes (78.9%) reported following a diet than female recreational/intramural athletes (21.1%; p <0.0001).
### Table 3: Collegiate Sports by Gender

<table>
<thead>
<tr>
<th>Collegiate Sports</th>
<th>Males (N=27)</th>
<th>Females (N=22)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (N)</td>
<td>% (N)</td>
</tr>
<tr>
<td>Football</td>
<td>25.9 (7)</td>
<td>20.8 (5)</td>
</tr>
<tr>
<td>Marching Band/Majorettes</td>
<td>25.9 (7)</td>
<td>Cheerleading</td>
</tr>
<tr>
<td>Lacrosse</td>
<td>7.4 (2)</td>
<td>Dance</td>
</tr>
<tr>
<td>Soccer</td>
<td>7.4 (2)</td>
<td>Swimming and/or Diving</td>
</tr>
<tr>
<td>Track &amp; Field</td>
<td>7.4 (2)</td>
<td>Equestrian</td>
</tr>
<tr>
<td>Archery</td>
<td>3.7 (1)</td>
<td>Tennis</td>
</tr>
<tr>
<td>Basketball</td>
<td>3.7 (1)</td>
<td>Track &amp; Field</td>
</tr>
<tr>
<td>Golf</td>
<td>3.7 (1)</td>
<td>Basketball</td>
</tr>
<tr>
<td>Tennis</td>
<td>3.7 (1)</td>
<td>Cross Country</td>
</tr>
<tr>
<td>Volleyball</td>
<td>3.7 (1)</td>
<td>Rifle</td>
</tr>
<tr>
<td>Did Not Specify</td>
<td>7.4 (2)</td>
<td>Soccer</td>
</tr>
</tbody>
</table>

*Two females specified participating in 2 or more sport
Table 4: Recreational/Intramural Sports by Gender

<table>
<thead>
<tr>
<th>Rec/Intra Sports</th>
<th>Males (N=476)</th>
<th>Females (N=217)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball</td>
<td>20.2 (96)</td>
<td>19.8 (43)</td>
</tr>
<tr>
<td>Flag Football</td>
<td>20.0 (95)</td>
<td>19.4 (42)</td>
</tr>
<tr>
<td>Soccer</td>
<td>14.9 (71)</td>
<td>15.2 (33)</td>
</tr>
<tr>
<td>Softball</td>
<td>7.8 (37)</td>
<td>6.9 (15)</td>
</tr>
<tr>
<td>Ultimate Frisbee</td>
<td>6.5 (31)</td>
<td>6.5 (14)</td>
</tr>
<tr>
<td>Volleyball</td>
<td>5.9 (28)</td>
<td>6.0 (13)</td>
</tr>
<tr>
<td>Tennis</td>
<td>5.0 (24)</td>
<td>5.1 (11)</td>
</tr>
<tr>
<td>Golf</td>
<td>5.0 (24)</td>
<td>Other^b</td>
</tr>
<tr>
<td>Other^a</td>
<td>14.7 (70)</td>
<td>21.7 (47)</td>
</tr>
<tr>
<td>Softball</td>
<td>6.9 (15)</td>
<td>6.5 (14)</td>
</tr>
<tr>
<td>Basketball</td>
<td>20.0 (95)</td>
<td>19.4 (42)</td>
</tr>
<tr>
<td>Soccer</td>
<td>14.9 (71)</td>
<td>15.2 (33)</td>
</tr>
<tr>
<td>Softball</td>
<td>7.8 (37)</td>
<td>6.9 (15)</td>
</tr>
<tr>
<td>Ultimate Frisbee</td>
<td>6.5 (31)</td>
<td>6.5 (14)</td>
</tr>
<tr>
<td>Volleyball</td>
<td>5.9 (28)</td>
<td>6.0 (13)</td>
</tr>
<tr>
<td>Tennis</td>
<td>5.0 (24)</td>
<td>5.1 (11)</td>
</tr>
<tr>
<td>Golf</td>
<td>5.0 (24)</td>
<td>Other^b</td>
</tr>
<tr>
<td>Other^a</td>
<td>14.7 (70)</td>
<td>21.7 (47)</td>
</tr>
</tbody>
</table>

^aOther for males: Raquetball, dodge ball, gym, none indicated, swimming/diving, rugby, lacrosse, bowling, other, archery, table tennis, skateboarding, ROTC hunting, humans vs zombies, friendly, wrestling, triathlon, wheelchair basketball, Quidditch, biking/cycling/spinning, climbing, running/jogging, aikido (all were <5% participation each)

^bOther for females: Dodge ball, gym, tennis, archery, yoga, cheerleading, dance, running/jogging, lacrosse, golf, tennis, racquetball, fitness class, biking/cycling/spinning, Quidditch, equestrian, at home/on own, outside activities, swimming, bowling, walking, ROTC (all were <5% participation each)
Table 5: Adherence of Athletes to a Specific Diet to Improve Performance

<table>
<thead>
<tr>
<th></th>
<th>Males (N=292)</th>
<th>Females (N=174)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (N)</td>
<td>% (N)</td>
</tr>
<tr>
<td>Collegiate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>55.6 (15)</td>
<td>31.8 (7)</td>
</tr>
<tr>
<td>No</td>
<td>44.4 (12)</td>
<td>68.4 (15)</td>
</tr>
<tr>
<td>Rec/Intra a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>67.5 (179)</td>
<td>31.6 (48)</td>
</tr>
<tr>
<td>No</td>
<td>32.5 (86)</td>
<td>68.4 (104)</td>
</tr>
</tbody>
</table>

*a p=< 0.0001 – Significant difference between Male Recreational/Intramural Athletes and Female Recreational/Intramural Athletes
In contrast, there was no significant difference by gender when comparing the prevalence of collegiate athletes who followed a specific diet (Table 5).

More specifically, Table 6 displays the results to the free response question participants were asked regarding what specific diets they may have followed, if any, for athletic performance. Regardless of athlete type, the four most chosen diets for both genders were increased carbohydrate intake, decreased carbohydrate intake, increased protein intake, and increased water intake. Of these diets, male collegiate athletes followed a decreased carbohydrate diet (20.8%) most followed by an increased carbohydrate diet (12.5%). In contrast, female collegiate athletes indicated following an increased carbohydrate diet (22.2%) most, then an increased water intake diet (22.2%), followed by a decreased carbohydrate diet (11.1%). Of these choices, male recreational/intramural athletes mostly specified following an increased protein intake diet (23.0%) followed by a decreased carbohydrate diet (14.8%), while female recreational/intramural athletes mostly followed a decreased carbohydrate intake diet (23.8%) followed by an increased protein intake diet (12.5%). No comparison was made between the type of sport played and the specific diet followed by any of the athlete types.

While no participant self-reported intentionally following a Mediterranean Diet, the purpose of this study was to determine if participants followed diets with Mediterranean characteristics through their reporting of consumption of specific components within the diet through the reporting of a Mediterranean Diet Score (Martínez-Gonzalez et al, 2004). The results of this analysis by gender and athlete status
Table 6: Adherence of Collegiate and Recreational/Intramural Athletes to Specific Diets* by Gender

<table>
<thead>
<tr>
<th></th>
<th>Males (N=292)</th>
<th>Females (N=174)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male Collegiate Diets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased Carbohydrate Intake</td>
<td>20.8 (5)</td>
<td>Decreased Carbohydrate Intake</td>
</tr>
<tr>
<td>Increased Carbohydrate Intake</td>
<td>12.5 (3)</td>
<td>Increased Carbohydrate Intake</td>
</tr>
<tr>
<td>Other^a</td>
<td>66.7 (16)</td>
<td>Water/ Water Diet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other^b</td>
</tr>
<tr>
<td><strong>Male Rec/Intra Diets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased Protein Intake</td>
<td>23.0 (28)</td>
<td>Increased Protein Intake</td>
</tr>
<tr>
<td>Decreased Carbohydrate Intake</td>
<td>14.8 (18)</td>
<td>Decreased Carbohydrate Intake</td>
</tr>
<tr>
<td>Water/ Water Diet</td>
<td>5.7 (7)</td>
<td>Water/ Water Diet</td>
</tr>
<tr>
<td>Increased Carbohydrate Intake</td>
<td>9.0 (11)</td>
<td>Other^d</td>
</tr>
<tr>
<td>Other^c</td>
<td>46.2 (55)</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Female Collegiate Diets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased Carbohydrate Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased Carbohydrate Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water/ Water Diet</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other^d</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Female Rec/Intra Diets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased Protein Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased Carbohydrate Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water/ Water Diet</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other^d</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a: Other (<5%) includes Increased Fat Intake, Increased Protein Intake, Gluten Free, No Fried Foods, Fruit (8.3%), Gaining Weight/Bulking/Caloric Surplus (16.7%), Healthy/Clean Eating (12.5%), Vegetables (8.3%)
b: Other includes Fruit (11.1%), Grilled Foods (11.1%), Diet Plan Recommended by Coach (11.1%), Paleo Diet (11.1%), Gluten Free (11.1%)
c: Other (<5%) includes Caloric Surplus/ Gaining Weight, Healthy/ Clean Eating, Paleo Diet, Fruits, Did not include, Calorie Counting/ Tracking, Vegetables, No junk, processed, fried foods, Personal, Carbohydrate balance, Vegetarian, Low-Fat Diet, Supplements, Ketogenic Diet, Gluten Free, Jordon Burroughs Workout, Military Diet, Chicken And Rice, South Beach Diet, Juice Cleanse, Caloric deficit/losing weight (6.6%)
d: Other (<5%) includes Healthy/ Clean Eating, Vegetarian Diet, Calorie Counting/ Tracking, Vegetables, Caloric Surplus/ Gaining Weight, Caloric Deficit/ Losing Weight, Increased Carbohydrate Intake, Gluten Free, Low-Fat Diet, Supplements, No Sodium, Liquid Diet, Grilled Foods, Gatorade Only, Daniel Fast, Cheat Day Sunday, Paleo Diet (7.5%), Fruits (6.3%), No junk, processed, fried foods (5.0%), Did Not Include (5.0%)

*No athletes reported following the Mediterranean Diet
are shown in Figure 1. The majority of students in all categories in both genders obtained an overall Mediterranean Diet score of 26 or less.

The percentage of students with an overall score at or below 26 ranged from 63% of male collegiate athletes to 82% of male non-athletes. Participants with an overall score at or above 27 included 18% of male non-athletes and 37% of male collegiate athletes. Despite an apparent trend for male and female collegiate athletes to have high Mediterranean Diet scores compared to recreational/intramural athletes and non-athletes, these differences in total Mediterranean Diet scores did not reach significance. These scores are consistent with self-reported diets that were followed in that following a Mediterranean Diet wasn’t a specific diet initially followed by participants for athletic performance.

Further analysis of Table 7 shows consumption scores for individual components of the Mediterranean Diet, including non-refined cereals, potatoes, fruits, vegetables, legumes, fish, red meat and potatoes, poultry, full-fat dairy products, olive oil, and alcohol. When considering all types of athletes and non-athletes, males ate significantly more potatoes (p=0.02), fish (p=0.006), red meat (p <0.0001), and poultry (p = 0.0003) than females. In addition, when comparing all athletes to non-athletes by gender on their Mediterranean Diet scores for potatoes, fruit, vegetables, and alcohol, female college who participated in sports consumed significantly more potatoes (p=0.02), fruit (p=0.007), vegetables (p=0.01) and alcohol (p=0.01) than non-athlete female college students. These differences may be explainable based upon self-reported participation in particular sports. The majority of male athletes reported participating in
Figure 1 - Overall Mediterranean Diet Score

- A score of $\leq 26^a$ represents a lower Mediterranean Diet score. A score of $\geq 27^a$ represents a higher Mediterranean Diet score. Score was obtained by totaling individual components of the Mediterranean Diet score which includes non-refined cereals, potatoes, fruits, vegetables, legumes, fish, red meat and products, poultry, full fat dairy products, olive oil, alcohol. The ranges of total values were 0-81.
Table 7: Individual Mediterranean Diet Score for Food Categories by Athletic Status and Gender

<table>
<thead>
<tr>
<th>Food Category</th>
<th>Collegiate Males (N=27)</th>
<th>Collegiate Females (N=22)</th>
<th>Rec/Intra Males (N=265)</th>
<th>Rec/Intra Females (N=152)</th>
<th>Non-Athlete Males (N=171)</th>
<th>Non-Athlete Females (N=296)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (N)</td>
<td>% (N)</td>
<td>% (N)</td>
<td>% (N)</td>
<td>% (N)</td>
<td>% (N)</td>
</tr>
<tr>
<td>Non-Refined Cereals b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>88.9 (24)</td>
<td>95.5 (21)</td>
<td>86.4 (229)</td>
<td>93.4 (142)</td>
<td>91.2 (156)</td>
<td>98.0 (290)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>11.1 (3)</td>
<td>4.5 (1)</td>
<td>13.6 (36)</td>
<td>6.6 (10)</td>
<td>8.8 (15)</td>
<td>2.0 (6)</td>
</tr>
<tr>
<td>Fruits c</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>74.1 (20)</td>
<td>68.2 (15)</td>
<td>75.1 (199)</td>
<td>64.5 (98)</td>
<td>82.5 (141)</td>
<td>76.7 (227)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>25.9 (7)</td>
<td>31.8 (7)</td>
<td>24.9 (66)</td>
<td>35.5 (54)</td>
<td>17.5 (30)</td>
<td>23.3 (69)</td>
</tr>
<tr>
<td>Vegetables d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>81.5 (22)</td>
<td>90.9 (20)</td>
<td>88.7 (235)</td>
<td>81.6 (124)</td>
<td>88.3 (151)</td>
<td>90.5 (268)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>18.5 (5)</td>
<td>9.1 (2)</td>
<td>11.3 (30)</td>
<td>18.4 (28)</td>
<td>11.7 (20)</td>
<td>9.5 (28)</td>
</tr>
<tr>
<td>Legumes e</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>14.8 (4)</td>
<td>22.2 (6)</td>
<td>37.0 (98)</td>
<td>39.5 (60)</td>
<td>39.2 (67)</td>
<td>45.3 (134)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>85.2 (23)</td>
<td>72.7 (16)</td>
<td>63.0 (167)</td>
<td>60.5 (92)</td>
<td>60.8 (104)</td>
<td>54.7 (162)</td>
</tr>
<tr>
<td>Fish f</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>18.5 (5)</td>
<td>36.4 (8)</td>
<td>34.0 (90)</td>
<td>46.7 (71)</td>
<td>40.4 (69)</td>
<td>52.0 (154)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>81.5 (22)</td>
<td>63.6 (14)</td>
<td>66.0 (175)</td>
<td>53.2 (81)</td>
<td>59.6 (102)</td>
<td>48.0 (142)</td>
</tr>
<tr>
<td>Red meat and products g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>59.2 (16)</td>
<td>36.4 (8)</td>
<td>70.2 (186)</td>
<td>50.7 (77)</td>
<td>69.6 (119)</td>
<td>41.9 (124)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>40.7 (11)</td>
<td>63.6 (14)</td>
<td>29.8 (79)</td>
<td>49.3 (75)</td>
<td>30.4 (52)</td>
<td>58.1 (172)</td>
</tr>
<tr>
<td>Poultry h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>18.5 (5)</td>
<td>0.00 (0)</td>
<td>23.4 (62)</td>
<td>10.5 (16)</td>
<td>74.3 (127)</td>
<td>8.4 (25)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>81.5 (22)</td>
<td>100.0 (22)</td>
<td>76.6 (203)</td>
<td>89.5 (136)</td>
<td>25.7 (44)</td>
<td>91.6 (271)</td>
</tr>
<tr>
<td>Full fat dairy products i</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>100.0 (27)</td>
<td>100.0 (22)</td>
<td>95.8 (254)</td>
<td>99.3 (151)</td>
<td>93.6 (160)</td>
<td>98.0 (290)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>0.00 (0)</td>
<td>0.00 (0)</td>
<td>4.2 (11)</td>
<td>0.7 (1)</td>
<td>6.4 (11)</td>
<td>2.0 (6)</td>
</tr>
<tr>
<td>Olive Oil j</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>25.9 (7)</td>
<td>31.8 (7)</td>
<td>29.8 (79)</td>
<td>26.3 (40)</td>
<td>40.9 (70)</td>
<td>36.5 (108)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>74.1 (20)</td>
<td>68.2 (15)</td>
<td>70.2 (186)</td>
<td>73.7 (112)</td>
<td>59.1 (101)</td>
<td>63.5 (188)</td>
</tr>
<tr>
<td>Alcohol k</td>
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<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>3.7 (1)</td>
<td>4.5 (1)</td>
<td>14.0 (37)</td>
<td>8.6 (13)</td>
<td>7.0 (12)</td>
<td>2.4 (7)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>96.3 (26)</td>
<td>95.5 (21)</td>
<td>86.0 (228)</td>
<td>91.4 (139)</td>
<td>93.0 (159)</td>
<td>97.6 (289)</td>
</tr>
</tbody>
</table>
a: Non-Refined Cereals: Individual score is increased as serving per week of non-refined cereals increases or is high
  • No significant differences found
b: Potatoes: Individual score is increased as serving per week of potatoes increases or is high
  • $p = .03$ Comparison between Rec/Intra Men and Women
  • $p = .02$ Comparison between Total Male and Female Athletes
  • $p = .001$ Comparison between Male and Female College Students That Do Not Play Sports
  • $p = .02$ Comparison between Total Female Athletes and Female College Students That Do Not Play Sports
c: Fruits: Individual score is increased as serving per week of fruits increases or is high
  • $p = .02$
  • $p = .03$ Comparison between Rec/Intra Men and Women
  • $p = .007$ Comparison between Total Female Athletes and Female College Students That Do Not Play Sports
d: Vegetables: Individual score is increased as serving per week of vegetables increases or is high
  • $p = .01$ Comparison between Total Female Athletes and Female College Students That Do Not Play Sports
e: Legumes: Individual score is increased as serving per week of legumes increases or is high
  • $p = .03$ Comparison between Total Athletes and Total College Students That Do Not Play Sports
f: Fish: Individual score is increased as serving per week of fish increases or is high
  • $p = .01$
  • $p = .006$ Comparison between Total Male and Female Athletes
  • $p = .02$ Comparison between Male and Female College Students That Do Not Play Sports
  • $p = .03$ Comparison between Total Athletes and Total College Students That Do Not Play Sports
g: Red Meat and Products: Individual score is increased as serving per week of red meat and products decreases or is low
  • $p < .0001$ Comparison between Rec/Intra Men and Women
  • $p < .0001$ Comparison between Total Male and Female Athletes
  • $p = .004$ Comparison between Total Athletes and Total College Students That Do Not Play Sports
h: Poultry: Individual score is increased as serving per week of poultry decreases or is low
  • $p = .002$ Comparison between Rec/Intra Men and Women
  • $p = .0003$ Comparison between Total Male and Female Athletes
i: Full Fat Dairy Products: Individual score is increased as serving per week of full-fat dairy products increases or is high
  • $p = .006$ Comparison between Rec/Intra Men and Women
  • $p = .02$ Comparison between Male and Female College Students That Do Not Play Sports
j: Olive Oil: Individual score is increased as serving per week of olive oil increases or is high
  • $p = .04$ Comparison between Total Female Athletes and Female College Students That Do Not Play Sports
  • $p = .01$ Comparison between Total Male Athletes and Male College Students That Do Not Play Sports
  • $p = .002$ Comparison between Total Athletes and Total College Students That Do Not Play Sports
k: Alcohol: Individual score is increased as serving per week of alcohol decreases or is low
  • $p = .02$ Comparison between Male and Female College Students That Do Not Play Sports
  • $p = .005$ Comparison between Total Female Athletes and Female College Students That Do Not Play Sports
  • $p < .0001$ Comparison between Total Athletes and Total College Students That Do Not Play Sports
football, marching band, basketball, and soccer. In addition, female athletes reported participating in mainly marching band, cheerleading, soccer, and volleyball.

Consumption of a diet high in lean protein such as fish and poultry, as well as complex carbohydrates, are typical characteristics of diets followed when individuals participate in sports that involve anaerobic activities which is what the majority of the men participate in, such as football, basketball, and soccer. When comparing male athletes of both types together to non-athletes males, male athletes reported consuming significantly more olive oil than non-athlete males (p=0.01).

Regardless of gender and level of athletic participation, participants in sports had significantly altered diet scores for individual components of the Mediterranean Diet. This supports the concept that certain components of the Mediterranean Diet are being followed by athletes. Fruit (p=0.008), legumes (p=0.03), fish (p=0.001), olive oil (p=0.002), and alcohol (p <0.0001) were consumed significantly more in athletes than in non-athletes. However, in opposition to a Mediterranean Diet consumption pattern, athletes also ate significantly more red meat (p=0.004) than non-athletes. In addition, potatoes (p=0.003) were consumed significantly less in athletes than in non-athletes.

Similar trends were observed among recreational/intramural and non-athletes when comparing males to females. Specifically, among males and females who played recreational/intramural sports, males ate more potatoes (p=0.03), fish (p=0.01), red meat (p <0.0001), and poultry (p=0.002) than females. In contrast, these same females ate more fruit than male recreational/intramural athletes (p=0.02). Finally, among non-athletes, males ate more potatoes (p=0.001), fish (p=0.02), full fat dairy products (p=0.02), and alcohol (p=0.02) than females.
Chapter 4 - Summary and Discussion

The main goal of this study was to determine whether collegiate and recreational/intramural athletes and non-athlete college students adhere to a Mediterranean-type Diet. The hypothesis for this study was shown to be true in that less than 50% of college athletes enrolled in a Healthful Living course (HLTH 1520) at Georgia Southern University adhere to the Mediterranean Diet, and also that female athletes, both recreational and collegiate, adhere to the Mediterranean Diet more often than male recreational and collegiate athletes.

The first specific aim of this study was to determine how if recreational and collegiate athletes adhere to a Mediterranean-type Diet based on the frequency of consumption for foods common in the Mediterranean Diet. This study showed that there were no significant differences among the high and low total Mediterranean Diet scores in any of the categories. However, many of the participants in all categories had a Mediterranean Diet score of 26 or below which indicated that the majority of these college students have a low adherence to the Mediterranean Diet. These results are not surprising since according to studies conducted on university students in the United States, students displayed dietary habits below the recommended levels for fruits and vegetables, and at an increased intake level for high saturated fat foods (Silliman et al, 2004). In addition, when students self-reported following particular diets to improve athletic performance, no one indicated following a Mediterranean Diet. Overall, the Mediterranean Diet pattern which includes a high intake of fruits and vegetables and low consumption of high saturated fat foods such as poultry and red meat products is in opposition to reported intakes by those participants. This observation may be due to
college being a critical period of transition for college students. Environmental factors, including on and off-campus living, may have an effect on students eating behaviors. In addition, other studies reported that college students state that availability, lack of time, and appeal of food are factors that have influence on their eating behaviors (Deliens et al, 2014). With an inability to adapt to their new environment, negative dietary habits can occur, such as lower consumptions of vegetables and the possibility of weight gain (Deliens et al, 2014). The data from the current study support this idea.

In Aim 2, the number of recreational athletes, collegiate athletes, and non-athletes that adhere to the Mediterranean Diet without the consideration of gender was compared. As described earlier, there were no significant differences found in any of the categories when comparing total Mediterranean Diet scores so there were no differences between collegiate, recreational/intramural athletes and non-athletes. Likewise, Aim 3 compared the number of female and male recreational, collegiate, and non-athletes adherence to a Mediterranean-type Diet. Again, there were no significant differences found between genders in any athlete category when comparing total Mediterranean Diet scores. Based on the results of this study, athlete status and gender did not appear to overall influence adherence to a Mediterranean Diet by college students even though it affected individual scores. This may suggest that issues discussed before regarding environmental and time factors influencing the dietary patterns of college students may be applied to all athlete categories, non-athletes, and genders alike. Although athletes, in general, may be expected to have greater nutrition knowledge and more adequate nutritional intakes than non-athletes, research shows that an athlete’s dietary patterns can be substandard. In a study conducted by Hinton et al, 2004, only 15% of male athletes and 26% of female
athletes had adequate intakes of carbohydrate and protein. Furthermore, from the same study, male athletes were more likely to exceed the Dietary Guidelines for fat, saturated fat, cholesterol, and sodium than female athletes. This research shows that it is possible for the diets of collegiate and recreational athletes to be similar to that of non-athlete college students, thereby supporting the results of the current study.

Since the majority of both athlete and non-athlete college students in the current study have a lower adherence to the Mediterranean Diet, all underclassmen college students could benefit from receiving nutrition education and information about the Mediterranean Diet and its link to decreased mortality risk and increased cardiovascular health (Petroka et al, 2016). Specific aspects of the Mediterranean Diet such as high intakes of complex carbohydrates, plant foods, fish, olive oil, and antioxidants are also important for athletes to help maintain and improve their performance. Education of athletes on these specific components in the Mediterranean Diet may also be beneficial to help improve performance. Specifically, an emphasis on a diet characteristically high in complex carbohydrates, lean sources of protein, plant-based foods, omega-3 fatty acids, and antioxidants could be beneficial.

Prior studies have shown that both male and female college students benefit from nutrition education interventions. Educational nutrition lectures and cooking demos have been shown in past research to increase the consumption of fruits and vegetables after the intervention (Lua & Wan Putri Elena, 2012). In the current study, the majority of participants had prior nutrition education coursework in high school, with no significant differences between genders, athlete type, and non-athletes. While not asked of participants, it is likely that nutrition education received in high school was incorporated.
into health classes with a small emphasis on nutrition. To be more effective, a study conducted by Mirsa (2007) recommends offering stand-alone nutrition education courses and programs in college.

This study is limited in that it included class sections selected for the completion of the survey mostly being comprised of freshman (78%). Due to this, the study only utilized an underclassmen population. In the future, inclusion of juniors and seniors in a similar study may allow for a more thorough analysis of adherence of students throughout college to a Mediterranean Diet. In addition, the distribution of athlete categories in the current study were uneven. Collegiate athletes represented a low percent of the participant population (5.3%). In contrast, recreational and intramural athletes (44.5%) and non-athlete students (50.1%) represented a greater proportion of the participants. Surveying additional sections of HLTH 1520 may have increased the number of collegiate athlete participants.

Future studies may compare upperclassmen to underclassmen collegiate athletes, recreational/intramural, and non-athletes to determine see whether year in college or age plays a role in adherence to the Mediterranean Diet. In addition, a future study could include a larger variety of athletes and sports and to see if there is any distinction between type of sport and adherence to the Mediterranean Diet. In conclusion, the results of this study add information to the body of knowledge regarding adherence to the Mediterranean Diet among college aged collegiate, recreational and intramural athletes and non-athletes.
Reference List


Appendices
Appendix A: Copies of Instruments
Appendix A1: Demographics Questions

1. Gender (check one):
    ____ Male                          ____ Female

2. Age
    _______

3. Class in School
    _____ Freshman                 _____ Sophomore
    _____ Junior                      _____ Senior

4. Do you currently live on-campus at Georgia Southern University?
    _____ Yes                          _____ No

5. Do you currently participate in a meal plan at Georgia Southern University?
    _____ Yes                           _____ No

6. How often do you prepare/plan your own meals?
    _____ Often (more than 10 times a month)      _____ Sometimes (5-10 times a month)
    _____ Rarely (less than 5 times a month)      _____ Never

7. Have you had a nutrition class/lecture in college or high school of any kind before today?
    _____ Yes                          _____ No

8. If yes, when?
    _____ College          _____ High School

9. Which level of sports do you participate in at Georgia Southern?
    _____ Intramural               _____ Recreational                _____ Collegiate
    _____ None                          _____ Other (_____________________________)

10. Which of the intramural/recreation sports do you participate in at Georgia Southern? (choose all that apply)
    _____ Softball     _____ Flag Football      _____ Volleyball       _____ Ultimate Frisbee
    _____ Tennis       _____ Basketball         _____ Golf             _____ Soccer
    _____ None          _____ Other (_____________________________)

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11. Which of the collegiate sports do you participate in at Georgia Southern?

- [ ] Baseball
- [ ] Basketball
- [ ] Golf
- [ ] Track & Field
- [ ] Soccer
- [ ] Tennis
- [ ] Rifle
- [ ] Cross Country
- [ ] Softball
- [ ] Swimming and/or Diving
- [ ] Volleyball
- [ ] None
- [ ] Other (___________________________________)

12. Have you ever followed a specific diet to improve your athletic performance?

- [ ] Yes
- [ ] No

13. If yes, which type of diet(s)?

__________________________________________________________________________________
### Appendix A2: Mediterranean Diet Score

How often do you consume the following items per week?

<table>
<thead>
<tr>
<th>Item</th>
<th>Servings Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Non-refined cereals (whole grain bread, pasta, rice, etc.)</td>
<td>Never, 1-4 servings, 5-8 servings, 9-12 servings, 13-18 servings, &gt;18 servings</td>
</tr>
<tr>
<td>(1 slice of bread, 1 cup of ready-to-eat cereal, or ½ cup of cooked rice, cooked pasta, or cooked cereal)</td>
<td></td>
</tr>
<tr>
<td>14. Potatoes (1 medium boiled or baked white potato; 1 cup diced or mashed potato)</td>
<td>Never, 1-4 servings, 5-8 servings, 9-12 servings, 13-18 servings, &gt;18 servings</td>
</tr>
<tr>
<td>15. Fruits (1 medium fruit; ½ cup chopped)</td>
<td>Never, 1-4 servings, 5-8 servings, 9-12 servings, 13-18 servings, &gt;18 servings</td>
</tr>
<tr>
<td>16. Vegetables (1 cup raw leafy vegetables; ½ cup other vegetables)</td>
<td>Never, 1-4 servings, 5-8 servings, 9-12 servings, 13-18 servings, &gt;18 servings</td>
</tr>
<tr>
<td>17. Legumes (beans) (1/2 cup cooked or canned)</td>
<td>Never, 1-4 servings, 5-8 servings, 9-12 servings, 13-18 servings, &gt;18 servings</td>
</tr>
<tr>
<td>18. Fish (8 ounces of uncooked fish)</td>
<td>Never, 1-4 servings, 5-8 servings, 9-12 servings, 13-18 servings, &gt;18 servings</td>
</tr>
<tr>
<td>19. Red meat and products (hot dogs, bacon, etc.) (2 to 3 ounces of cooked leans meat)</td>
<td>Never, 1-4 servings, 5-8 servings, 9-12 servings, 13-18 servings, &gt;18 servings</td>
</tr>
</tbody>
</table>
20. Poultry (2 to 3 ounces of cooked leans meat)

_____ Never  _____ 1-4 servings  _____ 5-8 servings
_____ 9-12 servings  _____ 13-18 servings  _____ >18 servings

21. Full fat dairy products (cheese, yoghurt, and milk)
(1 cup milk yogurt; 2 ounces processed cheese)

_____ Never  _____ 1-4 servings  _____ 5-8 servings
_____ 9-12 servings  _____ 13-18 servings  _____ >18 servings

22. Use of olive oil in cooking (times/week) (1 tablespoon)

_____ Never  _____ 1-4 servings  _____ 5-8 servings
_____ 9-12 servings  _____ 13-18 servings  _____ >18 servings

23. Alcoholic beverages (ounces per day)
(1 beer = 12 oz. and 1 restaurant served glass of wine = 5 oz.)

_____ Less than 10 oz/ day  _____ 10 oz/ day  _____ 13.5 oz/ day
_____ 17 oz/day  _____ 20 oz/ day  _____ >23.7 oz/ day
Appendix B: Informed Consent and Institutional Review Board Approvals
Appendix B1: Informed Consent and IRB Approvals

Georgia Southern University
Office of Research Services & Sponsored Programs
Institutional Review Board (IRB)

Phone: 912-478-5465
Fax: 912-478-0719

Veazey Hall 3000
PO Box 8005
Statesboro, GA 30460

To: Ugbo, Amber
Romanchik-Cerpovicz, Joelle

From: Office of Research Services and Sponsored Programs
       Administrative Support Office for Research Oversight Committees
       (IACUC/IBC/IRB)

Initial Approval Date: 12/9/2016
Expiration Date: 11/30/2017
Subject: Status of Application for Approval to Utilize Human Subjects in Research – Expedited

After a review of your proposed research project numbered H17171 and titled “Adherence to the Mediterranean Diet Among Recreational and Collegiate Level Athletes,” it appears that (1) the research subjects are at minimal risk, (2) appropriate safeguards are planned, and (3) the research activities involve only procedures which are allowable. You are authorized to enroll up to a maximum of 2250 subjects.

Therefore, as authorized in the Federal Policy for the Protection of Human Subjects, I am pleased to notify you that the Institutional Review Board has approved your proposed research. Description: This project will survey male and female college students enrolled in Healthful Living Class (HLET 1520) to assess their adherence to the Mediterranean Diet.

If at the end of this approval period there have been no changes to the research protocol, you may request an extension of the approval period. In the interim, please provide the IRB with any information concerning any significant adverse event, whether or not it is believed to be related to the study, within five working days of the event. In addition, if a change or modification of the approved methodology becomes necessary, you must notify the IRB Coordinator prior to initiating any such changes or modifications. At that time, an amended application for IRB approval may be submitted. Upon completion of your data collection, you are required to complete a Research Study Termination form to notify the IRB Coordinator, so your file may be closed.

Sincerely,

Eleanor Haynes
Compliance Officer
# Appendix B2: Research Compliance

## Research Compliance Combined Cover Page

**Georgia Southern University**  
*Application for Research Approval*

<table>
<thead>
<tr>
<th>Name of Principal Investigator:</th>
<th>Phone: 404-909-6583</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amber Udjo</td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:aud251@georgiasouthern.edu">aud251@georgiasouthern.edu</a></td>
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<table>
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<tr>
<th>Name(s) of Co-Investigators:</th>
<th>Phone: 912-871-1420</th>
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</thead>
<tbody>
<tr>
<td>Dr. Jocie Romanchik-Cerpowicz</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:jromanchik@georgiasouthern.edu">jromanchik@georgiasouthern.edu</a></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Faculty □ Doctoral □ Specialist □ Masters □ Undergraduate □ Other:</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Faculty; □ Doctoral; □ Specialist; □ Masters; □ Undergraduate; □ Other;</td>
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</table>

<table>
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<tr>
<th>Department Name and PO Box: Department of Health and Kinesiology, P.O. Box 8076</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Protocol ID</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Personal and/or Institutions Outside of Georgia Southern University involved in this research (Attach training certification):</th>
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</thead>
<tbody>
<tr>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Project Information: (Please list all projects MUST match grant title)</th>
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<tr>
<td>Title: Adherence to the Mediterranean Diet Among Recreational and Collegiate Level Athletes</td>
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<table>
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<tr>
<th>Brief (less than 50 words): Project Summary: This project will survey male and female college students enrolled in Healthful Living class (HLTH 1520) to assess their adherence to the Mediterranean Diet.</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Compliance Information:</th>
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<tbody>
<tr>
<td>Please indicate which of the following will be used in your research: (application may be submitted simultaneously)</td>
</tr>
<tr>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>□ Human Subjects (Complete Section A: Human Subjects below)</td>
</tr>
<tr>
<td>□ Care and Use of Vertebrate Animals (Complete Section B: Care and Use of Vertebrate Animals below)</td>
</tr>
<tr>
<td>□ Biohazards (Complete Section C: Biohazards below)</td>
</tr>
<tr>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>Do you or any investigator on this project have a financial interest in the subjects, study outcome, or project sponsor. (Conflicts of interest must be submitted with the application)</td>
</tr>
<tr>
<td>Desired Start Date: 1/19/2017 (no more than 1 year)</td>
</tr>
<tr>
<td>Anticipated renewals □ year 2 □ year 3</td>
</tr>
<tr>
<td>Check out: □ New submission □ Resubmission #</td>
</tr>
<tr>
<td>Funding Source: □ Federal □ State □ Private □ Internal GSU □ Self-funded/non-funded</td>
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<td>Funding Agency/Department:</td>
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<table>
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<tr>
<th>Section A: Human Subjects</th>
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<tbody>
<tr>
<td>Number of Subjects (Maximum) 2250</td>
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<table>
<thead>
<tr>
<th>Please indicate if the following are included in the study (Check all that apply):</th>
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<tr>
<td>□ Survey delivered by email to georgiasouthern.edu addresses</td>
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<tr>
<td>□ Human Subjects Incentives</td>
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<tr>
<td>□ Deception</td>
</tr>
<tr>
<td>□ At Risk Populations (prisoners, children, pregnant women, etc)</td>
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<tr>
<td>□ Video or Audio Tapes</td>
</tr>
<tr>
<td>□ Medical Procedures, including exercise, administering drugs/dietary supplements, and other procedures, or ingestion of any substance</td>
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</table>

<table>
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<tr>
<th>Section B: Care and Use of Vertebrate Animals</th>
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<tbody>
<tr>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

Updated 10/22/16
Purpose of use/care of animals:

- Research
- Teaching
- Demo only
- Student participation in faculty work
- Class Project
- Exhibition
- Display

Please indicate if the following are included in the study:

- Physical intervention with vertebrate animals
- Housing of vertebrate animals
- Euthanasia of vertebrate animals
- Use of sedation, analgesia, or anesthesia
- Surgery
- Farm animals for biomedical research (e.g., tissues, organs, etc.)
- Farm animals for agricultural research (e.g., food/ fiber production, etc.)
- Observation of vertebrate animals in their natural setting

Section C: Biological Research

- Not Applicable
- Submitted Separately

Biosafety Level:

- Exempt
- BSL 1
- BSL 2
- BSL 3

Please indicate if the following are included in the study:

- Use of rDNA
- Non-native/invasive plant species
- Last IHS lab safety inspection date:
- Last IBC biosafety lab inspection date:

Signature of Applicant(s) (PI, CoPI):

Date:

If student project please complete research advisor's information below. Note that advisor signature must be received before application will be reviewed. If faculty project please complete department chair's information below.

Department Chair or Research Advisor's Name: Dr. Joel Romanchik-Cepovicek
E-mail: jromanchik@georgiasouthern.edu
Phone: 912-478-1420
Department: Health and Kinesiology
P.O. Box: 8076

If student project - Signature of faculty member who is responsible for the student conducting research.
If faculty project - Signature of department head or chair.

By signing this cover page I acknowledge that I have reviewed and approved this protocol for scientific merit, rationality and significance. I further acknowledge that I approve the ethical basis for the study.

Signature of Committee Chair/Research Advisor (if student)/Department Chair (if faculty):

Date:

Please submit this protocol to IRB@georgiasouthern.edu in a single email; scans, signatures and official Adobe electronic signatures are accepted. Applications may also be submitted via mail to the Georgia Southern University Office of Research Integrity, P.O. Box 8005.

The application should contain all required documents specific to the committee to which you are applying. Questions or comments can be directed to (912) 478-5465 or IRB@georgiasouthern.edu.
Appendix B3 – Certification of Investigator Responsibilities

CERTIFICATION OF INVESTIGATOR RESPONSIBILITIES

By signing below I agree/certify that:

1. I have reviewed this protocol submission in its entirety and I state that I am fully cognizant of, and in agreement with, all submitted statements and that all statements are truthful.

2. This application, if funded by an extramural source, accurately reflects all procedures involving human participants described in the proposal to the funding agency previously noted.

3. I will conduct this research study in strict accordance with all submitted statements except where a change may be necessary to eliminate an apparent immediate hazard to a given research subject.
   a. I will notify the IRB promptly of any change in the research procedures necessitated in the interest of the safety of a given research subject.
   b. I will request and obtain IRB approval of any proposed modification to the research protocol or informed consent document(s) prior to implementing such modifications.

4. I will ensure that all co-investigators, and other personnel assisting in the conduct of this research study have been provided a copy of the entire current version of the research protocol and are fully informed of the current study procedures (including procedure modifications); (b) informed consent requirements and process; (c) anonymity and/or confidentiality-assurance promised when securing informed consent (d) potential risks associated with the study and the steps to be taken to prevent or minimize these potential risks; (e) adverse event reporting requirements; (f) data and record-keeping requirements; and (g) the current IRB approval status of the research study.

5. I will not enroll any individual into this research study (a) until such time that the conduct of the study has been approved in writing by the IRB; (b) during any period wherein IRB renewal approval of this research study has lapsed; (c) during any period wherein IRB approval of the research study or research study enrollment has been suspended, or wherein the sponsor has suspended research study enrollment; or (d) following termination of IRB approval of the research study or following sponsor/principal investigator termination of research study enrollment.

6. I will respond promptly to all requests for information or materials solicited by the IRB or IRB Office.

7. I will submit the research study in a timely manner for IRB renewal approval.

8. I will not enroll any individual into this research study until such time that I obtain his/her written informed consent, or, if applicable, the written informed consent of his/her authorized representative (i.e., unless the IRB has granted a waiver of the requirement to obtain written informed consent).

9. I will employ and oversee an informed consent process that ensures that potential research subjects understand fully the purpose of the research study, the nature of the research procedures they are being asked to undergo, the potential risks of these research procedures, and their rights as a research study volunteer.

10. I will ensure that research subjects are kept fully informed of any new information that may affect their willingness to continue to participate in the research study.

11. I will maintain adequate, current, and accurate records of research data, outcomes, and adverse events to permit an ongoing assessment of the risks/benefit ratio of research study participation.

12. I am cognizant of, and will comply with, current federal regulations and IRB requirements governing human subject research including adverse event reporting requirements.

13. I will notify the IRB within 24 hours regarding any unexpected study results or adverse events that injure or cause harm to human participants.

14. I will make a reasonable effort to ensure that subjects who have suffered an adverse event associated with research participation receive adequate care to correct or alleviate the consequences of the adverse event to the extent possible.

15. I will notify the IRB prior to any change made to this protocol or consent form (if applicable).

16. I will notify the IRB office within 30 days of a change in the PI or the closure of the study.

Amber Ugbo
Principal Investigator Name (typed)

Dr. Josie Romantini-Carpoiviz
Faculty Advisor Name (typed)

Signature: [Signature]
Date: 11/17/16

*Faculty signature indicates that he/she has reviewed the application and attests to its completeness and accuracy.
Appendix B4 – IRB Proposal Narrative

GEORGIA SOUTHERN UNIVERSITY INSTITUTIONAL REVIEW BOARD
INSTRUCTIONS FOR PREPARATION OF PROPOSAL NARRATIVE

Instructions: Please respond to the following as clearly as possible. The Narrative should include a step by step plan of how you will obtain your subjects, conduct the research and analyze the data. Make sure the narrative clearly explains aspects of the methodology that provide protection for your human subjects. Your narrative should be written to be read and understood by a general audience who does not have prior knowledge of your research and by committee members who may not be expert in your specific field of research. Your reviewers will only have the information you provide in your application. Explain any technical terms, jargon or acronyms. The narrative is a part of the complete application.

The application may be submitted electronically at irb@georgiasouthern.edu (small attachment) or sent to the Office of Research Integrity, at PO Box 8005, Statesboro, GA 30460, fax (912) 478-0719.

Personnel. Please list any individuals who will be conducting research on this study. Also please detail the experience, level of involvement in the process and the access to information that each may have.

No other individuals will be participating in the research beyond the advisor, Dr. Joelie Romanchik-Cerpovicz. The personal investigator, Amber Ugbo, is an undergraduate student completing research for the Honor's Program. Amber will be involved in the majority of the project. Dr. Joelie Romanchik-Cerpovicz, a professor at Georgia Southern University in the College of Health and Human Services, will be advising Amber during the research process. Only these two individuals will have access to the data. Amber Ugbo will be involved in the collection of the data. Both Amber Ugbo and Dr. Joelie Romanchik-Cerpovicz will be involved in the analysis, preparation, presentation of the data at professional conferences, and publication of the data.

Purpose. 1. Briefly describe in one or two sentences the purpose of your research. 2. What questions are you trying to answer in this experiment? Please include your hypothesis in this section. The jurisdiction of the IRB requires that we ensure the appropriateness of research. It is unethical to put participants at risk without the possibility of sound scientific results. For this reason, you should be very clear about how participants and others will benefit from knowledge gained in this project.

1. The purpose of this research is to observe how closely college students, specifically college athletes, follow the Mediterranean Diet. The purpose is to also see whether there are differences between male and female college students and recreational and collegiate level athletes.

2. Questions to be answered in the study include: How often do college students consume foods that are related to the Mediterranean Diet? Do athletes follow a specific diet to aid athletic performance? Do females follow the Mediterranean Diet more closely than males? Do eating habits differ between recreational level athletes and collegiate athletes?

The hypothesis of this study is that less than 50% of college athletes enrolled in a Healthful Living course (HUTH 1520) at Georgia Southern University follow a Mediterranean-type Diet, that collegiate athletes follow a Mediterranean-type Diet more often than recreational athletes, and that female athletes, both recreational and collegiate, follow a Mediterranean-type Diet more often than male recreational and collegiate athletes.

Literature Review. Provide a brief description of how this study fits into the current literature. Have the research procedures been used before? How were similar risks controlled for and documented in the literature? Have your instruments been validated with this audience? Include citations in the description. Do not include dissertation or thesis chapters.

In the current literature, Webber et al (2015) found that female athletes had a higher overall diet quality than males. In addition, Webber et al (2015) also found that certain athletes in certain sports report higher diet quality compared to others. According to Potgieter (2013), many characteristics of the Mediterranean diet include a high consumption of grains, vegetables, and fruits and have generally been recommended in the diets of all athletes in order to maintain and improve performance. It is important to educate both female and male athletes and recreational and collegiate level athletes that current research on the Mediterranean Diet points to possible ergogenic effects and various other health benefits.


Outcome. Please state what results you expect to achieve? Who will benefit from this study? How will the participants benefit (if at all). Remember that the participants do not necessarily have to benefit directly. The results of your study may have broadly stated outcomes for a large number of people or society in general.
GEORGIA SOUTHERN UNIVERSITY INSTITUTIONAL REVIEW BOARD
INSTRUCTIONS FOR PREPARATION OF PROPOSAL NARRATIVE
The results to be expected are that female college athletes at both levels of performance will follow a Mediterranean-type diet more than male college athletes, that collegiate level athletes follow a Mediterranean-type diet more than recreational collegiate athletes, and that less than half of students enrolled in the nine Healthful Living courses will adhere to a Mediterranean-type diet. In the future, students may benefit from the possible education that will arise from the result of this study. This education will include the benefits of the Mediterranean Diet and how it can be used to aid in athletic performance.

Describe your subjects. Give number of participants, and applicable inclusion or exclusion requirements (ages, gender requirements, etc.).
The number of participants in this study will be a total of 2,250 college students enrolled in nine sections of the Healthful Living course (HLTH 1520). The participants of this study will be above the age of 18. There will be no minors participating in this study. There are no gender requirements, however they will be asked to provide this information if they decide to. Data will be collected from a voluntary survey handed out at the end of the classes. All participants taking the survey will remain anonymous and no identification will be necessary, except for noting age and gender and whether they are a participant in a collegiate or recreational sport.

Recruitment and Incentives: Describe how subjects will be recruited. (Attach a copy of recruitment emails, flyers or etc.) If provided, describe what incentives will be used and how they will be distributed.
Individually participating in the study will be recruited from Georgia Southern University's Healthful Living courses (HLTH 1520). See email detailing permission to administer survey in the classes. There will be no incentives used to recruit individuals for the study.

Research Procedures and Timeline: Enumerate specifically what you will be doing in this study, what kind of experimental manipulations you will use, what kinds of questions or recording of behavior you will use. Focus on the interactions you will have with the human subjects. (Where applicable, attach a questionnaire, focus group outline, interview question set, etc.) Describe in detail any physical procedures you may be performing.
For this study, a voluntary survey will be distributed and collected by the investigators to college students during the last ten minutes of the period in their Healthful Living class. The instrument used will be one derived from an eleven-item survey by Panagiotakos et al (2006). The food items in the survey will include non-refined cereals, potatoes, fruits, vegetables, legumes, red meats and products, full fat dairy products, and alcohol intake.


Data Analysis: Briefly describe how you will analyze and report the collected data. Include an explanation of how will the data be maintained after the study is complete and anticipated destruction date or method used to render it anonymous for future use.
The frequency of the college athlete's adherence to the Mediterranean Diet will be analyzed for significance using a chi-square test within InStat Biostatistics (version 3.05; Graph Pad Software, San Diego, California, 2000). All survey data and demographics collected on subjects for presentation purposes will be kept confidential and stored in a locked file drawer in Holli 1128B. Data collected for this study will be archived for 3 years. This information will be available only to the investigators. The data will be destroyed after 3 years.

Special Conditions:
Risk. Is there greater than minimal risk from physical, mental or social discomfort? Describe the risks and the steps taken to minimize them. Justify the risk undertaken by outlining any benefits that might result from the study, both on a participant and societal level. Even minor discomfort in answering questions on a survey may pose some risk to subjects. Carefully consider how the subjects will react and address ANY potential risks. Do not simply state that no risk exists. Carefully examine possible subject reactions. If risk is no greater than risk associated with daily life experiences state risk in these terms.
There are minimal risks associated with this study. Data collected will remain confidential.

Research involving minors. Describe how the details of your study will be communicated to parents/guardians. If part of an in-school study (elementary, middle, or high school), describe how permission will be obtained from school officials/teachers, and
GEORGIA SOUTHERN UNIVERSITY INSTITUTIONAL REVIEW BOARD
INSTRUCTIONS FOR PREPARATION OF PROPOSAL NARRATIVE

indicate whether the study will be a part of the normal curriculum/school process. Please provide both parental consent letters and child assent letters (or processes for children too young to read). If not applicable indicate N/A or delete this section.

Deception. Describe the deception and how the subject will be debriefed. Briefly address the rationale for using deception. Be sure to review the deception disclaimer language required in the informed consent. Note: All research in which active deception will be used is required to be reviewed by the full Institutional Review Board. Passive deception may receive expedited review. If not applicable indicate N/A or delete this section.

Medical procedures. Describe your procedures, including safeguards. If appropriate, briefly describe the necessity for employing a medical procedure in this study. Be sure to review the medical disclaimer language required in the informed consent. If not applicable indicate N/A or delete this section.

Literature Review Reference list:
N/A

Cover page checklist. Please provide additional information concerning risk elements checked on the cover page and not yet addressed in the narrative. If none, please state "none of the items listed on the cover page checklist apply." The cover page can be accessed from the IRB forms page. (Note – if a student, make sure your advisor has read your application and signed your cover page. (Your advisor is responsible for the research you undertake in the name of Georgia Southern.)

Reminder: No research can be undertaken until your proposal has been approved by the IRB.
Appendix B5 – Informed Consent

GEORGIA
SOUTHERN
UNIVERSITY

COLLEGE OF HEALTH AND HUMAN SCIENCES

DEPARTMENT OF HEALTH AND KINESIOLOGY

ADHERENCE TO THE MEDITERRANEAN DIET AMONG RECREATIONAL AND COLLEGIATE LEVEL ATHLETES

1. My name is Amber Ugbo and I am a senior Nutrition and Food Science and Exercise Science undergraduate at Georgia Southern University. I am a student in the University Honor’s Program and I am conducting this research as my capstone project. I am interested in discovering how closely college students, choose to eat foods in the Mediterranean Diet.

2. Purpose of the Study: The purpose of this research is to study if college students follow the Mediterranean Diet, if there are any differences between males and females following the diet, as well as collegiate athletes and recreational athletes.

3. Procedures to be followed: Participation in this research will include completion of a twenty three-question survey relating to specific characteristics of the Mediterranean Diet. This survey will remain anonymous.

4. Discomforts and Risks: The risks are minimal and include the possibility of feeling uncomfortable answering a question regarding their dietary intake of certain foods. The possibility of harm or discomfort that could occur during the study is no greater than those encountered in ordinary life. The students are informed that they can withdraw at any time during the completion of the survey. Hence, the risks are minimal.

5. Benefits: Participating in this research will include benefitting from recognizing aspects of their own food consumption patterns as well as aspects of the Mediterranean diet.

6. Duration/Time required from the participant: The time required to take survey is minimal and should last no longer than ten to fifteen minutes.

7. Statement of Confidentiality: All survey data and demographics collected on subjects for presentation purposes will be kept confidential and stored in a locked file drawer in Hollis 1128B. This information will be available only to the investigators. Your identity will not be revealed in publications or presentations so as to protect your privacy and confidentiality. All data will be reported as means and standard deviations. Data collected for this study will be archived for 3 years. The data will be destroyed after 3 years.

8. Right to Ask Questions: You have the right to ask questions and have those questions answered. If you have questions about this study, please contact the researcher named above or the researcher’s faculty advisor, whose contact information is located at the end of the informed consent. For questions concerning your rights as a research participant, contact Georgia Southern University Office of Research Services and Sponsored Programs at 912-478-5465.

9. Compensation: You will not be compensated for participation in this study. Participation is completely voluntary.
10. Voluntary Participation: This study is completely voluntary. You may end their participation at any time by telling the person in charge, or by not finishing or turning in the survey. You also have the right to not answer any questions that you do not want to answer.

11. Penalty: There is no penalty for deciding not to participate in this research study. You may at any time decide to withdraw from the study. If you consent to participate in this research study and to the terms above, please sign your name and indicate the date below.

12. You must be 18 years of age or older to consent to participate in this research study. If you consent to participate in this research study and to the terms above, please sign your name and indicate the date below.

You will be given a copy of this consent form to keep for your records. This project has been reviewed and approved by the GSU Institutional Review Board under tracking number H17171.

Title of Project: Adherence to the Mediterranean Diet Among Recreational and Collegiate-Level Athletes
Principal Investigator: (Amber Ugbo, School of Health and Kinesiology; au00251@georgiasouthern.edu)
Faculty Advisor: (Dr. Joelle Romanchik-Cerpovicz, School of Health and Kinesiology; 912-478-1420; jromchik@georgiasouthern.edu)

Participant Signature ___________________________ Date _______________

I, the undersigned, verify that the above informed consent procedure has been followed.

Investigator Signature ___________________________ Date _______________
Appendix B6 – Certifications
COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COMPLETION REPORT: PART 1 OF 2
COURSETWORK REQUIREMENTS*

*NOTE: Please on the Actual Completion Report reflect only completions at the time of requirements for the courses were met. See list below for details. See another Core Course if more than one Core Course is taken. Include three or more optional (supplemental) course options.

Name: Joelle Florinich-Caropaxio (ID: 19218808)
Email: joelle@georgiame.nih.gov
Institution: Emory University (ID: 19218808)
Institution Unit: Health and Kinesiology
Phone: 912-478-1420

- Core Course Group: Human Subjects-Social & Behavioral Research - Data/Refresher
- Core Course Group: Same as Core Curriculum
- Core Course Group: Stage 2 - Refresher Course
- Description: Choose this course to satisfy CITI training requirements for Investigators and staff involved primarily in Social/Behavioral Research with human subjects.

- Report ID: 210573273
- Completion Date: 06-04-2016
- Certification Date: 06-04-2016
- Minimum Passing: 60
- Score: 100

REQUIRED/RECOMMENDED MODULATORY COURSES

| Course Title                                                                 | Core ID | Core Unit | Score | Date Taken | Date Completed | Completion Date | GPP
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<td>06-04-2016</td>
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</table>

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing Institution identified above or have been a paid Independent Learner.

Verify at: http://www.citiprogram.org/verify1?7ce00415d0-0a01-4266-8667-f4776e699a1f

CITI Program
Email: info@citiprogram.org
Phone: 415-509-1007
Web: www.citiprogram.org

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COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 2 OF 2

COURSEWORK TRANSCRIPT

• This report on the Transcript Report reflects the most current quiz completions, including quizzes on optional (supplemented) elements of the online session below. Any separate Requirements Report for the reported course at the time will report elements for the course were not.

NAME:

Vesna Romancescu-Cosovici (ID: 169896)

Institution: Florida Southern University (ID: 10353)

Institution Unit: Health and Biomedical

Phone: 863-874-1420

- Curriculum Group:
  - Human Subjects-Social & Behavioral Research - Basic/Refresher
- Change Login Group:
  - Same as Curriculum Group
- Status:
  - Stage 2 - Refresher Course
- Description:
  - Choose this group to satisfy CITI training requirements for investigators and staff involved primarily in Social/Behavioral research with human subjects.

- Report ID:
  - 21007393
- Report Date:
  - 14-Nov-2018
- Current Score:
  - 100

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For the Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid independent learner.

Verify at: https://www.citiprogram.org/verify/?74ee6245d4-9d01-4dd6-d267-b41778e96bb4

CITI:

Collaborative Institutional Training Initiative (CITI Program)

Email: support@citiprogram.org

Phone: 866-429-8692

Web: https://www.citiprogram.org
Appendix B7 – Survey Administration Approval

11/17/2018

Georgia Southern University Mail - Undergraduate Research Survey

Amber Ugo <au00251@georgiasouthern.edu>

Undergraduate Research Survey

Julie Kuykendall <jkuykendall@georgiasouthern.edu>
To: Joelle Romanchik-Cerovicz <jromanchik@georgiasouthern.edu>
Cc: Robert Clouse <rclouse@georgiasouthern.edu>, Sarah Davis <sdavis@georgiasouthern.edu>, Stephanie Peeples <swness@georgiasouthern.edu>, au00251@georgiasouthern.edu

Amber Ugo will be coming to our HLTH 1520 classes the week of January 19th to administer a survey about the Mediterranean diet to our students for her research. We will be allowing her to give the survey during the last 10 minutes of class. The survey takes approximately 5 minutes to complete. Thanks!

Julie Kuykendall, M.S.
Temporary Instructor
Department of Health and Kinesiology
Post Office Box 8076
HOLLIS 311G
912-478-4357
Appendix C: Time Schedule of Study
Appendix C: Time Schedule of Study

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<td>Data Analysis</td>
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<td>Submit Final Draft of Thesis to Mentor</td>
<td>March 2018</td>
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<td>Presentation of Thesis</td>
<td>April 2018</td>
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Appendix D: Biography
Appendix D: Biographical Summary

Amber Ezinne Ugbo
Date of Birth: July 12, 1996

Home Address:
18 Rollingbrook Vista
Newnan, GA 30265

Georgia Southern University:
2014-2018

Bachelor of Science:
Nutrition and Food Science
Exercise Science

Emphases:
Dietetics
Kinesiology

Thesis Title:
Adherence of Collegiate Level, Recreational/Intramural and Non-Athlete College Students to the Mediterranean Diet

Mentor: Dr. Joelle Romanchik-Cerpowicz