A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Family Consumer Sciences

by

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DEDICATION

This thesis is dedicated to:

To my mother & father: Thank you for always giving me the opportunity to chase my dreams!

To Scott Fujii, my mentor and coach: Thank you for always believing in me and letting me know in not-so-subtle ways that I can always do more. I would not be where I am today without you!

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ABSTRACT

THE EFFECTS OF INDIVIDUALIZED NUTRITION COUNSELING ON CSUN’S VARSITY ATHLETES’ BODY FAT COMPOSITION AND NUTRIENT INTAKE

By

Simona Hradil

Master of Science in
Family Consumer Sciences

This study assessed nutrition and anthropometric parameters at pre- and post-nutrition education intervention of 80 collegiate athletes. The purpose was to determine if participation in individualized nutrition counseling would improve body fat composition and have a positive influence upon macronutrient, carbohydrate, percentages in Division I collegiate athletes. The collected findings are to serve as a guideline for the development of individualized nutrition education counseling to increase positive changes in macronutrient distribution and decrease body fat percentages. Five athletic teams from California State University, Northridge participated in this study over the course of one academic year in a quasi-experimental design. Athletes completed two body fat measurement tests in the BOD POD, as well as two separate dietary analyses: pre and post-nutrition counseling. Subjects included 66 female (82%) and 14 male (18%) athletes. This study suggests that the CSUN varsity athlete could benefit from additional individualized nutritional counseling,
particularly regarding the understanding of the role of macronutrients pre and post training.
CHAPTER I

INTRODUCTION

Nutrition is an integral part of daily life and plays a key role in development throughout the lifespan. Eating a well balanced diet helps us develop, grow, and achieve wellness. An imbalance in daily nutrition intake can lead to a lower quality of life and possibly lead to chronic disease. Nutrition is especially pertinent for athletes who must optimize their performance and achieve personal, as well as team success. Research has shown that dietary intake is an integral component of athletic performance, particularly since athletic performance could be negatively impacted by a deficiency of nutrients in student varsity athletes (ADA, 2009).

Statement of the Problem

For many young athletes entering college, they may be away from home for the first time and not know how to access healthy foods. Many may not know how to efficiently shop for food, prepare their own food, or even cook their own meals. Often overlooked, nutrition education and dietary assessment can lead to improved fitness, minimizing fatigue in training and competition that may be due to under-fueling and poor hydration, and improving recovery. As of 2014, there were 460,000 collegiate athletes across the country (National Collegiate Athletic Association [NCAA], 2014). Dietary counseling can play a important role in helping maximize potential in athletic performance, and thus help contribute to the success of student athletes.

Purpose

The purpose of this research was to determine if nutritional education counseling helps to increase the student athlete’s intake of nutrient dense foods in California State
University, Northridge (CSUN) varsity athletes and has a positive effect on the student athlete’s body fat composition. Determining an athlete’s body fat composition and macronutrient intake could possibly help to implement an individualized nutrition education program to optimize performance for all student athletes.

**Definitions**

1. **Athlete**: a person trained or gifted in exercises or contests involving physical agility, stamina, or strength; a participant in a sport, exercise, or game requiring physical skill. [http://dictionary.reference.com](http://dictionary.reference.com)


3. **Body fat**: the percentage of a person’s body that is not composed of water, muscle, bone, and vital organs. [https://www.medical-dictionary.thefreedictionary](https://www.medical-dictionary.thefreedictionary)

4. **Collegiate/student athlete**: a student whose enrollment was solicited by a member of the athletics staff or other representative of athletics interests with a view toward the student’s ultimate participation in the intercollegiate athletics program. Any other student becomes a student-athlete only when the student reports for an intercollegiate squad that is under the jurisdiction of the athletic department (NCAA Division I Manual, 2013-14)

6. Dietary recall: 24-hour dietary recalls are a retrospective method of assessing the food and supplement intake of free-living individuals. Subjects recall everything they ate and drank during the previous day.
https://www.icts.uiowa.edu/content/24-hour-dietary-recalls

7. ESHA Food Processor®: food processor diet analysis software that includes automatic nutrient analysis and an extensive and meticulously researched ingredient database. http://www.esha.com/products/food-processor/

8. Macronutrient: any of the nutritional components of the diet that are required in relatively large amounts: protein, carbohydrate, fat, and the macrominerals.
http://dictionary.reference.com

9. Micronutrient: an essential nutrient, as a trace mineral or vitamin that is required by an organism in minute amounts. http://dictionary.reference.com


http://dictionary.reference.com


14. Sports medicine team: an interdisciplinary subspecialty of medicine, which deals with the treatment and preventive care of athletes, and includes specialty
physicians and surgeons, athletic trainers, physical therapists, coaches, and

15. Sports nutrition: integration and application of scientifically-based nutrition and
exercise physiology principles that support and enhance training, performance,
and recovery.  https://www.medical-dictionary.thefreedictionary

Hypotheses

Null Hypothesis

The data analyses for this thesis was guided by the following null hypothesis:

• Individualized nutrition counseling will not positively impact CSUN varsity athletes’
dietary intake, as macronutrients, and body fat composition.

Research Hypothesis

Based on the review of literature in Chapter 2, the following research hypothesis was
developed.

• If athletic performance and body composition are related to appropriate nutrition, then
individualized nutrition intervention will improve the dietary intake, macronutrients,
and body fat composition of CSUN varsity athletes.

Assumptions

The results of this study are based on the following assumptions:

• The participants were representative of the athletes attending California State
University, Northridge (CSUN).

• The participants understood the content of the nutrition education.

• The participants understood the rules for BOD POD body fat testing.

• The participants understood the rules for completing the three-day dietary recall.

• It is understood that all athletes were not coached on how to fill out the three-day
dietary recall and participated truthfully and honestly.

- It is understood that the three-day dietary recall was analyzed and printed correctly.
- It is understood that all the athletes were coded, entered and stored correctly.

**Limitations**

This research has the potential to determine the effect of individualized nutrition counseling on the CSUN athlete’s nutrient intake and body fat composition. However, certain limitations do exist:

- Self reported dietary analysis may not represent actual dietary behavior.
- Responses of collegiate athletes from these five specific teams at CSUN cannot be generalized to other universities or other athletes in general.
- The study is limited to a total of only 80 athletes from five athletic teams.
- The lack of flexibility for all athletes to schedule nutrition consultations may hinder the amount of athletes receiving intervention education.
CHAPTER II
LITERATURE REVIEW

As of 2014, the National Collegiate Athletic Association includes more than 460,000 student athletes participating in 23 sports at more than 1,100 universities and colleges nationwide (NCAA, 2014). The collegiate athlete balances academic, social, and athletic experiences with the highest level of integrity and sportsmanship in pursuit of the excellence. Sports nutrition is seen as a vital component to the Sports Medicine Team, which includes the team doctor, strength and conditioning coach, athletic trainer and dietitian, and helps to promote optimal performance for the student athlete, and may also help set the precedence for a life-long change in dietary patterns and lifestyle (NCAA, 2014). The purpose of this chapter is to provide a review of the existing research about collegiate athletes and nutrition. This research will contribute to current information about the effectiveness of dietary counseling interventions on improving athletic performance.

Overview of Sports Nutrition

The goal of sports nutrition is to apply science to fuel fitness and performance, as well as promote nutrition practices that enhance lifelong health, fitness and sports performance (SCAN, 2014). The Academy of Nutrition and Dietetics (2014) defines the goal of sports nutrition as attaining energy balance by ensuring an adequate caloric balance intake in the appropriate proportion of macronutrients. Achieving this energy balance is vital for the athletes to sustain their rigorous training levels required for optimal performance and athletic success. Nutrition, joined with high-level training and sufficient rest throughout the busy semesters, are what set apart the collegiate athlete from other athletes (Maughan, 2002). Nutrition recommendations differ for each athlete and their respective sport, and are based
upon age, gender, body fat composition, and activity level (Rosenbloom, 2000).

Nutrition can be the deciding factor between winning and losing in collegiate athletics. Topics of interest with collegiate athletes are changing (1) body composition and (2) macronutrient intake through proper nutrition. Nutrition counseling is a tool that can be used to convey the fundamentals basic nutrition concepts, as well as specific sports nutrition fundamentals of nutrient timing, recovery, and hydration (Maughan, 2002). Nutrition’s role in individualized nutrition education and it’s impact on the collegiate athlete’s nutrition intake, and body fat composition will be evaluated.

**Athletic Performance and Nutrition Intake**

Evidence-based research from a Joint Paper by the American Dietetic Association, Dietitians of Canada and the American College of Sports Medicine (2000) suggests that competitive athletes can benefit from proper nutrient intake before, during, and after physical activity; research has shown that being properly hydrated and fueled has enhanced the athletic performance of athletes. Knowing when to consume certain nutrients and how much of that nutrient to have are two important factors that can help optimize the athlete’s nutritional status and, as a result, improve their performance in their sport. Three prominent professional organizations, the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine, agree that physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition (Rodriguez, DiMarco, Langley, Denny & Hager, 2009).

According to Rodriguez et al. (2009), inadequate energy intake in comparison to energy expenditure negatively affects performance and cancels out the benefits of training. It is possible that many student athletes are not consuming the correct amount of fluids and
foods for their daily needs for a variety of reasons, including a limited access to food, the
time constraints of being a student athlete, and the lack of knowledge of their dietary needs.
Further, Rodriguez et al. (2009) reported that dehydration (loss of >2% body weight) can
compromise aerobic exercise performance, particularly in hot weather, and may impair
mental/cognitive performance. The Dietary Guidelines for Americans suggests that 45%-65%
of the energy requirements come from carbohydrates, 10%-35% from protein, and
25%-35% from fat. Carbohydrates and fat are the main sources of energy for athletes
(USDA, 2009; Hoffman, 2011). In a Joint Paper by the Academy of Nutrition and Dietetics,
Dietitians of Canada and the American College of Sports Medicine (2000), the governing
bodies supported research stating that athletes need to replenish their glycogen stores and
consume protein to promote the repair and building of new tissue post exercise, as well as
include fat intake at 20-25% of total energy needs to consume the adequate amounts of
essential fatty acids and fat-soluble vitamins. They agreed that an athlete’s body weight and
body fat composition do affect his or her performance.

Sport nutrition guidelines differ depending on sport and level of participation.
Carbohydrates should contribute to 7 to 10g/kg of body weight, protein 1.2 to 1.4g/kg of
body weight, and dietary fat intake to make up the remainder of energy intake of 20 to 25%
of total energy (ACSM, ADA, & DC, 2009). To meet daily macronutrient needs, sports
nutrition experts recommend team-sport athletes consume 5–7 g carbohydrate/ kg/day and
1.2–1.7 protein/kg/day (American Dietetic Association et al., 2000; Holway & Spriet, 2011).
Tanaka, Tanaka & Landis, (1995) states that sports nutrition professionals recommend that
team-sport athletes participating in intermittent high-intensity exercise for ≥1 hr consume 1-4g carbohydrate/kg 1-4 hr before, 30-60 g carbohydrate/hr during, and 1-1.2 g
carbohydrate/kg/hr and 20-25 g protein as soon as possible after exercise. Other sports nutrition experts recommend that team-sport athletes participating in intermittent high-intensity training or competition for ≥ 1 hr ingest 30–60 g of carbohydrate every hour of exercise (American Dietetic Association et al., 2009; Burke et al., 2011; Holway & Spriet, 2011) to provide fuel to the muscle and central nervous system (Burke et al., 2011).

Clark, Reed, Crouse, and Armstrong (2003), identified that the frequent consumption of foods high in protein and fat replaced more carbohydrate rich and nutrient dense foods within the female athlete’s energy requirements. This could pose a problem for the female athlete to consume adequate amounts of carbohydrates. Studies also show that female athletes have a history of low carbohydrate intake, which results in the athlete’s body being unable to resynthesize glycogen used during exercise (Clark et al, 2003; Nutter, 1991; Tanaka, Tanaka & Landis, 1995). In a study by Clark et al. (2003), members of a NCAA Division I women's soccer squad completed 3-day diet records, anthropometrics, and physical tests, including VO2peak. Results showed that carbohydrate intake failed to meet minimum recommendations to promote glycogen repletion (7-10 g/kg), protein and fat intakes were above minimum recommendations. Tarnopolsky (2000) advises the need for more gender specific nutritional recommendations based on data demonstrating greater lipid and lower carbohydrate oxidation in women compared to men during endurance exercise (Tarnopolsky, Atkinson, Phillips, & MacDougall, 1995).

Nutrient timing is also of great importance and the strategic incorporation of macronutrients (carbohydrates, proteins and fats) can substantially influence an optimal performance for athletes (Burke, Kiens, & Ivy, 2004; Hoffman, 2011; Kerksick et al., 2008; Moore et al., 2009; Skolnick & Chernus, 2010). Adequate nutrition education regarding
appropriate macronutrients and hydration choices in conjunction with justified timing and appropriate amounts would further solidify the athlete’s understanding of how nutrition can maximize performance (Abood, Black & Birnbaum, 2004; Hoffman, 2011; Nichols, Jonnalagadda, Rosenbloom, & Trinkaus, 2005; Rosenbloom, Jonnalagadda & Skinner, 2002).

Strategies for individualized athlete counseling include recommending carbohydrate-rich foods with moderate-to-high glycemic index to aid in glycogen synthesis, which can be beneficial in the hours following an exercise session; nutrient-rich carbohydrate foods consumed post-workout should also provide a good source of protein; and early refueling may be enhanced by a higher rate of carbohydrate intake, especially helpful when intake is in the form of small, frequent meals (Burke, Hawley, Wong, & Jeukendrup, 2011). According to Jentjens, Cale, Gutch, & Jeukendrup (2003), eating a carbohydrate source of food before exercise, instead of going into a workout in a fasting state, improved cycling performance. This information is important to note because carbohydrate intake before an aerobic activity proved beneficial for cycling athletes.

Rodriguez et al. (2009) noted that a great amount of research studies have illustrated that nutrient intake, specifically carbohydrate intake, during physical activity that lasts longer than sixty minutes has improved athletic performance. Some athletes may have misconceptions about the correct nutrients to consume during exercise or they may not know that there may be a need to have any nutrient intake at all. Furthermore, athletes may also think that carbohydrate intake is necessary for any exercise after sixty minutes. They do not acknowledge that the intensity level of the activity being performed also plays a factor in the decision to incorporate carbohydrates. According to Currell, & Jeukendrup (2008),
carbohydrate intake is beneficial for endurance performance and a softball athlete participating in a light practice for an hour and a half may not need a source of carbohydrates at the hour mark. It will be up to the registered dietitian and/or sports dietitian to determine the nutrient needs for their athletes during exercise or physical activity. Holway & Spriet, (2011) suggest that most team-sport athletes use a combination of anaerobic and aerobic energy systems which both use carbohydrates as the primary fuel source. Eating before a practice or game replenishes liver glycogen stores, especially if the activity is performed in the morning. The recommendation for a pre-exercise meal is to be consumed 1-4 hours before exercise and contain 1–4 g carbohydrate/ kg (Burke et al., 2011). Restoring the carbohydrate used from the muscle and liver during both aerobic and anaerobic-type activity is an important post-exercise nutrition practice for team-sport athletes. It is also recommended that most team-sport athletes consume about 20–25 g of protein to start the recovery process as soon as possible after each training session and game to maximize muscle protein synthesis (Phillips & van Loon, 2011).

The timing and composition of a post game meal, post exercise meal or recovery snack depends on the length and intensity of the exercise session and is also dependent on the timing of the next intense practice or competition (Rodriguez et al., 2009). For distance athletes a meal replacement may be necessary to replenish their glycogen stores when another intense session is scheduled soon after. However, Burke et al. (1996) suggested athletes who rest one or more days between intense training sessions do not need to worry about nutrient timing for glycogen replenishment if adequate carbohydrates are consumed in the next twenty-four hours after exercise. The strategic approach to the quantities, timing and macronutrient selections pre and post training can maximize athletic performance.
Nutrition Intake of Collegiate Athletes

Hornstrom, Friesen, Ellery, and Pike, (2011) stated that the majority of athletes today understand that proper fueling through proper nutrition is a key component of training and may even result in a competitive edge. Yet many college athletes do not consume adequate nutrients and many of these athletes enter college with little or no nutritional knowledge. A survey of 243 Division I collegiate athletes showed that less than 40% received nutritional information or education before embarking upon college (Batson, Sease, Stanek, & Leski, 2004). These athletes may not be consuming appropriate amounts of macronutrients for the level of physical activity they are performing as competitive collegiate athletes. Some athletes are consuming far less than their recommended total energy intake requirements. According to Wenzel, Valliant, Chang, Bomba, & Lambert, 2012 some are even consuming 50% less than their estimated total energy intake requirements. Jacobson, Sobonya, & Ransone, (2001) found that athletes were unaware of the correct macronutrient percentages of carbohydrates, proteins and fats recommended and only 3% of the participants identified the correct recommended intake for protein. Torres-McGehee et al. (2012) found that athletes only had a 16% adequate level of nutrition knowledge.

One of the biggest challenges faced by collegiate athletes is the lack of access to easily prepared, convenient, and nutrient-dense foods. The typical college athlete has limited time, as well as limited space, tools and skills to prepare a healthy meal within their dormitories, apartments, or shared housing (Dunn, Turner & Denny, 2007; McDowall, 2007). Along with deficits in nutritional knowledge, collegiate athletes also struggle with special dietary needs such as vegetarian, vegan or restricted dietary intake, and gluten and lactose
intolerances, which can make the issue even more challenging (Torres-McGehee et al., 2012). Hornstrom et al., (2011) found a correlation between the collegiate players’ nutrition knowledge and their dietary habits: the lower their nutritional knowledge scores on an assessment test, the more deficient their dietary intake tended to be. Deciphering nutritional information on their own proves to be a challenge for athletes trying to decide between fact and myth. Common sources of information for nutrition range from the Internet, to dietary apps (e.g. Instagram), to teammates, coaches, athletic trainers (ATs), strength and conditioning coaches (SCSs), and registered dietitians (RDs) (Torres-McGehee et al., 2012). Burns, Schiller, Merrick, and Wolf (2004) noted that the primary sources of nutritional information for athletes were athletic trainers (39.8%), strength and conditioning coaches (23.5%), and RDs (14.4%). Jacobson et al. (2001) surveyed 16 universities, finding that the primary sources of nutritional information for male athletes were strength and conditioning coaches (21.9%) and athletic trainers (19.0%), while women listed university classes and nutritionists as their top sources. In a study assessing sports nutrition knowledge among collegiate coaches, athletic trainers (ATs), and strength and conditioning specialists, Torres-McGehee et al., (2012), found that ATs (71.4%) and SCSs (83.1%) had higher nutrition assessment scores than coaches, who yielded only 35.9% adequate nutrition knowledge. Yet registered dietitians are the most qualified, i.e. “nutrition experts”, for providing accurate nutrition information (Torres-McGhee et al., 2012). There are still numerous collegiate institutions that have not utilized the expertise of dietetic professionals to enhance their athletes’ nutritional knowledge and performance (Hornstrom et al., 2011). Ray Burigo’s 2006 study showed that California State University, Northridge’s (CSUN) varsity athletes were among the numerous athletes nationwide that were unclear regarding proper nutrition.
Burgio, (2006) determined that CSUN athletes were highly interested in expanding their knowledge on optimal nutrition for sport and performance, and the skills needed for successfully surviving college campus life by incorporating a healthier lifestyle.

**Nutrition Counseling and the Collegiate Athlete**

The National Collegiate Athletic Association (NCAA) legislation once placed limits on the amount of times collegiate athletes were allowed to eat at a separate eating facility on collegiate campuses designed to provide meals prepared specifically for them known as a “training table” ([2001-02 NCAA Division I Manual](#)). Hinton, Sanford, Davidson, Yakushko, and Beck, (2004) determined that athletes consuming meals prepared away from home were more likely to exceed the recommended intake of fat, saturated fat, cholesterol, and sodium. Fox (2004) found that athletes from schools that did not have a training table or a separate eating facility for athletes sought nutritional information more often. The NCAA legislation was amended in 2014, stating that universities and colleges could provide unlimited meals to collegiate athletes (NCAA, 2014). Yet some academic institutions still do not have the financial resources to feed their athletes through a training table and it is still the responsibility of the athlete to seek out information regarding nutrient dense meals for themselves to supplement their training.

According to Anderson (2010) and Wenzel et al. (2012), providing college athletes with nutrition education will help to improve their macronutrient and overall dietary intakes. Athletes have been shown to perform more efficiently when they are consuming adequate nutrients to support their level of physical activity, yet many college athletes lack the knowledge that would enable them to obtain proper nutrition (Anderson, 2010 and Wenzel et al., 2012). The more support and education the athletes are provided with, the better chance
they have at adhering to a proper diet and meal plan. Educating student athletes about nutrient dense food selection, food preparation, dining out meal selection and pre/post exercise foods would be beneficial to the athletes’ nutritional status, and thus, performance (Clark et al. 2003).

**Nutrition Counseling and the Collegiate Athletes’ Body Fat Composition**

A critical area of research in sports nutrition is how to effectively use nutrition counseling to positively impact collegiate athletes’ body fat composition. According to Sammarone Turocy et al. (2011), there is a positive correlation between body composition, specifically lean muscle mass, and athletic performance. According to research findings by Sammarone Turcoy et al. (2011), having a higher ratio of muscle-to-fat enhances athletic stamina and performance. Body composition, or the make-up of lean muscle mass and fat percentage, is affected by caloric intake combined with weight training (Sammarone Turcoy et al., 2011). In order to maximize athletic performance, it is recommended that caloric needs for athletes must be individualized, such that total caloric needs are calculated for each athlete’s current body weight, body composition, and specific physical demands or requirements. Thus, even within the same sport, there is a room for variation among athletes’ individual dietary plans. The dietary plan for an athlete is so individual and sport-specific that only a registered dietitian, athletic trainer, or other healthcare professional should provide such information (Sammarone Turcoy et al., 2011).

According to Garthe, Raastad, and Sundgot-Borgen (2013), inadequate energy intake relative to energy expenditure can negatively affect an athlete’s performance, and may inhibit the benefits of training. The authors investigated the effect of nutritional counseling on enhancing body composition by using a control group and an intervention group to increase
elite athletes’ lean muscle mass over an 8-to-12 week period, using strength-related activities, providing 500 extra daily calories, and 24 hour dietary recalls. The intervention group received nutritional counseling, an individualized diet education on portion size, a recovery meal within 30 minutes post-workout, and a completely balanced meal 1-2 hours post-training. The intervention group increased lean body mass by 72%; mean gain in fat mass was 30.8 ± 3.8%; and improved in strength and performance tests. These findings suggest that while nutritional counseling has the potential to increase lean body mass and performance, administering 500 additional calories without consideration of the unique sport’s activity and may be detrimental to specific types of sports and suggests that more sport-specific nutritional guidance is needed.

Currently there are approximately 460,000 collegiate athletes across the United States, with 191,100 being female (NCAA, 2014). Batson et al. (2004) found that over 70% of female athletes’ main goal was to lose weight, while most male athlete’s goal was to gain or maintain their current weight (Hinton et al., 2004). Approximately 62% of female and 23% of male athletes wanted to lose 5 or more pounds. Nutritional counseling for the collegiate athlete may prove to be beneficial to help athletes safely achieve their desired weight and body composition and effectively help optimize athletic performance. This research will contribute to current information about the effectiveness of nutritional intervention strengthening the dietary intakes of collegiate athletes.
CHAPTER III

METHODOLOGY

The purpose of this study was to determine if participation in individualized nutrition counseling would decrease body fat composition and have a positive influence upon macronutrient percentages in Division I collegiate athletes at CSUN. Customized nutrition education can encourage each athlete to make healthier choices in their daily selection of food. Two research questions to be addressed were (1) does individualized nutrition counseling decrease body fat composition and (2) does individualized nutrition counseling positively change the macronutrient distribution of the athlete’s diet. This chapter defines the parameters of the methods used to conduct the study. Descriptions regarding the research design, setting, sample, data collection, and analysis methods will also be addressed.

Procedure

Five California State University, Northridge (CSUN) varsity athletic teams participated in the Quality Campus Fee (QCF) program. The five teams included Men’s Basketball, Women’s Basketball, Women’s Tennis, Women’s Water Polo, and Softball. The institutional Committee for the Protection of Human Subjects of the Office of Research and Sponsored Projects approved the research procedure (Appendix A).

There were 80 athletes from five teams involved in this study. The body composition data were gathered using the BOD POD analysis owned by the Magaram Center. Each team was scheduled to have body fat measurements taken at three different points throughout the 2013-2014 academic-year. Athletes were scheduled for nutrition consultations with the researcher consisting of one-hour appointments. Each of the 80 athletes was provided with a three-day dietary recall form before their respective appointments. The dietary recall forms
included an instructional sheet describing the methods to complete the forms accurately, including guesstimating portion sizes. After completion and submission, the three-day dietary recall was analyzed through the ESHA Food Processor® producing a report known as the dietary analysis. The dietary analysis report produced a macro and micronutrient breakdown of the foods consumed over the three-day food recall. The three body fat composition tests and the initial three-day food recall with dietary analysis were all included in the CQF grant. The follow up three-day food recall with dietary analysis and the use of existing data proposal was submitted to the CSUN Institution Review Board (IRB) for approval.

Protecting the rights of the participants in this study was the main priority. In order to protect their rights, high standards of research ethics were implemented throughout the duration of the study. Throughout the study, the researcher worked closely with individual athletes in a counseling setting. Because of this, confidentiality practices were enforced. Participants could feel comfortable telling the nutrition counselor/researcher personal information without fearing that personal information will be used in the study. Names of participants would not be associated with the data collected. Furthermore, only one person was performing the counseling and handling the data, which greatly increased the confidentiality within the study. All participants received an informed consent form detailing that their previously recorded body fat percentages and macronutrient breakdown percentages would be analyzed to determine if the individualized nutrition counseling they received made an impact on their post counseling percentages. By signing the form, the participants agreed to participate in this research study, but were in no way being forced to participate.
Sample Description

The method of inclusion of collegiate athlete participants was based on the following criteria. First, the athletes’ team was among the five that participated in the QCF program. Second, the athletes who were contacted showed poor dietary patterns noted from initial dietary recall and the scheduling of a nutrition consultation. Therefore, the athletes included in this study are not a representative sample of collegiate athletes at the institution; rather, they were on selected teams and showed potential for improvement in food intake behaviors based on screening. The athletes who were invited for the study but chose not to receive nutritional counseling served as the control group for the body fat analysis.

Research Design

The goal of this research study was to explore the effects of individualized nutrition counseling on collegiate athletes. The time dimension of the study ranged over the course of the 2013-2014 academic year. The quasi-experiment included an experimental group consisting of the athletes that did receive the counseling session and a control group consisting of athletes that did not receive the nutrition counseling session. The individualized counseling session was a one-on-one session with the athlete and fundamentals of nutrition education were discussed, including hydration, nutrient timing and recovery nutrition.

For the body fat analysis, the dependent variable was body fat as the percentage of total body volume. The independent variable or treatment was participation in individualized nutrition counseling. The macronutrient change part of the study assessed the changes in total caloric intake from carbohydrate (as opposed to fat or protein) before and after participating in the nutritional counseling. The main focus of this study was to determine if carbohydrate percentages from the three day food recall fell into the USDA
recommendations of 45-65\% of the total caloric intake. The USDA recommended macronutrient proportions are 45-65\% carbohydrate, 20-35\% fat, and 10-35\% protein (USDA, 2010). If the athlete’s carbohydrate percentage was lower than the recommended 45\%, or on the lower end in general, the athlete was counseled on how to increase their carbohydrate percentage. If the athlete’s carbohydrate percentage fell above the 65\% recommendation, the athlete was counseled on how to bring their carbohydrate portions into the 45-65\% range. Adherence to the USDA ranges for carbohydrates percentages will be seen as a positive change. Since there are no body fat ranges set for specific sports for men and women, this study looked for any decrease in body fat percentage, a stated goal from the coaches running each athletic team program. The goal of this research study was to see if the intervention will have an effect on body fat composition and macronutrient percentage breakdowns.

**Measurement**

Body fat composition data collection for this study occurred over the course of one academic year. The same researcher performed all BOD POD body fat composition testing to ensure accuracy and consistency throughout the all three rounds of testing. During each BOD POD visit, the researcher gathered information about each participant’s gender, ethnicity, height and weight. Each athlete had his or her body fat percentage measured three times over the course of the study. The body fat composition that was included as the “post” measurement was the next scheduled BOD POD test following the nutrition counseling. Each of the five teams had different BOD POD schedules, because some teams started their first round of testing in September, and others started their first round of testing in November. All BOD POD tests were performed three months apart. Among three data
points, the one taken just before and just after the nutritional counseling served as pre-test and post-test scores. For this reason, the exact timing of pre and post-tests are different for different athletes.

Dietary analysis was used to gather data on dietary intake. Each participant filled out a three-day diet recall in which they listed all of the foods that they had consumed over the last three days. These foods were then entered into a program called ESHA Food Processor®. This software program is an extensive database of food items that analyzes dietary intake. This program looks at over 100 different nutrients and compares the current dietary intake of the participant to the recommended nutrient standards. The USDA recommended macronutrient proportions are 45-65% carbohydrate, 20-35% fat, and 10-35% protein (USDA, 2010). There were three student nutrition interns assisting with the dietary analysis of the study. The interns inputted the three-day dietary recalls into the Food Processor software in order to be analyzed. The actual data used were percentage of total caloric intake from carbohydrate before (pre-test) and after (post-test) participation in nutritional counseling.

**Intervention**

All nutrition counseling sessions with the athletes occurred in the researcher’s office at CSUN. All individualized nutrition counseling sessions were one hour in length and consisted of an introduction of the MyPlate, defining all components and educating the athlete on a balanced plate for each of their meals. One of the goals was to ensure balance, variety, and moderation at meals. The three macronutrients were defined, along with the USDA recommendations for each. The athletes were then educated on how their own personal macronutrient percentages from the dietary analysis compared to the USDA
percentages. They were instructed on how to either increase or decrease each macronutrient to fit within the USDA guidelines. Each macronutrient was defined in detail and examples of each were discussed. Hydration was also covered in the session, with a recommendation for each athlete to drink at least half of their body weight in ounces of water daily. The individualized nutrition sessions also included recommendations for eating a pre-workout meal two to four hours before hand consisting of 1.5g/kg carbohydrates and a post workout recovery meal within 30 minutes consisting of .65g/kg carbohydrates/kg and 20-25g of protein to aid in muscle recovery and muscle growth. Each athlete was provided with examples of carbohydrate rich items they could incorporate as pre and post training foods. The importance of breakfast was included and healthy breakfast options were recommended to all athletes regardless if they were already consuming a breakfast meal or not. There was time at the end of the sessions for questions from the athletes regarding anything specific they wanted to inquire about.

**Data Preparation and Analyses**

The three-day food recall was run through the ESHA Food Processor® to produce a report known as the dietary analysis. Dietary information and macronutrient intake percentages were revealed for each athlete. The data for pre and post body composition analysis were processed through the Statistical Package for Social Sciences software (SPSS version 13.0).

To test the first hypothesis on the differences in body fat change between the athletes who received individualized nutritional counseling and those who did not, repeated measures ANOVA was used to compare the differences in pre, and post body fat measurements between two groups of athletes, all of whom completed pre and post BOD POD composition
testing. Pre-and post-intervention body fat was the dependent variable, and the participation in individualized nutritional counseling (vs. not) was the independent variable. Differences were considered significant at p<0.10. The higher p-value reflects the limited sample size of the current study. A paired t-test tested the second hypothesis on the changes in macronutrients, and in particular carbohydrate intake as the total caloric intake.

The measurement instrument used to measure body composition was the BOD POD located on the CSUN campus. The BOD POD is considered one of the gold standards for body composition testing and is based on Air Displacement Plethysmography (ADP) technology (COSMED, 2015). This study viewed true scores since body fat compositions and macronutrient percentage breakdowns were measured and are not observable. The study possessed a high level of reliability because the study participants were not tested on their opinions. BOD POD measurement conditions remained consistent as a result of the same operator measuring all the athletes for the duration of the study. The same verbal instructions were given to each athlete on how to have their body fat composition measured. The instructions on the front page of the three-day food recall form were the same for all the participants as well. Reliability coefficients were used to measure reliability. The type of reliability that was used included a test-retest, as the three-day food recall forms and dietary analysis were given at the beginning of the study and after participation in the nutrition counseling intervention.
CHAPTER IV

RESULTS

The purpose of this research was to determine if individualized nutrition counseling had a positive effect on body fat measurements and macronutrients percentage breakdowns among student athletes. Specifically, changes in body fat and carbohydrate percentages were of interest.

Participants

The participants included 80 college athletes, 75 of which completed at least two consecutive rounds of BOD POD body fat composition testing and of those 75, 33 athletes received individualized nutrition counseling. A majority of the athletes were female (76%), as four out of the five teams were women’s sports. Participants varied in age from 18 years old to 23 years old, which is consistent with the age of the majority of college athletes.

Figure 1 represents the distribution of all 80 athletes involved in the program, per team.

![Figure 1. Athletes by Sport]

Figure 1. Athlete participation in the program by sport.

Figure 2 represents the distribution of all 80 athletes by ethnicity and race. 23% of the
athletes were African American, 10% Asian/Pacific, 11% Hispanic/Latino, 7% Bi-racial/Mixed, and 49% Caucasian.

Figure 2. Athletes by Race and Ethnicity

Figure 2. Athlete distribution by race and ethnicity.

Figure 3 represents the distribution of athletes who received nutrition counseling (41%), those who did not receive nutrition counseling (53%) and those that dropped out of the program (6%).

Figure 3. Participation in Nutrition Counseling

Figure 3. Athlete participation in individualized counseling.
Participation in Individualized Nutrition Counseling

After the first round of body composition testing for each team, athletes were scheduled to receive individualized nutrition counseling with the researcher. There was a large amount of athletes who forfeited their counseling sessions. Out of the 33 athletes who did receive individualized nutrition counseling, 24 athletes (73%) completed the program.

Table 1

<table>
<thead>
<tr>
<th>Athlete's Characteristics by Participation in Counseling</th>
<th>Number Participating in Counseling</th>
<th>Total Team Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teams ***</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Men's Basketball</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Women's Basketball</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Women's Softball</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Women's Tennis</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Women's Water Polo</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Total Athletes</td>
<td>33</td>
<td>47</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Body Fat</th>
<th>With Counseling Mean (SD)</th>
<th>W/O Counseling Mean (SD)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test</td>
<td>23.77%</td>
<td>25.41%</td>
<td>25.1% ± 8%</td>
</tr>
<tr>
<td>Post Test</td>
<td>23.01%</td>
<td>24.97%</td>
<td>24.2% ± 8%</td>
</tr>
</tbody>
</table>

Note: These numbers reflect team participation in nutrition counseling as either Yes, received counseling or No, not having received counseling. The ***p-value of <.001 is statistically significant.

Table 1 describes the athlete characteristics by participation in counseling per number of participants. Of the initial 80 athletes, 43% of male athletes completed the program (n=6) and 27% of female athletes completed the program (n=18). For Men’s Basketball, eight athletes were counseled and six completed the program. For Women’s Basketball, 13 athletes were counseled and 10 completed the program. For Softball, one athlete was counseled and one athlete completed the program. For Women’s Water Polo, six athletes were counseled and three completed the program. For Women’s Tennis, five athletes were counseled and four completed the program. Figure 4 represents all athletes and their

26
progression in the program. Academic and travel schedules, negative body image issues, and lack of interest account for low athlete completion of the program.

Figure 4. Program Participation

![Bar chart showing program participation breakdown by team.](image)

**Figure 4.** Athlete program participation breakdown by team.

**Changes in Body Composition**

Comparison of biometrics from pre-nutrition counseling to post-nutrition counseling was assessed using the BOD POD. This device evaluates the ratio of body fat percentage to percent lean body mass. All athletes (N=80) had their body fat composition evaluated in the first round of testing. Athletes then participated in a second round of testing three months from their initial testing. Each team participated in body fat composition testing separately, yet maintained three months in between the second (N=75) and third (N=68) rounds of testing. There were a total of 58 athletes (7 males and 51 females) that completed all three rounds of testing. There were 18 Women’s Softball athletes, six Women’s Tennis athletes, seven Men’s Basketball athletes, 11 Women’s Basketball athletes and 16 Women’s Water Polo athletes.
Changes in body fat composition from pre nutrition counseling to post-nutrition counseling were examined to test the hypothesis that body fat composition changes after receiving the nutrition counseling intervention. The control group of athletes was compared to the intervention group of athletes, determining that there was no difference in body fat composition. A repeated measures ANOVA was conducted to compare the different means of body fat percentages for pre (M=.2377) and post body fat composition (M=.2301) for athletes who received nutrition counseling and those who did not (Table 2). These results prove that nutrition counseling in this study did not have an impact on body fat composition change. The results show that the original hypothesis regarding body fat composition was not supported. Further, for both the treatment and control groups, there were no significant differences across the two time points, pre and post-nutrition counseling.

<table>
<thead>
<tr>
<th>Counseling</th>
<th>BF Pre M</th>
<th>BF Post M</th>
<th>Total</th>
<th>F(p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>23.77%</td>
<td>23.01%</td>
<td>25.1% ± 8%</td>
<td>2.19(.67)</td>
</tr>
<tr>
<td>No</td>
<td>25.41%</td>
<td>24.97%</td>
<td>24.2% ± 8%</td>
<td>2.73(.10)</td>
</tr>
</tbody>
</table>

*Note: The F model was not significant, thus individualized counseling did not have an impact on body fat change. This table lists least square means of each category.*

Changes in Macronutrient Percentages

A paired sample t-tests compared the differences of carbohydrate percentage from dietary analysis between the time prior to and after receiving the nutritional counseling for athletes who received nutrition counseling (M=0.0257) (Table 3). A complete data on
macronutrients, including carbohydrate, for the athletes who did not participate in the counseling was not available; therefore, multivariate analysis was not possible for this part of the study. Specifically, the t-test assessed the pre-nutrition counseling carbohydrate intake minus the post-nutrition counseling carbohydrate intake. Results showed a statistically significant, positive numeric value indicating a decrease in carbohydrate percentage points after participating in the nutritional counseling (T-value, =1.78, p=0.08) at p<0.10. The high p value of 0.10 coincides with a Type I error. These results show that the original hypothesis regarding carbohydrate intake was not supported.

Table 3

<table>
<thead>
<tr>
<th>T-test Results for Pre And Post Carbohydrate Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Pre test carbohydrate intake minus post test carbohydrate intake*</td>
</tr>
</tbody>
</table>

Note: This 2 group paired t-test result proved that both hypotheses were not significant. The minimum result from carbohydrate intake one to carbohydrate intake two was positive in percent points, * p<.10
CHAPTER V
DISCUSSION

The purpose of this study was to determine if nutritional education counseling helps to increase the student athlete’s intake of nutrient dense foods in CSUN varsity athletes and has a positive effect on the student athlete’s body fat composition. The collected findings are to serve as a guideline for the development of cohesive individualized nutrition counseling program, as well as a permanent sports nutrition program for all CSUN varsity athletes. The findings showed there were no significant differences between pre-nutrition counseling body fat and post-nutrition counseling, as well as no significant differences between the pre-nutrition counseling carbohydrate intake minus the post-nutrition counseling carbohydrate intake.

Athlete Compliance

Out of the 80 athletes who participated in the CQF Grant to assess dietary behavior, only 24 actually completed the entire study. There were distinct challenges per each particular team. The Men’s Basketball team presented with several no-shows to the individualized counseling sessions and only 6 out of the initial 17 athletes finished the study. The Women’s Basketball team was more compliant in participating in the individualized nutrition counseling, with 10 out of the initial 16 athletes finishing the study. The Women’s Water Polo team had a low level of compliance with three out of the initial 22 athletes finishing the study. The Softball team also showed a low level of compliance with only one out of the initial 22 athletes finishing the study. The Women’s Tennis team had a high level of compliance, with four out of the initial six athletes finishing the study.

The varying degrees of program compliance were due to several unforeseen
circumstances. There were four athletes who dropped out of the program entirely due to negative body images associated with body fat composition testing. It was not disclosed if any of the four were dealing with eating disorders or high levels of disordered eating. Across all five teams, there were athletes who, for undisclosed reasons, did not complete the entire study. It was noted that several athletes quit the team halfway through the study, while others were graduating seniors who were no longer available after their seasons ended due to offers to play overseas. It was noted that some athletes felt that the program was too time consuming and simply refused to participate.

**Threats to Internal and External Validity**

It has been acknowledged that the research design was a quasi-experimental research design with a control group in the study, and that there was no random assignment of participants into groups. For this study, it was necessary to let all the athletes in the study have the treatment because the researcher felt it would be unfair not to try and help all the athletes improve their nutrition status. Without random assignment, there was potential for a threat to internal validity. However, since this study was a one-group design, selection as a threat to internal validity was not an issue.

Additionally, measuring the athlete’s body composition and dietary intake before the treatment could have possibly been an issue regarding the threat of internal validity known as testing. This may have been an issue because the athletes may have felt the need to not be truthful on their three-day food recalls because they were embarrassed, wanted to follow an acceptable norm, and/or would not consistently and appropriately input their dietary food intake. Furthermore, the athletes may have not known how to assess the right amount of portions of food they consumed and may have given incorrect portion sizes in their dietary
recall, despite the instructional page attached to the three-day food recall. In the future, the athletes will need to be trained on how to properly measure portion sizes before giving them a three-day dietary recall. Analyzing three-day food recalls which are properly filled out and faithfully reported by the athletes is vital to determining an accurate distribution of macronutrients. Instrumentation may have also been a threat to internal validity because three different individuals entered the three-day dietary recall in the ESHA Food Processor®. In the future, there will need to be one person inputting the dietary recall in the ESHA Food Processor® to avoid this threat. The final threat to internal validity can be seen as mortality. Given that the athletes were college students, it may have been a challenge to gather the body fat composition data, macronutrient data and provide nutrition counseling, because students missed their appointments due to their busy schedules consisting of practices, games and academic classes. A better show rate amongst the student athletes could be achieved if there is a procedure set in place to assure these participants will make their appointments and/or some type of repercussion if they do not. In regards to generalizability, it is questionable whether or not nutrition counseling would be effective for other student athletes in other universities.

Implications

Although the findings of this study were not significant, a more comprehensive individualized nutrition education program could strengthen the dietary intakes of collegiate athletes. The data showed that 13 athletes who did receive individualized nutrition counseling improved their body fat composition by up to 7%. Even though differences were not significant, great strides were made by individual athletes on the Men’s and Women’s Basketball teams. A male athlete presenting with type II diabetes improved his body fat
composition by decreasing 7% post-nutrition counseling. Results also showed that a female athlete lowered her body fat composition by 7% post-nutrition counseling. Counseling played a significant role in body fat composition improvement, yet other factors such as exercise, stress and possibly under-fueling could have contributed to decreases in body fat composition. Improvement was seen in body fat composition individually, but not collectively. Results showed a trend for the potential of intervention of individualized nutrition counseling for athletes.

Collegiate athletes need to be educated on the necessary relationship between diet and training in order to fully optimize performance. Dietary assessment and analysis of an athlete’s diet should be promoted to determine specific vulnerabilities and provide nutritional counseling accordingly. A long-term sports nutrition program utilizing these procedures has the potential to strengthen the dietary behaviors of the collegiate athlete (Clark et al, 2003). Incorporating a dietitian and/or sports dietitian into the Sports Medicine team can provide athletes with valid resource to help encourage them to consume nutrient dense diets based on high carbohydrate foods as well as sufficient amounts of protein and fat.

**Recommendations for the Future**

This study paves the way for future research into the implementation and importance of individualized nutrition counseling for collegiate athletes. The data analysis of the 24 athletes who completed the program showed no significant results. We can look further to see how individualized nutrition education can benefit all collegiate teams at universities and colleges around the country with a multiple-session, year long nutrition counseling program. A multiple-session, year-long nutrition counseling program could strongly benefit all student athletes by encouraging them to make more sound dietary choices and expand their
nutritional knowledge. Incorporating a pre-test for all athletes assessing their existing nutritional knowledge may serve as a tool for the depth and direction of nutrition education provided. Implementing a student athlete-based nutritional counseling program at the collegiate level throughout the entire nation could improve the athletic performance and well-being of all collegiate teams. Further, it is possible that including a registered dietitian and/or a sports dietitian as a part of the athletic program could further enhance student athletes’ nutritional knowledge. The effectiveness of a sports dietitian would be critical in increasing not only the nutritional knowledge of student athletes, but could also be critical in providing a nutritional training table for the athletic department. Implementation of a training table along with nutrition counseling would surround the athletes with proper guidance about healthy eating, eating for optimal performance, including pre and post training meals, and hydration status. Having adequate nutritional knowledge helps the athlete to increase athletic performance (Rodriguez, DiMarco, Langley, Denny & Hager, 2009); thus, by incorporating personnel specific to sports nutrition education, collegiate teams can reap the unlimited benefits to not only improve performance, but academic performance as well. Athletes would have the opportunity to build trust with a permanent on-staff registered dietitian and/or sports dietitian. They would be comfortable having a staff member part of the Sports Medicine team dedicated to their personal health and nutrition, while maximizing their athletic performance.

While the athletes participating in the CQF grant only had one individualized counseling session, the benefits of long-term counseling could be endless. Athletes participating in weekly or bi-monthly nutrition education sessions with a sports dietitian could continually increase their knowledge of sports nutrition related topics. Continuous
counseling sessions would increase the athlete’s exposure to multiple nutrition education topics over time. More time could be spent on hydration, pre/post training meals and snacks, specific nutrient timing, recovery foods, and individualized meal plans tailored for the athlete.

**Conclusion**

The purpose of this study was to determine if nutritional education counseling helps to increase the CSUN varsity student athlete’s intake of nutrient dense foods has a positive effect on the student athlete’s body fat composition. These findings provide a foundation for the development of a sports nutrition education program used to enhance the nutritional knowledge and ultimately improve the dietary intake of CSUN varsity athletes. These findings may also be used to propel further research on sports nutrition providing a registered dietitian an/or sports dietitian with a more comprehensive understanding of the dietary needs and challenges of CSUN athletes. This study suggests that the need for the development of a sports nutrition program serving the needs of CSUN athletes is not only warranted, but necessary. The decrease in body fat composition of the athletes was shown to be inadequate. The difference in carbohydrate percentages was shown to be inadequate as well.

A large majority of athletes did not complete the study (n=55), even though participation was of no cost to them. Determining the specific reasons for a low compliance in the program would be needed to successfully educate the athletes and promote optimal performance through nutrition. Determining the specific challenges the athletes felt they encountered throughout the study would also be beneficial for further studies on nutrition education. Identifying the barriers and challenges the athletes faced would help to develop a thorough sports nutrition education program in the future ensuring high compliance.
Athletes may face obstacles such as lack of time, money to purchase recommended foods, cooking or meal prep skills or a combination of these and other challenges. Further research on these obstacles is highly recommended. Additional research is warranted to evaluate the correlation between nutritional knowledge and actual dietary intake.
REFERENCES


Institute for Clinical & Translational Science at the University of Iowa. Retrieved March 2, 2014, from https://www.icts.uiowa.edu/content/24-hour-dietary-recalls


Knowledge, attitudes, and behaviors regarding hydration and fluid replacement of


assessment and education improves body composition and diet in NCAA female volleyball players. Topics in Clinical Nutrition, 27(1), 67-73. doi:
10.1097/TIN.0b013e318246223b
APPENDIX A
Human Subjects Approval Form

California State University, Northridge
CONSENT TO ACT AS A HUMAN RESEARCH PARTICIPANT

The Effect of Individualized Nutrition Counseling on California State University Northridge’s Athletes’ Body Fat Composition and Nutrient Intake

You are being asked to participate in a research study. The Effect of Individualized Nutrition Counseling on California State University Northridge’s Athletes’ Body Fat Composition and Nutrient Intake, a study conducted by Simona Hradil as part of the requirements for the M.S. degree in Nutrition and Dietetics. Participation in this study is completely voluntary. Please read the information below and ask questions about anything that you do not understand before deciding if you want to participate. A researcher listed below will be available to answer your questions.

RESEARCH TEAM
Researcher:
Simona Hradil
Family and Consumer Sciences
18111 Nordhoff St.
Northridge, CA 91330-8308
818-585-0594
simhradil@gmail.com

Faculty Advisor:
Dr. Terri Lisagar, EdD, RD, Chair
Family & Consumer Sciences
18111 Nordhoff St.
Northridge, CA 91330-8308
818 677-3119
terri.lisagar@csun.edu

PURPOSE OF STUDY
The purpose of this research study is to investigate the effects of athlete participation in individualized nutrition counseling and body fat composition testing on body fat composition and macronutrient intake. The results can be used to strengthen CSUN’s athletes’ nutritional knowledge and decrease body fat percentages.
SUBJECTS
Inclusion Requirements
You are eligible to participate in this study if you
- Are an athlete within CSUN’s five varsity athletic teams participating in the Campus Quality Fee grant for the Family and Consumer Sciences Department.

Exclusion Requirements
You are not eligible to participate in this study if you
- Are not an athlete in one of the five selected varsity athletic teams at CSUN covered by the Campus Quality Fee.

Time Commitment
This study will involve approximately one hour of your time.

PROCEDURES
The following procedures will occur:
- Your data from the 2013-1014 BOD POD measurements under the Campus Quality Fee will be analyzed.
- If you are an athlete who has had individualized nutrition counseling with Simona, the nutrition counselor, you will be asked to complete a follow up three-day food recall summarizing the food items you have eaten.
- After completing the three-day Food recall, you will submit the three-day food recall form to the BOD POD room in Sequoia 112.
- A diet analysis will be entered and completed through the ESHA Food Processor in room Sequoia 112. A report will be generated containing your macronutrient percentages including the percentage of protein, fat and carbohydrates. The report will also contain your micronutrient percentage breakdowns as well as your total daily calories. Each of the three-day food recalls will be analyzed separately as well as an average of the three days total.
- You will then be contacted by Simona Hradil by email to discuss the results of your dietary analysis through an individualized counseling session.

RISKS AND DISCOMFORTS
The possible risks and/or discomforts associated with the procedures described in this study include personal and social risks. Completing a dietary recall form can trigger negative emotions related to body image. If you have any negative feelings about your self, your dietary habits and/or your sport while completing the dietary recall form, you have the option to be referred to Ellen Bauersfeld, RD at the Klotz Student Health Center. As a registered dietitian, Ellen Bauersfeld is able to mitigate any emotional, psychological and social feelings you may have.
BENEFITS
Subject Benefits
You may not directly benefit from participation in this study.

Benefits to Others or Society
Benefits include possible increases in the nutritional knowledge of CSUN athletes and better athletic performance.

ALTERNATIVES TO PARTICIPATION
The only alternative to participation in this study is not to participate.

COMPENSATION, COSTS AND REIMBURSEMENT
Compensation for Participation
You will not be paid for your participation in this research study.

Costs
There is no cost to you for participation in this study.

WITHDRAWAL OR TERMINATION FROM THE STUDY AND CONSEQUENCES
You are free to withdraw from this study at any time. If you decide to withdraw from this study you should notify the research team and the respective team trainer immediately. The research team may also end your participation in this study if you do not follow instructions, miss scheduled visits, or if your safety and welfare are at risk.

CONFIDENTIALITY
Subject Identifiable Data
- All identifiable information that will be collected about you will be removed and replaced with a code. A list linking the code and your identifiable information will be kept separate from the research data.

Data Storage
- Identifiable research data will be stored in a locked cabinet in a locked office in Sequoia Hall Room 200F.
- All de-identified research data will be stored electronically on a secure computer and network with password protection in Sequoia Hall Room 200F.
- The list linking identifiable data with de-identified data will be stored on a password protected hard drive locked in Sequoia Hall Room 291.
Data Access
- The researcher and faculty advisor named on the first page of this form will have access to the study records. Any information derived from this research project that personally identifies you will not be voluntarily released or disclosed without your separate consent, except as specifically required by law. Publications and/or presentations that result from this study will not include identifiable information about you.

Data Retention
- Existing data includes three body composition tests and one three-day food recall with diet analysis report. New data collected by the researcher includes one-three day food recall and diet analysis report.
- The researcher intends to keep the existing identified and de-identified research data in a repository indefinitely. Other researchers will have access to the data for future research.
- The researcher intends to keep the new identified and de-identified research data in a repository indefinitely. Other researchers will have access to the data for future research.

IF YOU HAVE QUESTIONS
If you have any comments, concerns, or questions regarding the conduct of this research please contact the research team listed on the first page of this form.

If you have concerns or complaints about the research study, research team, or questions about your rights as a research participant, please contact Research and Sponsored Projects, 18111 Nordhoff Street, California State University, Northridge, Northridge, CA 91330-8232, or phone 818-677-2901.

VOLUNTARY PARTICIPATION STATEMENT
You should not sign this form unless you have read it and been given a copy of it to keep. Participation in this study is voluntary. You may refuse to answer any question or discontinue your involvement at any time without penalty or loss of benefits to which you might otherwise be entitled. Your decision will not affect your relationship with California State University, Northridge. Your signature below indicates that you have read the information in this consent form and have had a chance to ask any questions that you have about the study.

I agree to participate in the study.

Participant Signature ___________________________ Date ___________________________