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ASSESSING SPORTS NUTRITION KNOWLEDGE OF ADOLESCENT FEMALE ATHELTES AND THEIR PARENTS: AN INTERVENTION APPROACH

by

MEREDITH FOSTER HAWK

(Under the Direction of Amy Jo Riggs)

ABSTRACT

The purpose of this study was to examine the effect of a sports nutrition intervention on nutrition knowledge and dietary choices among adolescent female soccer players and their parents.

Participants from this study were year-round, travelling soccer team members recruited from the Augusta Arsenal Soccer Club in addition to one parent of the minor (n=38). Adolescent athlete participants in the study completed a demographic survey including information on their age, school grade, position typically played, years in sport, whether or not they participated in any other sports, and if they had ever taken a nutrition class. In addition, a parent demographic survey was administered to obtain parents age, highest level of education, nutrition background, whether or not they previously played sports and who typically prepared meals at home. All participants completed a twenty-three item sports nutrition questionnaire (Zinn et al., 2005). The adolescent athlete participants also completed a three-day food record on two separate occasions. In a randomized design, participants were placed in the intervention group (n=18) or control group (n=20). Participants in the intervention group (n=18) attended nutrition education sessions for four weeks, lasting 20-30 minutes in duration. The following sports nutrition topics were discussed: carbohydrates, protein needs, vitamins/minerals, hydration, and recovery. After the intervention period, all participants were asked to submit a second set of three-day food records

and complete the twenty-three item sports nutrition questionnaire once more. Results of the adolescent athlete's sports nutrition knowledge questionnaire indicated that there was a significant difference between the intervention and control groups in general nutrition knowledge ($P=0.008$) with the intervention group scoring significantly higher compared to the control group (11.11 ± 23.64 ; 4.70 ± 27.89). For general nutrition knowledge, a significant interaction was seen between the intervention and the control groups pre to post intervention period ($P<0.0001$). Both the parents in the intervention and control group increased their knowledge, however, the parents in the intervention group increased their knowledge more (29.22 ± 13.87 ; 21.00 ± 13.16). There was also a significant interaction seen for fluid knowledge between the intervention and control groups pre to post ($P<0.0001$). Both groups increased their knowledge, however, the parents in the intervention group increased their knowledge more (5.78 ± 4.10 ; 2.80 ± 3.89). The three-day food records reflected changes in calcium ($P=0.009$) and fluid intake ($P=0.003$) as well with both the intervention and control groups increasing post-intervention.

INDEX WORDS: Adolescent female Athletes, Sports Nutrition Knowledge, Nutrition Intervention, Sports Nutrition Questionnaire

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ATHLETES AND THEIR PARENTS: AN INTERVENTION APPROACH

by

MEREDITH FOSTER HAWK

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THEIR PARENTS: AN INTERVENTION APPROACH

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MEREDITH FOSTER HAWK

Major Professor: Amy Jo Riggs
Committee: Barry Joyner
Kristina Kendall

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Chapter 1

Introduction

Healthy food choices and adequate nutrition are essential in any adolescent's life, but are especially important for those involved in sports (Croll et al., 2006). There is an increased energy demand for those involved in sports; however, most adolescents do not adequately meet all nutrient recommendations (Croll, et al., 2006). Sports nutrition education is necessary to understand proper fueling before, during, and after sporting events and to avoid illness and injury (Purcell, et al., 2013). Despite the increased need for nutrition education for adolescent athletes, to date there is a limited amount of research in this area (Nemet & Eliakim, 2009).

Several studies have shown that increased energy demands are not being properly met in adolescent athletes (Croll et al, 2006; Petrie et al., 2004; Purcell et al., 2013). When athlete's enter adolescence (13-18 years old) energy demands are increased and vary based on gender and activity level (Purcell et al., 2013). It is important that adolescent athletes understand that their energy needs will be different based on age, growth rate, and level of activity, and it is vital to educate athletes on these increased energy needs to avoid deficiencies. (Purcell et al., 2013). Like adults, adolescents struggle with the same environmental factors that influence nutrient intake: lack of time, travel, and body image (Croll, et al., 2006). Some athletes, especially female athletes, tend to have inadequate dietary practices due to their desire to be lean (Cupisti, D'Alessandro, Castrogiovanni, Barale, & Morelli, 2002; Maughn & Shirreffs, 2007). This desire conflicts with the fact that their energy needs are increased not only for their sport, but also for their growing bodies (Cupisti, et al., 2002). Inadequate nutrient intake can lead to decreased sports performance (delayed recovery and inability to adapt to training stimulus) as well as health problems (depressed immune systems and problems with reproductive function) (Cupisti,

et al., 2002). Several studies have shown that adolescent female athletes have inadequate intakes of calcium and iron (Cupisti et al., 2002; Croll et al., 2006; Nemet et al., 2009). Both of these micronutrients are necessary to support proper body functions and normal growth. A diet without adequate calcium and iron can negatively affect the reproductive system and bone development. Calcium is necessary for proper bone development and maintenance, normal muscle contraction and enzyme activity especially during adolescence (Purcell, 2013). Because soccer is considered a weight-bearing activity, it can help increase bone mass, however problems can arise if calcium levels are insufficient for proper bone development (Maughn & Shirreffs, 2007). Likewise, extra iron is needed during adolescence for proper delivery of oxygen to the tissues and more is needed during adolescence to support increases in blood volume and lean muscle mass (Purcell, 2013). In addition, differences in race, cultural background, and type of sport can lead to different nutritional practices (Cupisti, et al., 2002). This further demonstrates the importance for nutrition education and more specifically in the female adolescent population.

Children (from birth to 17 years old) do not typically prepare their own meals, so most food choices are dependent on what parents provide. Studies have shown that children as young as five to six years old are able to identify healthy snacks if given the proper tools (Baskale and Bahar, 2011 & Pettigrew, 2009). Recent research has examined what role nutrition plays in the young athlete's (6-13 years old) diet, specifically looking at types of food and beverage these athletes are consuming, parental attitudes toward the food setting at sporting events, and how willing parents are to make healthier choices (Thomas, Nelson, Harwood, & Neumark-Sztainer, 2012). Thomas (2012) found that some parents did not feel that they were capable of picking healthy snacks due to their lack of knowledge and inability to decipher what is actually a "healthy" snack. Slater et al., (2011) found that knowledge on energy balance increased when

individuals had more access to healthier food choices and beverages. Therefore, children are more likely to eat healthy foods if they are more readily available in the home.

In 2003, Neumark-Sztainer et al. assessed family meal patterns and its association with adolescent dietary intake using Project EAT data. The study showed that increased frequency of family meals was positively associated with healthy eating behaviors among adolescents. Family meals were also positively associated with adequate micronutrient intakes of Vitamin A, C, E, B-6, calcium, iron, and folate indicating balanced meals with ample fruits, vegetables, and whole grains. Similarly, Macfarlane et al., (2010) and Slater et al., (2011) found strong associations with increased healthy food availability and increased consumption patterns among adolescents. Macfarlane et al., (2010), found it to be beneficial for parents to listen to the food preferences of their children and to provide a positive family mealtime environment to reinforce healthy eating. Likewise, Slater et al., (2011), found strong associations between paired knowledge of adolescents and parents, suggesting that interventions should target the entire family rather than one individual in the family.

Purpose Statement

The purpose of this study was to examine the effect of a sports nutrition intervention on nutrition knowledge and dietary choices among adolescent female soccer players and their parents.

Research Questions

1.) Will adolescents in the intervention group score higher on the post nutrition knowledge questionnaire?

2.) Will parents in the intervention group score higher on the post nutrition knowledge questionnaire?

3.) Will post intervention dietary food records reflect healthier food choices among adolescents in the intervention group compared to the control group?

Hypotheses

1.) Both adolescents and parents receiving the nutrition intervention will have a significant increase on the sports nutrition knowledge questionnaire compared to the control group following the intervention.

2.) Adolescents in the intervention group will show higher consumption of complex carbohydrate intake compared to control group following the intervention.

3.) Adolescents in the intervention group will show lower consumption of saturated fat intake compared to the control group following the intervention.

4.) Adolescents in the intervention group will have higher consumption of lean protein intake compared to the control group following the intervention.

5.) Adolescents in the intervention group will have higher consumption of fiber intake compared to the control group following the intervention.

6.) Adolescents in the intervention group will have higher consumption of calcium intake compared to the control group following the intervention.

7.) Adolescents in the intervention group will have higher consumption of iron intake compared to the control group following the intervention.

8.) Adolescents in the intervention group will have higher consumption of fluid intake compared to the control group following the intervention.

Rationale:

Cupisti et al. (2002) investigated nutrition knowledge in young Italian adolescents; however, nutrition education was never attempted. Several other studies have researched dietary intake on younger athletes, however, none have attempted nutrition education to improve the athletes dietary intake and, more specifically, improve dietary intake during a competitive season (Iglesias-Gutiérrez, et. al., 2012 and Cupisti, et. al., 2002). Several studies have compared the athletic population to non-athletic populations, but no interventions have been performed to enhance nutrition knowledge of athletes or non-athletes (Croll et al., 2006 and Cupisti et al., 2002). Furthermore, few studies to date have attempted educating both the parent and adolescent athlete as a family unit.

This study will aim to examine the effect of sports nutrition education over time on nutrition knowledge scores and dietary choices among adolescent female soccer players and their parents using both a sports nutrition questionnaire and an intervention program.

Delimitations

- Only using Division 1 female soccer players from the Augusta Arsenal Soccer Club in Augusta, Georgia
- Athletes will be in-season
- Female adolescent athlete population only
- Only using soccer
- Only using one parent

Limitations

- Small sample size (n=38)
- Insufficient time frame (4 weeks)
- Self-reported dietary food records
- School vacation during data collection

Assumptions

- All athletes/parents who sign up and are randomly assigned to the intervention group, will show up for all the nutrition intervention sessions
- Athletes/parents of the intervention group will not discuss or share information they receive in the nutrition sessions with the control group
- Athletes will be honest and concise when recording food and beverage consumption

Chapter 2

LITERATURE REVIEW

Childhood Nutrition Intervention

Past studies have shown that childhood nutrition interventions can result in healthier eating patterns (Pettigrew, 2009). In 2011, Baskale & Bahar (2011) demonstrated that children as young as five years old can be taught healthy eating behaviors and inadequate diets can be attributed to the parent's knowledge or lack thereof. Educating parents and children on proper nutrition can help reduce unhealthy eating behaviors at a young age and increase the chance of a healthier future (Baskale & Bahar, 2011; Pettigrew, 2009).

In 2009, Pettigrew conducted a study addressing the childhood obesity epidemic taking place in Australia. The intervention was aimed at the parents, the primary caregivers, of the children to help elicit a more significant change in child eating behaviors. Furthermore, Pettigrew divided the parents and children into different socioeconomic classes prior to investigation of nutrition behaviors and beliefs, seeking to create nutrition interventions geared more specifically to socioeconomic statuses. The purpose of this study was to assess nutrition-related beliefs and behaviors among parents of different socioeconomic statuses (SES) to help assist in the development of obesity prevention interventions.

Subjects included 181 parents (25-44 years old) of primary school aged children. Three primary schools were used representing different socioeconomic statuses: low, medium, and high. Questionnaires were issued to parents via mail delivery. The questionnaire addressed issues pertaining to nutritional attitudes and behaviors and was composed of six statements regarding the importance of healthy and varied meals, role of fast food, media coverage of children's diets and the role of school canteens. Responses were assessed through a scale ranged "1-5" with "1"

representing “strongly agree” and “5” representing “strongly disagree”. The parents were also asked about varying behaviors: number of evening meals consumed as a family/week, extent to which television is viewed during mealtimes, whether the family typically eats meals that are perceived to be healthy by the parents, how much physical activity the children engage in and whether children are required to finish all food during mealtimes. In addition, responses for the behavior portion were measured both on a 5-point scale and on a 3 point-scale with “1” indicating “always or yes”, “2” indicating “sometimes or try to” and “3” indicating “never or no”.

Results of the study indicated that the respondents show a good understanding of the issues being examined. Future intervention could spend less time on general awareness of children’s diet and instead seek to change specific behaviors among the children. Significant differences were found between the attitude statement: “School canteens should provide only healthy foods” with the high SES group agreeing the most, followed by the middle SES group and lastly the low SES group. Significant differences were found between the high SES and middle SES groups ($P < 0.05$) and the middle SES groups and low SES groups ($P < 0.05$). Results of the behavior portion of the questionnaire indicated that all groups of SES parents could use further education on appetite regulation; however, middle-income families would benefit the most. Further education is needed on offering new foods multiple times to encourage liking as the results indicated there were significant differences between the high SES and middle SES groups ($P < 0.01$) as well as the middle and low SES groups ($P < 0.005$) with most of the emphasis needed on the middle SES group. Lastly, education regarding television viewing during mealtime would be beneficial for both middle and low SES groups ($P < 0.001$). Overall, this

study indicated that there are varying needs for nutrition education when it comes to different socioeconomic classes.

In 2011, Baskale and Bahar aimed to address the issue of why children's diets are unbalanced and inadequate. Much of the reasoning can be linked to the education level of the mother, socioeconomic status of the family, and lack of nutrition knowledge for the child's nutritional needs. The purpose of this study was to develop nutrition education for preschool aged children based on Piaget's theory and to examine the effects of this education on children's nutritional knowledge, nutritional behaviors, and anthropometric measurements.

The study was designed as a pre- and post-experimental study. All children included in the study were five years of age. The initial pre-test contained 238 children, post-test 1 contained 227 (n=141, experimental; n=97, control) children and post-test 2 had 115 (n=67, experimental; n=48, control) children. The study lasted approximately 15 months.

Four different forms were used to collect data: a demographic form, nutrition knowledge form, food consumption frequency form, and an anthropometric form. The nutrition knowledge form was prepared by the USDA entitled "Eat Smart with My Pyramid for Kids." The food frequency form contained questions about all of the different food groups. Anthropometric measurements taken on the children included weight, height and mid-upper arm circumference. The nutrition intervention was based on Piaget's cognitive development theory, which is child-led. Children's nutrition knowledge was assessed three times throughout the year and anthropometric data was collected twice. Children of the experimental group underwent a six-week education period and then completed their second set of data. Nine months later the parents received nutrition education for four weeks and the children received a three-week refresher course prior to the completion of the third set of data.

Results showed that those in the experimental group had increased nutrition knowledge scores ($p < .001$) and healthy food consumption compared with those in the control group. No changes were found in anthropometric data between the two groups. Piaget's cognitive development theory was found to be beneficial in this study where children involved in interactive learning were able to transfer the information they learned into long-term memory.

Nutrition Knowledge of Parents

The home environment is highly associated with children's eating behaviors. Parents play a major role in child and adolescent eating behaviors, but the extent is uncertain (Macfarlane et al., 2010). Adolescence is a time that is crucial for obesity prevention (Nelson et al., 2009). Understanding energy balance and expenditure is necessary for healthy weight maintenance (Nelson et al., 2009; Slater et al., 2011). Looking at both adolescent and parent nutrition knowledge along with the home environment may be an important aspect for behavioral change (Slater et al., 2011). Parental concern about weight and other health related issues can play a major role in healthful eating behaviors (Thomas et al., 2012).

In 2010, Macfarlane et al. carried out a study to assess whether or not parents concerned with their child's weight were actually providing supportive, healthy home food environments. The purpose of this study was to observe associations between parental concern about adolescent weight and adolescent perceptions of their dietary intake, home food availability, family mealtime environment, and parents feeding practices. The one-year study was set up as a cross-sectional study. Subjects included 1,448 adolescent-parent pairs, with adolescents ranging in age from 12-15 years.

Questionnaires were administered to 37 schools in Australia. Parent adolescent consent forms were mailed and parents completed a demographic survey, which included highest level of parent education. Parents were also asked to complete a questionnaire, which drew on their concern and perceptions of their adolescent's weight. Parents concern for their adolescents weight was measured from the following responses, "not at all concerned", "a little concerned", "quite concerned", and "very concerned." Parents were also asked to classify their adolescents weight at the time of the study from the following responses, "underweight", "average", "overweight", or "very overweight." Teachers administered a food habit survey to the students during class via the internet. Questions from the survey came from the Youth Eating Patterns (YEP) survey and took students 20 minutes to complete. The YEP survey contained demographic questions, adolescent dietary intake through means of a food frequency questionnaire (FFQ), adolescent perceptions of home food availability, adolescent perceptions of family mealtime environment, and adolescent perceptions of parental feeding practices.

Results indicated that parents concerned about their adolescent's weight was associated with adolescent consumption of extra food items ($P < 0.001$) and energy-dense snack food items ($P < 0.001$). Adolescents of concerned parents reported less consumption of extra food items and energy-dense snack foods compared to adolescents of less concerned parents. Adolescents of concerned parents also reported that their parents considered their food preferences less often compared to those adolescents of less concerned parents. However, concerned parents did not provide any more fruits or vegetables or provide a positive family environment than less concerned parents. Although there was less unhealthy food consumed in the concerned parent's homes, parents are encouraged to listen to their children's opinions and food preferences and use negotiation as a strategy to encourage healthy eating behaviors among their adolescent children.

To enhance obesity-prevention programs for adolescents, more information is needed on their nutrition knowledge and understanding of energy intake and expenditure (Nelson et al., 2009). In 2009, Nelson et al. aimed to assess adolescent's knowledge about energy intake and expenditure, and the extent to which the knowledge was associated with adolescent weight status, diet, and activity. In addition, the study aimed to assess knowledge transmission through families, associations between parent and child knowledge as well as associations between parent knowledge and adolescent health outcomes.

This study was a cross-sectional linear regression design. It drew on information from the "Identifying Determinants of Eating and Activity (IDEA)" study, a 3-year study following adolescents and an adult caregiver. Three hundred and forty-nine male and female adolescents in grades 9-11 were recruited. Adolescent and parent knowledge were assessed via a 15-item survey. The survey asked questions to assess knowledge about energy balance, possible response options, and response frequency patterns for adolescents and parents. Adolescent-level characteristics were assessed using self-reported and objective measurements. Adolescents were assessed on eating behaviors, physical activity levels, hours of television viewing, anthropometric measurements, and socioeconomic status. Results indicated that overall knowledge scores were significantly correlated between adolescents and parents ($P < 0.01$), however, responses to individual items were weakly correlated. A positive association was found between adolescent knowledge and moderate physical activity, while a negative association was found with television viewing ($P < 0.05$). Neither adolescent or parent knowledge scores were a strong indicator of adolescent fast-food intake, sweetened beverage intake, weight status or body composition. Findings of this study support the need for energy balance education for both adolescents and parents.

An individual's knowledge on energy balance can affect the home environment. Knowledge along with behavioral skills, role models, reinforcements and incentives can all influence a child's behavior. In 2011, Slater et al. conducted a study to evaluate the associations between energy balance knowledge and the home environment between youth, parents, and the overall family units. This study was a cross-sectional analysis of baseline data collected for the TREC IDEA study. Three hundred and forty-nine male and female adolescents aged 10-16 years old were recruited for this study.

Energy balance knowledge was assessed via a 15-item scale included in both the youth and parent questionnaires. Total household knowledge was characterized by the average of both the adolescent and parents score to create a paired knowledge score. Both the adolescents and parents completed a home food inventory indicating healthy and unhealthy food choice availability. Parents completed a physical activity and media inventory, which reflected the home availability and accessibility of physical activity and media screen activity. Parents knowledge scores were significantly higher than adolescent scores ($P < 0.0001$) and parent and youth scores were weakly correlated ($r = 0.17$). Paired energy balance knowledge scores were negatively associated with the Media Availability and Accessibility summary ($P = 0.0005$). Paired knowledge scores were positively associated with fruit ($P = 0.0004$), vegetable ($P = 0.032$), healthful snack ($P = 0.005$) and healthful beverage availability ($P = 0.003$). The study did not find a significant association between energy balance knowledge and availability or accessibility to physical activity equipment ($P < 0.05$). This study found that there is a powerful effect of the total family unit, so future intervention programs may aim to target the entire family rather than one family member.

Eating together as a family can be challenging due to different schedules among family members, however, studies have shown that families who eat together tend to eat healthier meals and have a higher consumption of fruits and vegetables. In 2003, Neumark-Sztainer et al. examined family meal patterns and its association with sociodemographic characteristics and dietary intake in adolescents. This study used an older adolescent population to assess the family meal patterns as children grow older and are able to drive and hold jobs outside of the home. Subjects from this study were recruited from the Project EAT (Eating Among Teens) study. Four thousand seven hundred and forty-six male and female adolescents (11-18 years old) with varying socioeconomic and racial backgrounds were recruited for this study.

Frequency of family meals, dietary intake assessed by the Youth and Adolescent Food Frequency Questionnaire (YAQ), and self-reported demographic information were assessed. Results showed varying levels of frequency of family meals. Based on sociodemographic characteristics, boys tended to report higher frequency of family meals compared to girls and middle school students reported a higher frequency of family meals than high school students. Asian Americans tended to have the highest frequency of family meals when compared to other racial backgrounds and frequency of family meals was highest in those with mothers who were unemployed. There was also a positive association between those with higher socioeconomic status and frequency of family meals. Frequency of family meals was also positively associated with higher intakes of fruits, vegetables and calcium rich foods ($P < 0.001$) and grains ($P < 0.002$). The results of this study indicate that more frequent family meals can lead to healthier food choices, which could provide a good foundation for future eating patterns in the transition from adolescence to adulthood.

Over 44 million youth participate in some type of sports each year (Thomas et al., 2012). While these children may have healthier eating habits than non-sport involved peers, they too, can have unhealthy eating habits. The youth sport food environment does not help the situation by providing sugary, calorie dense food options. In 2012, Thomas et al. aimed to examine foods and beverages that young athletes consume, specifically basketball players, by interviewing their parents. In addition, this study looked at parent's attitudes toward the food offered in sport environments and the opportunity to support healthy eating in youth sport settings. Sixty children ranging from 6-13 years of age and their parents were recruited.

Eight focus group sessions lasting 35 to 60 minutes in duration were held. One moderator facilitated all groups and questions were asked in a semi-structured manner allowing flexibility within groups. Focus group topics consisted of snacks, beverages, decision-making, sport league guidelines, youth sport, and meals. Results showed that in general, unhealthy snack options were made available at sporting events, parents were unhappy about the options made available at sporting events, and that parents want more sport-specific nutrition knowledge. Parents identified time restraints and limited availability of nutritious food at sporting events as two barriers to healthy eating. This study indicates the need for further nutrition education, specifically sport nutrition education, among young athletes and their parents to aid in healthy eating.

Adolescent Athlete Nutrient Status

It is widely known that proper nutrition is necessary during an adolescent's life for optimal growth (Iglesias-Gutiérrez et al., 2005). Adolescent athletes have specific nutrient needs due to the additional requirements necessary during competitive periods (Iglesias-Gutiérrez et al., 2005). There is little information known about nutritional status of adolescent soccer players

living at home while training and competing (Iglesias-Gutiérrez et al., 2005). Even less is known about the nutrient demands of soccer players based on their playing position (Iglesias-Gutiérrez et al., 2011). Nutrient status and bioenergetics are important to consider when planning nutrition interventions for adolescent athletes (Iglesias-Gutiérrez et al., 2011).

Nutrition status and eating habits are important when considering young athletes, not only for optimal performance but also for optimal growth and development. Iglesias-Gutiérrez et al. (2005) observed elite, young soccer players in their own home environments to assess their food habits and nutritional status. Thirty-three male subjects aged 16-21 years old were recruited from a First Division Soccer League Club. Anthropometric measures were analyzed and included height, mass, BMI, and skinfolds.

The players recorded daily dietary intake for six days excluding their match day using the weighed food intake method. All families were given specific questionnaires designed to gather information on typical eating patterns and other related behaviors. Families were also given a digital food-weighing scales and were instructed to not change any of their dietary behavior during the study period. Information for total daily energy expenditure (TDEE) was also compiled to determine the athletes' daily activity profile. Fasting blood samples were drawn to measure hematological and biochemical parameters. Performance was assessed by means of sprinting ability and three types of vertical jump: squat jump (SJ), countermovement jump (CMJ), and countermovement jump with free hands (CMJF). Lastly, a Yo-Yo intermittent endurance test was used to assess individuals' ability to abstain intense exercise intervals over long periods.

Results indicated that mean cholesterol, fat, and protein intakes were above the nutritional recommendations for most subjects' while carbohydrate intake was low. Mean fiber and relative contribution of saturated fatty acids (SFA) were within recommended levels. Vitamins and minerals were above recommendations with the exception of folate, Vitamin E, calcium, magnesium and zinc. Results of this study indicate that while most of the nutrient needs of adolescent athletes were met, there is still room for improvement. Understanding athletes' eating habits in the home environment is important when designing nutrition programs for optimal performance.

Further research done by Iglesias-Gutiérrez et al. (2012) observed whether or not there are different eating patterns among varying soccer player positions. This study, as in the previous study, used male soccer players (aged 16-21 years old) from the Spanish First Division Soccer League Club. The players were divided into six different positions: goalkeepers (G), fullbacks (FB), centre-backs (CB), midfielders (M), wingers (W), and forwards (F).

As in the previous study, anthropometric data was analyzed and included height, body mass (BM) and skinfolds. Three different tests were used to evaluate performance and subjects were familiarized with the tests by at least one pre-test. The tests included sprinting ability (10, 20, and 30 meters) using photoelectric cells, counter movement jump (to evaluate muscular strength of the lower extremities) on a touch-sensitive mat and the Yo-Yo test (to evaluate intermittent endurance).

Dietary intake was monitored by the soccer players with a six day food record (excluding match days) using the weighed food intake method. Players and family members were issued with food record questionnaires and digital food weighing scales. Performance assessment

results showed that FB, M, and W had a significantly higher endurance capacity than G (P=0.041; P=0.001; P=0.013, respectively). G and CB had better results in jumping ability compared with M (P=0.014; P=0.004, respectively). Dietary intake indicated that daily carbohydrate intake was below the recommendations for all players. Main differences in positional groups were shown in the cereal, derivatives and potatoes group, and the meat, poultry and derivatives group. There was a higher carbohydrate intake in those with higher aerobic energy production. Lowest energy intake was seen in goalkeepers. Understanding the different macronutrient contents that are utilized based on player position would be beneficial when developing nutrition education.

Adolescent Nutrition Knowledge: Non-Athletes

A typical diet of an adolescent does not reflect the healthiest food choices (Pirouznia, 2001). There are numerous factors that influence an adolescents eating behavior, including nutrition knowledge (Pirouznia, 2001). Due to the unhealthy diets seen in adolescents, there has been a massive trend of children being categorized as overweight or obese (Fahlman et al., 2008). Poor eating habits during childhood typically follow into adulthood (Fahlman et al., 2008). To prevent obesity and unhealthy lifestyles, several programs have been set up to address eating behaviors and nutrition knowledge (Fahlman et al., 2008).

Many factors contribute to food choices during adolescence (Pirouznia, 2001). In 2001, Pirouznia compared the differences between eating habits of females and males, assessed nutrition knowledge of middle school aged children, and determined if there is a correlation between the amount of nutrition knowledge and eating behavior based on gender. Middle school students (n=532) participated in this study. The CANKAP (Comprehensive Assessment of

Nutrition Knowledge, Attitudes, and Practices) was used to assess nutrition knowledge and eating behaviors.

The CANKAP survey consisted of 30 questions, 10 of which measured eating behaviors, and 20, which measured nutrition knowledge for 6th graders. The questionnaire for the seventh and eighth-grade students had 35 questions, 10 that measured eating behaviors and 25 that measured nutrition knowledge. One of the questions on the CANKAP identified the student's gender.

Results indicated that there was not a significant difference in nutrition knowledge between sixth grade boys and girls ($P=0.3$). Results from an ANOVA test did indicate that the mean nutrition knowledge scores of seventh and eighth grade girls was significantly higher than that of the boys ($P=0$). There was no significant difference in the mean value for eating behaviors between sixth grade boys and girls ($P = 0.3$); however, there was a significant difference between the mean eating behavior scores of seventh and eighth grade boys and girls ($P = 0$). There was a correlation between nutrition knowledge and eating behavior of girls in the seventh and eighth grade ($P < 0.006$). These scores indicate that a better nutrition education program needs to be set up for all grades.

Unhealthy eating patterns can be transferred from childhood to adulthood (Fahlman, Dake, McCaughtry, & Martin, 2008). Various programs are being developed to help educate kids on the obesity epidemic (Fahlman, et al. 2008). Fahlman aimed to look at the Michigan Model (MM), which addresses dietary patterns, one of the six health risk behaviors as identified by the Centers for Disease Control and Prevention. This study was a pre/post assessment quasi-experimental design. At the end of the pre-post assessment periods, there were 576 subjects that completed the study.

Those assigned to the intervention group (n=407) received eight nutrition lessons and included information on food groups, food pyramid, food labels, advertising, and body image. The Pre-assessment was conducted after the nutrition lessons were taught over a 1-month period and then the post-assessment was re-administered two weeks following the unit conclusion. Results showed that the intervention group had significant improvements on consumption of fruits (P=.047), vegetables (P=.018), and a significant decrease of other foods consisting primarily of junk food (P=0.25) when compared to the control group. Students in the intervention group demonstrated significant improvement in pre-post assessments (P<.001). The results indicate that a school-based intervention can be beneficial for improving middle school children's dietary eating behaviors as well as increase self-efficacy in regards to making healthier food choices.

Adolescent Nutrition Knowledge: Athletes

Nutrition knowledge and eating behaviors are highly important when it comes to sport performance (Croll et al., 2006). Athlete's nutrient needs are increased; however, studies have shown there are certain nutrients not being properly met (Croll et al., 2006). Specifically, adolescent females have been marked as a group with inappropriate energy levels and nutrient intakes (Cupisti et al., 2002). Lack of nutrition knowledge and common nutrition misconceptions are leading causes for inappropriate dietary intake and/or behaviors seen among adolescent females (Cupisiti et al., 2002). Therefore, it is important to assess athletes and those providing sport nutrition knowledge with a valid and reliable sport nutrition questionnaire to accurately evaluate sport nutrition knowledge (Zinn, Schofield & Wall, 2005).

Nutrient intake and adequacy can vary in different sports due to different bioenergetics systems at play (Croll et al., 2006). Past research examining dietary intakes among adolescent

athletes failed to split athletes into different sporting groups (Croll et al., 2006). In 2006, Croll et al. aimed to assess eating behaviors and nutrient intakes (iron, zinc, protein, and calcium) of those involved with either power-team or weight-related physical activity and compared nutrient intakes to adolescents who are not involved with sports. Data was drawn from the Project Eating Among Teens (EAT) study. Data for this study was taken from the Project EAT Physical Activity Questionnaire. Male and female weight-related sports participants, power team sport participants, and those with no consistent physical activity were included in the study for a total of 4,476 adolescent (aged 11-18 years old) participants.

Researchers used three surveys of the Project EAT study to assess the adolescents: Project Eat Student Survey, Youth and Adolescent Food Frequency Questionnaire (YAQ), and the Project Eat Physical Activity Questionnaire. Specific parameters assessed included eating behaviors, nutrient intakes, composite nutrient adequacy scores, physical activity levels, anthropometrics and demographics.

Results indicated that both males and females who were involved with a sport consumed breakfast more frequently than those not involved in sports. In females, mean calcium was significantly lower for non-sport involved persons and did not reach recommended daily intake for any of the three sport groups. Mean calcium intake was found the highest in males involved with weight-related sports, however, non-sport involved males did not meet the recommendations for calcium. For males, mean nutrient adequacy scores were significantly lower in the sport-involved peers ($P < 0.0001$). Overall, non-sport involved females had a significantly lower mean nutrient adequacy score compared to their sport-involved peers ($P = 0.0004$). Participating in sports shows improved eating behaviors; however, nutrient intakes still did not meet recommendation levels, especially for sport-involved female adolescents.

Nutrition interventions would be helpful for these athletes to learn how to get in adequate nutrients, particularly calcium and iron, in beneficial ways.

Adolescent female athletes, especially those involved with weight related sports, are identified as a high-risk group due to their generally, unhealthy food practices and their desire to be lean (Cupisiti, D' Alessandro, Castrogiovanni, Barale and Morelli, 2002). The desire to be lean, in addition to the inadequate nutrition information available through the internet, can lead to several unhealthy nutrition behaviors affecting growth and sport performance (Cupisiti et al., 2002). In 2002, Cupisiti et al. evaluated dietary intake and nutrition knowledge in Italian adolescent females and assessed the role of sports activity on those aspects. Subjects included 119 (60 athletes, 59 non-athletes) Italian Caucasian adolescent females aged 14-18 years old involved in various weight related team sports. Participants completed a three-day dietary recall and a non-standardized nutrition knowledge questionnaire.

The results showed that reported daily energy intake was similar in both athletes and non-athletes and that both were significantly lower than recommended. Athletes did have a higher intake of carbohydrates and a lower intake of fats compared to the non-athlete group. Athletes did report more refined sugars than non-athletes ($P < .001$). Dietary protein was similar in both groups and covered the recommended daily intake. Iron and Vitamin A intakes were higher ($P < .001$ and $P < .05$, respectively) in athletes compared to the non-athletes. Dietary fiber was higher in the athletes as the recalls indicated a higher intake of fruits, vegetables and grains.

For both groups, mineral intakes were less than 100% RDA value. There were five questions on the nutrition knowledge questionnaire that more than 50% of the adolescents got wrong, indicating the need for more nutrition education in those areas. Overall, the athletes did

have more correct answers on the questionnaire than the non-athletes ($P < .01$). The results indicate that individuals involved in sports tend to have a better understanding of nutrition than non-sport-involved peers, however, there are misconceptions that still need to be addressed.

There is a strong need for the development of a well-validated nutrition knowledge questionnaire (Zinn, Schofield, and Wall, 2005). An accurate sports nutrition questionnaire will provide more information on nutrition behaviors and act as an aid when developing intervention programs (Zinn et al., 2005). In 2005, Zinn et al. developed a psychometrically valid and reliable sports nutrition questionnaire. The questionnaire was broken into five sub-categories: identifying general nutrition, recovery nutrition, fluids, weight control, and supplement usage and practices.

Four hundred and forty-one subjects participated in this study and represented five different population groups with varying sport nutrition knowledge: 1. University business staff, 2. Dietitians, 3. Nutrition students, 4. Business students, and 5. Fitness students. Test-retest reliability was established by re-distributing the surveys to two of the groups (business staff and registered dietitians). Pearson's product-moment correlation was calculated for the first and second mean total and sub-category nutrition knowledge scores. The second measure for test-retest reliability allowed for participants first scores to be compared with their second scores of each question.

Results indicated that dietitians and nutrition students achieved significantly higher mean scores compared to the other groups. Business students had the lowest scores compared to other groups ($p = 0.0001$) for total mean score and for the sub-categories, general nutrition, fluid and weight control. Pearson's product-moment correlation revealed acceptable test-retest reliability with exception of the fluid sub-category. Correlation coefficients ranged from 0.74-0.89

indicating that a satisfactory temporal stability was achieved. The second method of test-rest reliability was acceptable with approximately 81% of the questions being answered with the same response from the initial survey to the re-distributed survey. Overall, the survey was found to have good levels of reliability and validity and is considered acceptable for measuring sports nutrition knowledge (Zinn, Schofield & Wall, 2005).

Chapter 3

METHODOLOGY

The purpose of this study was to examine the effect a sports nutrition intervention on nutrition knowledge scores and dietary choices among adolescent female soccer players and their parents.

Pilot Study Data

The sports nutrition questionnaire was administered to sixteen adolescent female athletes not affiliated with the study to test the questionnaire's reliability. The 23-item questionnaire data was entered into SPSS and a reliability test was run using Cronbach's Alpha. The results indicated that the sports nutrition questionnaire was highly reliable (23 items; $\alpha=.85$).

Participants

One hundred and twenty-eight participants (adolescents and one accompanying parent) were recruited for this study. Sixty-four female participants on a year-round, travelling soccer team were recruited from the Augusta Arsenal Soccer Club in addition to one parent of the minor (n=128). Participants were adolescent females on an elite Division 1 soccer team between the ages of 13-17 years old. The athletes were in their competitive season during data collection. All participants that agreed to participate in this study signed an informed consent form. In addition, since the participants were minors, their parents also signed a minor informed consent form. This study was approved by the Institutional Review Board (IRB) at Georgia Southern University.

Instruments

Participants in the study completed a demographic survey including information on their age, school grade, position typically played, years in sport, whether or not they participate in any other sports, and lastly whether or not they have ever taken a nutrition class. In addition, a parent demographic survey was administered to obtain information including their age, highest level of education, nutrition background (if any), whether or not they previously played sports and who typically prepares the meals at home.

Adolescent athletes agreeing to participate in this study completed a twenty-three item sports nutrition questionnaire (Zinn et al., 2005) and a three-day food record on two separate occasions. One parent of the minor also completed a twenty-three item sports nutrition questionnaire (Zinn et al., 2005) on two separate occasions. All participants completed every section of the questionnaire, including the supplement section; however, statistical tests were not run on the supplement section of the sports nutrition questionnaire. All participants completed their first questionnaires prior to the nutrition intervention. The adolescent athlete participants also completed their first set of three-day food records. After the intervention period, all participants completed the sports nutrition questionnaire again. The adolescent athlete participants completed their second set of three-day food records and returned them following the last intervention session. During the intervention period, participants assigned to the intervention group received previously created nutrition handouts from Eat Right's Sports, Cardiovascular, and Wellness Nutrition practice group and EAS Academy Sports Nutrition Science performance lab.

Procedures

All participants were informed about the purpose and protocols of the study. The informed consents for both the parents and minors were administered and signed during the first meeting. The adolescent and parent demographic surveys were also administered and returned during the first meeting. Parent-child duos were randomly assigned to either the intervention group (n=18) or control group (n=20). Prior to the intervention, all participants were asked to complete a 23-item sports nutrition questionnaire. In addition, the adolescent female athletes were asked to complete a three-day food record. The questionnaire was previously found valid and reliable ($r=0.74-0.93$). Instructions for completing the three-day food records were given during Week 1 of the study and the three-day food records were returned the following week. The questionnaire addressed varying nutrition topics in relation to sports performance. Questions on the following nutrition topics were addressed on the questionnaire: carbohydrates, proteins, fats, micronutrients, beverages, and supplement usage as well as proper timing of meals and beverages as related to sport performance. Those participants (adolescent and parent) assigned to the intervention group received nutrition information every week for four weeks. Participants (adolescent and parent) in the intervention group missing more than one weekly session were excluded from the final data analysis. Each week focused on a specific topic: Week 3- carbohydrates; Week 4- proteins/fats; Week 5- vitamins/minerals and Week 6- recovery/re-hydration. Nutrition lessons were approximately 20-30 minutes in length and took place prior to the athlete's practices. The three-day food record determined the type of meal (i.e. breakfast, lunch, dinner), time of meal, specific type of food, beverage (per glass/cup/can), portion size, and location of the meal. Week 2 of the study was the collection of the three-day food records. Week 3 began the nutrition lessons with a discussion about carbohydrates including the importance of

carbohydrates, different types of carbohydrates (simple versus complex), where carbohydrates can be found, and best sources of carbohydrates for athlete's. Week four focused on the importance of proteins and fats including, quality sources of protein, recommended amounts of protein for athletes, good fats versus bad fats, food sources that contain fats. Week five was a discussion on vitamins/minerals that are important in an athlete's diet including, calcium, iron, Vitamin C, folate, and Vitamin D. Week six concluded the nutrition lessons with a discussion about recovery and hydration. Participants received educational handouts at the end of each nutrition lesson. During Week 7, the nutrition questionnaire was administered again following the four-week intervention to all participants and adolescent athlete participants were asked to hand in another three-day food record. Lastly, adolescent athlete participants in the intervention group were questioned about their experience, including what they liked most about the intervention, what they liked the least, what they learned, and if they plan on utilizing the information. Participants in the control group received the nutrition hand-outs that the intervention group received during the study after they completed the post-intervention questionnaire.

Study Time Line

Week 1: A meeting with the athletes', parents, and coach was held to explain the purpose and protocols of the study. Participants were given a packet that included a demographic survey, an informed consent letter and a minor consent form. If adolescent athletes and parents chose to participate they were asked to complete surveys and consent forms. Upon completion of forms, parent-child duo was assigned to either the intervention or the control group. All participants agreeing to participate completed the pre-intervention nutrition knowledge questionnaire at this time. In addition, instructional procedures for completing a 3-day food record was given.

Week 2: The first set of three-day food records were collected from all adolescent athlete participants.

Weeks 3-6: During these weeks, the intervention group attended a weekly nutrition session and received handouts to take home. The control group did not attend these sessions or receive any nutrition information until the end of the study.

Week 7: Adolescent athlete participants returned another set of three-day food records and all participants completed the post- nutrition knowledge questionnaire. A wrap-up discussion of the study was held. A short discussion was held with the intervention group to gather information from the athletes about the intervention.

Statistical Analysis

SPSS was used to evaluate the data. Sixteen two-way ANOVAs with repeated measures were used to evaluate nutrition knowledge of both the adolescent athletes and the parent's for both the intervention and control groups (pre/post) for each subcategory of the sports nutrition questionnaire (general nutrition, weight management, fluid, and recovery). The three-day food records were analyzed using My Diet Analysis. After the three-day food records were entered into My Diet Analysis, SPSS was used to analyze the data. Fourteen two-way ANOVAS with repeated measures were used to evaluate the adolescent athlete's three-day food records (pre/post) for each subcategory (saturated fat, fiber, calcium, iron, carbohydrate, fluid, and protein). A *p* value of <0.01 was considered statistically significant. Numbers were expressed as means ± standard deviations.

Chapter 4

RESULTS

Participant Characteristics

Nineteen adolescent female Division 1 soccer players participated in this study. All participants completed pre and post three-day food records and pre and post sports nutrition questionnaires. Descriptive statistics are summarized in Table 1. Nineteen parents participated in this study with their daughters. Parent participants completed pre and post sports nutrition questionnaires. Descriptive statistics are summarized in Table 2.

Variable	Mean ± SD
Age (years)	15.26 ± 1.19
School Grade	9.58 ± 1.26
Duration in Sport (years)	9.58 ± 3.45
Other Sport Play (yes or no)	No
Past Nutrition Class (yes or no)	No

Table 2. Parent Demographics	
Variable	Mean ± SD
Age (years)	48.11 ± 6.22
Highest Education Level	College or higher
Nutrition Background (yes or no)	No
Typical Meal Preparer (Mom/Dad/ Both)	Mom
Past Sport Play (yes or no)	No

Sports Nutrition Knowledge Questionnaire

Results of the adolescent athlete's sports nutrition knowledge questionnaire indicated that there was a significant difference between the intervention and control groups for general nutrition knowledge (P=0.008). The intervention group scored significantly higher compared to the control group (11.11 ± 23.64; 4.70 ± 27.89). See table 3 for details.

Adolescent Athletes

Table 3. Sports Nutrition Knowledge Questionnaire, Standard Deviations and Interactions							
	Pre- Intervention	Post- Intervention	Pre- Control	Post- Control	Interaction	Pre/Post Difference	Group Difference
General Knowledge (46)	6.67 ± 8.75	15.56 ± 7.42	4.30 ± 4.83	5.10 ± 4.53	P=0.072	P=0.034	P=0.008*
Weight Control (15)	.56 ± 4.13	2.89 ± 3.14	3.30 ± 2.67	2.40 ± 2.95	P=0.181	P=0.545	P=.0245
Fluid (5)	1.67 ± 2.74	3.67 ± 4.21	3.30 ± 1.95	3.10 ± 1.66	P=0.228	P=0.321	P=0.570
Recovery (7)	-2.00 ± 3.77	0.33 ± 2.00	.30 ± 4.27	-.90 ± 2.33	P= 0.095	P= 0.095	P=0.637

*-Indicates significance. n=9 (intervention); n=10 (control)

Results of the parent sports nutrition knowledge questionnaire is shown in Table 4. For general nutrition knowledge, a significant interaction was seen between the intervention and the control groups pre to post intervention period ($P < 0.0001$). Both the parents in the intervention and control group increased their knowledge, however, the parents in the intervention group increased their knowledge more (29.22 ± 13.87 ; 21.00 ± 13.16). There was also a significant interaction seen for fluid between the intervention and control groups pre to post ($P < 0.0001$). Both groups increased their knowledge, however, the parents in the intervention group increased their knowledge more (5.78 ± 4.10 ; 2.80 ± 3.89). There was significant change seen in both groups regarding questions about recovery ($P = 0.002$). Both groups increased their knowledge (1.09 ± 4.47 ; 3.21 ± 4.47).

Parents

Table 4. Sports Nutrition Knowledge Questionnaire, Standard Deviations and Interactions							
	Pre- Intervention	Post- Intervention	Pre- Control	Post- Control	Interaction	Pre/Post Difference	Group Difference
General Knowledge (46)	23.67 ± 10.83	29.22 ± 8.79	20.50 ± 10.31	21.00 ± 10.18	$P < 0.0001^*$	$P < 0.0001^*$	$P = 0.233$
Weight Control (15)	6.11 ± 3.79	8.22 ± 4.18	5.40 ± 2.88	5.60 ± 2.72	$P = 0.099$	$P = 0.050$	$P = 0.272$
Fluid (5)	1.56 ± 2.70	5.78 ± 2.44	2.20 ± 3.36	2.80 ± 3.12	$P < 0.0001^*$	$P < 0.0001^*$	$P = 0.384$
Recovery (7)	1.89 ± 3.95	5.33 ± 3.08	.30 ± 4.88	1.10 ± 5.40	$P = 0.037$	$P = 0.002^*$	$P = 0.157$

*-Indicates significance. n=9 (intervention); n= 10 (control)

Results of the three-day food record indicated there was a significant change in calcium from pre to post for both the intervention and control groups (P=0.009). Both groups significantly increased their calcium levels post intervention period. (1648.83 ± 256.88; 2310.06 ± 232.14). There was also a significant change in fluid intake from pre to post for both the intervention and control groups (P=0.003). Both groups significantly increased their fluid intake levels post intervention period (14.91 ± 16.95; 18.22 ± 14.21).

Three-Day Food Record

Table 5. Three- Day Food Record Standard Deviations and Interactions							
	Pre- Intervention	Post- Intervention	Pre- Control	Post- Control	Interaction	Pre/Post Difference	Group Difference
Saturated Fat	59.78 ± 21.33	64.66 ± 23.03	61.40 ± 14.65	69.10 ± 18.25	P=0.789	P=0.860	P=0.681
Fiber	41.32 ± 19.83	46.74 ± 11.31	48.75 ± 13.46	45.26 ± 11.76	P=0.421	P=0.545	P=0.447
Calcium	1272.30 ± 570.46	2524.83 ± 887.93	2025.36 ± 952.10	2095.28 ± 311.00	P=0.017	P=0.009*	P=0.522
Iron	26.90 ± 7.44	29.26 ± 7.22	29.99 ± 8.02	31.21 ± 8.65	P=0.795	P=0.417	P=0.399
Carbohydrate	703.13 ± 90.44	704.36 ± 132.53	801.90 ± 189.88	819.42 ± 81.65	P=0.860	P=0.839	P=0.016
Protein	202.20 ± 62.71	204.10 ± 44.13	214.01 ± 31.72	215.18 ± 37.95	P=0.980	P=0.916	P=0.455
Fluid	14.36 ± 3.20	17.44 ± 2.54	15.45 ± 3.68	19.00 ± 2.33	P=0.813	P=0.003**	P=0.191

*-Indicates significance. n=9 (intervention); n= 10 (control)

Chapter 5

DISCUSSION

The purpose of this study was to assess sports nutrition knowledge of adolescent athletes and to examine the effect of sports nutrition education over time on dietary intake. The researchers hypothesized that sports nutrition education would improve sports nutrition knowledge scores and improve dietary choices. Several studies have shown that additional nutrition education is needed to enhance sports nutrition knowledge (Cupisti et al, 2002, Thomas et al, 2012, Iglesias-Gutiérrez et al, 2012). The main finding of this study was that sports nutrition education over time improved general nutrition knowledge scores of the adolescent athlete intervention group ($P=0.008$) and their parents ($P<0.0001$). Parents in the intervention group also showed improved fluid knowledge scores ($P<0.0001$), however adolescent athletes did not show improvements in the other areas (fluid, recovery & weight control) of the questionnaire. The majority of past research has assessed nutrition knowledge based on previously created surveys including Project EAT (Eating Among Teens), The Youth and Adolescent Food Frequency Questionnaire (YAQ), Michigan Model (MM) Nutrition Curriculum, and Comprehensive Assessment of Nutrition Knowledge, Attitudes and Practices (CANKAP). The questionnaires listed above assess eating habits and nutrition knowledge but lack sport specific nutrition knowledge questions (Croll et al., 2006, Fahlman et al., 2008, & Pirouznia, 2001). In 2002, Cupisti et. al measured sports nutrition knowledge using a validated sport nutrition questionnaire; however, did not attempt nutrition education during the study. Several studies have shown that athletes tend to have greater nutrition knowledge compared to their non-athlete peers; but they too could benefit from nutrition education (Cupisti et. al, 2002, Croll et. al 2006).

Nutrition education has been shown to enhance nutrition knowledge and reflect healthier dietary choices in previous studies (Fahlman et. al, 2008, Baskale & Bahar, 2011). Advocating nutrition education early on in an adolescent's life helps to improve future eating habits (Fahlman et al., 2008). Fahlman et al. (2008) and Baskale et al. (2011) have shown that given adequate amounts of time and well-designed nutrition education programs, positive changes can be seen in both nutrition knowledge and eating behaviors. The current study did reflect a significant change in general nutrition knowledge scores but there were no changes seen in questions regarding sports nutrition recovery, fluid and/or weight control topics. The previous studies had longer nutrition education time-lines than the current study. Fahlman et al., (2008) spent a period of one month on eight lesson plans spending approximately 8-10 hours educating the students while the current study intervention period lasted a total of four weeks, but included 20-30 minute sessions. Baskale & Bahar (2011) spent the same amount of time as the current study educating the participants (20-30 minutes/session), however, the intervention period lasted a total of six weeks. The questionnaire utilized in the current study was pilot tested on an adult population rather than on an adolescent population, which may offer some explanation as to why additional significant changes were unseen.

Both Baskale (2011) and Fahlman (2008) found improved dietary choices after attempting a nutrition education intervention. The current study did show some improvements in dietary calcium and fluid intake pre to post intervention. The Recommended Dietary Allowance (RDA) for calcium is 1300 mg/day for female adolescents. The results indicated that the athletes did not meet RDA values for calcium before (~566 mg/day) or after (~776 mg/day) intervention, but calcium intake increased in both the control and intervention groups ($P=0.009$). Calcium is important for bone growth, muscle contraction, blood clotting, and normal enzyme activity

(Purcell, 2013). The results of the current study were similar to Gibson et al. (2011) study, which found that a majority of junior elite Canadian female soccer players were deficient in many micronutrients, including calcium. Inadequate intakes of calcium for adolescent athletes can result in lower bone-mineral density, increasing the risk for stress fractures (Gibson et al., 2011).

Fluid recommendations for adolescent athletes are based on age and body weight. Proper hydration requires the athlete to consume fluids before, during and after activity (Purcell, 2013). For events lasting sixty minutes or less, water is adequate, however, events lasting more than sixty minutes and/or taking place in hot, humid weather conditions require a 6-8% carbohydrate solution containing sodium chloride (Purcell, 2013). The current study did not assess anthropometric data on the adolescent athletes, so actual fluid recommendations were unavailable. Fluid recommendations for athletes during a sporting event are 400-600 ml prior to the event and 150-300 ml during the event every 15-20 minutes (Purcell, 2013). Based on the aforementioned fluid recommendations, participants need a minimum of 1183 ml of fluids before and during the sporting event. The results from the current study showed that the athletes, on average, consumed 1183 to 1419 ml/day pre to post intervention. Results indicate that participants did not receive adequate amounts of fluid daily; however, fluid consumption did increase from pre to post in both groups ($P=0.003$). Participants in the current study consumed significantly less fluid than participants from the Gibson et al. (2011) study ($2,260 \pm 713$ ml/day). Fluid intake is essential to an athlete as inadequate intake can lead to dehydration, which can then cause not only decreased performance but also heat stroke (Purcell, 2013). Adequate fluids are necessary to prevent dehydration and heat stroke. Athletes also need fluids to help maintain body temperature and to replace fluids lost during sweating. In addition,

dehydration has a profound effect on sport performance causing both physiological and psychological disturbances.

Furthermore, previous studies have shown that iron consumption, especially among female athletes, is a major concern due to athletes not meeting recommended values (Gibson et al., 2011, Cupisti et al., 2002, Iglesias-Gutiérrez et al., 2005). Iron recommendations for female, adolescent athletes is 15mg/day. Results of this study showed that iron levels were within recommendations both pre (28.53 ± 7.70 mg/day) and post (30.28 ± 7.85 mg/day) intervention periods. Female adolescent athletes need adequate iron for oxygen delivery to the tissues but are at high risk for iron depletion due to a combination of factors including loss from menses, lack of dietary intake, and increased iron demands required for optimal growth (Gibson et.al, 2011; Purcell, 2013). Whether or not iron deficiency alone causes a decrease in performance is unknown, however, iron deficiency with anemia can cause a reduced aerobic capacity, therefore reducing maximal exercise performance (Sandström, G., Börjesson, M. & Rödger, S., 2012). Consuming adequate amounts of iron will help aid in overall performance by potentially increasing endurance performance (Rowland, 2012). The current results were not congruent with other studies, showing an adequate intake of iron among female, adolescent athletes (Cupisti et. al, 2002 & Gibson et al., 2011). All of the female adolescent athletes in this study consumed both non-heme and heme sources of iron, which may indicate why iron levels were higher compared to previous studies.

According to Purcell (2013), the minimum amount of calories needed for an adolescent female (ages 15-18 years old) is 2,200 calories. This does not take into account extra calories burned during athletic activities. Saturated fat intake should be limited to 20-25 grams/day depending on caloric intake (2,000 kcal-2,500 kcal diets). While results of this study did not

show a decrease in saturated fat intake between groups or pre to post intervention, it did indicate that these athletes were consuming an acceptable amount of saturated fat in their diets (~20-22 grams/day). Adequate fat in the diet is essential for normal growth, hormone function, and energy intake (Meyer et al., 2007).

The current study hypothesized that saturated fat intake would decrease and lean protein intake would increase after nutrition education. Cupisti et. al. (2002), found that female adolescent athletes compared to their non-athlete peers were more likely to decrease fat intake, however, the current study did not observe any differences in saturated fat intake pre to post intervention or between groups. Differences between results could be contributed to the fact that Cupisti et al. (2002), compared diets of athletes versus non-athletes and the study took place in Italy where diets differ from American diets. In 2005, Iglesias-Gutiérrez et al. assessed nutritional status of male adolescent soccer players (aged 14-16 years) and found that only 9% of energy intake was contributed to saturated fat intake. Similar to Cupisiti et al. (2002), Iglesias-Gutiérrez et al. (2005) study took place in Spain olive oil (a mono-unsaturated fatty acid) is the primary added fat and fish consumption is much higher than red meat, chicken, or meat derivative consumption as seen in the American diet.

Carbohydrate is the most utilized source of energy for soccer players due to repeated high-intensity periods of activity (Gibson et al., 2011). Inadequate consumption of carbohydrate could lead to early glycogen depletion, which could lead to poor performance (Gibson et. al, 2011). The recommendation for carbohydrate intake is 45-65% of total caloric intake for adolescents (Purcell, 2013). Forty-five to 65% carbohydrate intake is a minimum of 2,200 kcals/day, which does not factor in physical activity. Additional calories are needed when considering physical activity and that is dependent on the duration of exercise, gender, and age

(Purcell, 2013). Taking into account that female, adolescents need at least 2,200 kcals/day to support growth and health maintenance (248-358 g/day of carbohydrate), the results of the current study indicated that athletes were not consuming enough carbohydrates (Pre= 252 grams/day pre intervention and Post= 255 grams/day). The carbohydrate intake of the adolescent athletes were bare minimum intakes and do not take into account physical activity. These results were similar to Gibson et al. (2011) who found that over 50% of the female soccer players (aged 15.7 ± 0.7 years) were below carbohydrate recommendations. The current study also hypothesized that fiber would increase following the nutrition intervention. The Daily Recommended Intake (DRI) for fiber is 25 grams/day for adolescent females. Results indicated that athletes did not consume enough fiber before or after the intervention in their daily diets (mean \pm 15 gram/day pre/post).

Protein also plays an important role for an adolescent athlete. It supports proper immune system functioning, tissue repair, growth and development, and has the potential to be used as an energy source (Gibson et. al, 2011). The typical American diet is adequate in protein unless an individual is a vegetarian and is not eating a variety of plant-based protein foods. Protein intake should comprise 10-30% (55-165 g/day) of total energy intake for adolescents (Purcell, 2013). Using the 2,200 kcals/day as a reference for daily caloric intake the results of this study indicated that the athletes received adequate amounts of daily protein (\sim 69g/day pre to post). These findings were similar to Cupisti et al. (2002) who found Italian female adolescents (14-18 years old) consumed more than 15% of their energy intake from dietary protein, however, this study used body weight when calculating protein needs in comparison to the current study. In contrast, Gibson et al (2011) found that a group of Canadian female adolescent athletes (aged 15.7 ± 0.7

years) were not meeting protein recommendations based on body weight recommendations (1.2-1.7g/kg/day).

Based on past research, researchers hypothesized that educating both the parent and the adolescent participant simultaneously on nutrition education would result in positive changes seen via food records. The parent demographic survey in the current study indicated that all of the participant's parents prepared the meals in the home environment, specifically the mother. All participants parents of the study were also educated (college or higher). Neumark-Sztainer et al., (2003) found that adolescents who consumed more meals with their families reported having higher quality dietary intake. The study reported increased intakes of calcium, iron, folate, fiber, and various vitamins following family meal consumption. The current study did not assess family meal patterns; however, it did look for changes in dietary intake following nutrition education. The dietary food records did reflect changes in calcium intake pre to post intervention, but no other micronutrients that were assessed changed. The results of the current study did, however, find that parents participating in the intervention group scored significantly higher in the fluid section of the questionnaire compared to those in the control group ($P < 0.0001$; 1.88 ± 3.06 ; 4.29 ± 2.83), so the intervention was successful in educating parents on adolescent athlete fluid needs.

Parent's general nutrition knowledge scores were much higher than that of their adolescent children. Parents in the intervention group scored significantly higher in the general knowledge portion of the questionnaire compared to parents in the control group ($P < 0.0001$; 29.22 ± 13.87 ; 21.00 ± 13.16). This demonstrates that the nutrition intervention was also successful in delivering general nutrition knowledge to parents in the intervention group. Although, the adolescents did not show as significant a change, it is equally important for the

parents to gain knowledge, as they are primary providers of both nutrition knowledge and food. Significant findings were not observed in knowledge about fluid recommendations and weight control. This is similar to Nelson et al. (2009) study which found that while parents general nutrition knowledge was higher than that of their child's, there were still several nutrition misconceptions. This study suggested that targeting families as a unit for nutrition education would result in improved dietary food records, but the current study did not report many changes. This could have been because the current study did not look at all vitamin and mineral statuses, but instead chose to focus on areas where female adolescents tend to fall below recommended intake levels (calcium, iron, and carbohydrate).

Past research indicates that educating both the parent and the adolescent together, dietary food records would reflect improved food choices. The current study did reflect positive changes in calcium and fluid intake on the dietary food records for both groups pre to post intervention. This could have been a result of the researcher reiterating to the girls, after receiving their first 3-day food records, for them to specify how much fluid they were getting (i.e. 1 cup water versus water). While the adolescent athlete sports nutrition knowledge questionnaire results did not reflect significant changes pre to post, there was a trend that nutrition knowledge increased in both groups with the intervention group scoring higher post-intervention than the control group (11.11 ± 23.64 ; 4.70 ± 27.89).

Although this study was a randomized, controlled study, it had limitations. It was up to the participants to accurately report their dietary intake onto the food records. Because some of the reporting took place during spring break, pre- dietary food records may not have properly reflected their typical daily diets. While food recordings are considered a reliable method of assessing dietary intake, they are not the gold standard (Iglesias-Gutiérrez et al., 2005). The gold

standard for assessing dietary intake is weighed food records. Due to monetary limitations, issuing scales to all participants was not an option. Another limitation to the study was the small sample size (n=38). For this reason, the results cannot be generalized to a broader community. Although the treatment order was randomized, the selection of the subjects was non-randomized. This study was limited to the Augusta Arsenal Division 1 female adolescent soccer players, and for that reason the results may not be generalized to other populations. It is also likely there may have been a school bus effect. There was no way to control participants in the intervention group from sharing information in the intervention sessions with participants in the control group.

Educating both the parent and adolescent did appear to increase overall general nutrition knowledge scores from pre to post intervention, however, it did not reflect many changes in dietary food records. In the future, more research should be done effectively educating both a parent and an adolescent simultaneously in order to reflect greater changes in dietary food records. Future studies should expand upon the period of the study and make a conscious effort to get coaches and soccer club administration on board with the education of the athletes.

Another future strategy might include collecting data while the athletes are at a soccer camp and are on a more structured, similar meal pattern. Future studies should also focus on educating parents and adolescents on recovery nutrition, fluid requirements, and weight control strategies by integrating some type of hands on interactive learning sessions as those areas reflected less knowledge and little change. Lastly, future studies should also assess various micronutrients, to observe a more detailed nutrient intake. Lastly, future studies should utilize the weighed food method since it is considered more reliable when assessing nutrient intake.

In conclusion, the results of this study show that the nutritional intake of female adolescent elite- level soccer players do not meet all nutritional requirements for age, gender, and

physical activity level. Further research needs to be done to determine actual nutrient needs taking into account anthropometric data such as weight and height. As previous research has shown, while adolescent athletes do tend to meet recommended nutritional requirements more closely than their peers, they too need further education. It is important to look at nutritional needs of adolescent athletes, specifically females, to ensure adequate calories, protein and fat are being received for growth, maintenance, and maximal sport performance. The following information is beneficial for implementing sport nutrition education sessions, especially for those looking to play at higher levels (college and professional) in their future.

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APPENDICES

APPENDIX A

ATHLETE DEMOGRAPHIC SURVEY

Code:

1. Name:
2. Age:
3. School Grade
4. Position Typically Played:
5. Years in Sport
6. Do you participate in any other sports? (Yes or No)
7. Have you take a nutrition class before? (Yes or No)

APPENDIX B

PARENT DEMOGRAPHIC SURVEY

Parent Demographic Survey

Code:

1. Name:
2. Age:
3. Highest level of education:
4. What is your nutrition background?
5. Who typically prepares meals in the home?
6. Have you ever played a sport (in high school or college)?
7. Contact Phone Number:
8. Email Address:

APPENDIX C

SPORTS NUTRITION QUESTIONNAIRE

Below are 23 questions identifying a variety of sports nutrition topics. Based on **your** current knowledge, please answer the quiz as best you can.

Nutrients

1. Do you think these foods are *high* or *low* in carbohydrate? (Check one box per food).

	High	Low	Unsure
Chicken	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Baked beans	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
White bread	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Butter	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cornflakes cereal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cream of rice pudding	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Do you think these foods are *high* or *low* in protein? (Check one box per food).

	High	Low	Unsure
Chicken	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Baked beans	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fruit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Margarine	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cornflakes cereal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Peanuts	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Do you think these foods are *high* or *low* in fat? (Check one box per food).

	High	Low	Unsure
Avocado	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Baked beans	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pasta	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Margarine	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cottage Cheese	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Oatmeal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Peanuts	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
White bread	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Honey	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Hard yellow cheese (Such as Cheddar)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Do you think these foods are *high* or *low* in saturated fat? (Check one box per food).

	High	Low	Unsure
Butter	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Margarine	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Whole milk	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Red meat	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Salmon	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Chocolate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peanuts	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

5. The following foods contain cholesterol. (Check one box per food).

	True	False	Unsure
Red Meat	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eggs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fish	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Margarine	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Whole milk	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Would you *agree* or *disagree* with the following statements? (Check one box per statement).

a. A high carbohydrate diet helps to reduce protein breakdown in the body.

Agree Disagree Unsure

b. Tannins in tea decrease the amount of iron absorbed from food.

Agree Disagree Unsure

c. Spinach and chard are good sources of iron that is available to the body.

Agree Disagree Unsure

d. Ascorbic acid (Vitamin C) increases the amount of iron absorbed from food.

Agree Disagree Unsure

7. Would you *agree* or *disagree* with the following statements? (Check one box per statement).

a. There is more protein in a glass of whole milk than in a glass of non-fat milk.

Agree Disagree Unsure

b. There is more calcium in a glass of whole milk than in a glass of non-fat milk.

Agree Disagree Unsure

c. Calcium is easily obtained in the diet through green leafy vegetables.

Agree Disagree Unsure

d. If someone wanted to cut down on fat, but didn't want to give up French fries, choosing baked French fries would be a better choice than fried French fries.

Agree Disagree Unsure

Fluid

8. In a two-hour intense training session, the optimum amount of fluid needed during this session is *approximately*: (Check one box only.)

- 12-20 ounces water
- 24-64 ounces water
- 48-128 ounces water
- Unsure

9. The following drink is not a sports drink: (Check one box only).

- Vitamin water
- Gatorade
- PowerAde
- Restore
- Unsure

10. The percentage of carbohydrate in a 'sports drink' should be: (Check one box only).

- 4-8%
- 8-10%
- 10-15%
- 20-25%
- Unsure

11. Which is the most appropriate fluid to consume after a two-hour training session? (Check one box only).

- Fruit juice
- Sportsdrink
- Coke
- Water

Monster
Unsure

12. Would you *agree* or *disagree* with the following statements? (Check one box per statement).

a. Fluid loss of only 2% of body weight can reduce your performance by up to 20%.

Agree Disagree Unsure

b. Weighing players before and after training would be a good way to determine each individual's fluid requirements.

Agree Disagree Unsure

c. The best advice to give to a player about fluid during a training session would be to drink when they are thirsty.

Agree Disagree Unsure

d. Fruit juice is a good fluid to have during a training session and at half time of a game.

Agree Disagree Unsure

e. Energy drinks such as Monster and 'Red Bull' are good drinks to have 30 minutes leading up to exercise.

Agree Disagree Unsure

Recovery

13. The most important nutrient to replace after a one -hour run is: (Check one box only).

Carbohydrate
Protein
Fat
Unsure

14. Which one of the following set of 2 snacks would you suggest that a player eat after training. (ie. i. 4 slices white bread, 2 tsp jam OR 1 packet chips). (Check one box for each question a-d).

- a. 4 slices white bread, 2 tsp nutella **OR** 1 package chips
- b. 1 cinnamon bun **OR** 2 pigs in a blanket
- c. ½ cup jellybeans **OR** 2 apples
- d. 2 low fat pot pies **OR** 2 cups cream of rice pudding

15. Click on one snack (per set of 2 snacks) which provides more carbohydrate. (ie. i. ½ cup bag of marshmallows OR ½ cup bag of peanuts). (Check one box for each question a-d).

- a. ½ cup of marshmallows **OR** ½ cup of peanut M and M's
- b. ½ cup chopped dried dates **OR** 1 pot pie
- c. ¾ cup skinless chicken breast **OR** 2 slices white bread, 2 tsp marmite
- d. 11.5oz can of Coke **OR** 3 cups of green salad
(lettuce, tomato, cucumber, low fat dressing)

16. The optimal time for a rugby player who is training daily to eat after exercise is: (Check one box only).

- Within 30 minutes
- Within 45 minutes

- Within one hour
- Between 2-3 hours
- Unsure

17. Which of these is the most accurate definition of the term ‘Glycemic index’. (Check one box only.)

- The amount of carbohydrate a food contains
- The extent to which carbohydrate food raises blood sugar levels
- The extent to which protein food raises blood sugar levels
- The extent to which carbohydrate food raises blood pressure
- Unsure

Weight gain

18. Do you *agree* or *disagree* with the following statements? (Check one box per statement.)

a. For lean muscle mass gain to occur, protein is the most important nutrient to increase in the diet.

- Agree Disagree Unsure

b. Protein powder is an essential product to have if you want to increase lean muscle mass.

- Agree Disagree Unsure

c. If exercise is unchanged, it is possible for a rugby player to put on weight if they have six glasses of fruit juice **in addition** to their normal food intake.

- Agree Disagree Unsure

19. A player is eating the following meal for dinner: ½ cup skinless chicken breast, 1 cup cooked rice and 2 cups vegetables (broccoli, carrots, cauliflower). If he kept the rest of his day’s diet the same and only altered his dinner meal, which option would be the preferred one to increase his lean body mass? (Check one box only).

- Eat 7/8 cups chicken.
- Eat the chicken with the skin on.
- Eat 2 cups rice and 3/4 cup skinless chicken.
- Eat 4 cups vegetables
- Eat the same amount, but train harder at the gym.
- Unsure

Weight loss

20. If a player was trying to lose weight and they had the following snacks to choose from for breakfast, which one of each of the following set of two snacks should they choose? (Check one box for each question a-f).

- a. 4 salami sticks **OR** 1 piece fruit
- b. 2 bags of chips **OR** 1 cereal bar
- c. 1 small can creamed rice **OR** 1 large chocolate bar
- d. 1/2 cup peanuts **OR** 1 Primo chocolate milk
- e. 1 yogurt **OR** 1 croissant with egg salad
- f. 1 ice cream sandwich **OR** 6 crackers with cheddar cheese

21. Do you *agree* or *disagree* with the following statements? (Check **one** box per statement).

If a rugby player wanted to lose weight, they should:

a. Exchange 1 tsp of butter on sandwiches for 1 tsp of regular margarine.

Agree Disagree Unsure

b. Eat more Cheddar cheese than Part-Skim Mozzarella cheese.

Agree Disagree Unsure

c. Eat less salami and more turkey breast.

Agree Disagree Unsure

d. Stop eating pasta and rice after 4pm.

Agree Disagree Unsure

e. Exchange his yogurt, muesli bar and fruit snacks for protein shakes.

Agree Disagree Unsure

Supplements

22. Do you *agree* or *disagree* with the following statements? (Check **one** box per statement).

a. Creatine supplement would be most beneficial to a player wanting to increase peak power output.

Agree Disagree Unsure

b. Creatine supplement has more of an effect when natural body stores are low.

Agree Disagree Unsure

c. The performance-enhancing mechanism of creatine is that it aids to increase fat metabolism.

Agree Disagree Unsure

d. Creatine is most useful to those players wanting to increase fitness for endurance exercise.

Agree Disagree Unsure

23. Do you *agree* or *disagree* with the following statements? (Check one box per statement).

a. Multivitamin tablets should be taken by most athletes.

Agree Disagree Unsure

b. Iron tablets should be taken when a player feels extremely tired and is pale.

Agree Disagree Unsure

c. Vitamin C should be routinely supplemented by athletes.

Agree Disagree Unsure

d. B vitamins should be taken when feeling low in energy.

Agree Disagree Unsure

e. The main performance-enhancing effect of hydroxy-methyl butyrate (HMB) is that it helps to breakdown body fat during exercise.

Agree Disagree Unsure

f. Salt tablets should be used for players that get a cramp during exercise.

Agree Disagree Unsure

g. Appetite suppressants (i.e. thermogenic tablets) are recommended to be taken by athletes when weight loss is a goal.

Agree Disagree Unsure

Thank-you for your time, it is very much appreciated.

APPENDIX D

SCORING OF THE SPORTS NUTRITION QUESTIONNAIRE

Question responses were scored as follows:

<u>Points Assigned</u>	<u>Responses</u>
-1	Incorrect Response
0	No Response
1	Correct Response

There was a possible 84 points with the supplemental section included on the sports nutrition questionnaire. For the purpose of this study, the supplemental questions were answered but no data was analyzed. The total amount of points for the sports nutrition questionnaire in this study was 73. The following table represents each sub-category of the questionnaire and possible points attained for each.

<u>Subcategories</u>	<u>Possible Points</u>
General Nutrition Knowledge	46
Weight Control	15
Recovery	7
Fluid	5

APPENDIX E

IRB INFORMED MINOR ASSENT

COLLEGE: Health and Human Sciences

DEPARTMENT: Health & Kinesiology

MINOR ASSENT (to be read aloud if necessary)

Dear Athletes:

My name is Meredith Foster and I am a graduate student at Georgia Southern University completing my Master's in Kinesiology with an emphasis in Sports Nutrition. For my required thesis project, I am doing research that looks at athletes' level of sports nutrition knowledge. If you agree to participate in this research study, you will be asked to: 1.) Complete a 3-day food record; 2.) Complete a brief survey that will give us information on your age, position you typically play, how long you have played soccer, and if you have had a nutrition class before and 3.) Complete a sports nutrition questionnaire that has 23 questions asking about nutrition and sports performance. It will take you approximately 30-45 minutes to complete the survey and sports nutrition questionnaire. You do not have to answer any of the questions if you don't want to and nothing bad will happen if you decide to stop. If you decide to complete the survey and questionnaire, you will be placed in a group (intervention or control group). If you are in the intervention group, you will be asked to attend four separate nutrition education sessions that will take 20-30 minutes of your time. These nutrition sessions will talk about different sports nutrition topics. Individuals that attend the nutrition education sessions will be asked to not share any nutrition information with those individuals in the other group (control group). If you are in the other (control) group, you will not attend these nutrition sessions. After the last nutrition education session is complete, all participants will meet again to turn in another 3-day food record and re-take the sports nutrition questionnaire. After all questionnaires are turned in, individuals not included in the nutrition, sessions will receive the nutrition information that the other group received during the study.

You do not have to participate if you do not want to and you can drop out at any given time without getting in any trouble. It is your choice to decide if you want to do this study or not.

If you decide you want to do this study, surveys and questionnaires will be given via paper and pencil. You will not put your name on these papers, so your information will be private.

All information collected will be kept private and stored in a locked file drawer in Hollis 2121-A. This information will be available only to the main investigators. Your name will not be revealed in publications or presentations that result from this study to protect your privacy. All of the information will be kept for 3 years and then deleted permanently. Electronic information will be kept on a password-

protected computer and will be deleted as soon as the information is processed and the manuscript is complete.

You have the right to ask me questions and have those questions answered. If you or your parents have any questions or concerns regarding this study at any time, please feel free to contact Meredith Foster Hawk (706) 399-6522 or mfooster7@georgiasouthern.edu.

To contact the Office of Research Services and Sponsored Programs for answers to questions about the rights of research participants please email IRB@georgiasouthern.edu or call (912) 478-0843.

By signing on the line below, you are saying that you understand what you just read or what was read and explained to you.

You will be given a copy of this form to keep for your records. This project has been reviewed and approved by the GSU Institutional Review Board under tracking number H14319.

Title of Project: *Assessing Sports Nutrition Knowledge of adolescent female athletes & their parents: an intervention approach*

Principal Investigator: Meredith Foster, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, mfooster7@georgiasouthern.edu, 706-399-6522

Other Investigator(s):

Dr. Amy Jo Riggs, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, ajriggs@georgiasouthern.edu, 912-478-7753

Dr. Kristina Kendall, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, kkendal@georgiasouthern.edu, 912-478-8013

Dr. Barry Joyner, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, joyner@georgiasouthern.edu, 912-478-0200

Minor Signature

Date

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

APPENDIX F

IRB ADULT INFORMED CONSENT

COLLEGE: Health and Human Sciences

DEPARTMENT: Health & Kinesiology

ADULT INFORMED CONSENT

Dear Parent or Guardian:

My name is Meredith Foster and I am a graduate student at Georgia Southern University working on my Master's in Kinesiology with emphasis in Sports Nutrition. I am currently working on my thesis research project, which will examine sports nutrition knowledge among adolescent female athletes.

Participation in this research will include filling out a survey, which will ask you about your age, highest level of education, past sport play, nutrition background and questions regarding preparation of meals in the household. Paper/pencil surveys will take approximately 10-15 minutes to complete. If you decide to participate in this study, you will be randomly assigned to either a control group or intervention group. If you are assigned to the intervention group, you will be asked to attend four different nutrition education sessions that will talk about a variety of nutrition topics and sports performance. Each session will be approximately 20-30 minutes in length.

Hard copies of the surveys will be collected by me. Surveys will be scanned and data will be entered into a database. Risk for providing any personally identifiable information on surveys will be minimized by only providing the last four digits of their phone number on each survey. This unique identifier will be used to connect your responses to your child's responses. Finally, an additional page at the end of the survey requests permission to contact you (name, telephone number and e-mail address) to remind you of weekly sessions if randomly selected to the intervention group or to remind you and your child of the post-sports nutrition questionnaire to be completed.

Survey databases will be stored on a password protected computer for a period of three years. At which time, assuming data are no longer needed for grant writing and publication efforts; data will be deleted permanently from the computer.

You have the right to ask questions and have those questions answered. If you have any questions or concerns regarding this study at any time, please feel free to contact Meredith Foster Hawk (706) 399-6522 or mfoster7@georgiasouthern.edu.

To contact the Office of Research Services and Sponsored Programs for answers to questions about the rights of research participants please email IRB@georgiasouthern.edu or call (912) 478-0843.

You do not have to participate in this research and may end your participation at any time by telling the individual collecting the data and/or not returning the survey. You do not have to answer any questions you do not want to answer. There is no penalty for you or your child for deciding not to participate in the study.

In order to protect the confidentiality of your information, a number and not a name will appear on all of the surveys. All survey data will be collected without revealing any personal identifiable information.

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 **H14319**.

Title of Project: *Assessing Sports Nutrition Knowledge of adolescent female athletes & parents: an intervention approach*

Principal Investigator: Meredith Foster Hawk, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, mfoster7@georgiasouthern.edu, 706-399-6522

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Dr. Kristina Kendall, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, kkendall@georgiasouthern.edu, 912-478-8013

Dr. Barry Joyner, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, joyner@georgiasouthern.edu, 912-478-0200

Participant Signature

Date

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

Investigator Signature

Date

APPENDIX G

IRB PARENTAL CONSENT

COLLEGE: Health and Human Sciences

DEPARTMENT: Health & Kinesiology

PARENT INFORMED CONSENT

Dear Parent or Guardian:

My name is Meredith Foster and I am a graduate student at Georgia Southern University working on my Master's in Kinesiology with emphasis in Sports Nutrition. I am currently working on my thesis research project, which will examine sports nutrition knowledge among adolescent female athletes.

I am asking for permission for your child to participate in this study. Participation in this research will include filling out some surveys, which will ask about you about your age, highest level of education, past sport play, nutrition background and questions regarding preparation of meals in the household. If you and your child decide to participate in this study, your child will be randomly assigned to either a control group or intervention group. If your child is assigned to the intervention group, you and your child will be asked to attend four different nutrition education sessions that will talk about a variety of nutrition and sports performance topics. Each session will be approximately 20-30 minutes in length.

If you agree to participate in this research study, your child will be asked to: 1.) Complete a 3-day food record on two separate occasions; 2.) Complete a brief demographic survey that will give us information on their age, position typically played, how many years in sport, and if you have had any past nutrition education; and 3.) Complete a 23-item sports nutrition questionnaire that asks questions regarding nutrition and sports performance on two separate occasions. If assigned to the intervention group, you and your child will be asked to meet on four separate occasions for a nutrition education lesson lasting approximately 20-30 minutes in length. After completion of the intervention period, all participants will be asked to complete the sports nutrition knowledge questionnaire once more and turn in a second set of three-day dietary food records. If your child is in the intervention group, they will also be asked to fill out a short survey on the quality of the intervention program. The study will further the line of inquiry on sport nutrition knowledge of adolescent female athletes and their eating habits and possibly inform future educators on areas of sport nutrition education to focus on when programming for adolescent female athletes.

Paper/pencil surveys will take approximately 30-45 minutes to complete. Participants in the intervention group will be asked to attend four separate nutrition education sessions that will each last 20-30 minutes in length.

Hard copies of the surveys will be collected by the principal investigator (Meredith Foster). Surveys will be scanned and data will be entered into a database. Risk for providing any personally identifiable information on surveys will be minimized by only providing the last four digits of their phone number on each survey. This unique identifier will be used to connect your responses to your child's responses. All scientific and personal data collected on participants for presentation purposes will be kept confidential and stored in a locked file drawer in Hollis 2121-A. This information will be available only to the principal investigators. Your identity will not be revealed in publications or presentations that result from this study to protect your privacy and confidentiality. All data will be reported as means and standard errors. Data will be kept for 3 years and then destroyed. Electronic data will be kept on a password protected, encrypted private hard drive and will be destroyed as soon as the data analysis has been run and the manuscript is complete. The destruction of all data and records will be done at Georgia Southern University.

You and your child have the right to ask questions and have those questions answered. If you have any questions or concerns regarding this study at any time, please feel free to contact Meredith Foster (706) 399-6522 or by e-mail at mfoster7@georgiasouthern.edu.

To contact the Office of Research Services and Sponsored Programs for answers to questions about the rights of research participants please email IRB@georgiasouthern.edu or call (912) 478-0843.

Your child does not have to participate in this research and may end their participation at any time by telling the individual collecting the data and/or not returning the survey. They do not have to answer any questions they do not want to answer. There is no penalty for your child for deciding not to participate in the study.

I am asking your permission for your child to participate in this study, and will provide her with a simplified "assent" letter/verbal description before enrolling them in this study.

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 **H14319**.

Title of Project: *Assessing Sports Nutrition Knowledge of adolescent female athletes & parents: an intervention approach*

Principal Investigator: Meredith Foster, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460, mfoster7@georgiasouthern.edu, 706-399-6522

Other Investigator(s):

Dr. Amy Jo Riggs, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460,
ajriggs@georgiasouthern.edu, 912-478-7753

Dr. Kristina Kendall, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460,
kkendall@georgiasouthern.edu, 912-478-8013

Dr. Barry Joyner, Georgia Southern University, PO Box 8076, Statesboro, GA, 30460,
joyner@georgiasouthern.edu, 912-478-0200

Participant Signature

Date

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

Investigator Signature

Date