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Eating Behaviors and Supplement Use of College Upperclassmen Athletes Versus Lowerclassmen Athletes

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ACCEPTANCE

This thesis, EATING BEHAVIORS AND SUPPLEMENT USE OF COLLEGE UPPERCLASSMEN ATHLETES VERSUS LOWERCLASSMEN ATHLETES, by Marissa F. Wertheimer was prepared under the direction of the Master's Thesis Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Master of Science in the Byrdine F. Lewis School of Nursing and Health Professions at Georgia State University. The Master's Thesis Advisory Committee, as representatives of the faculty, certify that this thesis has met all standards of excellence and scholarship as determined by the faculty.

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ABSTRACT

EATING BEHAVIORS AND SUPPLEMENT USE OF COLLEGE UPPERCLASSMEN ATHLETES VERSUS LOWERCLASSMEN ATHLETES
by
Marissa F. Wertheimer

Background: Past studies have shown that optimal nutrition can enhance physical activity, athletic performance, and recovery from exercise. It is important for college athletes to incorporate positive eating behaviors into their daily lives, such as consuming breakfast, eating frequently throughout the day, and not skipping meals in order to maintain energy levels and reach their sports performance potential.

Objective: The purpose of this study was to compare the eating behaviors and dietary supplement use of underclassmen and upperclassmen student athletes at Georgia State University.

Methods: Underclassmen (freshmen, sophomores) and upperclassmen (juniors, seniors, fifth-year seniors) athletes (n=255) completed a nutrition screening questionnaire. Chi-square analysis was used to assess group differences in eating behaviors and supplement use.

Results: Underclassmen student athletes were significantly more likely than upperclassmen to consume breakfast most days of the week (p=0.008). The underclassmen also reported significantly more eating occasions during the day than upperclassmen (p=0.012). The majority of both groups reported skipping meals, and breakfast was the meal most frequently missed. No significant difference was found for

supplement use between the classes, but over half of the underclassmen (53%) and upperclassmen (59%) have taken or currently take protein supplements.

Conclusions: The underclassmen athletes at Georgia State University displayed better eating habits than the upperclassmen, but dietary supplement use was the same in both groups. The findings indicate that all student athletes at the university could benefit from learning about ways to improve their eating habits and obtain peak performance through diet, without supplements.

EATING BEHAVIORS AND SUPPLEMENT USE OF COLLEGE UPPERCLASSMEN ATHLETES VERSUS LOWERCLASSMEN ATHLETES

by
Marissa F. Wertheimer

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

Acceptable Macronutrient Distribution Ranges – AMDR

American Dietetic Association – ADA

American College of Sports Medicine – ACSM

Food and Drug Administration – FDA

National Collegiate Athletic Association – NCAA

Dietary Reference Intake – DRI

Recommended Dietary Allowance – RDA

Body Mass Index – BMI

Athletic trainer – AT

Strength and conditioning specialist – SCS

Registered Dietitian – RD

CHAPTER I

EATING BEHAVIORS AND SUPPLEMENT USE OF COLLEGE UPPERCLASSMEN ATHLETES VERSUS LOWERCLASSMEN ATHLETES

Introduction

Collegiate athletes participate in strength conditioning and training to achieve peak performance in their sport, but many times they overlook nutrition and the role it plays in their athletic performance. Nutrition is an important component of any physical fitness program and affects an athlete in many ways. At the basic level, it plays an important role in achieving and maintaining health.[1] At the physical level, adequate nutrition is essential for optimizing athletic performance and can reduce fatigue, allowing an athlete to train and compete longer or recover faster in between training sessions.[1-4] In a joint position paper by the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine, it was stated, "physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition".[3] The position paper provided recommendations for carbohydrate, protein, and fat intake for active adults and competitive athletes. Carbohydrate recommendations range from 6 to 10 g/kg body weight per day. The amount required depends on the athlete's daily energy expenditure, sport, gender, and environmental conditions. Protein recommendations for endurance and strength-trained athletes range from 1.2 to 1.7 g/kg body weight per day.

According to the position paper, “these recommended protein amounts can generally be met through diet alone, without the use of protein or amino acid supplements.” As for fat intake, there are currently no weight-based guidelines for athletes. Thus, athletes are advised to follow the Acceptable Macronutrient Distribution Ranges (AMDR) for dietary fat, which should range from 20% to 35% of total energy intake.[3,4]

The depth of an athlete’s nutritional knowledge has been found to have a direct correlation to the food choices they make on a daily basis.[5] Collegiate athletes often seek nutritional guidance from a variety of sources, including coaches, athletic trainers, strength and conditioning staff, physicians, teammates, parents, nutrition class, and popular media.[6] However, these sources may be offering limited factual information about nutrition, which could affect the athletes’ dietary behaviors and in turn hinder their health status and their performance.[7]

It is important that athletes have easily accessible resources for nutrition guidance and are provided accurate information, tailored to the individual and his/her sport, to produce positive eating habits. Positive eating habits for competitive athletes include, but are not limited to, consuming adequate energy during periods of high-intensity and/or long-duration training; drinking adequate fluids to prevent dehydration; following individual carbohydrate, protein, and fat recommendations; not skipping meals; and consuming sufficient energy from a variety of foods to maintain a desirable and healthy body weight.[3] The current study focused on similar positive eating behaviors such as breakfast consumption, daily meal and snack frequency, and not skipping meals. According to the joint position paper by the American Dietetic Association (ADA) and American College of Sports Medicine (ACSM), athletes should be advised against

skipping meals (especially breakfast).[3] Previous research on athletes has shown that eating breakfast significantly improves performance by restoring the level of liver and muscle glycogen after the overnight fast.[8] In addition, research has suggested athletes who eat a minimum of 5 times per day maintain energy levels throughout the day and supply working muscles with adequate amounts of carbohydrate.[4]

It is likely, however, that for various reasons, not all athletes are able to consume a diet that meets their nutritional needs and in turn, resort to dietary supplements with the intention of preventing deficiencies and even enhancing performance.[9] Many dietary supplements have the reputation of being harmless because they consist mainly of natural compounds and tend to be advertised as safe and legal.[10] However, despite their seemingly "natural" composition, supplements are not required to go through the rigorous Food and Drug Administration (FDA) testing before they are sold.[11] This means the FDA provides no assurance of purity, safety, or effectiveness.[12] The Dietary Supplement and Health Education Act of 1994 states that "the manufacturer of a dietary supplement or dietary ingredient is responsible for ensuring that the product is safe before it is marketed".[13]

In 2009, it was reported that consumers spent $26.7 billion on dietary supplements.[14] With the supplement market being what it is today, supplements are readily available to athletes and are more accepted within the athletic culture.[10] The expanding dietary supplement industry has a dramatic impact on college athletes who are continually seeking a competitive edge. The most cited reasons for use among those who admit to using supplements, are to improve athletic performance, for general health benefits, and for weight loss or weight gain.[2] However, many student athletes seek

nutritional guidance from personnel who may not deliver factual information, resulting in misconceptions and misuse of dietary supplements.[7, 15-17] Without having a full understanding of the safety and efficacy of dietary supplements, collegiate athletes are vulnerable to misinformation and inappropriate recommendations, which could lead to risky side effects, health issues, or NCAA eligibility concerns.[15] It is important that coaches, strength and conditioning coaches, and athletic trainers stay informed about the different products on the market and educate student athletes on the importance of consuming the nutrients their bodies need through food and fluid.[12]

The foundation of a healthy diet includes food from each food group, including whole grains, fruits and vegetables, lean proteins, low-fat dairy, and healthy fats. Each food group supplies the body with different macro- and micronutrients needed for proper function and growth. A key message from the ADA-ACSM joint position paper is that vitamin and mineral supplements are not required if athletes are consuming an adequate amount of calories from a variety of foods.[3] Multivitamin supplements or single-nutrient supplements may be appropriate for a specific medical or nutritional reasons, but athletes can obtain the performance enhancement they need through proper diet and training, without supplements.[11]

Guidance from a sports dietitian could help an athlete make better food choices, improve health and exercise performance, reduce risk of injury and illness, achieve or maintain an appropriate weight, and make sure sport foods, drinks, and supplements comply with National Collegiate Athletic Association (NCAA) rules.[2]

The general purpose of this study was to assess the eating behaviors and supplement use of student athletes at Georgia State University. This study aimed to

describe several eating behaviors, including breakfast consumption, daily meal frequency, and/or skipped meals, in relation to the athletes' academic year in school. Specifically, this examination focused on the following questions: 1) do upperclassmen (juniors, seniors, and fifth year) student athletes have better eating habits than underclassmen (freshmen and sophomores) student athletes? And 2) what is the prevalence of dietary supplement use among athletes at Georgia State University and is the use of supplements influenced by the student athletes' year in school? To answer these questions, this study focuses on examining data from a nutrition screening questionnaire distributed to the Georgia State University athletes at their pre-participation physical examinations in August 2012. The researcher expected to see better eating behaviors reported by the upperclassmen, particularly because this group has had more time to become acclimated to being on a college sports team, access to sports nutrition services, and greater understandings of the role nutrition plays on performance. Previous research in athletic programs has shown that time spent in the athletic program may improve nutritional awareness and positively influence eating behaviors.[18] The researcher also expected to see a considerable number of subjects reporting the use of dietary supplements, because of the growing industry, wide availability, and collegiate athletes' desire for a competitive edge.

An analysis of the student athletes' eating habits and supplement use can serve to help the sports nutrition team refine and improve their education strategies. It is important that student athletes are educated on how to achieve peak performance safely with food, hydration, and exercise, rather than through the use of supplements.

CHAPTER II

Review of Literature

Eating Habits

Eating habits and dietary patterns influence an individual's energy consumption, nutrient (carbohydrate, protein, fat, vitamin, and mineral) intakes, and hydration status, which are important for athletic performance and recovery. According to a study by Zeigler et al,[19] athletes need to be educated about consuming adequate calories throughout the day in order to meet the energy needs of their activity. This study examined the contribution of breakfast, lunch, dinner, and snacks to the macronutrient and micronutrient intake of elite male and female figure skaters. The study consisted of 94 (46 male and 48 female) figure skaters who participated in the 1999 U.S. National Figure Skating Championship. They were each asked to keep a 3-day food record during the competitive season, and macronutrient and micronutrient intakes from meals were assessed. Results showed that the majority of the figure skaters in this study appeared to be starting their days with low energy reserves and therefore needed to be educated about the benefits of consuming breakfast, as well as energy intake throughout the day to sustain the cognitive and physical aspects of their training and performance. Nutrient intake at breakfast has received a great deal of scientific attention, largely because it is the most frequently skipped meal and its omission has been associated with reduced cognitive function, less nutrient-dense diets, and more nutrient inadequacies.[19]

Sports nutrition guidelines have been established for breakfast consumption, meal and snack frequency, hydration, and other nutrition-related behaviors. A recent study by Shriver et al[4] assessed the dietary intakes and eating habits of female college athletes and compared them with the minimum sports nutrition standards. Data was obtained from 52 female college athletes from a NCAA Division I university. The eating habits were evaluated using a nutrition questionnaire, which included questions about a variety of nutritional practices, such as meal/snack frequency (the number of meals and snacks eaten per day), dining out (frequency per week and type of restaurant) hydration practices, weight management, self-evaluation of diet quality, and breakfast consumption. Dietary intakes were collected through a 3-day food record and compared with the current macronutrient (carbohydrate, protein, fat) recommendations established for athletes. Results indicated that energy and carbohydrate intakes were below the minimum recommended amount for the majority of the athletes. Only 9% of the participants met their energy needs and 74% failed to consume the minimum amount of carbohydrates that is required to support training. Results on eating habits revealed that the majority of these athletes reported no regular breakfast consumption. In addition, they consumed an average of 5 meals/snacks per day, but 36% reported consuming fewer than 5 meals/snacks a day. The mean frequency of dining out was 5.4 times per week, with the most frequent dining places being sandwich shops, Mexican restaurants, and fast food restaurants. Lastly, only 16% of the participants reported monitoring hydrations status on a regular basis. These findings indicate that effective nutrition interventions are needed to improve dietary intakes and increase awareness of basic sports nutrition recommendations among female college athletes.

The macronutrient composition and the timing of meals and snacks are critical components for peak athletic performance because they impact the upcoming training sessions or competition, as well as the athlete's immediate recovery.[5] Over three decades ago, Short and Short[21] conducted a study at Syracuse University, where they assessed the macro- and micronutrient intakes of 554 male and female athletes using 1-day and 3-day diet records. This comprehensive study was done over a period of four years and found that athletes' caloric intakes cannot be grouped, as some athletes have extremely high (over 10,000 kcal per day) and others had very low intakes (400 kcals per day) depending on their sport and gender. However, in 2004 Hinton et al[22] reassessed the nutrient intakes and dietary behaviors of collegiate athletes for a more updated version of Short and Short's 1983 examination. The researchers recruited 345 male and female student athletes at a NCAA Division I university to participate in the study. Data was collected at mandatory meetings through a written questionnaire. The questionnaire booklet contained a food frequency questionnaire and questions regarding sociodemographics and dietary behaviors. Dietary behaviors assessed included: restricting dietary fat, carbohydrate, protein, or fluids, and using supplements other than vitamins or minerals for the purpose of weight control. How often athletes consumed meals and snacks prepared away from home was also determined by the questionnaire. Macro and micronutrient intakes were assessed using the Dietary Reference Intakes (DRIs), Dietary Guidelines, and the ADA-ACSM joint position on nutrition and athletic performance. Absolute energy intakes were compared to the Recommended Dietary Allowances (RDAs), giving a conservative estimate of adequacy, because the RDAs were not designed for the athletic population.[22] The results of this study found that the mean energy intake for females met the

recommended level for female collegiate athletes, however the mean energy intake for the male athletes was approximately 400 kcals below that recommended for male collegiate athletes. This was an interesting finding because results also showed that males were more likely to exceed the Dietary Guidelines for fat, saturated fat, and sodium than females. This may be associated because males reported that they ate more meals and snacks prepared away from home than the females. Furthermore, 62% of female athletes reported wanting to decrease their body weight by at least 5 pounds, compared to 23% of males. About a quarter of the female athletes said they restricted their dietary fat or carbohydrate intake to prevent weight gain. In contrast, male athletes reported using supplements for weight control, which could be for either weight gain or weight loss. The study found that male athletes were more likely to have micronutrient intakes below the average DRIs, and that although female athletes' desire to lose weight was associated with calorie and macronutrient restriction, their micronutrient intakes were adequate. In addition, the diets of both the male and female athletes were low in carbohydrate and protein. Together, only 15% of athletes had adequate intakes of carbohydrate and 26% had adequate protein intake. In their review of literature, Hinton et al[22] found that insufficient carbohydrate intake is a common finding among collegiate athletes and has been attributed to lack of knowledge about the benefits of adequate dietary carbohydrate, recommended intakes that are difficult to meet through the consumption of complex carbohydrates, and purposeful restriction of overall energy intake.

Nutrition Knowledge and Sources of Information

Coaches, athletic trainers (ATs), strength and conditioning specialists (SCSs), and registered dietitians (RDs) are common nutrition resources for athletes.[17] Although not all athletic programs currently fund a full-time registered dietitian, many athletic departments have created positions for RDs, offering nutrition services to their student athletes for the duration of their eligibility. According to a 2012 study by Torres-McGehee et al[17] 50.1% of athletic departments had a full-time (21.9%, n=74) or part-time (28.2%, n=95) RD designated for athletes, and the other 49.9% (n=168) had access to a RD from either the student health center or a private practice away from campus. Torres-McGehee et al[17] examined the nutrition knowledge among athletic trainers (ATs), strength and conditioning specialists (SCSs), coaches, and athletes, and determined confidence levels in the correctness of answers to questions about nutrition knowledge. A total of 579 volunteers (192 ATs, 71 SCSs, 131 coaches, and 185 athletes) from 100 NCAA Division I, II, and III universities participated in the study. After all volunteers completed an online consent form, a sports nutrition knowledge questionnaire was administered and consisted of 20 multiple-choice questions about basic nutrition, supplements and performance, weight management, and hydration. An overall score of 75% or more on the questionnaire indicated adequate nutrition knowledge and a score less than 75% indicated inadequate nutrition knowledge (highest achievable score was 100%). After each question, participants were instructed to specify their confidence in the correctness of their answers by selecting from a 4-point Likert scale. The results showed that participants averaged 68.5% in all domains. The ATs and SCSs had the highest average scores. Adequate knowledge was found in 71% of ATs, 83% of SCSs, 36% of

the coaches, and only 9% of athletes. The most used nutrition resources for coaches, ATs, and SCSs were registered dietitians. Overall, this study demonstrated that ATs and SCSs have adequate sports nutrition knowledge but that most coaches and athletes have inadequate knowledge about nutrition. Since athletes have frequent contact with ATs and SCSs, proper nutrition education among these staff members is critical.

Another study by Rosenbloom et al[6] assessed the nutrition knowledge of 237 athletes at a National Collegiate Athletic Association (NCAA) Division I institution that employed a full-time sports dietitian. Data was collected through a self-administered nutrition knowledge questionnaire distributed to athletes during their yearly physicals. An individual nutrition knowledge score was calculated for each athlete as the sum of correct responses to the nutrition questions. A minimum score of 0 indicated no correct responses, and a maximum score of 11 indicated all responses were correct. The mean nutrition knowledge score of all athletes was 5.8 ± 1.8 (mean ± SD). The researchers found that athletes at this particular NCAA Division I institution had misconceptions about the roles carbohydrates, proteins, fats, vitamins, minerals, and supplements in sports performance, and suggested that both male and female athletes need to be targeted for nutrition education to assist them in making proper dietary decisions. For instance, among the athletes, only 63% of men and 54% of women knew that carbohydrate and fat are the main energy sources for physical activity. Athletes who do not know that carbohydrate and fat are the primary energy sources for working muscles may be lacking in these nutrients, which could lead to early fatigue and a decline in performance.[6] Forty seven percent of men and 43% of women believed protein was the main source of energy for muscle. In addition, 35% of men and 34% of women believed protein supplements

were necessary. These results showed that athletes could benefit from education on the role of protein as an energy source as well as its role in building muscle mass. Results also showed that most of the athletes, (67% of men and 53% of women) believed vitamin and mineral supplements increased energy. This is a common belief among college athletes and the researchers suggested that they could benefit from learning how vitamins and minerals affect performance and should be cautioned that supplements cannot make up for a poor diet. The authors concluded that if athletes made food choices based on misconceptions and inaccurate nutrition information, it could have negative consequences on their performance. Therefore, it is imperative that student athletes receive correct information for questions about food, nutrition, and dietary supplements, either by seeking out their school's sports dietitian or asking an AT or SCS who can get in touch with a RD.

One study by Jonnalagadda et al[23] on the dietary practices, attitudes, and physiological status of collegiate freshmen football players, suggested that this population of athletes may benefit from education about healthy dietary practices and the proper use of supplements. Thirty-one freshmen football players at a NCAA Division I school were recruited and instructed to complete a self-administered nutrition screening questionnaire designed to determine their dietary practices and attitudes. After completing the questionnaire, these players reported eating 3.6 times per day and going out to eat an average of 4.8 times per week, choosing fast food restaurants more than half of the time. Forty-two percent of these athletes reported the use of dietary supplements, and over 50% were misinformed about the role of protein and the use of vitamin and

mineral supplements. This study is another example that suggests education about healthy dietary practices and the proper use of supplements is needed.

A study by Kunkel et al[24] found that a peer nutrition education program was an effective way to improve nutrition knowledge and encourage behavioral changes in their participants. A group of 32 female athletes voluntarily participated in a peer nutrition education program led by 4 female Dietetics students, who were at least juniors and recommended by a faculty advisor. Each peer educator was assigned 8 athletes and was responsible to contacting and scheduling a time to meet with each athlete once per week. The peer nutrition educators taught about basic nutrition that covered a variety of topics such as: healthy food choices, serving sizes, in-season and out-of-season diets, pre-competition meals, weight management, snacks, and guidelines for dining out. Each participant completed a nutrition knowledge questionnaire that contained 50 questions prior to attending the education program, and then again at the end of the program. The researchers of this study concluded that one-on-one meetings between peer educators and athletes had the greatest potential for success because nutrition information and interventions could be tailored to the specific needs of the athlete. This study shows that if college athletes are properly educated on nutrition and the selection of healthy foods, the nutritional quality of their food choices improves. This is important for both the short-term, to help improve performance, but also for long-term habits of healthful eating.

Dietary Supplement Use

The use of dietary supplements is becoming more widespread, and collegiate athletes may be more prone than non-athletes to use these products for a competitive

edge. The NCAA as defines nutritional/dietary supplements: herbs, botanicals, or any ingredient or product other than ephedrine intended to supplement the diet.[25] Examples include amino acids, creatine products, thermogenetics (used for weight loss), chromium, protein products, nitric oxide products, energy drinks, and multivitamin and mineral products. These dietary supplements target athletes and are being marketed to improve health and athletic performance, and to accelerate the body's recovery from exercise, injury, and the healing process.[26]

The *National Study of Substance Use Trends Among NCAA College Student-Athletes*[25] was a study conducted by the NCAA research staff in the years 2005 and 2009. This report provides summary information concerning substance use behaviors of men and women's intercollegiate athletics programs at NCAA institutions in 2005 and 2009. Completed surveys were received from 20,474 student-athletes across the 23 sports, which is a large number, but only a fraction of the 440,000 NCAA student athletes. According to the report, 61% of NCAA athletes surveyed reported no use of the dietary supplements listed in the survey (amino acids, chromium, creatine, glucosamine, general multivitamins, multivitamins with caffeine, and multivitamins and minerals with other additives). Among those who used supplements, the most frequently used were general multivitamin (20.3%), creatine (13.8%), and multivitamin and mineral with other additives (11.3%). A larger percentage (approximately 40%) of the respondents reported drinking energy drinks and consuming protein products.

A survey conducted by Froiland et al[15] examined the prevalence of nutritional supplement use among 203 college athletes and their sources of information. Participants included 115 male and 88 female varsity athletes at a NCAA Division I university.

Classification was evenly distributed among freshmen, sophomores, juniors, and seniors. This survey was made up of several parts, which asked each athlete to define *supplement*; report supplement use, frequency, and type; report their source of information; and provide reasons for use. The results for frequency of supplement use showed that 23% of the athletes regularly (>5 times per week), 16% occasionally (2-4 times per week), and 22% seldom (<2 times per week) used a nutritional supplement. However, researchers noticed that the majority of study participants reported that they had or were currently using products such as Gatorade, Boost, recovery mix, energy mix, or energy bars. This was an important finding because it shows that many athletes did not consider sports drinks or calorie replacement products as supplements. According to the researchers, "it is evident that many athletes do not have a clear or complete understanding of what qualifies as a dietary supplement." Only twenty-three athletes (11%) reported that they had never, nor were currently taking any form of nutritional supplement. This leaves 89% that were currently taking or had previously taken supplements. The most frequently used supplements were energy drinks (73%), calorie replacement products of all types (61%), multivitamin (47%), creatine (37%), and vitamin C (32%). When asked where athletes receive their information about nutritional supplements, female athletes were more likely to obtain information from family members, and males reported seeking information from a store nutritionist, fellow athletes, friends, coach, television, or a magazine. Based on this study, it is apparent that the athletic staff, along with the athletes' family and peers, plays an important role in providing information regarding nutritional supplements.

A different study surveyed student athletes at eight NCAA Division I universities to determine supplement use and perceived efficacy of supplements.[16] Forty-five survey

packets were mailed to the participating universities to be distributed to student athletes. Each survey requested information on demographics, nutritional supplement use, perceived efficacy of nutritional supplements, availability of a registered dietitian, availability and use of nutrition services, and perceptions about athletic trainers. Student athletes rated their perception regarding the efficacy of nutritional supplements on a 5-point Likert scale, with the number one representing a small perceived impact and five representing a large perceived impact on healing and athletic performance. A total of 236 athletes out of 360 responded to the survey, and 88% of the respondents reported using at least one nutrition supplement and 58% reported using two or more supplements. The mean perceived efficacy of nutritional supplements on healing and sports performance was a 2.9 or less out of 5 on the Likert scale. About half reported a registered dietitian on staff, whereas 23.5% did not have a dietitian and 27% were unsure of the availability. A greater awareness of whether a dietitian is on staff could lead to greater execution of the nutrition services provided to them.[16] Athletic trainers were the primary source of nutrition information because they are accessible to student athletes on a daily basis. Athletic trainers may have adequate knowledge about nutrition, but they should be encouraged to refer their student athletes to the dietitian for in-depth information regarding nutrition and supplement use. Overall, this study documented a high incidence of nutritional supplement use among college athletes, accompanied by moderately low perceived benefits of supplements in healing/rehabilitation and sports performance.

Through the years, college athletes have become more competitive and this increased pressure to win could motivate athletes to alter their diets or body weight in the belief that it will improve their performance.[22] The aforementioned studies reveal that

many collegiate athletes harbor misconceptions about the effects food and nutrition have on sports performance, as well as on the relationships between dietary supplements and performance. The current study aimed to investigate the eating habits and supplement use of upperclassmen and lowerclassmen student athletes at Georgia State University, and compared the findings between the two groups.

CHAPTER III

Methods

The methods section explains the procedures used to conduct research for this study. This section includes the following subsections: Subjects, Data Collection Instrument, Research Design, Procedures, and Data Analysis.

Subjects

The study sample consisted of 255 NCAA Division I men and women athletes at Georgia State University. To be considered for this study, participants had to be enrolled as full-time students with a minimum of twelve credit hours at Georgia State University and a member of one of the seventeen sports teams at the university. Athletes from the following sports teams were included: baseball, men's and women's basketball, football, men's and women's golf, men's soccer, men's and women's tennis, women's track and field, softball, sand volleyball, and court volleyball. The participants ranged in age from 17 to 24 and in college rank from freshman to fifth-year seniors. Participants were obtained through non-probability convenience sampling, where they were recruited based on accessibility.

Data Collection Instrument

Data for this study were collected through a self-administered nutrition screening questionnaire (Appendix A). Dr. Christine Rosenbloom, a Registered Dietitian and Board

Certified Specialist in Sports Dietetics, designed the nutrition questionnaire for use with student athletes at pre-participation physicals. The questionnaire was developed to collect information on the athletes' demographics, eating habits, use of dietary supplements, goals for healthy eating, and interest in learning more about nutrition. Additionally, the female athletes were asked questions about menstrual history, as it relates to bone health (Appendix B). The sports nutrition team works closely with the athletic training staff to screen for nutrition-related issues such as iron-deficiency anemia, disordered eating, inappropriate supplement use, and weight concerns. This questionnaire was a helpful instrument used to identify athletes at risk for poor eating habits and need for individualized nutrition counseling.

The various components of the nutrition questionnaire included: demographic information, personal eating habits, supplement and energy drink use, goals for improving nutrition and body composition, and nutrition education topics of interest. The demographic section required the subjects to answer questions about their gender, age, year in school, and sport. Students' responses to the eating habits section were one of the main focuses of this study and consisted of eight questions. We asked questions to gather information on if there are any foods or types of foods they avoid; if they are vegetarians; how often they eat breakfast; how many times they eat per day; if they skip meals, which one they are most likely to miss; reasons why they miss meals; what their favorite fast food restaurants are; and what restaurants on campus they have eaten at or would like to try. These questions help us gain an understanding of each individual student athletes' eating habits. The component on dietary supplement use was another main focus of this study. One question listed twelve common dietary supplements (general multivitamin,

iron, creatine, protein shakes/drinks/powders, amino acids, hydroxymethyl butyrate monohydrate (HMB), andro/norandro, calcium, herbal supplements, glucosamine/chondroitin, weight loss supplements, and weight gain supplements) and asked the athletes to 'indicate which dietary supplements they have taken in the past or are currently taking'. This section also asked student athletes if they know which dietary supplements are banned or restricted by the NCAA, and if they drink energy drinks. For the athletes who responded "yes" to drinking energy drinks, a subsequent question asked when and why they drink energy drinks. Goals for healthy eating were asked in one question, to check all that apply from a list of changes they would make to improve their nutrition. Answers included: eat more often, eat more calories, eat less often, eat fewer calories, eat a greater variety of foods, eat healthier foods, eat less fast foods, eat more fruits and vegetables, learn more about good nutrition, cook for myself, eat out less, get better access to healthy foods on campus, get better access to healthy foods while traveling for competition, time my eating around practice and/or competition, and no improvement. The nutrition questionnaire also included two questions about body satisfaction and body composition goals. One asked how satisfied he/she is with the physical appearance of his/her body and the other question asked if he/she has any personal goals for body composition. If the athletes checked "yes", a subsequent question asked to explain what their goals are. Athletes could check all that apply from 'gain lean mass/weight gain', 'decrease body fat', or 'lose weight'. In the last section of the questionnaire, one question asked the student athletes to indicate which nutrition-related topics they would be interested in learning more about. Topics included: 'nutrition programs for peak performance', 'weight control (maintenance or weight loss)', 'weight

gain', 'eating disorder awareness', 'learning how to grocery shop', 'learning how to cook', 'easy to make recipes', 'tips on eating out', and 'information on dietary supplements'. Another question had athletes check all or any of the ways they thought would help meet their nutritional needs. The strategies listed were: being able to meet with a sports dietitian in the training room, posting nutrition information to the sports nutrition Facebook page, having short nutrition information sessions before or after practice, posting information to the bulletin board in the training room, leaving handouts in the training room, posting information to the sports nutrition website through athletics, leaving recipes in the training room, and posting short video clips on the sports nutrition website. These questions were intended to help the researchers identify popular topics of interest and effective approaches for nutrition education among the student athletes.

Research Design

The research design of this study was a cross-sectional observational study. Cross-sectional studies are observational in nature because the researcher is looking for an association among variables without any manipulation. The cross-sectional method was used here because participants were studied at one particular point in time and the data collected were used to assess the prevalence of certain eating behaviors and supplement use among underclassmen and upperclassmen student athletes. There was no follow-up questionnaire. This study used quantitative data from the student athletes' responses to the nutrition questionnaire to draw conclusions about the eating behaviors and dietary supplement use of the Georgia State University underclassmen and upperclassmen athletes.

Data Collection Procedure

Approval for the study was obtained from the Georgia State University Institutional Review Board. On August 18, 2012, the weekend before classes began, all student athletes reported to the Georgia State University Sports Arena for yearly pre-participation physical examinations. Pre-participation physicals gave the sports nutrition team an opportunity to introduce themselves and meet the student athletes. Participants were asked to complete a nutrition screening questionnaire as one of the components of their physical examination. An informed consent form (Appendix C) was distributed to the 255 student athletes to read and sign before they completed the nutrition screening questionnaire. The consent form contained information regarding the purpose of the nutrition questionnaire, the procedure, risks and benefits that may be associated with this research, and assurance of anonymity. The questionnaire took approximately 5 to 10 minutes to complete. Upon each participant's completion, the questionnaires were collected and stored in a locked cabinet in Dr. Rosenbloom's office.

Data Analysis

Participants were assigned a unique identification number to keep their information confidential. Variables from the questionnaire were coded and all information was entered into an Excel spreadsheet, which was then transferred into Statistical Package for Social Sciences (SPSS version 20.0). Frequency analysis was used to describe the demographic information of the student athletes (age, gender, year in school, and sport). Age and year in school were not normally distributed, so the median age was calculated (20) with the interquartile range (18,21).

The student athletes were divided into two groups based on their year in school; underclassmen, which were classified as freshmen and sophomores, and upperclassmen, which consisted of juniors, seniors, and fifth-year seniors. Pearson's Chi-square tests were used to analyze the data and determine if there was an association between the groups and their eating behaviors and supplement use.

Differences in eating behaviors were assessed for underclassmen and upperclassmen separately and analyzed for significance ($p<0.05$) using Chi-square analysis. Eating behaviors were split into three categories: Breakfast Consumption, Eating Frequency, and Skipped Meals. We did not include responses to questions about favorite fast food restaurants and favorite restaurants on campus for this study. All study participants answered the questions 'how often do you eat breakfast?', 'how many times do you usually eat per day (including meals and snacks)?', 'if you skip meals, which one are you most likely to miss?', and 'what is your main reason for skipping meals?'. Subsets of each variable were coded and entered into SPSS.

To determine how often student athletes ate breakfast each week, we looked at the participants' answers to question 12, which asked 'How often do you eat breakfast?' They had the option to check 'everyday (7 days a week)', '5 to 6 days a week', '2 to 4 days a week', 'once a week', or 'never'. Participants who answered '7 days/week' and '5-6 days/week' were combined and coded as a "1" for data analysis to indicate that eating breakfast 5 to 7 days per week was a good eating behavior. All other responses ('2-4 days/week', 'once a week', and 'never') were classified as "2".

Eating Frequency was determined by using each participant's answer to question 13, 'How many times do you usually eat per day (including meals and snacks)?' All

participants who answered ‘3 times per day’, ‘4 to 5 times per day’, and ‘more than 5 times per day’ were coded as a “1”, which indicated a good eating behavior. Those who responded ‘1 to 2 times per day’, were classified as a “2”.

Participants’ responses to questions 14 and 15 were used to determine Skipped Meals. The first question was stated as, ‘If you skip meals, which one are you most likely to miss?’ Athletes who responded ‘I do not skip meals’ were coded as a“1” and those who selected either ‘breakfast’, ‘lunch’, or ‘dinner’ were categorized as a “2”. For those who reported that they skipped meals, we asked ‘What is your main reason for skipping meals?’ Answer responses included: ‘lack of time’, ‘food not around’, practice conflicts with meal time’, ‘not hungry’, ‘to manage my weight’, ‘not enough money’, or ‘other’. The athletes were able to check all that applied and frequency analysis was conducted to determine the top responses for skipping meals.

Dietary supplement use was determined by using the student athletes’ answers to question 9, which asked them to indicate which dietary supplements they have taken in the past or are currently taking. Athletes checked all supplements that applied under the column of ‘taken in the past’ or ‘currently take’, or they could leave it blank to indicate that they had never taken supplements or were currently not taking any. All subjects who checked a supplement as ‘taken in the past’ or ‘currently take’ were coded as a “1” and all those who left the space blank were coded as a “2”, indicating the use or non-use of the dietary supplements. The frequencies of each dietary supplement listed in the questionnaire were determined for underclassmen and upperclassmen after coding.

CHAPTER IV

Results

Demographic Data

The characteristics of the student athletes who participated are shown in Table 1. The nutrition questionnaire was completed by 255 student athletes at Georgia State University. Of these athletes, 170 were males (67%) were males and 85 were females (33%). Participants were members from 13 different sports teams, including: baseball, men's and women's basketball, football, men's and women's golf, men's soccer, men's and women's tennis, sand volleyball, softball, women's track and field, and volleyball. The age of the athletes within this sample ranged from 17 to 24 years of age. Age was not normally distributed; therefore median age within the interquartile range was calculated (20 [18,21]).

The student athletes were separated into two classes, underclassmen and upperclassmen, for the purpose of this study. Of the 255 participants, 117 (46%) were underclassmen in their first and second years of college, and 138 (54%) were upperclassmen in their third, fourth, or fifth years of college.

Table 1. Demographic characteristics of the participating Georgia State University athletes

	N (%)
Gender	
Male	170 (67)
Female	85 (33)
Median Age in years (25%, 75%)	20 (18, 21)
Year in school	
Freshman	69 (27)
Sophomore	48 (19)
Junior	70 (27)
Senior	60 (24)
Fifth-year	8 (3)
Class	
Underclassmen	117 (46)
Upperclassmen	138 (54)
Sport	
Baseball	34 (13)
Men's Basketball	15 (6)
Football	89 (35)
Men's Golf	8 (3)
Men's Soccer	23 (9)
Men's Tennis	1 (0.5)
Women's Basketball	13 (5)
Women's Golf	6 (2)
Sand Volleyball	12 (5)
Softball	18 (7)
Women's Tennis	4 (2)
Women's Track & Field	19 (7.5)
Volleyball	13 (5)

Eating Behaviors

Breakfast Consumption

Seventy-five percent of underclassmen and 59% of upperclassmen reported that they ate breakfast 5 to 7 days per week (Table 2). Underclassmen student athletes were significantly more likely than upperclassmen student athletes to consume breakfast every day or almost every day of the week (p=0.008). Among the athletes who ate breakfast 5

or more days a week, 55 underclassmen athletes (63%) and 58 upperclassmen athletes (71%) consumed breakfast every day (Table 3). For both classes, the highest reported category for frequency of breakfast consumption was 7 days/week, followed by 2-4 days/week for upperclassmen and 5-6 days/week for underclassmen. A significant difference was found when frequency of breakfast consumption was compared by class ($p=0.023$).

Table 2. Regular and irregular breakfast consumption of Georgia State University athletes and comparison by class

Breakfast Consumption	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
5 to 7 days per week	88 (75%)	82 (59%)	7.107	**0.008**
0 to 4 days per week	29 (25%)	56 (41%)		

Table 3. Reported breakfast consumption per week by Georgia State University athletes and comparison by class

Breakfast Consumption	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
Every day (7 days/wk)	55 (47)	58 (42)	11.364	**0.023**
5-6 days/wk	33 (28)	24 (17)		
2-4 days/wk	24 (21)	52 (38)		
1 day/wk	2 (2)	3 (2)		
Never	3 (3)	1 (1)		

Eating Frequency

In this study, eating frequently throughout the day (≥3 times/day) was defined by the researcher as a good eating behavior. The majority of underclassmen (95%) and upperclassmen (92%) reported that they ate at least 3 times each day (Table 4). When the eating behaviors of the two classes were compared, no significant difference was found (p=0.364). Approximately half of the underclassmen reported that they usually ate 4 to 5 times/day, whereas the upperclassmen had nearly an equal amount of those who ate 3 times/day and 4 to 5 times/day (Table 5). When the frequency of meals and snacks eaten per day were compared by class, a significant difference was found (p =0.012).

Table 4. Frequent and infrequent eating of meals/snacks per day by Georgia State University athletes and comparison by class

Eating Frequency	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
≥3 times per day	111 (95)	127 (92)	0.822	0.364
≤2 times per day	6 (5)	11 (8)		

Table 5. Reported eating occasions per day by Georgia State University athletes and comparison by class

Times eat per day	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
1-2 times/day	6 (5)	11 (8)	11.010	**0.012**
3 times/day	33 (28)	59 (43)		
4-5 times/day	60 (51)	60 (44)		
>5 times/day	18 (15)	8 (6)		

We conducted further analysis and found a statistically significant association between breakfast consumption and eating occasions per day (p=0.005). More frequent daily eating occasions were associated with regular breakfast consumption. Sixty-nine percent of athletes who reported eating ≥3 times/day ate breakfast on a regular basis (5-7 times/week). The opposite was also true; the majority (65%) of athletes who reported eating less frequently throughout the day (≤2 times) reported eating breakfast 0 to 4 days per week (Table 6).

Table 6. Association between breakfast consumption and eating frequency

	Breakfast 5-7 days/wk N (%)	Breakfast 0-4 days/wk N (%)	$\chi 2$	P
Eat ≥3 times per day	164 (69)	74 (31)	8.067	**0.005**
Eat ≤2 times per day	6 (35)	11 (65)		

Skipped Meals

Twenty-seven percent of underclassmen and 20% of upperclassmen reported that they do not skip meals (Table 7). Approximately half of the students from each class expressed that if they skipped a meal, it was most likely breakfast. Both underclassmen student athletes and upperclassmen student athletes were more likely to skip a meal than not (Table 8). A Fisher's exact test was conducted to determine if there was a difference in meals skipped by class, but no significant difference was found (p=0.185).

Table 7. Reported meals skipped by Georgia State University athletes and comparison by class

Most likely missed meal	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
Do not skip meals	32 (27)	28 (20)	2.719	0.437
Breakfast	58 (50)	72 (52)		
Lunch	25 (21)	37 (27)		
Dinner	2 (2)	1 (1)		

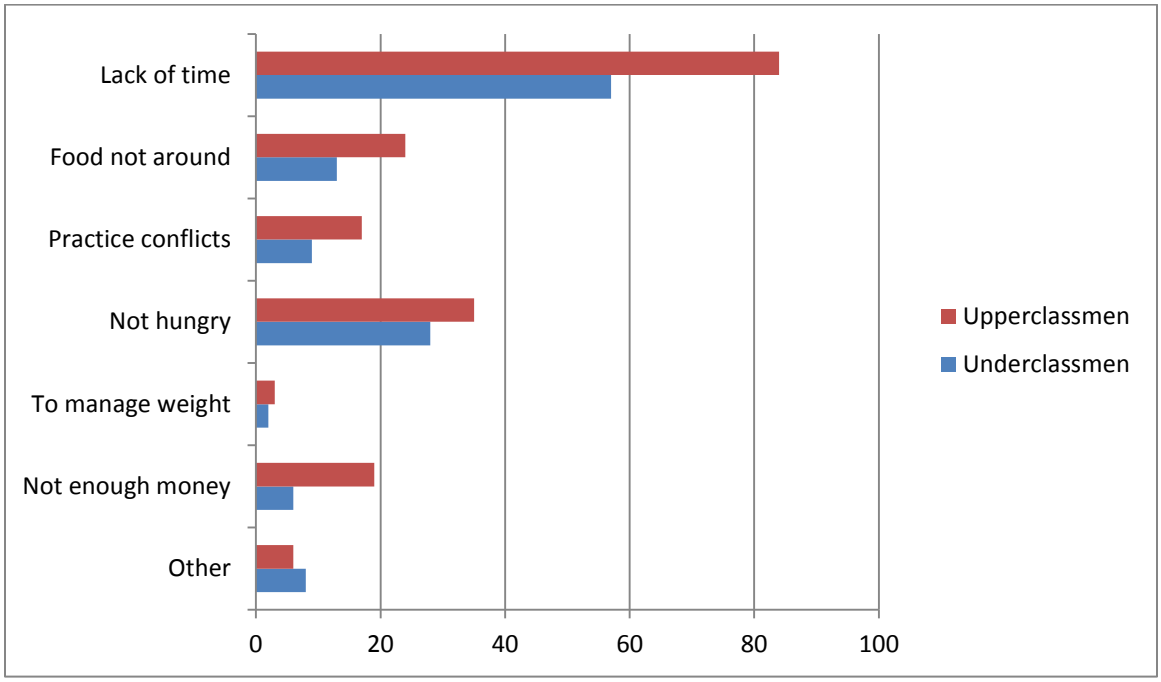
Table 8. Prevalence of skipped meals among Georgia State University athletes and comparison by class

	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
Do not skip Meals	32 (27)	28 (20)	1.754	0.185
Skip meals (B, L, D)	85 (73)	110 (80)		

B= breakfast, L= lunch, D= dinner

For a Division I student athlete, time can be very limited due to busy class and practice schedules. Further analysis was conducted to examine the student athletes' main reasons for skipping meals. Approximately one quarter of the student athletes checked that they do not skip meals. Of those who do skip meals however, the majority reported their main reason for skipping meals is due to a lack of time. Other commonly reported reasons for skipping meals included not being hungry, not having food available, practice conflicts, and not having enough money (Figure 1).

Figure 1. Reasons for skipped meals



Dietary Supplement Use

Subjects were asked in the nutrition screening questionnaire to indicate which dietary supplements they have taken in the past or are currently taking. The supplement categories listed in the questionnaire were: general multivitamin, iron, creatine, protein shakes/drinks/powders, amino acids, hydroxy methyl-butyrate (HMB), andro/norandro, calcium, herbal supplements, glucosamine/chondroitin, weight loss supplements, weight gain supplements, or other. Athletes could check all that applied for each category under the column 'taken in the past' or 'currently take'. Although the subjects indicated in the questionnaire if they had taken supplements in the past or are currently taking, these two variables were combined as one when data was analyzed to represent reported use of any supplements. If the question was left blank, it was assumed that the subjects had never taken supplements or were not currently taking any. The majority of both groups (73%)

reported that they currently take or have previously taken at least one of the dietary supplements listed in the questionnaire and no significance was found (Table 9). Frequencies were determined for each dietary supplement and compared by class (Table 10). Protein products, general multivitamins, and creatine were the highest reported supplements taken among both underclassmen (53%, 38%, and 19%) and upperclassmen (59%, 38%, and 26%). Other prevalent dietary supplements were calcium, weight gain supplements, and amino acids. Herbal supplement use showed a slight difference between the underclassmen and upperclassmen, but it was not significant. Overall, there were no significant differences for dietary supplement use between Georgia State University underclassmen and upperclassmen athletes.

An additional question was asked in the nutrition screening questionnaire regarding energy drinks (Red Bull, 5-hour energy, Jolt, etc.). A total of 45 student athletes (24 underclassmen and 21 upperclassmen) reported that they drank energy drinks and no significance was found between classes. The athletes who drank energy drinks were asked when and why they drank energy drinks, and most reported it was to help them stay awake or to give them more energy throughout the day (Figure 2).

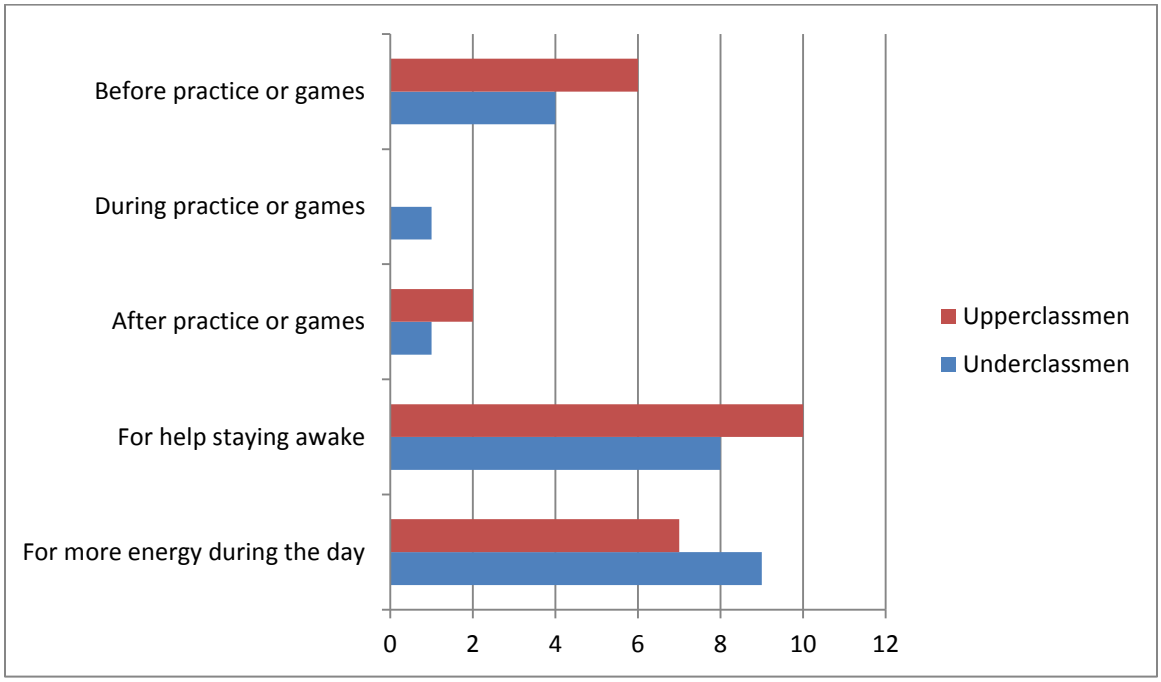
Table 9. Reported use and non-use of dietary supplements in Georgia State University athletes and comparison by class

Dietary Supplement Use	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
Currently take or taken in the past	85 (73)	101 (73)	0.009	0.923
No use of supplements	32 (27)	37 (27)		

Table 10. Dietary supplement usage by Georgia State University athletes and comparison by class

Dietary Supplement	**Underclassmen N (%)**	**Upperclassmen N (%)**	**$\chi 2$**	**P**
General multivitamin/mineral	44 (38)	52 (38)	0.000	0.990
Iron	6 (5)	11 (8)	0.822	0.364
Creatine	22 (19)	36 (26)	1.912	0.167
Protein shakes, drinks, or powders	62 (53)	82 (59)	1.065	0.302
Amino acids	13 (11)	17 (12)	0.089	0.765
HMB	1 (1)	2 (1)	0.193	0.661
Andro/norandro	0 (0)	3 (2)	2.574	0.109
Calcium	16 (14)	20 (15)	0.035	0.852
Herbal supplements	2 (2)	9 (7)	3.553	0.059
Glucosamine/chondroitin	3 (3)	9 (7)	2.212	0.137
Weight loss supplements	2 (2)	7 (5)	2.103	0.147
Weight gain supplements	12 (10)	21 (15)	1.383	0.240
Other	2 (2)	2 (2)	0.028	0.868
Energy Drinks	24 (21)	21 (15)	1.164	0.281

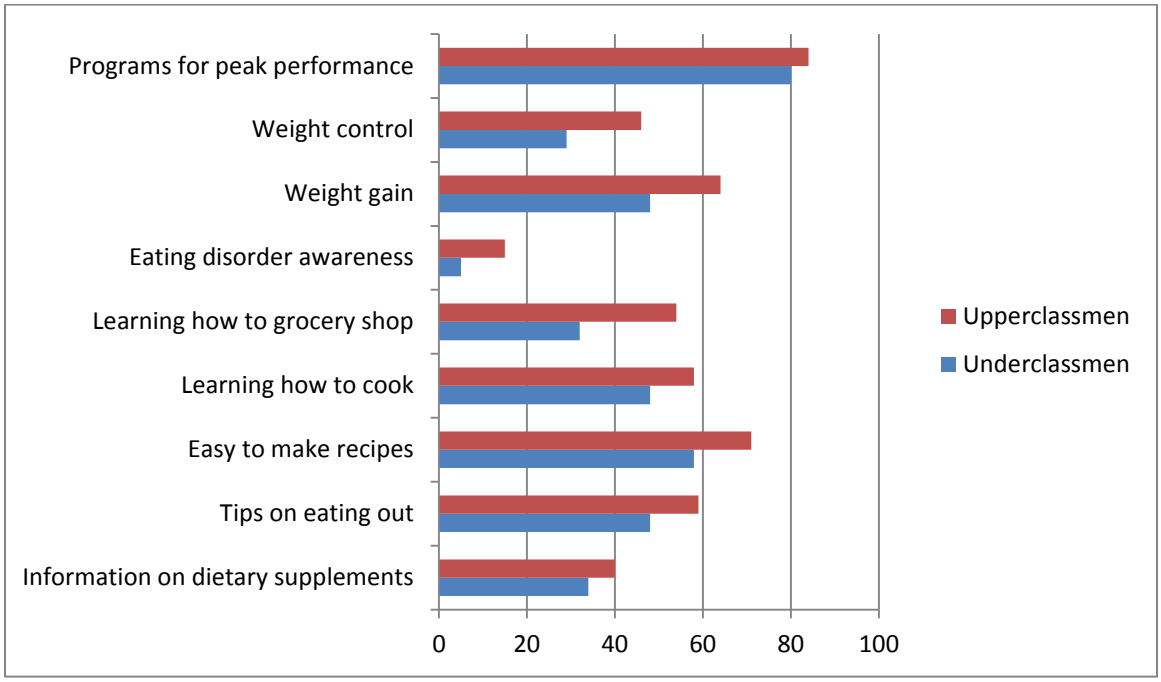
Figure 2. Times and reasons for drinking energy drinks



Topics of interest

In the questionnaire, the participants were given a list of nutrition-related topics where they could either check "yes" or "no" to indicate if they were interested in learning about the specified topic. Figure 3 shows the athletes' responses to the nutrition-related topics. Sixty-four percent of the study participants (80 underclassmen and 84 upperclassmen) indicated that they would like to learn more about nutrition programs for peak performance. Many of the student athletes were also interested in learning easy recipes (51%), tips for weight gain (44%), tips on eating out (42%), and how to cook (42%). 'Information on dietary supplements' was one of the least marked topics among the athletes, with only 29% of participants (34 underclassmen and 40 upperclassmen) interested in this topic.

Figure 3. Nutrition-related topics of interest among Georgia State University athletes



CHAPTER V

Discussions and Conclusions

The main purpose of this study was to compare the eating behaviors and dietary supplement use of Georgia State University underclassmen and upperclassmen athletes. Data was collected through a nutrition screening questionnaire that consisted of 25 questions for males, and 29 questions for females (4 additional questions on menstruation history). This study focused on 17 of the questions, which included demographic information, questions on dietary supplement use, eating behaviors, and nutrition topics of interest to athletes.

The researcher expected to see a significant difference in eating behaviors between the two groups of athletes, with upperclassmen regularly consuming breakfast, eating more frequently throughout the day, and not skipping meals. It was predicted that since the upperclassmen had spent more time in a college athletic program than the underclassmen, that they would have greater nutritional awareness and would report better eating habits. However, this was not the case; the underclassmen were the ones who were found to have better eating behaviors. The group of freshmen and sophomores (n=117) were significantly more likely than upperclassmen (n=138) to consume breakfast every day or almost every day of the week (75% versus 59%). This could be due to the fact that many of the younger student athletes live on campus and have easy and unlimited access to the Georgia State University dining hall facilities. According to information obtained from the Georgia State University Athletics Business Department, a

total of 123 student athletes were on a meal plan scholarship for the 2012-2013 school year. The scholarship included on-campus housing and access to the 7-day meal plan, which offered students unlimited access to "all you can eat" dining at two locations. Of these meal scholarship participants, 65 were underclassmen and 58 were upperclassmen. Unfortunately, the total number of student athletes on the meal plan who were not receiving the meal scholarship is unknown. However, it is possible that the number (n=58) of upperclassmen who were on the meal plan substantially contributed to the 59% who reported regular breakfast consumption (5 to 7 days/week).

Consuming breakfast every day (7 days/week) was the highest reported answer for both groups (47% underclassmen and 42% upperclassmen), followed by 2-4 days/week for upperclassmen (38%), and 5-6 days/week for underclassmen (28%). Many of the upperclassmen athletes may live off campus and have the ongoing responsibility to manage meal planning, grocery shopping, meal preparation, and food handling and storage for the first time.[2] With the increased time demands of class, schoolwork, practice, and competition, college athletes may find they have little time for meal preparation.[7] However, athletes in our study had higher breakfast consumption than a finding from a recent study. Shriver et al[4] reported that only 27% of the female college athletes in their study sample had regular breakfast consumption, with participants consuming breakfast cereal and sausage biscuits most frequently. Stockman et al[20] clearly demonstrated that breakfast consumption makes an important contribution to overall health and well-being, and suggests that the omission of breakfast may contribute to reduced cognitive function and less nutrient-dense diets. Although our study did not assess *what* the athletes at Georgia State University were choosing to eat in the mornings,

it might have been useful information to further understand the student athletes' eating behaviors and nutrient intakes.

Athletes are not only advised to eat breakfast regularly, but also to consume frequent meals and snacks each day in order to maintain energy levels and supply adequate amounts of carbohydrates to working muscles.[4] The nutrition screening questionnaire included a question that asked athletes to indicate how many times they usually ate per day, which included all meals and snacks. Based on previous scientific literature, the researcher of the present study defined eating at least 3 times per day as a good eating habit for student. Ninety-five percent of underclassmen and 92% of upperclassmen reported that they ate ≥3 times/day, and no significant difference was found between the two groups when eating frequencies of ≥3 times/day or ≤2 times/day were compared. However, when the number of daily eating occasions were broken down (1-2 times, 3 times, 4-5 times, or >5 times) and analyzed by class, a significant difference was found. Half of the underclassmen reported that they ate 4 to 5 times per day, whereas the upperclassmen had nearly an equal number of those who ate 3 times/day as those who ate 4-5 times/day. Fifteen percent of the underclassmen and 6% of the upperclassmen reported eating more than 5 times per day, and a small number of athletes ate only 1 to 2 times each day. It is possible that bodyweight-conscious athletes might deem snacks as undesirable.[5]

Low energy intakes leave athletes vulnerable to a variety of health problems including poor bone density, suppressed reproductive function, and stress fractures.[27] Because fracture risk doubles for each standard deviation decline in bone mass and because low bone density is a cause of stress fractures, anything that impairs bone

mineral content would be undesirable to anyone, especially athletes who want to excel in their sport and avoid injury.[27] Frequent snacking during the day is encouraged among athletes because it is positively associated with higher energy intakes.[28] The ADA-ACSM joint position paper suggests that athletes in heavy training or doing multiple daily workouts may need to eat more than 3 meals and 3 snacks per day and should consider every possible eating occasion.[3] The Australian Olympic athletes from the study by Burke et al[29] typically reported ~5 separate eating occasions each day, and a moderate relationship was found between total energy intake and the number of separate eating occasions each day. Nearly all athletes in a study by Shriver et al[4] failed to meet their estimated energy needs. Half of their study sample of female athletes reported intakes of less than 2,000 kcal/day, which represents the amount of calories recommended for a young woman who is at a low to moderate activity level,[30] and is not enough to support the high physical and nutritional demands of female athletes. Based on group mean intakes, the female athletes in Shriver et al[4] also consumed inadequate amounts of carbohydrate and high dietary fat intakes. The group average for protein intake was not significantly below the minimum recommended level of 1.2 g/kg, but more than half of the athletes consumed less protein than recommended. Studies with findings that used group mean intakes demonstrated a common problem with interpreting dietary assessment data. However, with this limitation in mind, the researcher of the present study believed it would have been useful to distribute a dietary assessment instrument with the nutrition screening questionnaire to Georgia State University athletes. It is possible that the findings would have benefited student athletes by putting into perspective how much they are consuming in relation to the recommended energy and

nutrient amounts. This information would have also been beneficial to the sports nutrition team to generate nutrition interventions that increased awareness of basic sports nutrition recommendations, and ways to optimize energy intakes and nutritional status of for peak performance.

Further analysis was conducted and found a significant association between breakfast consumption and daily eating frequency, which included all meals and snacks. The majority of students who ate breakfast on a regular basis (5-7 days/week) typically ate more frequently throughout the day (≥3 times/day). The opposite was true for those who did not consume breakfast regularly. Irregular breakfast consumption (0-4 days/week) was associated with less frequent eating throughout the day (≤2 times/day). This may seem as though it is a specious argument, however people may skip breakfast but eat multiple snacks throughout the day. In this case, the daily eating frequency wouldn't necessarily be smaller if breakfast is skipped. In order to understand the association between breakfast consumption and eating frequency to a greater extent, two separate questions about the number of 'meals' and 'snacks' eaten each day should have been asked in the nutrition screening questionnaire.

Nearly one-quarter of the underclassmen (27%) and one-fifth of the upperclassmen (20%) reported they did not skip meals. However, the majority of athletes from both groups (73% and 80% respectively) expressed that they did skip meals. No statistically significant difference was found for skipped meals between the two groups. Among those who did skip meals, breakfast was the most frequently skipped meal and dinner was the least frequently skipped meal. This finding was consistent with previous research.[4, 20, 29] In the study by Shriver et al,[4] only 27% of the sample consumed a regular

breakfast, and the researchers stated that the college athletes in their sample consumed the largest proportion of their calories in the evening hours. This was similar to the findings of Burke et al,[29] whose study on Australian Olympic athletes showed that the smallest amount of daily energy was consumed at breakfast (19%) and the largest proportion was consumed at dinner (34%), with lunch and snacks (24% and 21%) contributing moderately to daily energy intake. Stockman et al[20] found that breakfast was the most frequently skipped meal among participants in their study, with a total of 26% of subjects skipping breakfast at least once during their 3-day food record. Breakfast was more frequently skipped on 2 of the 3 days when compared to lunch and dinner. Dinner was the least frequently skipped meal with no subjects skipping it all 3 days, and a total of 13% skipping it 1 or 2 days during the 3-day food record.

The athletes in the present study who skipped meals were asked their main reasons for missing meals. The majority reported their main reason for skipping meals was a lack of time. Other common response choices among the athletes who skipped meals were poor appetite and/or food unavailability. The findings were similar to those of Burke et al[29] which stated "heavy training schedules, fear of gastrointestinal discomfort during exercise, suppressed appetite, and poor availability of foods and beverages have been identified as common reasons for missed food and fluid intake over the day among athletes." Hinton et al[22] studied the dietary intakes and behaviors of male and female collegiate athletes and indicated that a likely factor of suboptimal nutrient intake in athletes may have to do with purposeful restriction of food consumption in order to lose weight, maintain a low body weight, or meet a weight requirement. The majority of female athletes in their study reported wanting to lose weight, and about 25% of them

reported that they restricted their dietary fat or carbohydrate intake to prevent weight gain.[22] It was not reported, and therefore cannot be assumed that the female athletes in their study were skipping meals, but it is probable that intentionally restricting dietary fat or carbohydrate was linked to skipping meals or snacks. A positive finding from our study that differed from the findings of Hinton et al[22] revealed that skipping meals to manage weight was not a general concern for our athletes.

In contrast to the female athletes in the study by Hinton et al[22] who restricted their diets for weight control, the male athletes reported using dietary supplements for weight control, either for weight gain or weight loss. According to the *National Study of Substance Use Trends Among NCAA College Student-Athletes*,[25] male NCAA athletes were at least twice as likely to have taken weight gain products than weight loss products while in college. The opposite was true for females, who were more likely to have used weight loss products than weight gain products while in college. On average, 6% of male and female athletes from the NCAA survey used weight loss supplements and 11% of athletes from the survey took weight gain supplements.[25] Our study had similar findings, with 2% of underclassmen and 5% of upperclassmen who took weight loss supplements, and 10% of underclassmen and 15% of upperclassmen who used weight gain supplements.

Froiland et al[15] found that female athletes reported to take supplements for their health or because of an inadequate diet, while males were more likely to take supplements to improve speed and agility, strength and power, or for weight/muscle gain. Twenty-three (11%) of the Division I varsity athletes from Froiland et al[15] reported that they never took, nor were currently taking any form of nutritional supplements. This left

89% that were currently or previously taking nutritional supplements.[15] Eighty-eight percent of Division I athletes from a study by Burns et al[16] reported using at least one nutritional supplement, and 58% reported using two or more. In a study by Jonnalgadda et al,[23] 42% of the freshman football players surveyed reported the use of some form of dietary supplements. In the present study, 73% (n=191) of underclassmen and upperclassmen athletes at Georgia State University athletes were currently or previously taking a dietary supplement. Of those who reported current or past use of supplements, protein shakes/drinks/powders were the most frequently used supplement for both groups, followed by multivitamins and creatine. Calcium, weight gain products, and amino acids were also highly reported among surveyed Georgia State athletes.

Student athletes in the present study had much higher uses of protein supplements than that previously cited (53% underclassmen and 59% upperclassmen). Burns et al.[16] reported that among NCAA Division I athletes, 40% of the respondents consumed protein supplements. Another study that involved athletes at a Division I university revealed that 48% of the subjects used protein supplements at the time the study took place.[15] The NCAA's *Study of Substance Use Trends Among NCAA College Student-Athletes* found that 38% of student athletes surveyed used protein products while in college.[25] However, this was an average of all responses from both genders and 21 different sports. Of the male sports, athletes from ice hockey, baseball, and wrestling reported the highest use of protein products (66%, 60%, and 59%), and all 11 men's sports in the survey reported a percentage greater than the average, with basketball as the lowest users of protein products (41%). From the women's sports, the highest reported protein supplement users were track, swimming, and golf (23%, 22%, and 22%).[25]

Dietary protein is required to promote growth, repair damaged tissue and cells, synthesize hormones, and for a variety of metabolic activities.[31] With the multi-billion dollar dietary supplement industry constantly marketing new sports nutrition products, many student athletes buy these products instead of choosing nutrient-rich foods and fluids. Protein and amino acid supplements can serve as a convenient way to ensure timely and appropriate intakes, but evidence shows that the level of protein needed for athletes can be obtained from a regular and varied diet. According to the joint ADA-ACSM paper, current evidence indicates that protein and amino acid supplements are no more effective than food when energy intake is sufficient to maintain body weight. [3] Generally, most athletes tend to eat ample protein.[32] However, certain individuals may be at risk of consuming insufficient protein, such as those participating in intense training and competition, those with insufficient energy intakes, vegetarians, athletes competing in weight-class competitions, and those undergoing weight-loss programs.[32] In any discussion of protein requirements and recommendations, it is important to consider energy intake, as it has just as much of an influence on protein requirements as protein itself. Energy balance, or the consumption of adequate energy, particularly in the form of carbohydrates, is important to protein metabolism so that amino acids are spared for protein synthesis and not oxidized to assist in meeting energy balance. [3]

Thirty-eight percent of the underclassmen and upperclassmen in the present study reported taking a multivitamin supplement. Compared to previous studies, the student athletes in our study had a very standard use of multivitamins. Froiland et al[15] found that 47% of athletes reported taking a multivitamin supplement; 23% of collegiate freshman football players in the study by Jonnalgadda et al[23] used vitamins; and about 20% of

participants from the NCAA survey reported taking a general multivitamin during college, with the highest reported use in women's track, men's swimming, and men's ice hockey. [25]

The present study on Georgia State University athletes had fewer consumers of creatine than that previously cited (19% of underclassmen and 26% of upperclassmen). Burns et al[16] documented creatine use by 31% of their Division I university athletes; Jonnalagadda et al[23] reported 36% of the freshman football players in their study used creatine; Froiland et al[15] found that 37% of athletes in their study had or were currently taking creatine; and 39% of male athletes from the Jacobson et al[33] study reported its use. Creatine is currently the most widely used ergogenic aid among athletes wanting to build muscle and enhance recovery.[3] It is one of the few supplements that has sufficient evidence, and has been shown to be effective in repeated short bursts of high intensity activity in sports such as sprinting and weight lifting. [3] The majority of ergogenic aids currently on the market, however, do not perform as claimed and have inconclusive evidence as performance enhancers. Some supplements included in the nutrition screening questionnaire that fall into this category include: amino acids, beta hydroxymethylbutyrate (HMB), ginseng (as an herbal supplement), and carnitine (as a weight loss supplement).

Some products, such as energy drinks, may be dangerous and put athletes at risk for disqualification due to high levels of caffeine and other stimulants.[12] Seventy-three percent of the athletes in Froiland et al[15] reported using energy drinks, and 44% of the respondents in the NCAA survey of college student athletes reported drinking energy drinks while in college.[25] The athletes in the present study reported a much lower

consumption of energy drinks. A total of 45 athletes (18%) checked “yes” when asked if they drink energy drinks and no significant difference was found between the two groups The lower number of responses in the present study may have been due to 1) the researchers’ definition of “energy drink” and 2) the way the question was phrased. First, the researchers in the present study considered energy drinks to be beverages such as Red Bull, 5-hour energy, Jolt, and Monster, which contain large doses of caffeine and other stimulants like guarana and ginseng. Only a small number of student athletes in the present study reported using these types of beverages, however, Froiland and colleagues considered Gatorade, Powerade, All Sport, and Red Bull as some examples of energy drinks in their study, which is what likely generated the higher response rate. Second, the question in our nutrition screening questionnaire was stated “do you drink energy drinks?”, whereas the NCAA phrased their question, “have you taken energy drinks while in college?” The former likely gave the reader the impression that we were asking about regular energy drink consumption, and the latter seems to have included both frequent and infrequent consumption.

Future Investigations:

The findings of this study suggest the need for further investigations related to dietary behaviors and supplement use of collegiate athletes. Specific to this study, further interest in the eating patterns and meal frequencies of collegiate athletes may play a role in meeting various goals of sports nutrition. For example, previous literature has stated that adequate nutrition is important for good health, maintaining energy throughout the day, maximizing athletic performance potential, reducing fatigue and the risk of health

problems, and faster recovery.[3, 4, 8, 20, 27, 28] A comprehensive determination of nutritional knowledge, attitudes, and beliefs that could motivate athletes to adopt positive eating habits would be useful for educational purposes. Also, learning more about the types of supplements collegiate athletes are using, the prevalence of use, and the athletes' knowledge and perceived benefits of particular supplements would help the sports nutrition staff to properly educate the athletes.

Regarding the knowledge of supplements, results from Jacobson et al[33] found that only 37% of athletes in their study correctly identified the appropriate functions of vitamins, and that 30% thought vitamins provided a direct source of energy. The athletes in the study by Burns et al[16] expressed that they considered vitamin and mineral supplements to have the highest impact on health and rehabilitation, while protein and creatine supplements were considered to have the highest perceived impact on sports performance. Furthermore, a study by Rosenbloom et al[6] revealed that many of the athletes in their sample believed that protein is the main energy source for the muscle. In addition, 35% of men and 34% of women in their study believed that protein supplements were necessary.[6] The joint ADA-ACSM position paper and the NCAA have both reported that protein and amino acids supplementation are not necessary to meet protein requirements, and that athletes can meet the requirements and obtain the performance enhancement they want and through diet alone.[3, 11] Although our study did not examine the Georgia State University athletes' knowledge of nutritional supplements, previous literature demonstrates that the role of vitamins and protein in performance appear to be unclear to many collegiate athletes. It is likely that Georgia State student athletes would benefit from education on how vitamins and minerals affect performance, the role of

protein as an energy source and its role in building muscle, and techniques on how to meet nutrient recommendations through food and fluid choices.

The present study did however, ask the student athletes which topics they would like to learn more about. Answer choices included: nutrition programs for peak performance, weight control (maintenance or weight loss), weight gain, eating disorder awareness, learning how to grocery shop, learning how to cook, easy to make recipes, tips on eating out, and information on dietary supplements. Athletes checked 'yes' or 'no' depending on their interest in the topics. Approximately 64% of student athletes (80 underclassmen and 84 upperclassmen) marked 'yes' to indicate that they would like to learn more about nutrition programs for peak performance. Other highly desired topics of interest among the Georgia State athletes were 'easy to make recipes' and 'weight gain.' Surprisingly, 'information on dietary supplements' was one of the least marked topics among the athletes, with only 29% (34 underclassmen and 40 upperclassmen) who checked 'yes'. This information identified popular nutrition topics of interest among Georgia State University athletes and could be useful in the future for the sports nutrition team in guiding the topics of information sessions and developing education materials such as handouts and recipe cards. While the Georgia State University Athletic Department does not currently employ a full-time registered dietitian, it is imperative that the student athletes have reliable sources of information to turn to. Adding a registered dietitian to the Sports Medicine Department could potentially be a vital component of the student athletes' performance and injury rehabilitation, as well as the source of sound advice on food choices and the benefits of good nutrition in sports and in daily life.

Limitations:

The benefit of using a cross-sectional study design was that it is observational in nature and allowed the researchers to compare different variables from the nutrition questionnaire at the same point in time. However, a general limitation to cross-sectional studies is that is does not provide definite information about cause and effect relationships.[34] These studies do not consider what happened before or after, but are often used to make inferences about possible relationships or to gather preliminary data to support further research.[35] Therefore we cannot confidently explain why the underclassmen in this study had slightly better eating behaviors than the upperclassmen. It is possible that the underclassmen student athletes had past exposures to nutrition education programs or access to a sports dietitian before starting college. On the other hand, it is possible that the upperclassmen's eating behaviors were worse at the beginning of their college years and have improved due to effective education programs offered by the sports nutrition team, but we cannot know for sure. An observational longitudinal study, where researchers conduct several observations of the same subjects over time, could be beneficial for detecting developments or changes at both the group and the individual levels.

Another limitation of this study was that by dividing the Georgia State athletes into either an 'underclassmen' or 'upperclassmen' group, we were only comparing eating behaviors and supplement use by their year in school (which is typically reflective of age). When analyzing data, we did not adjust for gender differences of the two groups, which could indeed be a confounding factor. In addition, this study includes the usage of convenience sampling of athletes from only one urban university campus. Therefore, the

eating habits and supplement use may differ from students in other types of university settings. Despite these limitations, the outcomes of this study can be used to develop effective nutrition education plans for Georgia State University student athletes of all grade levels, and other similar audiences.

Conclusion:

The main focus of the present study was to make comparisons of the eating behaviors and dietary supplement use of underclassmen and upperclassmen student athletes at Georgia State University. Specifically, we focused on breakfast consumption, frequencies of daily food intake, skipped meals, and the use of dietary supplements. When responses from the nutrition questionnaire were compared, the underclassmen athletes displayed overall better eating habits than the upperclassmen athletes (i.e. more regular breakfast consumption and daily meal/snack frequency), but dietary supplement use was the same in both groups. Findings from this study indicate that all student athletes at Georgia State University could use improvements on their eating habits and could benefit from learning ways to obtain the performance enhancement they desire from choosing the right food and fluids, without supplements.

CHAPTER VI

Manuscript in Style of Journal

Eating Behaviors and Supplement Use of College Upperclassmen Athletes versus Lowerclassmen Athletes

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Abstract

Purpose: It is important for college athletes to incorporate positive eating behaviors into their daily lives, such as consuming breakfast, eating frequently throughout the day, and not skipping meals in order to maintain energy levels and reach their sports performance potential. The purpose of this study was to compare the eating behaviors and dietary supplement use of underclassmen and upperclassmen collegiate athletes at a NCAA Division I university. **Methods:** Underclassmen (freshmen, sophomores) and upperclassmen (juniors, seniors, fifth-year seniors) athletes (n=255) completed a nutrition screening questionnaire. Chi-square analysis was used to assess group differences in eating behaviors and supplement use. **Results:** Underclassmen athletes were significantly more likely than upperclassmen athletes to consume breakfast every day or most days of the week (p=0.008). The underclassmen also reported significantly more eating occasions during the day than upperclassmen (p=0.012). The majority of both groups reported skipping meals, and breakfast was the most frequently missed. There was no significant difference for dietary supplement use between the classes, but over half of the underclassmen (53%) and upperclassmen (59%) have taken or currently take protein supplements (shakes, drinks, and/or powder). **Conclusions:** Underclassmen displayed overall better eating habits than the upperclassmen. All student athletes at our university could benefit from learning about ways to improve their eating habits and obtain peak performance through diet, without supplements.

Keywords: Athletics, Collegiate, Eating Habits, Supplements

Introduction

Collegiate athletes participate in training and conditioning to achieve peak performance in their sport, but many times overlook the important role nutrition plays in their athletic performance. Nutrition is an important component of any physical fitness program and affects an athlete in many ways. At the basic level, proper nutrition helps achieve and maintain health (Ozdogan & Ozcelik, 2011). At the physical level, adequate nutrition is essential for optimizing athletic performance, reducing fatigue, decreasing the risk of injury, and enhancing recovery after exercise (Rodriguez, DiMarco, & Langley, 2009).

The depth of an athlete's nutritional knowledge has been found to have a direct correlation to the food choices they make on a daily basis (Burke, Cox, Cummings, Desbro, 2001). Research has shown that the sports nutrition knowledge of collegiate athletes was improved by effective nutrition education programming and that greater levels of nutrition knowledge were associated with more optimal dietary intakes among athletes (Kunkel, Bell, Luccia, 2001). Therefore, it is important for collegiate athletes to have access to resources for nutrition guidance and are provided with accurate information, tailored to the individual, in order to produce positive eating habits. Positive eating habits for competitive athletes include: consuming adequate energy during periods of high-intensity and/or long-duration training; drinking adequate fluids to prevent dehydration; following individual macronutrient recommendations; not skipping meals; and consuming sufficient energy from a variety of foods to maintain a desirable and healthy body weight (Rodriguez et al., 2009). Regularly consuming breakfast is another positive eating habit, as it significantly improves performance by restoring the level of

liver and muscle glycogen after an overnight fast (Burke, Kiens, & Ivy, 2004). In addition to eating breakfast, frequent snacking during the day is encouraged among athletes because a positive association has been found between adequate energy intake and the number of eating occasions per day (Kirsch & von Ameln, 1981). The ADA-ACSM joint position paper (2009) suggests that athletes consume more than 3 meals and 3 snacks per day in order to maintain energy levels and meet daily carbohydrate and energy needs.

Not all athletes are able to consume a diet that meets their nutritional needs and in turn, resort to supplements with the intention of preventing deficiencies and enhancing performance (Maughan, King, & Lea, 2004). Many dietary supplements have the reputation of being harmless because they consist mainly of natural compounds and tend to be advertised as safe. However, under the Dietary Supplement and Health Education Act of 1994, "the manufacturer of a dietary supplement or dietary ingredient is responsible for ensuring that the product is safe before it is marketed" (U.S. Department of Health and Human Services, 2013). Thus, there is no FDA assurance of purity, safety, or effectiveness before it is sold. With the expanding supplement industry, supplements are readily available to athletes and are more accepted within the athletic culture (Maughan et al., 2004). Unfortunately, many athletes seek nutritional guidance from sources that may deliver inaccurate information. Without having a full understanding of the safety and efficacy of dietary supplements, collegiate athletes are vulnerable to misinformation and inappropriate recommendations, which could lead to risky side effects, health issues, or National Collegiate Athletic Association (NCAA) eligibility concerns (Froiland, Koszewski, Hingst, & Kopecky, 2004).

The current study assessed the eating habits and dietary supplement use of student athletes at a NCAA Division I university. This study focused on breakfast consumption, daily eating frequency, skipped meals, and dietary supplement use, and compared the eating behaviors and supplement use of underclassmen and upperclassmen student athletes.

Methods

Subjects

This study consisted of male and female intercollegiate athletes at a NCAA Division I university. To be eligible for this study, participants must have been enrolled as full-time students at Georgia State University and a member of an athletic team. Before classes began in August 2012, student athletes reported to the campus Sports Arena for annual pre-participation physical examinations. Athletes were asked to complete a nutrition screening questionnaire as one component of the physical examination, which was used by the nutrition staff to identify athletes at risk for poor eating habits and need for individualized nutrition counseling. The athletes read and signed an informed consent form before they completed the questionnaire. Approval for the study was obtained from the university's Institutional Review Board before data collection began.

Data Collection Instrument

Data were collected through a self-administered nutrition screening questionnaire.

Eating behaviors of the athletes were evaluated using questions about breakfast consumption (eg, "How often do you eat breakfast per week?"), meal/snack frequency, (eg, "How many times do you usually eat per day?"), and skipped meals (eg, "If you skip meals, which one are you most likely to miss?" "What is your main reason for skipping meals?"). Additionally, the questionnaire included questions about dietary supplement use, energy drink use, and nutrition topics of interest among student athletes.

Statistical Analysis

Frequency analysis was used to describe the demographic characteristics of the student athletes. Age was not normally distributed, therefore median age was calculated with set quartiles (25%, 75%). The student athletes were divided into two groups: underclassmen, which consisted of freshmen and sophomores, and upperclassmen, which were juniors, seniors, and fifth-year seniors. Differences in eating behaviors and supplement use between the underclassmen and upperclassmen were analyzed using Chi-square tests. The level of significance was set at $p<0.05$. All statistical analyses were conducted using SPSS statistical software, version 20.0.

Results

Demographic Data

The demographic characteristics of the 255 student athletes are presented in Table 1. The majority of study participants were male. Of the university's 17 athletic teams, all but 4 sports were included in the study. Student athletes were split nearly equally into the groups of underclassmen and upperclassmen.

Eating habits

In this study, the researcher defined regular breakfast consumption as breakfast eaten 5 to 7 days per week. The reported number of days per week that breakfast was consumed by underclassmen and upperclassmen athletes is shown in Table 2. Eighty-eight underclassmen (75%) and eighty-two upperclassmen (59%) reported that they ate breakfast on a regular basis. Underclassmen were significantly more likely than upperclassmen to consume breakfast regularly ($p=0.008$). A significant difference was also found when frequency of breakfast consumption was compared by group ($p=0.023$).

Frequent eating throughout the day is encouraged among athletes to ensure adequate energy levels for practice and workouts. In this study, eating three or more times per day was defined as a good eating behavior by the researcher. This included all meals and snacks. The majority of underclassmen (95%) and upperclassmen (92%) reported that they ate 3 or more times per day and no significant difference was found between the groups when eating frequencies of ≥ 3 times/day or ≤ 2 times/day were compared ($p=0.364$). However, when the number of daily eating occasions were broken down and analyzed, a significant difference was found between the two groups ($p=0.012$). Table 3 shows the athletes' reported number of eating occasions per day.

When participants were asked a question regarding skipping meals, athletes from both groups reported that they were more likely to skip a meal than to not (Table 4). Among the athletes who did skip meals, breakfast was the meal most commonly missed, and dinner was the least missed meal. No significance was found in skipped meals between the underclassmen and upperclassmen. Further analysis was conducted to examine the student athletes' main reasons for skipping meals. The majority reported

their main reason was due to a lack of time. Other commonly reported reasons for skipping meals included not being hungry, not having food available, practice conflicts, and not having enough money.

Dietary Supplement Use

The majority of both groups (73%) reported that they had previously taken or were currently taking at least one of the dietary supplements listed in the questionnaire and no significance was found. Frequency analysis was conducted to determine the reported use of each dietary supplement, and Chi-square was used to analyze significance between the groups (Table 5). Protein products (shakes, drinks, or powders) were the highest reported supplements among both groups, followed by general multivitamins and creatine. Overall, there were no significant differences for dietary supplement use between the university's underclassmen and upperclassmen athletes.

A separate question was asked regarding energy drinks (Red Bull, 5-hour energy, Jolt, etc.). A total of 45 student athletes reported that they drank energy drinks and no significance was found between groups. The athletes who drank energy drinks were asked when and why they drank energy drinks, and most reported it was to help them stay awake or to give them more energy throughout the day.

When asked which topics they would like to learn more about, 64% (80 underclassmen and 84 upperclassmen) indicated they were interested in nutrition programs for peak performance (Figure 1). Many student athletes were also interested in learning easy recipes (51%), tips for weight gain (44%), tips on eating out (42%), and how to cook (42%).

Discussion

We predicted that there would be significant differences in the eating behaviors of the two groups of athletes, with upperclassmen regularly consuming breakfast, eating more frequently throughout the day, and not skipping meals. It was presumed that since the upperclassmen had spent a greater amount of time competing on a collegiate level than the underclassmen, that they would have greater awareness of the role nutrition plays on performance and would report better eating habits. However, this was not the case; the underclassmen were found to have better eating behaviors. This could be due to the fact that many of the younger student athletes live on campus and have easy and unlimited access to the university's dining hall facilities. Also, many of the upperclassmen athletes may live off campus and have the ongoing responsibility to manage meal planning, grocery shopping, meal preparation, and food handling and storage for the first time (Ketterly & Mandel, 2012). With the increased time demands of class, schoolwork, practice, and competition, college athletes may have little time for meal preparation. Compared to a recent study, athletes from the present study had higher breakfast consumptions. Shriver, Betts, and Wollenberg (2013) reported that only 27% of the female college athletes in their sample had regular breakfast consumption, with participants consuming breakfast cereal and sausage biscuits most frequently. Stockman, Schenkel, Brown, and Duncan (2005) clearly demonstrated that breakfast consumption makes an important contribution to overall health and well-being, and suggests that the omission of breakfast may contribute to reduced cognitive function and less nutrient-dense diets. Although our study did not assess what the athletes at this university were

choosing to eat in the mornings, it might have been useful information to further understand the student athletes' eating behaviors and nutrient intakes.

Nearly one-quarter of the underclassmen and one-fifth of the upperclassmen reported they did not skip meals. However, the majority of athletes from both groups (73% and 80% respectively) expressed that they did skip meals. No statistical significance was found for skipped meals between the two groups. Among those who did skip meals, breakfast was the most frequently skipped and dinner was the least frequently skipped. This finding was consistent with previous research (Shriver et al, 2013; Stockman et al, 2005; Burke et al., 2003). In the study by Shriver et al., (2013) only 27% of the college athletes in their sample consumed a regular breakfast and the athletes consumed the largest proportion of their calories in the evening hours. This was similar to a study by Burke et al. (2003) whose athletes showed the smallest amount of daily energy consumed at breakfast (19%) and the largest proportion consumed at dinner (34%), with lunch and snacks (24% and 21%) contributing moderately to daily energy intake. Stockman et al. (2005) found that breakfast was the most frequently skipped meal among participants in their study, with a total of 26% of subjects skipping breakfast at least once during their 3-day food record. Dinner was the least frequently skipped meal among subjects.

The majority of athletes in the present study reported that their main reasons for missing meals were due to a lack of time, lack of appetite, and not having food available. These findings were similar to those of Burke et al. (2003) which stated "heavy training schedules, fear of gastrointestinal discomfort during exercise, suppressed appetite, and poor availability of foods and beverages have been identified as common reasons for

missed food and fluid intake over the day among athletes." Hinton, Sanford, Davidson, Yakushko, and Beck (2001) studied the dietary intakes and behaviors of male and female collegiate athletes and indicated that a likely factor of suboptimal nutrient intake in athletes may have to do with purposeful restriction of food consumption in order to lose weight, maintain a low body weight, or meet a weight requirement. The majority of female athletes in their study reported wanting to lose weight, and about 25% of them reported that they restricted their dietary fat or carbohydrate intake to prevent weight gain (Hinton et al., 2001). It was not reported, and therefore cannot be assumed that the female athletes in their study were skipping meals, but it is probable that intentionally restricting dietary fat or carbohydrate was linked to skipping meals or snacks. A positive finding from our study that differed from the findings of Hinton et al. (2001) revealed that skipping meals to manage weight was not a general concern for our athletes.

According to the National Study of Substance Use Trends Among NCAA College Student-Athletes, or the NCAA survey, male athletes were twice as likely to have taken weight gain products than weight loss products while in college (Bracken, 2012). The opposite was true for females, who were more likely to have used weight loss products than weight gain products while in college. On average, 6% of male and female athletes from the NCAA survey (2012) used weight loss supplements and 11% of athletes from the survey took weight gain supplements. Our study had similar findings, with 2% of underclassmen and 5% of upperclassmen who took weight loss supplements, and 10% of underclassmen and 15% of upperclassmen who used weight gain supplements.

A study by Froiland et al. (2004) showed that 11% of the Division I athletes from their study reported that they never took, nor were currently taking any form of

nutritional supplements. This left 89% that were currently or previously taking nutritional supplements (Froiland et al., 2004). Eighty-eight percent of Division I athletes from a study by Burns, Schiller, Merrick, and Wolf (2004) reported using at least one nutritional supplement, and 58% reported using two or more. Jonnalgadda, Rosenbloom and Skinner (2001) surveyed freshmen football players and found that 42% reported using some form of dietary supplements. In the present study, 85 underclassmen and 101 upperclassmen reported that they were currently or previously taking a dietary supplement. This was about three-quarters of the athletes in both classes.

Student athletes in the present study had much higher uses of protein supplements than that previously cited. Burns et al. (2004) reported that among NCAA Division I athletes, 40% of respondents consumed protein supplements. Another study that involved athletes at a Division I university revealed that 48% used protein supplements at the time the study took place (Froiland et al., 2004). The NCAA's Study of Substance Use Trends Among NCAA College Student-Athletes (2012) found that 38% of athletes surveyed used protein products while in college.

Dietary protein is required to promote growth, repair damaged tissue and cells, synthesize hormones, and for a variety of metabolic activities (Kreider & Campbell, 2009). With the multi-billion dollar dietary supplement industry constantly marketing new sports nutrition products, many student athletes buy these products instead of choosing nutrient-rich foods and fluids. According to the joint ADA-ACSM paper (2009), current evidence indicates that protein and amino acid supplements are no more effective than food when energy intake is sufficient to maintain body weight. In any discussion of protein requirements and recommendations, it is important to consider

energy intake, as it has just as much of an influence on protein requirements as protein itself. Energy balance, or the consumption of adequate energy, particularly in the form of carbohydrates, is important to protein metabolism so that amino acids are spared for protein synthesis and not oxidized to assist in meeting energy balance (Rodriguez et al., 2009).

Compared to previous studies, athletes in the present study had a standard use of multivitamins. Froiland et al. (2004) found that 47% of athletes reported taking a multivitamin supplement; 23% of collegiate freshman football players in the study by Jonnalgadda et al. (2001) used vitamins; and about 20% of participants from the NCAA survey (2012) reported taking a general multivitamin during college. Athletes in the present study reported a lower consumption of creatine than that previously cited. Burns et al. (2004) documented creatine use by 31% of their Division I university athletes; Froiland et al. (2004) found that 37% of athletes in their study had or were currently taking creatine; and 39% of male athletes from the Jacobson, Sobonya, and Ransone (2001) study reported its use. Creatine is currently the most widely used ergogenic aid among athletes wanting to build muscle and enhance recovery (Rodriguez et al., 2009). It is one of the few supplements that has sufficient evidence, and has been shown to be effective in repeated short bursts of high intensity activity in sports such as sprinting and weight lifting. The majority of ergogenic aids currently on the market, however, do not perform as claimed and have inconclusive evidence as performance enhancers. Some supplements included in the nutrition screening questionnaire of the present study that fall into this category include: amino acids, beta hydroxymethylbutyrate (HMB), ginseng (as an herbal supplement), and carnitine (as a weight loss supplement).

Products such as energy drinks may be dangerous and put athletes at risk for disqualification due to high levels of caffeine and other stimulants. Seventy-three percent of the athletes in Froiland et al. (2004) reported using energy drinks, and 44% of the respondents in the NCAA survey (2012) of college student athletes reported drinking energy drinks while in college. The athletes in the present study reported a much lower consumption of energy drinks; eighteen percent checked "yes" when asked if they drink energy drinks. The lower number of responses in the present study may have been due to 1) the researchers' definition of "energy drink" and 2) the way the question was phrased. First, the researchers in the present study considered energy drinks to be beverages such as Red Bull, 5-hour energy, Jolt, and Monster, which contain large doses of caffeine and other stimulants. However, Froiland et al. (2004) considered Gatorade, Powerade, All Sport, and Red Bull as some examples of energy drinks in their study, which is what likely generated the higher response rate. Second, the question in our nutrition questionnaire was stated "do you drink energy drinks?", whereas the NCAA survey (2012) phrased their question, "have you taken energy drinks while in college?" The former likely gave the reader the impression that we were asking about regular energy drink consumption, and the latter seemed to include both frequent and infrequent consumption.

A general limitation to cross-sectional studies is that is does not provide definite information about cause and effect relationships. These studies do not consider what happened before or after, but are often used to make inferences about possible relationships or to gather preliminary data to support further research. Therefore we cannot confidently explain why the underclassmen in this study had slightly better eating

behaviors than the upperclassmen. An observational longitudinal study, where researchers conduct several observations of the same subjects over time, could be beneficial for detecting changes in eating behaviors. Another limitation of this study was that when analyzing data for the eating behaviors and supplement use, we did not adjust for gender differences of the two groups, which could indeed be a confounding factor. In addition, this study includes athletes from only one urban university campus. Therefore, the eating habits and supplement use may differ from students in other types of university settings. Despite these limitations, the outcomes of this study can be used to develop effective nutrition education plans for student athletes at this university.

Conclusions

When responses from the nutrition questionnaire were compared, the underclassmen athletes displayed overall better eating habits than the upperclassmen but dietary supplement use was the same in both groups. Findings from this study indicate that all student athletes at this university could use improvements on their eating habits and could benefit from learning ways to obtain the performance enhancement they desire from choosing the right food and fluids, without supplements. In the future, it may be useful to distribute a dietary assessment instrument, such as a 3-day food log, with the nutrition screening questionnaire to athletes. It is possible that the findings would benefit student athletes by putting into perspective how much they are consuming in relation to the recommended energy and nutrient amounts. This information would also be beneficial to the sports nutrition team to generate nutrition interventions that increased

awareness of basic sports nutrition recommendations, and ways to optimize energy intakes and nutritional status of for peak performance.

The findings of this study suggest the need for further investigations related to dietary behaviors and supplement use of collegiate athletes. Learning more about the types of supplements collegiate athletes are using, the prevalence of use, and the athletes' knowledge and perceived benefits of particular supplements would help the sports nutrition staff to properly educate the athletes. Although our study did not examine the athletes' knowledge of nutritional supplements, previous literature demonstrates that the role of vitamins and protein in performance appear to be unclear to many collegiate athletes (Rosenbloom, Jonnalagadda, & Skinner, 2002; Burns et al., 2004; Jacobson et al., 2001). It is likely that athletes in the present study would benefit from education on how vitamins and minerals affect performance, the role of protein as an energy source and its role in building muscle, and techniques on how to meet nutrient recommendations through food and fluid choices.

Many of the athletes indicated that they would like to learn more about programs for peak performance, easy to make recipes, and weight gain. This information identified popular nutrition topics of interest among athletes and could be useful for the sports nutrition team in guiding education sessions and developing education material. Adding a registered dietitian to the Sports Medicine Department could potentially be a vital component of the student athletes' performance and injury rehabilitation, as well as the source of sound advice on food choices and the benefits of good nutrition in sports and in daily life.

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Table 1. Demographic characteristics of the participating student athletes

	N (%)
Gender	
Male	170 (67)
Female	85 (33)
Median Age in years (25%, 75%)	20 (18, 21)
Year in school	
Freshman	69 (27)
Sophomore	48 (19)
Junior	70 (27)
Senior	60 (24)
Fifth-year	8 (3)
Class	
Underclassmen	117 (46)
Upperclassmen	138 (54)
Sport	
Baseball	34 (13)
Men’s Basketball	15 (6)
Football	89 (35)
Men’s Golf	8 (3)
Men’s Soccer	23 (9)
Men’s Tennis	1 (0.5)
Women’s Basketball	13 (5)

Women's Golf	6 (2)
Sand Volleyball	12 (5)
Softball	18 (7)
Women's Tennis	4 (2)
Women's Track & Field	19 (7.5)
Volleyball	13 (5)

Table 2. Reported breakfast consumption per week and comparison by group

Breakfast Consumption	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
Every day (7 days/wk)	55 (47)	58 (42)	11.364	0.023
5-6 days/wk	33 (28)	24 (17)		
2-4 days/wk	24 (21)	52 (38)		
1 day/wk	2 (2)	3 (2)		
Never	3 (3)	1 (1)		

Table 3. Reported eating occasions per day by athletes and comparison by group

Times eat per day	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
1-2 times/day	6 (5)	11 (8)	11.010	0.012
3 times/day	33 (28)	59 (43)		
4-5 times/day	60 (51)	60 (44)		
>5 times/day	18 (15)	8 (6)		

Table 4. Prevalence of skipped meals among student athletes and comparison by group

Most likely missed meal	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
Do not skip meals	32 (27)	28 (20)	2.719	0.437
Breakfast	58 (50)	72 (52)		
Lunch	25 (21)	37 (27)		
Dinner	2 (2)	1 (1)		

Table 5. Dietary supplement usage by student athletes and comparison by group

Dietary Supplement	Underclassmen N (%)	Upperclassmen N (%)	$\chi 2$	P
General multivitamin/mineral	44 (38)	52 (38)	0.000	0.990
Iron	6 (5)	11 (8)	0.822	0.364
Creatine	22 (19)	36 (26)	1.912	0.167
Protein shakes, drinks, or powders	62 (53)	82 (59)	1.065	0.302
Amino acids	13 (11)	17 (12)	0.089	0.765
HMB	1 (1)	2 (1)	0.193	0.661
Andro/norandro	0 (0)	3 (2)	2.574	0.109
Calcium	16 (14)	20 (15)	0.035	0.852
Herbal supplements	2 (2)	9 (7)	3.553	0.059
Glucosamine/chondroitin	3 (3)	9 (7)	2.212	0.137
Weight loss supplements	2 (2)	7 (5)	2.103	0.147
Weight gain supplements	12 (10)	21 (15)	1.383	0.240
Other	2 (2)	2 (2)	0.028	0.868
Energy Drinks	24 (21)	21 (15)	1.164	0.281

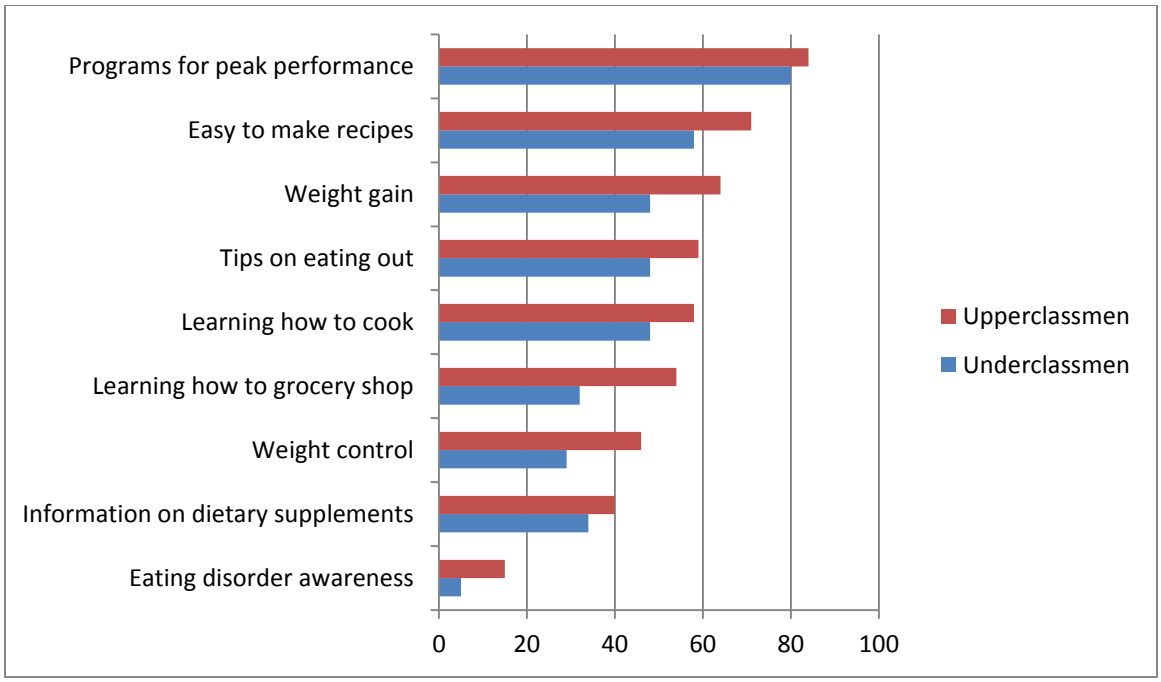

Figure 1. Nutrition topics of interest among student athletes. Both groups were especially interested in learning about programs for peak performance, easy recipes, and tips for weight gain. No significant difference was found.

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APPENDICES

Appendix A

Nutrition Screening Form for Georgia State University Female Athletes 2012-2013

1. Name:_____

Email:_____

2. Sport:_____

3. Position/Event (if applicable):_____

4. Age: _____years

5. Gender: ___Male ___Female

6. Year in school

___ Freshman ___ Sophomore

___ Junior ___ Senior

___ Fifth year senior

7. Do you **avoid (not eat)** any of the following foods? **(Check all that apply)**

____ Red meat (beef, pork) ____ Poultry (chicken, turkey)

____ Fish ____ Dairy (milk, cheese)

____ Vegetables ____ Fruits

____ Fried Foods ____ Breads

____ Grains (pasta, rice) ____ Fast foods

____ Sweets (candy, deserts) ____ Alcohol

____ Fats/oils (mayo, salad dressings, butter, margarine)

8. Are you currently a vegetarian?

____ No

____ Yes

If yes, what type of vegetarian?

____ Vegan (eat no animal foods)

____ Lacto-ovo vegetarian (eat cheese, yogurt, milk and eggs)

____ Other, please describe

_____

9. Please indicate which dietary supplements you have taken in the past or are currently taking.

	(Check all that apply)	
	Taken in the past	**Currently take**
General multivitamin/mineral	_____	_____
Iron	_____	_____
Creatine	_____	_____
Protein shakes, drinks or powders	_____	_____
Amino acids	_____	_____
HMB	_____	_____
Andro/Norandro	_____	_____
Calcium	_____	_____

Herbal supplements (Echinacea, Garlic, Ginseng, etc.)	_____	_____
Glucosamine/Chondroitin (for joints)	_____	_____
Weight loss supplements	_____	_____
Weight gain supplements	_____	_____
Other, specify_____	_____	_____

10. Do you know which dietary supplements are banned or restricted by the NCAA?

___Yes ___No ___Some but not all

11. Do you drink energy drinks? (ex, Red Bull, 5-hour energy, Jolt, etc.)

___ Yes ___ No

If yes, when/why do you drink energy drinks? (check all that apply)

___ Before practice or games

___ During practice or games

___ After practice or games

___ To help me stay awake

___ To give me more energy throughout the day

12. How often do you eat breakfast?

___ every day (7 days a week)

___ 5 to 6 days a week

___ 2 to 4 days week

___ once a week

___ never

13. How many times do you usually eat per day (including meals and snacks)?

____ 1 to 2 times per day

____ 3 times per day

____ 4 to 5 times per day

____ More than 5 times per day

14. If you skip meals, which one are you most likely to miss?

____ I do not skip meals

____ Breakfast

____ Lunch

____ Dinner

15. What is your main reason for skipping meals? **(Choose all that apply)**

____ I do not skip meals

____ Lack of time

____ Food not around

____ Practice conflicts with meal time

____ Not hungry

____ To manage my weight

____ Not enough money

____ Other

16. What is your favorite fast food restaurant? **(Select your top three)**

____ Burger King

____ Chick-Fil-A

____ McDonalds

____ Pizza (Pizza Hut, Dominoes, Papa John's, etc)

____ Subway

____ Taco Bell

____ Wendy's

____ Zaxby's

_____ KFC

_____ Other (list:_____)

____ I never eat fast food

17. Listed below are several restaurants around campus; please check the places that you have eaten or are likely to eat this year.

____ Broad Street Café

____ Ginseng Café

____ Mama Mia Pizza

____ Moe's

____ Reuben's Deli

____ Roly Poly

____ Sensational Subs

____ Smoothie King

____ Subway

____ Sweet Auburn Market

____ Tin Drum Asian Café

____ Willie's

____ Waffle House

18. If you could improve your nutrition, what changes would you make? (Check all that apply)

____ Eat more often

____ Eat more calories

____ Eat less often

____ Eat fewer calories

____ Eat a greater variety of foods

____ Eat healthier foods

____ Eat less fast food

____ Eat more fruits and vegetables

____ Learn more about good nutrition

____ Cook for myself

____ Eat out less

____ Get better access to healthy foods on campus

____ Get better access to healthy foods while traveling for competition

____ Time my eating around practice and/or competition

____ I do not need to improve my nutrition

19. How would you describe your eating habits?

___ Good

___ Fair

___ Poor

20. How important would you say that good nutrition is to sports performance?

___ Very important

___ Somewhat important

___ Not important

___ Don't know

21. Overall, how satisfied are you with the physical appearance of your body?

(Check one)

____ Very satisfied ____ Somewhat satisfied

____ Somewhat dissatisfied ____ Very dissatisfied

22. Do you have any personal goals for body composition? ___ Yes ___No

If Yes, which ones? **(Check all that apply)**

___Gain lean mass/weight gain

___ Decrease body fat

___Lose weight

___None

23. Please indicate the topics you would like to learn about by checking "Yes." If you are not interested in learning about a topic, mark "no."

Nutrition programs for peak performance ____ Yes ___ No

Weight control (mainteance or weight loss) ____ Yes ___ No

Weight gain ____ Yes ___ No

Eating disorder awareness ____ Yes ___ No

Learning how to grocey shop ____ Yes ___ No

Learning how to cook ____ Yes ___ No

Easy to make recipes ____ Yes ___ No

Tips on eating out ____ Yes ___ No

Information on dietary supplements ____ Yes ___ No

Other?

_____

24. What do you think would help you meet your nutrition needs as a student-athlete?

(Check all that apply)

____ Being able to meet with a sports dietitian/nutritionist in the training room

____ Posting nutrition information to a sports nutrition Facebook Fan page

___ Having short nutrition information sessions before or after practice

____ Posting information to the bulletin board in the training room

____ Leaving nutrition handouts in the training room

____ Posting information to a sports nutrition website through athletics

____ Leaving recipes in the training room

25. Have you ever been diagnosed with iron deficiency anemia? ___ Yes ___ No

Thanks for your participation!

Designed for Georgia State University athletes by Chris Rosenbloom, PhD, RD, CSSD.

Some items were taken from a recent

NCAA survey of nutrition and student athletes.

26. How old were you when you had your first menstrual period? _____yrs (usually a girl is 13 in the 7th grade)

27. How many periods have you had in the last 12 months (August 2011-August 2012)?

_____

(If you are taking birth control that limit the number of monthly cycles, like Seasonale or Seasonique, check here _____)

28. Do your periods change with changes in your training regimen? ___Yes ___No

29. Have you ever gone for more than 3 months without having a menstrual period?

____ Yes _____No

If yes, were you participating in sports at the time?

___ Yes _____No

If yes, how long did you go without menstruating?

____ months

Did you see a physician? ___Yes ___No

If yes, what did he or she tell you?

_____

Thanks for your participation!

Designed for Georgia State University athletes by Chris Rosenbloom, PhD, RD, CSSD.

Some items were taken from a recent

NCAA survey of nutrition and student athletes.

Appendix C

Georgia State University

Division of Nutrition

Informed Consent

Title: Nutrition screening of collegiate athletes

Principal Investigator: Christine Rosenbloom, PhD, RD, CSSD

Sponsor: Not applicable

I. Purpose:

You are invited to participate in the completion of a nutrition questionnaire as part of your pre-participation physical for Georgia State University. The purpose of the questionnaire is to collect information on your current eating habits, the use of dietary supplements, your goals for healthy eating, and your interest in learning more about nutrition. Additionally, females will be asked about menstrual history because this relates to bone health. You are invited to participate because you are a Georgia State athlete. All athletes will be asked to complete the nutrition screening questionnaire. Participation will require 5 to 10 minutes of your time during your pre-participation physicals schedule in June, July, and August, 2012 with additional physical taking place in January, 2013.

II. Procedures:

If you decide to participate, you will asked to complete a brief questionnaire. Information asked will include your name, age, if you are a male or female, your sport and position played. You will also be asked questions about your eating habits, dietary supplement use, and interest in learning more about nutrition for sport. The questionnaire will only take about 5 to 10 minutes to complete.

During the pre-participation physical, you will interact with Dr. Chris Rosenbloom. A volunteer nutrition graduate student may also be present to assist with completing the survey.

III. Risks:

You will not have any more risks than you would in a normal day of life.

IV. Benefits:

Participation in this study may not benefit you personally. Overall, I want to establish a data base of nutrition information on athletes so we can review the nutrition habits and nutrition interest of athletes from many sports. Information gathered from the screening questionnaire can help me to make a nutrition

education plan for Georgia State athletes.

V. Voluntary Participation and Withdrawal:

Participation in the screening is voluntary. You have the right to not compete the questionnaire. You may skip questions or stop participating at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled as a Georgia State athlete.

VI. Confidentiality:

We will keep your records private to the extent allowed by law. If the data are used at later date for publication, you will not be identified in any way. Data will only be reported as mean scores for groups of athletes (i.e., men versus women or freshman and sophomores versus junior and seniors or power and strength sports versus endurance sports). At the time the survey is completed, a graduate student may have access to the questionnaire as it is being completed, but not after the surveys have been collected. Only Dr. Rosenbloom will have access to the information you provide. It will be stored in a locked cabinet in the faculty office of Dr. Rosenbloom. Information entered into the computer for analysis will not use your name, only an assigned number that Dr. Rosenbloom will be able to identify. You will not be identified personally.

VII. Contact Persons:

Call Dr. Chris Rosenbloom at (404) 358-4889 or crosenbloom@gsu.edu if you have questions about this questionnaire. If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at 404 413-3513 or svogtner1@gsu.edu.

VIII. Copy of Consent Form to Subject:

We will give you a copy of this consent form to keep.

If you are willing to volunteer for this research, please sign below.

_____ _____

Participant Date

__Christine Rosenbloom _____ ____June 3, 2012_____

Researcher Date