

Nutrition Knowledge and Interest of Collegiate Athletes at a Division I University

Gilis JT¹, Anderson DL^{2,*}, Morgan AL² and Hamady CM²

¹The Ohio State University, Columbus, Ohio

²Bowling Green State University, Bowling Green, Ohio

*Corresponding author: Anderson DL, Bowling Green State University, Bowling Green, Ohio; Email: dawna@bgsu.edu

Received Date: September 18, 2014 Accepted Date: October 09, 2014 Published Date: October 13, 2014

Citation: Gilis JT, et al. (2014) Nutrition Knowledge and Interest of Collegiate Athletes at a Division I University. J Food Nutr 1: 1-7.

Abstract

This study surveyed student-athletes on 17 intercollegiate teams at a Midwestern university to determine 1) differences in nutrition knowledge among sports, gender, and academic years; 2) differences in nutrition topic interest between sports and gender; and 3) possible correlations between perceived and actual nutrition knowledge. ANOVA and Tukey's post-hoc analysis were used to compare survey responses, and frequencies and means were used to measure level of interest in specific nutrition topics. Pearson correlations determined relationships between perceived and actual nutrition knowledge, and a two-sample t-test compared enrollment in a nutrition course with overall nutrition knowledge. The level of significance was set at $p \leq 0.05$. Of 319 student-athletes surveyed, nutrition knowledge was higher in female student-athletes compared to male student-athletes ($p = 0.000$), and nutrition knowledge was highest in women's gymnastics and lowest in men's football and basketball compared to other teams ($p = 0.000$). No significant difference in nutrition knowledge was found between academic years. Student-athletes, who had taken at least one nutrition course, had increased nutrition knowledge ($p = 0.000$). Male student-athletes indicated that they were more likely ($p = 0.000$) to use the services of a registered dietitian than female student-athletes although no significant differences were found between sports. Overall, 56% of the student-athletes indicated that they would utilize a registered dietitian at least once a week if one was available to them. "Pre- and post-workout meals," "healthier fast food alternatives," and "energy requirements" were topics of highest interest. Females were most interested in "cheap, healthy meals" and "safe, healthy weight loss." Males were most interested in "sports drinks" and "muscle building." No correlations were found between perceived and actual nutrition knowledge ($r = 0.093$). Study findings suggest that nutrition education interventions for student-athletes should be tailored to optimize information retention and improve athletic performance and health.

Keywords: Sports nutrition; Nutrition knowledge; Nutrition interest; Collegiate athletes

Introduction

It is well-documented that the majority of collegiate athletes lack the nutritional knowledge required to optimize athletic performance [1-10]. Furthermore, athletes in the National Collegiate Athletic Association (NCAA) have been reported to have deleterious attitudes and behaviors with regard to proper nutrition [2-6,8,11,12]. Few studies, however, have determined with what nutritional information collegiate athletes would be most interested in learning. Collegiate athletic programs could potentially benefit greatly through the incorporation of adequate nutrition in the athletes' diets, but without first understanding what the athletes want, and more

importantly, need to know, valuable education is unattainable. In addition, Rockwell, Nickols-Richardson, and Thye concluded that further nutrition education requirements might be necessary for coaches and athletic trainers [13]. With coaches being an integral part in the collegiate athlete's athletic career, discovering the nutrition knowledge of these "coaches and trainers" may be crucial in assisting the development of nutritionally-sound dietary behaviors.

Due to the increased physical demand of collegiate athletic programs, collegiate athletes have greater, specific nutritional requirements. The American College of Sports Medicine (ACSM) recommends that, as a result of high-intensity exercise, athletes should consume 150% more water than what was lost in sweat to reduce the risk of dehydration [14]. Additionally, in order to ensure proper nutrition for those participating in a weight training regimen, consuming protein

before a bout of anaerobic training, specifically weight lifting, can assist in muscle recovery and consequently increase overall athletic performance [14]. Women, in particular, may need improved nutrition, such as an increased consumption of iron-containing foods or even iron supplementation, due to their risk for developing iron-deficiency anemia as a result of menses [14,15]. Additionally, female athletes have greater risk for developing osteoporosis later in life from insufficient calcium consumption [14,15]. Furthermore, Gabel suggested that female athletes commonly seen with amenorrhea, such as runners and other endurance athletes, might have a predisposition to the development of heart disease [15]. These considerations only begin to discuss the nutritional needs of collegiate athletics and the importance of tailored nutrition education in collegiate athletic programs.

In order for collegiate student-athletes to receive accurate and beneficial information on nutrition and nutrition-related practices, it is essential to first understand what the athletes need and want to know. In addition, there is no data available to determine what form of nutrition education is most relevant to individual collegiate athletic teams. Without first determining collegiate athlete interest with regard to nutrition-related topics and those methods that they would prefer to be informed about these topics, future nutrition education interventions are without guidance. Furthermore, a study to ensure the successful education of collegiate athletes, by determining their current and desired levels of nutritional knowledge, is critical. As collegiate athletics grow, student-athletes will continue to pursue the next level of performance through any means necessary, without regard for individual well-being. Improper nutritional advice can often provide athletes with what they believe to be necessary to succeed and surpass their competition. Without valid education on this crucial aspect required to achieve optimal performance, collegiate athletic programs run the risk of practicing unhealthy behaviors that have the potential to cause serious complications for the athletes and their futures in athletics. By understanding what NCAA student-athletes need and want to know, an apposite nutrition education program can build athletic prominence, while also maintaining overall health.

The major objectives of this study, which were achieved, with regard to student athletes were to determine: (1) how nutritional knowledge of athletes vary between sport, gender, and academic year; (2) how nutritional interest of athletes vary between sport and gender; and (3) how perceived nutritional knowledge correlates with actual nutritional knowledge.

Methods

For the purposes of this study, student-athletes of 17 intercollegiate teams were surveyed at a Midwestern university. The athletes were provided with a paper survey containing several multiple-choice questions regarding nutrition-related topics. After compiling the collected data, a statistical analysis, using several different tests, was conducted to evaluate the results. The study was approved through the Human Subjects Review Board (Project H11T240GE7).

Participants and Recruitment

The 17 intercollegiate athletic teams were evaluated using a survey to determine the nutritional knowledge of the collegiate athletes. There were seven men's teams (basketball, football, baseball, ice hockey, golf, soccer, and cross country) and ten women's teams (basketball, gymnastics, volleyball, golf, soccer, cross country/track and field, softball, swimming, and tennis) that participated, totaling 319 student-athletes surveyed (approximately 75% of the student-athlete population), ranging in gender and academic year. All subjects were 18 years of age or older. Out of the 319 subjects surveyed in this study, 98 (31%) were in their first year, 98 (31%) were in their second year, 78 (24%) were in their third year, 40 (13%) were in their fourth year, and three (1%) were in their fifth year or greater of study. Approximately 57% of the subjects were male, while approximately 43% were female.

The student-athletes of any particular team were surveyed after first receiving the permission of their head coach, which was attained through email communication. If a particular team was unable to be reached through their head coach, the team was surveyed before or after a team lift during a pre-scheduled strength and conditioning session. The participants then received an informational letter containing information on the following topics: purpose, procedure, voluntary nature, confidentiality, and contact information. Those that chose to complete the survey did not require submission of a signed informed consent form due to the nature of the research being no more than minimal risk and involving no procedures requiring written consent; therefore, implied consent was obtained by completion of the survey. In order to provide incentive to the athletes for completion of the survey, all the athletes that choose to participate were entered into a raffle to receive one of seventeen \$10 gift cards to a grocery store.

Instrument

The paper survey for the collegiate athletes consisted of 18 multiple-choice/ranking questions that required the participant to either indicate their choice with an "X" to the left of their selection or circle their level of interest for the topic provided on a scale from one to five. The question content covered nutrition-related coursework, perceived nutrition-related knowledge, nutrition knowledge, nutrition topics of interest, nutrition education preferences, projected registered dietitian use, participating sport, gender, and academic year. Specifically for the nutrition knowledge portion, if more than one answer was chosen for a question that had only one correct choice, the question was marked as incorrect.

All survey questions were created for this study and were developed to cover a range of nutrition knowledge levels (e.g. general, advanced, sports nutrition). Other topics included in the survey were incorporated after analysis of desired outcomes from the study. Two Food and Nutrition faculty members, one that is a registered dietitian, and a Human Movement, Sport, and Leisure Studies professor measured face and content validity through the review of the instrument.

The collegiate athlete survey was administered to the athletes at individual team meetings per sport throughout the Fall 2011 and Spring 2012 semesters, from August to March. The survey was collected in person, providing the student-athletes with

ample time to complete all questions, approximately 5-10 minutes.

Data Analysis

The data collected was analyzed using Minitab 16® using several descriptive statistics. These statistics included: Pearson correlation to test the correlation between perceived and actual nutrition knowledge, two-sample t-test to measure coursework effect on overall nutrition knowledge, frequency in the determination of percentage of subjects that chose a particular option for question eight, mean to measure the average level of interest for nutrition topics, and ANOVA tests to compare the differences between sports for nutrition knowledge, registered dietitian use, nutrition coursework, and several others. With regard to the ANOVA tests, specifically, Tukey post-hoc analysis was used to determine statistical significance between groups. Statistical significance was determined at $p \leq 0.05$.

Results

Consistent with previous research [1-10], this study found that nutrition knowledge was frequently deficient regardless of sport, gender, or academic year. Although deficiency with regard to nutrition-related knowledge was present, it was not universal. Out of the 14 nutrition knowledge questions posed to the student-athletes, the highest value scored by any athlete was 12, which was seen in seven of the 17 teams surveyed. However, when considering statistical significance, women's gymnastics had statistically significant higher nutrition knowledge than any other team surveyed ($p = 0.000$) (Table 1). Conversely, men's football and men's basketball showed statistically significant lower scores than the other 15 intercollegiate athletic teams surveyed, indicating that these teams may need greater nutrition education than other teams ($p = 0.000$) (Table 1). Furthermore, the female student-athletes tested

Sport	Nutrition Knowledge Score
Basketball (M) (n = 14)	6.6 $\pm$ 2.0 ^b
Basketball (W) (n = 15)	8.7 $\pm$ 1.8 ^a
Football (M) (n = 84)	7.5 $\pm$ 2.1 ^b
Baseball (M) (n = 25)	7.9 $\pm$ 1.9 ^{ab}
Ice Hockey (M) (n = 25)	9.1 $\pm$ 1.6 ^{ab}
Gymnastics (W) (n = 13)	9.9 $\pm$ 1.4 ^a
Volleyball (W) (n = 11)	8.1 $\pm$ 2.1 ^{ab}
Golf (M) (n = 8)	7.6 $\pm$ 2.1 ^{ab}
Golf (W) (n = 7)	9.1 $\pm$ 1.9 ^a
Soccer (M) (n = 17)	7.9 $\pm$ 1.6 ^{ab}
Soccer (W) (n = 29)	8.7 $\pm$ 1.2 ^a
Cross Country (M) (n = 11)	9.2 $\pm$ 1.9 ^a
CC/Track & Field (W) (n = 26)	9.2 $\pm$ 1.8 ^a
Softball (W) (n = 11)	7.6 $\pm$ 2.0 ^{ab}
Swimming (W) (n = 16)	8.4 $\pm$ 1.9 ^{ab}
Tennis (W) (n = 7)	9.4 $\pm$ 1.4 ^{ab}

Table 1: Average total nutrition knowledge score of student-athletes per sport (mean $\pm$ SD)*

*Maximum score = 14

**Means with different superscripts are significantly different at $p < 0.05$.

***M = men's sport, W = women's sport

significantly higher with regard to nutrition knowledge than male student-athletes ($p = 0.000$). There was no significant difference in nutrition knowledge noted between academic years, indicating that greater levels of education do not significantly affect nutrition knowledge.

When considering only the nine "general nutrition knowledge" questions that were posed to the student-athletes, nutrition-related knowledge scores were still the highest among the gymnastics team. Remaining consistent with the overall nutrition-related knowledge scores, the men's football team scored significantly lower than the other teams surveyed, along with women's softball, which had the lowest general nutrition knowledge score. Regarding gender, females still scored significantly higher on the general nutrition knowledge questions than males ($p = 0.000$), while academic year continued to show no relationship towards nutrition-related knowledge. Within the nutrition knowledge questions, three "advanced nutrition knowledge" questions were posed. All teams surveyed scored poorly on these questions, illustrating that nutrition-related knowledge is not more advanced in any one particular sport, gender, or academic year. A noteworthy phenomenon did occur, however, with the administration of these questions, with regard to one question, which asked, "Which of the following provides the most carbohydrate?" The correct answer was "One cup of regular ice cream," providing 30 grams of carbohydrate; however, 92% of the student-athletes, 294 out of 319, incorrectly chose "One cup pasta," which contains one-third fewer grams of carbohydrate. Only 1.6% of the student-athletes, 5 out of the 319 surveyed, correctly answered this question. This finding suggests that the vast majority of student-athletes may not fully understand sources of carbohydrates, possibly negatively affecting their diet, and consequent athletic performance.

When considering correlations between nutrition coursework and nutrition-related knowledge, it was noted that, although the majority of student-athletes, 84%, did not take an "Introduction to Human Nutrition course at the collegiate level," there was a significant difference in nutrition-related knowledge in those that had completed this coursework ($p = 0.000$). Furthermore, there was no significant difference in nutrition-related knowledge when considering the total number of courses taken at the collegiate level, which had discussed the topic of nutrition. Therefore, those that even had four or more classes discussing nutrition still did not score significantly higher on the nutrition knowledge questions than those that had one or less courses discussing the topic. For this reason, encouragement towards greater collegiate nutrition education through coursework may be ineffective at increasing nutrition-related knowledge, therefore reducing the probability of optimizing athletic performance in collegiate student-athletes.

After statistical analysis, it was discovered that male athletes were significantly more likely to use a registered dietitian more frequently than female athletes ($p = 0.000$). This finding was reinforced when the use of a registered dietitian was compared to sport, discovering that the most likely sports to use the registered dietitian on a more frequent basis included football and baseball, male sports, while tennis and softball, female sports, were least likely. However, it is to be noted that

there was no statistically significant difference in utilization of a registered dietitian between any sports, regardless of gender; it was only through comparison to gender alone that statistical significance was found ($p = 0.000$). This has high practical significance particularly because the male athletes were found to have lower nutrition-related knowledge compared to females, while also being more willing to visit a registered dietitian. It may be assumed, therefore, that males, due to their personal understanding towards a lack of nutrition-related knowledge, would be compensating by utilizing a registered dietitian more frequently; however, since males did not have any significant difference in perceived nutrition knowledge from females, this is unlikely. Overall, 56% of the student-athletes stated that they would utilize a registered dietitian once a week or greater if one was made available to them (Figure 1).

Through the analysis of perceived nutrition knowledge per individual, it was discovered that there was no significant difference in perceived nutrition knowledge when compared to actual nutrition knowledge, sport, gender, or academic year. It was hypothesized that student-athletes, particularly at the collegiate level, would be able to accurately assess their own knowledge level related to nutrition; however, there was no significant correlation found between perceived and actual nutrition knowledge in the athletes surveyed ($r = 0.093$) (Figure 2).

A major objective of this study was to determine the level of interest within each sport or gender with regard to

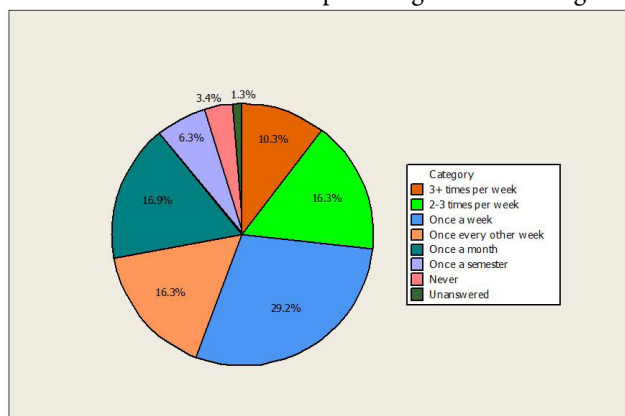


Figure 1: Projected Use of registered dietitian by collegiate athletes

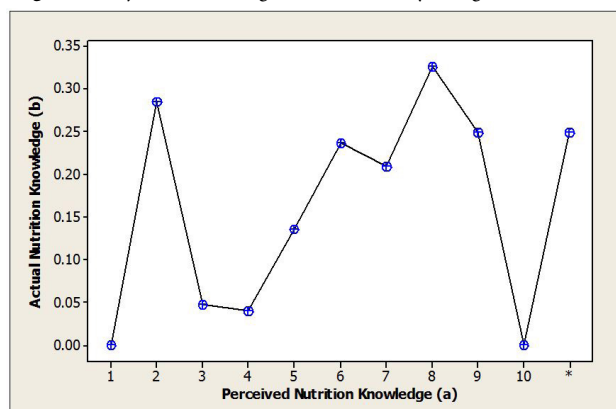


Figure 2: Comparison of perceived and actual nutrition knowledge in collegiate athletes : (a) Perceived Nutrition Knowledge value as indicated by participant on survey instrument (1 = Not knowledgeable at all, 10 = Very knowledgeable, and * = unanswered).

(b) Actual Nutrition Knowledge value is shown as the mean percentage of nutrition knowledge questions answered correctly on survey instrument.

nutrition-related topics in an effort to individualize nutrition education interventions for a given subpopulation. The topics of interest that were proposed to the subjects within this study were the following: sports drinks; energy drinks; protein supplements; pre- and post-workout meals; energy requirements; general nutrition; cheap, healthy meals; healthier fast food alternatives; muscle building; and safe, healthy weight loss. Concerning gender, specifically, varying levels of interest were noted between males and females. Females were found to have higher levels of interest in the topics of pre- and post-workout meals; cheap, healthy meals; and safe, healthy weight

Topic of Interest	Male (n = 184)	Female (n = 135)
Sports Drinks	3.9 ± 1.1	3.5 ± 1.2
Energy Drinks	2.8 ± 1.4	2.6 ± 1.5
Protein Supplements	3.7 ± 1.4	2.8 ± 1.4
Pre-Post Workout Meals	4.2 ± 0.9	4.3 ± 1.0
Energy Requirements	3.8 ± 1.0	4.0 ± 1.0
General Nutrition	3.7 ± 1.0	4.2 ± 0.9
Cheap, Healthy Meals	3.7 ± 1.1	4.3 ± 1.0
Healthier Fast Food Alternatives	3.7 ± 1.2	3.9 ± 1.3
Muscle Building	4.3 ± 0.9	3.6 ± 1.2
Safe, Healthy Weight Loss	3.1 ± 1.5	4.1 ± 1.3

Table 2: Nutrition topics of interest to student-athletes per gender (mean ± SD)*

*1 = low interest, 5 = high interest

loss compared to the other topics (Table 2). Alternatively, males ranked sports drinks, pre- and post-workout meals, and muscle building as the most interesting subjects compared to the others (Table 3). Both genders were equally as interested in learning more about pre- and post-workout meals, energy requirements, and healthier fast food alternatives, while neither group showed much interest towards the topic of energy drinks. Pre- and post-workout meals and energy requirements are topics of interest that are crucial for all athletes to understand in an effort to optimize athletic performance and gain a competitive edge; therefore, it is beneficial that both genders stated an equal level of interest in these topics. An equal interest in healthier fast food alternatives was also predictable due to the social environment of the division I university under review. Due to the high prevalence of fast food establishments in the area, as well as the low income of most collegiate athletes, the inclusion of this topic in future nutrition education interventions may prove to be highly advantageous. Interest differences by sport were also analyzed for assistance in the development of nutrition education interventions per team. Overall, “pre- and post-workout meals” was shown to be of high interest to 13 out of 17 collegiate athletic teams; therefore, signifying it as a topic to be addressed in future education interventions.

Understanding what collegiate athletes are most interested in learning about is only one component of a bigger picture. The other component is to determine with which educational methods they are most inclined to participate. When preferred methods for nutrition education interventions were analyzed by gender, female athletes found group sessions and individual

Topic of Interest	Sports Drinks	Energy Drinks	Protein Suppl.	Pre-Post Meal	Energy Req.	Gen. Nutr.	Cheap/ Healthy Meal	Fast Food Alt.	Muscle Build.	Safe Wt. Loss
Golf (M) (n = 8)	3.6 ± 0.9	2.8 ± 0.7	3.4 ± 1.2	4.3 ± 0.7	3.6 ± 0.9	3.8 ± 1.0	3.9 ± 1.1	3.5 ± 1.3	4.0 ± 0.9	3.6 ± 1.4
Golf (W) (n = 7)	3.4 ± 1.0	2.4 ± 1.3	2.7 ± 1.7	4.7 ± 0.5	3.7 ± 1.0	4.7 ± 0.5	4.6 ± 0.8	4.3 ± 1.1	3.9 ± 0.7	4.6 ± 1.1
Soccer (M) (n = 17)	3.9 ± 1.1	3.2 ± 1.5	3.8 ± 1.3	4.2 ± 0.8	4.2 ± 0.9	4.2 ± 0.7	3.9 ± 1.3	3.5 ± 1.6	4.4 ± 0.9	3.7 ± 1.3
Soccer (W) (n = 29)	3.9 ± 1.0	2.9 ± 1.4	2.5 ± 1.5	3.9 ± 1.0	3.9 ± 0.8	4.1 ± 0.8	4.4 ± 0.9	4.0 ± 1.2	3.2 ± 1.2	4.2 ± 1.1
Cross Country (M) (n = 11)	4.1 ± 0.8	2.3 ± 1.6	3.1 ± 1.8	4.3 ± 0.9	4.2 ± 0.9	3.6 ± 1.2	4.1 ± 0.7	3.7 ± 1.4	4.4 ± 0.9	2.5 ± 1.6
CC/Track & Field (W) (n = 26)	4.0 ± 0.9	2.9 ± 1.6	3.1 ± 1.5	4.6 ± 0.7	4.2 ± 1.0	4.5 ± 0.8	4.5 ± 1.0	3.7 ± 1.3	3.9 ± 1.3	3.5 ± 1.7
Softball (W) (n = 11)	2.9 ± 1.3	2.1 ± 1.5	2.4 ± 1.4	3.7 ± 1.0	3.4 ± 1.3	3.6 ± 1.1	3.8 ± 1.3	3.1 ± 1.5	3.5 ± 1.7	4.4 ± 1.3
Swimming (W) (n = 16)	3.4 ± 1.9	2.6 ± 1.4	3.2 ± 1.1	4.6 ± 0.6	3.9 ± 1.2	4.1 ± 0.9	4.1 ± 1.1	3.1 ± 1.4	3.2 ± 1.3	3.6 ± 1.3
Tennis (W) (n = 7)	3.3 ± 1.4	2.6 ± 1.5	2.4 ± 1.0	4.7 ± 0.5	4.6 ± 0.5	4.7 ± 0.5	4.4 ± 0.5	5.0 ± 0.0	3.6 ± 1.1	4.3 ± 1.0
Basketball (M) (n = 14)	3.1 ± 1.0	3.2 ± 1.3	2.9 ± 1.2	3.4 ± 0.7	3.3 ± 0.7	3.3 ± 0.9	3.4 ± 1.1	3.7 ± 1.2	3.9 ± 1.0	2.9 ± 1.2
Basketball (W) (n = 15)	3.4 ± 1.1	2.4 ± 1.4	2.3 ± 1.4	4.2 ± 1.2	3.7 ± 0.9	3.6 ± 1.1	4.4 ± 0.6	4.1 ± 0.9	3.5 ± 1.4	4.4 ± 0.9
Football (M) (n = 84)	4.1 ± 1.1	2.9 ± 1.3	3.7 ± 1.4	4.3 ± 0.9	3.9 ± 1.0	3.8 ± 1.0	3.7 ± 1.2	3.8 ± 1.1	4.4 ± 0.9	3.2 ± 1.5
Baseball (M) (n = 25)	4.0 ± 1.1	3.0 ± 1.4	4.1 ± 1.1	4.4 ± 0.8	3.8 ± 1.0	3.7 ± 0.9	3.6 ± 1.1	3.7 ± 1.2	4.5 ± 0.8	3.2 ± 1.5
Ice Hockey (M) (n = 25)	3.4 ± 1.2	2.1 ± 1.2	3.5 ± 1.2	4.1 ± 0.8	3.3 ± 1.1	3.4 ± 0.9	3.5 ± 1.0	3.3 ± 1.1	4.1 ± 0.7	2.5 ± 1.3
Gymnastics (W) (n = 13)	2.9 ± 1.5	2.5 ± 1.7	2.6 ± 1.6	4.2 ± 1.0	4.2 ± 0.9	4.4 ± 0.8	4.2 ± 0.9	3.9 ± 1.2	3.9 ± 1.0	4.7 ± 0.5
Volleyball (W) (n = 11)	3.0 ± 1.3	2.0 ± 1.4	3.4 ± 1.0	4.4 ± 1.3	3.9 ± 1.5	4.3 ± 0.9	4.0 ± 1.2	4.3 ± 0.8	4.2 ± 0.9	4.1 ± 1.3

Table 3: Nutrition topics of interest to student-athletes per sport (mean ± SD)*

*1 = lowest interest, 5 = highest interest **M = men's sport, W = women's sport

Education Preferences	Male (n = 184)	Female (n = 135)
Group Sessions	2.9 ± 1.3	3.2 ± 1.3
Individual Counseling	3.1 ± 1.4	3.2 ± 1.4
Newsletters	2.5 ± 1.3	3.1 ± 1.3
Independent Study Modules	2.5 ± 1.2	2.4 ± 1.2
Computer Training	2.5 ± 1.3	2.4 ± 1.2
Conferences	2.5 ± 1.1	2.5 ± 1.2
Academic Courses	2.8 ± 1.2	3.1 ± 1.3
Nutrition Graduate Student	2.9 ± 1.2	3.1 ± 1.2

Table 4: Nutrition education preferences of student-athletes per gender (mean ± SD)*

*1 = low interest, 5 = high interest

counseling as slightly more interesting than other methods for receiving nutrition education, while male athletes ranked individual counseling as the most interesting method out of those listed (Table 4). Individual counseling seemed to stand out as

a vastly more preferable nutrition education method between males and females, suggesting that collegiate athletes have a preference regarding the means with which they are educated on nutrition-related topics. This proposal, congruently, was consistent when the data was analyzed for each athletic team.

The two highest selected categories were "Individual counseling" and "Nutrition graduate student," the former being chosen five times and the latter being chosen seven times, providing that 12 out of 20 favored choices included these two methods for nutrition education interventions. Therefore, future nutrition education interventions aimed toward the collegiate athlete population should focus on these two modalities in an effort to maximize athlete interest and consequent information retention.

Discussion

Due to nutrition's role in the enhancement and optimization of athletic performance, an understanding of a population's current nutrition knowledge, as well as their interests related to the topic, is essential. After collection of extensive data through

Education Preference	Group Sessions	Ind. Counseling	Newsletters	Study Modules	Comp. Training	Conferences	Academic Courses	Nutr. Grad. Student
Basketball (M) (n = 14)	2.9 ± 1.1	3.2 ± 1.4	3.2 ± 1.1	3.1 ± 1.2	2.8 ± 1.4	2.8 ± 1.3	3.2 ± 1.3	3.4 ± 1.2
Basketball (W) (n = 15)	3.2 ± 1.2	3.1 ± 1.3	2.5 ± 1.1	2.0 ± 1.0	2.1 ± 1.1	2.3 ± 1.2	2.6 ± 1.2	3.3 ± 1.0
Football (M) (n = 84)	2.8 ± 1.4	3.4 ± 1.4	2.3 ± 1.2	2.4 ± 1.2	2.5 ± 1.3	2.5 ± 1.1	2.7 ± 1.3	2.7 ± 1.3
Baseball (M) (n = 25)	3.0 ± 1.4	3.0 ± 1.2	3.0 ± 1.3	2.9 ± 1.1	3.1 ± 1.2	3.0 ± 1.1	3.4 ± 1.0	3.4 ± 1.1
Ice Hockey (M) (n = 25)	2.6 ± 1.1	2.5 ± 1.1	1.9 ± 1.1	1.9 ± 0.9	2.0 ± 1.1	2.0 ± 0.9	2.7 ± 0.9	2.3 ± 1.1
Gymnastics (W) (n = 13)	3.0 ± 1.6	3.0 ± 1.5	3.3 ± 1.2	2.7 ± 1.1	2.5 ± 1.3	2.6 ± 0.8	2.9 ± 1.4	3.6 ± 1.2
Volleyball (W) (n = 11)	3.6 ± 1.2	3.5 ± 1.7	3.3 ± 1.4	2.7 ± 1.3	2.2 ± 1.0	2.6 ± 1.5	3.1 ± 1.7	3.7 ± 1.4
Golf (M) (n = 8)	2.6 ± 1.4	2.6 ± 1.6	2.6 ± 1.4	2.3 ± 1.3	2.3 ± 1.0	2.4 ± 1.2	2.4 ± 1.3	3.4 ± 0.7
Golf (W) (n = 7)	3.3 ± 1.4	3.7 ± 1.1	3.0 ± 1.2	2.0 ± 0.8	2.3 ± 0.8	2.4 ± 1.0	3.3 ± 1.0	3.6 ± 1.4
Soccer (M) (n = 17)	3.2 ± 1.4	3.3 ± 1.2	2.5 ± 1.2	2.3 ± 0.9	2.4 ± 1.2	2.6 ± 1.1	2.8 ± 1.1	2.6 ± 1.2
Soccer (W) (n = 29)	2.5 ± 1.4	2.7 ± 1.5	2.8 ± 1.2	2.0 ± 1.2	2.0 ± 1.2	2.0 ± 1.2	3.2 ± 1.4	2.6 ± 1.2
Cross Country (M) (n = 11)	3.1 ± 1.6	2.3 ± 1.6	2.6 ± 1.4	2.6 ± 1.4	2.8 ± 1.4	2.7 ± 1.5	2.7 ± 1.6	3.1 ± 1.4
CC/Track & Field (W) (n = 26)	3.5 ± 1.4	3.6 ± 1.5	3.3 ± 1.6	2.4 ± 1.5	2.6 ± 1.3	2.6 ± 1.3	3.5 ± 1.3	3.0 ± 1.4
Softball (W) (n = 11)	3.2 ± 1.3	2.3 ± 1.1	2.8 ± 1.7	2.2 ± 0.8	2.2 ± 1.1	2.6 ± 1.5	2.9 ± 1.5	2.6 ± 1.2
Swimming (W) (n = 16)	3.4 ± 1.2	3.7 ± 1.0	3.4 ± 0.9	3.0 ± 1.0	2.8 ± 1.1	2.8 ± 0.8	3.3 ± 1.1	3.2 ± 0.8
Tennis (W) (n = 7)	3.4 ± 1.0	2.9 ± 1.1	3.3 ± 1.1	3.0 ± 0.8	3.3 ± 1.1	3.0 ± 0.6	3.3 ± 1.4	3.3 ± 0.8

Table 5: Nutrition education preferences to student-athletes per sport (mean ± SD)*

*1 = lowest interest, 5 = highest interest

survey of 17 intercollegiate athletic teams, student-athlete nutrition knowledge, interest related to sports nutrition topics, and interest related to delivery of sports nutrition information was successfully collected and analyzed, greatly aiding planning for future nutrition education interventions within the collegiate athlete population.

When considering gender, male athletes were shown to have lower nutrition-related knowledge than female athletes, with men's football and men's basketball having statistically significant lower scores and women's gymnastics having statistically significant higher scores than the other athletic teams ($p = 0.000$). Nutrition knowledge was shown to have a negative correlation with projected registered dietitian use; however, some athletes may be relatively unaware of this service's availability and are likely in need of contact information. Each team also had individualized topics of interest that may be significant when considering future nutrition education interventions. Overall, female athlete nutrition education may benefit from focusing on cheap, healthy meals and safe, healthy weight loss, while male athlete nutrition education may benefit from focusing on sports drinks and muscle building. Since both genders

found equal interest in pre- and post-workout meals, energy requirements, and healthier fast food alternatives, these topics may be covered equally between male and female athletic teams.

Future nutrition education interventions may benefit from utilizing nutrition graduate students as well as individual counseling, as these methods were rated as being the most interesting by the collegiate athletes surveyed in this study. Those providing these interventions may also wish to consider, particularly during individual counseling, that perceived nutrition knowledge is not significantly correlated with actual nutrition knowledge. Even though the completion of an Introduction to Human Nutrition course showed statistically significant higher scores related to nutrition knowledge, it is uncertain how practically significant this is and may require further research before inclusion into recommendations.

Limitations

It is important to note that a major limitation of this study is that only one Midwestern university was surveyed. The implications of any data gathered may not be applicable to other

universities throughout the nation. In addition, some of the athletic teams do not have a large quantity of student-athletes. This factor may provide data that is not universal to the sport or other universities. Likewise, the population under review is limited to the student-athletes at the division I university studied. It is unclear whether this population size will provide a useful data pool to safely generalize the information to other universities across the nation.

With regard to the survey instrument itself, after the administration of the survey, it became apparent that some of the questions were misunderstood to a greater degree than anticipated. Many of the student-athletes marked several choices for answers when there was only one correction selection. In addition, the first question with regard to the completion of an Introduction to Human Nutrition course only asked whether the individual had completed a course and not whether they were in the process of completing the course. In addition, the survey instrument was not a previously validated instrument used to determine nutrition knowledge and no reliability tests were conducted. Collegiate teams and athletes have demanding schedules, and a longer, previously validated instrument may have posed limitations of its own, including respondent fatigue.

Implications for research and practice

These findings may prove beneficial in the development of future nutrition education interventions targeting a collegiate student-athlete population. By appealing to and incorporating each team's areas of interest, information retention is likely to increase. Furthermore, since each team also stated their preferences for the delivery of nutrition education, appropriate modalities can be used accordingly in an effort to optimize student-athlete participation and consequent intellectual growth. With regard to the incorporation of a registered dietitian as a source for information, this data illustrates that the majority of student-athletes would utilize this source at least weekly, if provided. Lastly, since men's football and men's basketball showed significantly lower nutrition-related knowledge scores than the other 15 teams, it may be relevant for nutrition education interventions to address this issue by increasing nutrition education opportunities with these teams. Similarly, women's gymnastics provided significantly higher nutrition-related knowledge scores than the other teams, possibly implying that this team can be educated with more advanced nutrition information.

References

- 1) Abood DA, Black DR, Birnbaum RD (2004) Nutrition education intervention for college female athletes. *J Nutr Educ Behav* 36: 135-137.
- 2) Hinton PS, Sanford TC, Davidson MM, Yakushko OF, Beck NC (2004) Nutrient intakes and dietary behaviors of male and female collegiate athletes. *Int J Sport Nutr Exerc Metab* 14: 389-405.
- 3) Nichols PE, Jonnalagadda SS, Rosenbloom CA, Trinkaus M (2005) Knowledge, attitudes, and behaviors regarding hydration and fluid replacement of collegiate athletes. *Int J Sport Nutr Exerc Metab* 15: 515-527.
- 4) Dunn D, Turner LW, Denny G (2007) Nutrition knowledge and attitudes of college athletes. *Sport Journal* 10: 45-53.

- 5) Froiland K, Koszewski W, Hingst J, Kopecky L (2004) Nutritional supplement use among college athletes and their sources of information. *Int J Sport Nutr Exerc Metab* 14: 104-120.
- 6) Bents RT, Marsh E (2006) Patterns of ephedra and other stimulant use in collegiate hockey athletes. *Int J Sport Nutr Exerc Metab* 16: 636-643.
- 7) Zawila LG, Steib CS, Hoogenboom B (2003) The Female Collegiate Cross-Country Runner: Nutritional Knowledge and Attitudes. *J Athl Train* 38: 67-74.
- 8) Steinbach P (2010) Food for thought. *Athletic Business* 34: 58-60.
- 9) Eberle B, Wilson D (1998) Nutrition attitudes and practices of young gymnasts ages 7 to 17. *Int J Sport Nutr* 8: 201-206.
- 10) Webb S (1996) The nutrition knowledge and dietary intake of female athletes at Hampton University. Hampton University, Hampton.
- 11) Rash CL, Malinauskas BM, Duffrin MW, Barber-Heidal K, Overton RF (2008) Nutrition-related knowledge, attitude, and dietary intake of college track athletes. *Sport Journal* 11: 48-54. 11)
- 12) Herbold NH, Visconti BK, Frates S, Bandini L (2004) Traditional and nontraditional supplement use by collegiate female varsity athletes. *Int J Sport Nutr Exerc Metab* 14: 586-593.
- 13) Smith-Rockwell M, Nickols-Richardson SM, Thye FW (2001) Nutrition knowledge, opinions, and practices of coaches and athletic trainers at a division 1 university. *Int J Sport Nutr Exerc Metab* 11: 174-185.
- 14) Clark N (2010) The athlete's kitchen. *ACHPER Active & Healthy Magazine* 17: 22-23.
- 15) Gabel KA (2006) Special nutritional concerns for the female athlete. *Curr Sports Med Rep* 5: 187-191.

Submit your manuscript to a JScholar journal and benefit from:

- ✓ Convenient online submission
- ✓ Rigorous peer review
- ✓ Immediate publication on acceptance
- ✓ Open access: articles freely available online
- ✓ High visibility within the field
- ✓ Better discount for your subsequent articles

Submit your manuscript at
<http://www.jscholaronline.org/submit-manuscript.php>