

HIGH SCHOOL COACH NUTRITION CONFIDENCE AND SKILL

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North Dakota State University's regulations and meets the accepted
standards for the degree of

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ABSTRACT

High school athletes obtain nutritional information from their coaches, yet high school coaches' capability in this area may be lacking. Therefore, the aim of this study was to examine both confidence and skill level regarding nutrition among Midwest high school coaches. Out of an estimated 2,700 possible invited coaches from two Midwest states in the US, 113 coaches completed the questionnaire. The questionnaire's first two sections consisted of demographics, and questions concerning confidence in nutritional knowledge. The third section 81 nutrition knowledge questions separated into categories: nutrient content, recovery, fluid, weight maintenance, and supplements. Coaches reported moderate overall confidence in their ability to give nutritional advice ($P=.0016$). The overall knowledge score was 58.7% (± 9.7). The highest score was obtained in the recovery subcategory, and the lowest score was in the supplements category. In conclusion, Midwest high school coaches would benefit from creating a working relationship with a dietitian.

Keywords: sport nutrition skills; nutrition training; sports nutrition; high school coaches

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CHAPTER 1. INTRODUCTION

Athletic performance is enhanced by following the recommended nutrition and diet guidelines for one's sport, sex, and age group (Academy of Nutrition and Dietetics, 2016). Collegiate athletes often receive personalized diet plans, pregame meals, and body composition testing conducted by their athletic coaches and staff. Collegiate-level coaches typically have education or training specific to coaching and team management (Poobalan, Aucott, Clarke, & Smith, 2014), and registered licensed dietitians are usually available to the athletes for individualized nutritional counseling (Rosenbloom, Jonnalagadda, & Skinner, 2002). Collegiate athletes can have a team of individuals to support their training and performance. Coaches, assistant coaches, athletic trainers and sports dietitians are often available to collegiate athletes (NCAA, n.d.). The availability of professional resources to these athletes creates a safe environment in which athletes can train at high levels (Rosenbloom, Jonnalagadda, & Skinner, 2002). However, before competing at the higher education level athletes build skills starting at a young age and can be very competitive starting as young as age 12 (Line, 2016). Unfortunately, support systems outside of coaching staff can be lacking at these younger ages of competition.

Statement of the Problem

Pre-collegiate school-based coaches are often teachers who have little to no nutritional training (Jacob, et al., 2016; Danaher & Curley, 2014; Trackman, 2016). During adolescence many nutritional behaviors are forming (Story, Neumark-Sztainer, & French, 2002); at the same time high school athletic coaches are preparing players for collegiate competition. Nutrition for sports performance is becoming an increasingly popular topic in the field of research and also in the popular press, however little research has been done with adolescent athletes. Some research that has been completed has shown that most high school athletes use coaches as their main

source of nutritional information (Cockburn, 2014; Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, Schofield, & Wall, 2005; Poobalan, Aucott, Clarke, & Smith, 2014; Rosenbloom, Jonnalagadda, & Skinner, 2002; Wiens; Erdman; Stadnyk; & Parnell, 2014). Surveys have shown a large discrepancy between what sports dietitians recommend for adolescent athletes and what coaches recommend (Jacob, et al., 2016; Danaher & Curley, 2014; Trakman, 2016).

Purpose of the Study

The purpose of this study is to assess the current level of nutrition skills among a sample of high school coaches in two Midwestern states, to explore their confidence and usual methods of addressing nutrition concerns among high school athletes who seek guidance, and to find out the sources of nutrition information. Chapter 2 will include a literature review of studies relevant to high school athlete nutrition skills, practices, and nutritional knowledge of high school coaches. Chapter 3 will include the methodology of the study and a description of the statistical analysis. Chapter 4 will include a journal article with results and a discussion of the study and suggestions for further research. Finally, a conclusion will emphasize key findings.

CHAPTER 2. LITERATURE REVIEW

The National Federation of State High School Associations' (NFHS) coaching code of ethics states “the coach shall be aware that he or she has a tremendous influence, for either good or ill, on the education of the student.” High school athletes look to their coach for guidance in both sport and nutritional matters (Cockburn, 2014; Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, 2010; NFHS n.d.; Poobalan, Aucott, Clarke, & Smith, 2014; Rosenbloom, Jonnalagadda, & Skinner, 2002; Wiens; Erdman; Stadnyk & Parnell, 2014). Therefore, both continuing and new education for coaching staff is of critical importance. Requirements vary from state to state. In North Dakota high school coaches must complete three courses before becoming registered: (1) concussion in sports, (2) first aid, and (3) health and safety and fundamentals of coaching (NFHS, n.d.); in contrast no nutritional training is currently required. High school athletes must eat to support both training and physical development which puts them at higher risk for nutrient and energy deficiencies according to the Sports Dietitians of Australia (SDA, 2014). Coaches' nutritional knowledge has an impact on high school athletes' nutritional behavior (Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, 2010; NFHS n.d.; Poobalan, Aucott, Clarke, & Smith, 2014; Erdman; Stadnyk; & Parnell, 2014).

In reviewing the literature relevant to the topic of “coaches' nutritional knowledge and confidence,” both context and content of the literature were included. A low number of studies regarding high school level articles were anticipated. Therefore, research examining high school and collegiate students and coaches as well as professional athletes and coaches were reviewed and included.

Primary electronic search engines used included PubMed, Google Scholar, EBSCO, and Cochrane Library. These databases were reviewed for relevant literature, which included a focus

on all of the key search terms used. The key search terms included: “athlete,” “nutrition,” “behavior,” “coach,” “eating disorder,” “diet,” “performance” “supplement,” “dietary intake,” “nutrition questionnaire,” “college athlete,” “high school athlete,” “athletic trainer,” “behavior change,” and “female athlete triad.” Few criteria for exclusion were identified due to the limited nature of literature on high school-level coaches’ nutritional knowledge. The following sections detail the findings of related research on nutrition knowledge of high school coaches and athletes.

Importance of Athlete Nutrition

High school athletes can count on their coaches to provide them with their training schedules and sport-related strategies. However, another large part of athletic performance is nutrition. High school athletes face unique challenges when strategizing approaches to nutrition. The Academy of Nutrition and Dietetics' (Academy) 2016 position statement “Nutrition and Athletic Performance” states:

"An appropriate energy intake is the cornerstone of the athlete’s diet because it supports optimal body function, determines the capacity for intake of macronutrients and micronutrients, and assists in manipulating body composition... Regardless of the terminology, it is apparent that low energy availability (the amount of energy available to the body to perform all other functions after the cost of exercise is subtracted) in male and female athletes may compromise athletic performance in the short and long-term.”

Students in high energy expenditure sports are at a higher risk of low energy availability. This is especially important in young athletes who are still developing physically (SDA, 2014).

The Sports Dietetic Association of Australia (SDA) has published a position statement concerning the distinctive needs of adolescent athletes (SDA, 2014). The paper places special

focus on the importance of daily eating patterns. For example, the paper includes an emphasis on encouragement of high quality carbohydrates and protein throughout the day and especially during training for young athletes (SDA, 2014). The position statement also recommends that consideration should be given to ensuring adequate intake of dietary calcium, vitamin D, and iron because of the higher risk for deficiency within the adolescent athlete population. The Australian position statement also focuses on the hydration needs of adolescent athletes, stating that clean, cool fluid should be available in adequate quantities before, during and after training (SDA, 2014). Finally the Australian position statement covers the subject of dietary supplementation, stating that food rather than supplements should provide nutrition (SDA, 2014).

Licensed and registered sports dietitian nutritionists (RDNs) are the most appropriate source of nutritional information for athletes. The American Dietetic Association (2008) (now the Academy of Nutrition and Dietetics) lists the job description of a sports dietitian as the following:

“The Sports Dietitian provides individual and group/team nutrition counseling and education to enhance the performance of competitive and recreational athletes, on-site and during travel. Primary responsibilities include counseling individuals and groups on daily nutrition for performance and health; translating the latest scientific evidence into practical sports nutrition recommendations; tracking and documenting outcomes of nutrition services, serving as a food and nutrition resource for coaches, trainers, and parents; providing sports nutrition education for health/wellness programs, athletic teams, and community groups; and maintaining professional competency and skills required for professional practice.”

Although RDNs are considered to be the nutrition experts due to credentialing and continuing education requirements, most high school students rely on their coach for nutritional guidance (Cockburn, 2014; Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, 2010; Poobalan, Aucott, Clarke, & Smith, 2014; Rosenbloom, Jonnalagadda, & Skinner, 2002; Wiens, Erdman, Scofield, & Unruh, 2006; Stadnyk; & Parnell, 2014). This is less than ideal when one considers the differences in training and access to nutrition knowledge between the RDN and high school coaches. A typical high school coach, even with a physical education degree, may only be required to take one college-level nutrition course as part of their higher education (Uhrich, 2010). Registered dietitian nutritionists have completed a four year undergraduate nutrition degree. In addition, dietetic students are required to complete courses such as chemistry, biochemistry, math and other prerequisites to understand the science of nutrition (Academy, 2013). Once a dietitian passes the registration exam they are required to complete 75 hours of continuing education every five year cycle (CADE, n.d.). Fortunately, once athletes reach collegiate-level athletics they often have access to an RDN. The same is true of professional athletes.

Sport specific nutrition strategies are important at every level of athletics. Nutrition research with a performance and recovery focus is expanding rapidly. New strategies such as adequate, type of and timed carbohydrate and protein intake while performing are being studied. During the 2012 Olympics, nutritional strategies were used to increase athletic performance. Sports dietitians and nutritionists were included in interdisciplinary teams supporting athletes. New research on nutrition such as nitrate supplementation and increased carbohydrate consumption strategies were implemented, and athletes' training schedules included research on their diet correlating with their acute optimized performance (Thomas, Erdman & Burke, 2013).

Nutrition strategies impact body composition as well as performance in events. The previously mentioned position paper created by the Academy includes a comprehensive set of guidelines that can be used for nutrition recommendations for improved performance among adult athletes and active individuals. The guidelines cover topics including timing, type, and amount of food and fluid intake for athletes of various body compositions across many types of sport scenarios. This position paper is intended for nutrition professionals and not for coaches; however, the coach can seek out information from this resource or RDNs. Regrettably, though this information is available, nutritional knowledge among coaches is not optimal (Cockburn, Fortune, Briggs, & Rumbold, 2014; Danaher & Curley, 2014; Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, 2010; Poobalan, Aucott, Clarke, & Smith, 2014; Rosenbloom, Jonnalagadda, & Skinner, 2002).

The position statement has a brief overview on macronutrients. Research has shown intake of carbohydrates during both long lasting and shorter events prevents hypoglycemia and maintains increased carbohydrate oxidation when compared with placebo ingestion (Jeukendrup, 2014). It was previously thought that an event would need to span a minimum of two hours for carbohydrate intake to impact performance; however, it was discovered that carbohydrate ingestion can increase performance in events lasting only one hour (Jeukendrup, 2014). The current Recommended Dietary Allowance (RDA) for protein intake is 0.8 grams per kilogram (kg) of body weight; this recommendation was made for the general healthy adult population. Increased protein consumption among athlete populations allows for preservation of lean mass during weight loss and increased muscular adaptations from training (Phillips, 2014), so the Academy position statement recommends a range of 1.2 to 1.7 g of protein per kg for active individuals, more for individuals starting a new exercise program, for individuals following a

vegan diet, still in growth and development or with pregnancy and lactation. Fat calories are recommended to make up at least 20% of the total intake of energy; any lower and athletes risk decreased performance. The Academy statement also addresses multiple research questions concerning nutrient timing including composition of intake leading up to, during and in recovery after athletic events. Strategies for timing and composition of macronutrients in an athlete's diet are most beneficial when based on the interactions between nutrients, substrate availability, training adaptations, and the energy pathway in use (Academy, 2016). The position statement provides specific energy and macronutrient calculations which take into consideration type of exercise, intensity, timing, trained or untrained, sex and other differences, and the athlete's body composition. Customized recommendations for daily intake of macronutrients should be made with consideration of an athlete's training/competition schedule and the comparative importance of undertaking that schedule with high or low energy intake according to the importance of promoting performance of high quality exercise vs. enhancing the training stimulus or training adaptation (Academy, 2016).

Nutrition Knowledge of Athletes

There is a multitude of information available to athletes on the subject of nutrition and how it impacts performance and recovery. Regrettably, many commonly used sources of information are less than reputable. In the United States, misinformation of nutrition recommendations appears to be common among student athletes who receive most of their nutritional knowledge from popular sports and health magazines, parents, and coaches (Hornstrom, Friese, Ellery, & Pike, 2011; Scofield, & Unruh, 2006). A 2011 study included an examination of the nutritional knowledge of female softball players attending the Mid-American Conference in which college-level athletes completed a nutrition questionnaire to determine level

of current nutritional knowledge. The questionnaire was developed using a combination of items from seven other previously validated survey tools. The questionnaire had six sections: basic nutrition and sports nutrition knowledge, nutrition quality of typical food choices, current dietary practices based on the food guide pyramid, likely source of information, attitudes toward nutrition and the intention to use proper nutrition to enhance softball performance. The questionnaire was pilot-tested using the Ball State University tennis team to ensure questions were understood by a similar population. The results of the pilot-test suggested changes should be made to the Likert scale used in the questionnaire to force participants to choose an answer based on their current nutrition knowledge. The revised questionnaire was reviewed by experts in the field to ensure the questions were relevant to the nutritional knowledge. Questions were coded as “correct” or “incorrect.” A correct answer received a score of one and an incorrect score received a score of zero. Participant scores were summed to create the nutrition knowledge score. The results showed: 2% of athletes majored in nutrition (n=3), 14% majored in exercise science (n=26) and 84% majored in a nonrelated subject (n=151). Scores on the nutrition questionnaire ranged from a low of 36% correct to a high of 70% correct. Sixty-five percent (n=117) of surveyed athletes failed the exam meaning they scored below a 60% cutoff (Hornstrom, Friesen, Ellery, & Pike, 2011). It was noted that participants who had previously taken nutrition courses had higher scores; however, they still did not reach adequate knowledge levels. The low scores show that nutrition education is needed to improve the dietary habits of these college athletes.

In a 2006 questionnaire based study on supplement use in high school athletes (n=139) 38% of participants listed the coach as their main source of nutritional information (Scofield, & Unruh, 2006). How athletes get their nutrition information has also been studied outside of the

United States. A study completed in 2010 included an examination of the nutritional knowledge of Iranian college level athletes; it aimed to assess which factors determine adequate nutritional knowledge (Jessri, Rashidkhani, & Zinn, 2010). Construct validity was confirmed using a between-groups analysis of variance with five different population groups (n=441): university staff (n=230), dietitians (n=96), nutrition students (n=25), business students (n=30) and fitness students (n=60). The questionnaire, developed in New Zealand, was shown to be psychometrically valid and reliable and suitable for use in athletic groups (Zinn, Schofield, & Wall, 2005). The multiple choice nutrition questions were separated into 5 categories including: nutrient content (46 questions), recovery (7 questions), fluid/hydration (9 questions), weight control (15 questions) and supplements (11 questions). All questions included an “unsure” answer for participants to indicate they did not have sufficient knowledge to answer the question. Athletes were encouraged to answer “unsure” to any question to prevent guessing. Answers were assigned a +1 score for the correct response and 0 score for an incorrect or unsure response for the purpose of determining the total mean percent correct score. The male athletes (n=109) scored 28.22 ± 15.6 out of 88 (32% correct) while female athletes (n=98) scored 38.72 ± 16.7 out of 88 (44% correct) on the general nutritional knowledge questionnaire. Significantly higher scores were associated with female athletes who were also medical students ($P < 0.05$) (Jessri, Rashidkhani, & Zinn, 2010). A large majority of the study participants (89%) listed a coach as their main source of nutrition information. Numerous athletes also received nutrition information from television cooking shows, parents and internet articles. Out of 207 collegiate athletes only two listed a dietitian as a good source of nutrition information (Jessri, Rashidkhani, & Zinn, 2010).

Coach Nutrition Knowledge

In a 2015 study in Quebec, researchers examined high school coaches' (n=47) knowledge in sports nutrition and the nutritional practices they recommend to their athletes (Couture, et al., 2015). Coaches were sorted by the sport they coached and whether it was a “leanness sports” which was defined as a sport where low body weight is important (e.g., cheerleading and gymnastics), or “non-leanness sports” in which low body weight is less important (e.g., football). High school coaches were recruited via email and took a nutrition questionnaire. The questionnaire was based on a study based on three previously validated works (Marinero, 2008; Parmenter & Wardle, 1999; Zinn, Schofield, & Wall, 2005). The coaches obtained an average score of 68% on the nutrition part of the questionnaire. Only 30% of the coaches were able to correctly answer the nutrition questions regarding macronutrients. There were no significant differences between the scores of coaches in leanness and non-leanness sports. There was a significant difference between scores of coaches who had completed some form of higher education. Coaches who had completed some form of higher education scored an average of 73% while coaches who did not have a higher degree scored an average of 63% ($P < 0.05$). There was also a significant difference between coaches who completed a coaching certification and those who had not. The questionnaire also asked about the sources of nutrition information coaches used. The most popular source was the internet with 55% of the coaches reporting they used the internet as a source of information frequently. The results of this study indicate that coaches may benefit from sports nutrition education (Couture, et al., 2015).

Nutrition Practices of Athletes

Another study in the United States focused on the nutritional knowledge of athletes as estimated by administering a survey to 238 collegiate athletes at a Division One National

Collegiate Athletic Association institution (Rosenbloom, Jonnalagadda, & Skinner, 2002). The survey had been developed by the author and previously published in a textbook guide for members of the Academy (Rosenbloom, 2000). The results of the survey revealed that 63% of men and 54% of women knew that carbohydrates and fats are the main sources of energy for the body, however 47% of men and 43% of women incorrectly answered that protein was the main source of energy for the muscles. This study was completed at an institution where an RDN was available to athletes for individualized nutritional counseling (Rosenbloom, Jonnalagadda, & Skinner, 2002). The lack of knowledge among athletes who have direct contact with nutrition professionals may show that athletes are utilizing unreliable sources of information even in the presence of an RDN. The author reports that a second iteration of the survey is in the process of release (Rosenbloom, 2000). Coach encouragement for the more frequent use of an RDN's services may be a useful strategy for improving athletes' nutritional knowledge.

Sports with required weight or those in which aesthetics are of high importance have an increased prevalence of detrimental nutrition practices among athletes (Academy, 2016; Wyon, Hutchings, Wells, & Nevill, 2014). Ballet is a sport with many restrictions on physical appearance which may put participating athletes at a higher risk of detrimental nutrition behaviors. Differences in nutritional practice and body composition between professional and student ballet dancers may be found because of an increased need to maintain muscle in professional dancers who are performing regularly and an increased awareness of nutrition knowledge (Wyon, Hutchings, Wells, & Nevill, 2014). A survey-based study in 2014 was used to evaluate the nutritional and body mass differences and also screened for disordered eating between elite students aged 11 to 18 years (n=139) and professional ballet dancers aged 19 to 39 years (n=41). The study included a total of 189 dancers, male and female. Anthropometric data

was measured prior to nutritional knowledge and behavior testing. Nutrition knowledge was determined using a General Nutrition Knowledge Questionnaire (Parmenter, & Wardle, 1999). The General Nutrition Knowledge Questionnaire is split into four sections totaling 88 questions. This questionnaire was developed in the 1990s in the United Kingdom and has since been validated for use with four other population groups (Kliemann, Wardle, Johnson, & Croker, 2016). Higher scores are representative of greater nutrition knowledge. Eating attitudes, i.e. potential eating disorders, were determined using the newer version of the Eating Attitudes Test-26 questionnaire. The EAT-26 questionnaire was first validated in 1979 by the Clarke Institute of Psychiatry in Toronto, Canada (Garner & Garfinkel, 1979). The professional dancers had significantly higher BMIs than the student dancers ($P < 0.001$). In both the female student and female professional categories, the General Nutrition Knowledge Score was positively associated with body mass index ($P = 0.002$, $r = 0.372$, and $P = 0.04$, $r = 0.567$, respectively). The dance school requires students to attend cooking classes to enhance nutritional knowledge and cooking skills for their professional career. However, even after the nutritional training students were required to take, the professional dancers still rated significantly higher on the nutritional knowledge questionnaire ($P < 0.001$). This is possibly explained by the need of professional athletes to implement dietary strategies themselves without the support of educators plus advanced maturity. Disordered eating scores on the EAT-26 questionnaire showed 0% prevalence for professional dancers while student dancers had an incidence rate of 33%. In professional dancers, nutritional knowledge had a positive impact on dietary intake ($P < 0.001$) (Wyon, Hutchings, Wells, & Nevill, 2014). Student nutrition knowledge was shown to increase for every year of school completed with no difference between sexes ($P < 0.001$). First year students (age 11/12) scored lowest, and scores improved with each year completed at the school. This is

logical because nutrition was an annual requirement starting in the first year and continuing through the final year (students age 17/18). Athletes in aesthetic sports or sports with weight limits strive to maintain lean mass (Academy, 2016). Athletes in these sports strive for low BMI and fat mass, while maintaining and increasing muscle mass (Academy, 2016). Knowledge of nutrition strategies for maintaining lean mass during weight loss may be especially beneficial for student athletes who compete in aesthetic or weight controlled sports.

A 2008 study in Brazil was used to estimate the dietary intake and body composition of 44 adolescent male tennis players (Otten, et al., 2006). Dietary intake was reported using a four-day nonconsecutive food diary, and body composition was determined using dual-energy X-ray absorptiometry. To determine the adequacy of intake researchers used a statistical approach originally created by the Institute of Medicine (Otten, et al., 2006). The technique compares the difference between the average reported intake and the estimated average requirement, and then takes into account the variability of the requirement and the day-to-day variability of the participant's reported intake. The final product of the calculation is a Z-score which reflects the degree of confidence that a participant meets his or her individual nutrient requirement. A Z-score of 0.85 was determined to be the cutoff point, which ensured an 80% probability of adequate intake. A caloric deficit of over 10% of estimated energy requirement was found in eight of the athletes' diets. The deficit ranged from 532-1709 kcals below the estimated energy requirement per day. If energy imbalances were continued, they would cause later issues for performance, growth, and development. It is especially important for adolescent athletes to consume enough energy because they are still growing. Most of the athletes' diets contained less than the recommended values of fiber, calcium, magnesium, and potassium than the adequate

intake or recommended daily allowance (Mayo Clinic, 2014; Juzwiak, Amancio, Vitalle, Pinheiro & Szejnfeld 2008).

In a 2014 study, Canadian researchers found that the majority of athletes below the age of 25 were taking dietary supplements. A sample of athletes aged 11 to 25 (n=567) were asked to complete a dietary questionnaire (Wiens, Erdman, Stadnyk, & Parnell, 2014). The Canadian equivalent to the US Food and Drug Administration (FDA) does not have a definition for dietary supplements. The definition from FDA (2015) is “products taken by mouth that contain a dietary ingredient intended to add further nutritional value to supplement the diet.” The questionnaire was modified from a previous Canadian questionnaire used to determine the dietary habits of high performance athletes. The modified questionnaire was tested for construct validity and reliability by a panel of five dietitians who were also members of the Coaching Association of Canada’s Sport Nutrition Advisory Committee. The questionnaire contained four questions on dietary supplementation. The questionnaire also included a list of 25 commonly used supplements and questions on where athletes were receiving their information on dietary supplements, including a section for participants to write in dosages and to list any supplements not already on the questionnaire (Wiens, Erdman, Stadnyk, & Parnell, 2014). The researchers found that sex, age, or sport type in over 20 sports represented no significant difference in general dietary supplementation use. Female athletes reported higher intakes of vitamin enriched water (P=0.020), while male athletes reported higher intakes of supplemental protein (P<0.001). Older athletes (aged 18-25) consumed significantly greater amounts of protein powder (P=0.001), glutamine (P=0.011) and energy drinks (P<0.001). Younger athletes (aged 11-17) consumed significantly more supplemental vitamin D (P=0.007), vitamin E (P=0.014), vitamin enriched water (P=0.007), calcium (P=0.001) iron (P=0.034) and sport gummies (P<0.01)

(Wiens, Erdman, Stadnyk, & Parnell, 2014). In addition, athletes reported reasons for dietary supplementation as the following: to stay healthy (81%), to increase energy (55%), immune support (52%), recovery (49%) and overall performance (49%). There was a difference between male and female athletes' reasons for dietary supplementation: to increase/maintain muscle mass, strength or power: male athletes (39%) female athletes (10%); to increase endurance: male athletes (14%) female athletes (8%); dietary supplementation for medical reasons: male athletes (7%) female athletes (19%); or because someone told the athlete to take a supplement: male athletes (12%) female athletes (21%) (Wiens, Erdman, Stadnyk, & Parnell, 2014). Athletes also reported sources of supplement information: family/friends (74%), coaches (44%), athletic trainers (40%), medical doctors (33%) and sport nutritionists (32%). Half of the participants (52%) had never met with a dietitian personally, however 38% listed that they had attended a group workshop or seminar on nutrition (Wiens, Erdman, Stadnyk, & Parnell, 2014).

Nutrition is of utmost importance for young athletes; hydration/fluid, energy and electrolyte imbalances can impact metabolism, performance and growth (SDA, 2014). While an increasing amount of reputable nutrition information is available to the general public through sources such as the Academy (eatright.org) and the Dietary Guidelines for Americans 2015-2020 (USDA, 2015), few athletes manage to find reputable nutrition sources and, therefore, dietary behaviors beneficial to their sport (Academy, n.d.; Hornstrom, Friesen, Ellery, & Pike, 2011; Jessri, Rashidkhani, & Zinn, 2010; Scofield, & Unruh, 2006; USDA, n.d; Wiens, Erdman, Stadnyk, & Parnell, 2014).

Coach Nutrition Skills

Coaches have been listed as a main source of nutritional knowledge by athletes in multiple studies (Jacob et al., 2016; Scofield, & Unruh, 2006; Trackman, Forsyth, Devlin, &

Belski, 2016). However, coaches' nutritional knowledge scores were below adequate in multiple separate questionnaire based studies (Cockburn, Fortune, Briggs, & Rumbold, 2014; Jacob et al., 2016; Danaher & Curley, 2014; Trakman, Forsyth, Devlin, & Belski, 2016). For example in one study, varsity coaches at a Canadian university (n=5) completed a nutritional knowledge survey (Danaher & Curley, 2014). Coaches were first asked to rate their own nutritional knowledge on a scale of one to ten and answered questions on nutritional topics relevant to athletes such as fluid needs, dietary supplementation and weight management. Modification to the psychometrically valid and reliable sports nutrition questionnaire was necessary owing to cultural food differences between Canadian and New Zealand coaches, who the questionnaire was originally designed to examine (Zinn, Schofield, & Wall, 2005). Additional questions were added after the examination of other nutrition questionnaires specifically targeting coaches. The modified questionnaire was pilot tested for face validity. After modification the nutrition knowledge questionnaire consisted of 95 questions most of which also required the coach to choose a degree of certainty in their answer. Mean scores were calculated using both the correct answer and the coaches' degrees of certainty. A score of 100% on each answer was achieved by selecting the correct choice and listing a high degree of certainty. The coaches' mean scores were six out of ten; however, all coaches in this study scored low in the nutritional knowledge section of the questionnaire. The section on pre-competition nutrition had the highest composite score (68%). The section on fluid needs had the lowest score (49%) (Danaher & Curley, 2014). While coaches' scores were acceptable in some areas, the authors concluded that it is detrimental for them to have given advice about areas in which they do not have adequate knowledge. It may be better for a coach to give no nutritional advice whatsoever than to give an athlete advice that is not accurate (Danaher & Curley, 2014).

In another survey based study coaches revealed below adequate knowledge about the current nutrition issues relevant to adolescent athletes (Cockburn, et al., 2014). The study was conducted in the United Kingdom comparing the relationship between coaches who give nutrition advice to athletes and nutritional knowledge of those coaches. Researchers distributed a standardized questionnaire to 163 eligible coaches. The validated questionnaire was comprised of two sections. The first section was general demographics; the second section consisted of 88 sports nutrition knowledge questions. These questions were modified from the previously mentioned New Zealand Questionnaire (Zinn, Schofield, & Wall, 2005). Sport nutrition questions were separated into five categories ranging from general nutrients to more specific categories: fluids, recovery, weight control and supplements. All questions could be answered with “yes”, “no” or “unsure.” This discouraged coaches from guessing at answers and allowed for differentiation between coaches with accurate, incorrect, and no nutrition knowledge. Coaches rated their nutrition knowledge as excellent (6%), average (45%), good (37%) or poor (12%). Coaches who participated in the survey reported how frequently they read nutrition information: 9% read on a weekly basis, 20% of coaches did not read about sports nutrition topics, 26% read every six months and 36% read on a monthly basis. Sources listed include: 2% sponsors, 26% lectures or courses, 44% sports magazines, 49% journal articles and 61% internet. Earlier research had determined a score of 70-75% correct on the nutrition portion of the questionnaire would determine adequate nutritional knowledge (Torres-McGehee, Pritchett, Zippel, Minton, Cellamare, & Sibilia, 2012). The average of correct questions answered by coaches on the questionnaire was $60 \pm 10\%$, while the average of incorrect was $25 \pm 7\%$. The number of unknown responses was $13.4 \pm 9.9\%$. When researchers applied negative scoring (subtracting a point for each incorrect answer while adding a point for each correct answer) to

the questionnaire, the mean score was 35.4% correct. Coaches scored significantly higher in nutrition and recovery categories compared with fluids, weight control and supplement categories (Cockburn, et al., 2014). Education on which sources to use for valid nutritional information as well as education on topics in which scores were low may be especially helpful for coaches.

In a third study, the effectiveness of a theory-based intervention system to assist high school coaches in making sports nutrition recommendations was researched (Jacob et al., 2016). Forty-one high school coaches of various sports were randomly assigned to two groups. Each group attended two 90-minute sessions based on the theory of planned behavior. These sessions consisted of intervention strategies for improving athlete nutrition. While both groups attended the sessions, one group was also given a decision making algorithm to help improve coaches' sports nutrition recommendations. The algorithm was a decision-making tool which allowed evidence-based sports nutrition information to be viewed in specific contexts (e.g., before, during, and after training and competition). In addition, it presented an example of an optimal plate for an athlete, provided examples of sources of all macronutrients, and suggestions for snacks during recovery (e.g., what to eat during effort/competition and what to eat in particular event situations). A different decision-making algorithm was given for each type of sport. During the two months after the intervention coaches' nutritional recommendations to their athletes were logged. Coaches who were provided with the decision-making algorithm that included formulas for determination of needed energy and macronutrients provided higher numbers of nutrition recommendations to their athletes during the two month post-intervention period (25.7 ± 22.0 recommendations per coach with formulas; 9.4 ± 6.5 recommendations per coach without formulas), indicating a significant difference ($P < 0.004$). Post-intervention knowledge was

increased in both groups, but in a two month follow-up session only the coaches provided with the formulas achieved a significant increase in nutritional knowledge ($P=0.04$) (Jacob et al., 2016).

Athletes count on coaches for training/event schedules and performance strategies, including nutrition advice. Coach suggestions for behavior change strategies can make an impact on athlete behavior. In a 2009 study, researchers asked coaches to follow a primary prevention and health promotion intervention program with female high school athletes (Ranby et al., 2009). The program focused on preventing steroid use, unhealthy weight loss and excessive creatine use. The program "Athletes Targeting Healthy Exercise and Nutrition Alternatives" (ATHENA) provided education for 25 different teams. Athletes were given educational assignments and presentations on the harmful effects of steroids, nutrition for sport performance, harmful effects of eating disorders, media impact on body image and self-efficacy tactics to resist unhealthy weight loss. Athletes who were included were in ninth or tenth grade. This age group included very few involved in steroid use or disordered eating. Thirty-five control teams were included who did not participate in the program. A post-test revealed decreased both short-and long-term intentions to use steroids and engage in unhealthy weight loss behavior. The ATHENA program was more successful in prevention of intended use of unhealthy eating behaviors or steroid use when compared with control groups. Implications of this study show coaches who are increasing athlete nutritional knowledge have a direct impact on the nutritional intentions and behaviors of those athletes. Coach interventions are important influences on adolescent disordered eating and could be substantially more successful if the topics are addressed before detrimental behaviors are in practice (Ranby et al., 2009). The compilation of media information and education on the harmful impact of practicing those unhealthy weight loss behaviors could be used as educational

settings over a wide spectrum. The implementation of preventive programs in high schools may be an effective tool to combat unhealthy nutritional behaviors among athletes (Ranby, et al., 2009).

Conclusion

The purpose of this review is to demonstrate some trends in coach and younger athlete nutrition knowledge. There is a lack of research on the nutritional knowledge in both coach and especially younger athlete groups; however, from what is available it is clear that nutrition knowledge is low among both groups. In addition it has been shown that nutrition education given or outlined by RDNs is beneficial. Yet few athletes or coaches list an RDN as a source of nutrition information. The source of coach nutritional knowledge for high school athletes is a subject that needs more exploration.

The high school sports coach has many responsibilities and holds the trust of the athletes (NFHS, n.d.). Previous survey results have shown that coaches are the main sources of nutritional information for high school athletes (Cockburn, et al., 2014; Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, 2010; Poobalan, Aucott, Clarke, & Smith, 2014; Rosenbloom, Jonnalagadda, & Skinner, 2002; Wiens, Erdman, Stadnyk, & Parnell, 2014). While licensed and registered sports dietitians are the most appropriate sources of nutrition information for athletes, they are not as accessible as the coach. Athletes without direct access to an RDN trust their coach to answer questions concerning nutrition for training. However, previous research has shown a large discrepancy between what sports dietitians recommend for adolescent athletes and what coaches recommend (Jacob, et al., 2016; Danaher & Curley, 2014; Trakman, Forsyth, Devlin, & Belski, 2016).

This discrepancy in recommendations begs the question: Do high school coaches believe they are giving their athletes the best nutritional recommendations, or do the coaches recognize a need for improvement? A study was designed to answer this and other questions. This study's main investigative objective is to determine if coaches' level of confidence in their ability to give nutritional advice correlates to their knowledge of nutritional topics that are relevant to high school athletes. To answer these questions the High School Coach Nutritional Skills Questionnaire was developed. The questionnaire is a modified version of a previously validated nutrition questionnaire (Zinn, Schofield, & Wall, 2005). The questionnaire first probes coaches to rate their confidence in their nutritional knowledge in a general sense, then in each nutritional category (carbohydrate, fat, protein, recovery, fluid, weight management and supplements). Second, coaches move on to nutrition questions concerning each category previously listed. The results from the nutrition knowledge questions are then scored to determine skill level. The questionnaire is meant to determine if overall confidence and confidence in each section of the nutrition questionnaire relate to overall score and section score. Does length of coaching experience impact score? Does sex impact score? Does age impact score? Does level of education impact score? Lastly, where do coaches source their nutrition information?

CHAPTER 3. METHODS AND PROCEDURES

The purpose of this study was to assess the current level of nutrition skills among a sample of high school coaches in two Midwest states and to explore their confidence and usual methods of addressing nutrition concerns among high school athletes who seek guidance.

Research Questions

- 1) Is there a relationship between high school coach confidence level in nutrition skills and their score on a nutrition questionnaire?
- 2) Are scores on High School Coach Nutrition Skills questionnaire related to age, sex, education level, or experience?
- 3) What are the primary sources for nutrition information for surveyed high school coaches?

Participants and Recruitment

A cross-sectional study was used to recruit high school athletics coaches employed in two Midwestern states who are members of the High School Coaches Association of their state. Each member was invited to participate in an electronic survey. Once this study's procedure and protocols were approved by the Institutional Review Board of North Dakota State University (Appendix C), permission to send out the survey was sought out and given by two state High School Coaches Associations.

Survey Design

This questionnaire developed for this study was based on a previously validated and published questionnaire (Zinn, Schofield, & Wall, 2005). The High School Coach Nutrition Skill Questionnaire is a modified version of an older iteration which was assessed for content validity and reliability, and it is quantitative in nature (Zinn, Schofield, & Wall, 2005). The design of the

Zinn, et al. study was fixed and the main objective to determine if coaches' level of confidence in their ability to give nutritional advice matched their nutrition skill level that are relevant to college athletes. Construct validity was confirmed using a between-groups analysis of variance with five different population groups: university staff (n=230), dietitians (n=96), nutrition students (n=25), business students (n=30) and fitness students (n= 60) (Zinn, Schofield, & Wall, 2005). The reliability of the questionnaire was confirmed using test–retest analysis (Zinn, Schofield, & Wall, 2005). This questionnaire was shown to be psychometrically valid and reliable and suitable for use in athletic groups (Zinn, Schofield, & Wall, 2005).

For the current study, some questions were modified slightly to ensure cultural translation from common New Zealand terminology to Midwest United States terminology. The questionnaire featured five different sections on nutrition (nutrients, fluids, recovery, weight control and supplements). The updated questionnaire was pilot tested for face validity. A group of 50 university students majoring in coaching or exercise science were asked to complete the nutrition section of the questionnaire. Thirty-seven students opted to take the questionnaire. The students scored an average of 60% correct. The scores ranged from 41% to 82%. The students scored best in the recovery section with an average of 68% correct, nutrients category 66%, fluids category 63%, weight management category 49%, supplements category 30% correct. These results are consistent with previous studies using the Zinn questionnaire. Students who took the questionnaire were asked to write comments if any questions needed more clarification. The only comment was in the nutrients section: “Do you mean to include empty carbs.” No differences between sex or major were calculated because students were instructed not to write their names to keep the information anonymous.

After face validity was confirmed, the questionnaire was approved by the NDSU Institutional Review Board (IRB) (see Appendix C). The electronic questionnaire (see Appendix B) was distributed to participants through Qualtrics (Provo, Utah). The questionnaire was administered three times to high school coaches in two different states in order to optimize the participation rate during a three week period in May of 2017. After the participant received the URL, they were directed to the informed consent form where instructions on survey completion were provided. Participants were not able to return to a section after completion of any section.

The final High School Coach Nutrition Skills Questionnaire included a demographic, nutrition confidence, and finally a nutrition skills section. The first section of the questionnaire consisted of ten demographic questions including age, sex, education level and number of years coaching. The second section contained eight multiple choice questions concerning confidence in nutrition knowledge. A five-point Likert scale was used to assess confidence in nutrition knowledge starting at 1 (not confident), 2 (low confidence), 3 (neutral), 4 (somewhat confident) and ending at 5 (very confident). Participants rated their confidence regarding their nutrition knowledge about the following topics: overall nutritional knowledge, carbohydrates, fats, protein, nutrition for recovery, fluid needs, weight management and supplements. The third section contained 81 nutrition knowledge questions. The multiple choice questions were separated into five categories: nutrient content, recovery, fluids, weight maintenance and supplements. All questions included an “unsure” answer for participants to indicate if they did not have sufficient knowledge to answer the question. Participants were instructed to choose this selection to eliminate the possibility of guessing. This allowed for the differentiation of the coaches who perceive self-correct, incorrect or insufficient knowledge. Answers were assigned a +1 score for the correct response and 0 score for an incorrect or unsure response for the purpose

of determining the total mean percent correct score. To complete the analysis the answers were assigned to three separate codes. One code was used for the correct answer, one code was used for an incorrect answer and one code was used for an answer of unsure. The scoring system was validated using Pearson's Product-Moment Correlation technique (Zinn, Schofield, & Wall, 2005). Previous research had determined that a score of 70-75% correct on the nutrition skills portion of the questionnaire would be representative of adequate nutritional knowledge (Torres-McGehee, et al., 2012). However, the Torres-McGehee article did not describe how determination of "adequate nutritional knowledge" was set.

Statistical Analysis

All statistical analyses were performed using SAS software (Statistical Analysis System 2015, Chicago, IL). Coaches' demographic data and their total and subcategory mean scores were calculated using descriptive statistics. Linear regression analysis with the nutrition confidence score as the dependent variable and total mean nutrition score as the independent variable were planned to determine if confidence in nutrition knowledge and ability to give nutritional advice predicted scores. Statistical significance was set with an alpha level of $P \leq 0.05$.

CHAPTER 4. NUTRITION SKILLS OF HIGH SCHOOL COACHES

Abstract

High school athletes obtain nutritional information from their coaches, yet high school coaches' capability in this area may be lacking. Therefore, the aim of this study was to examine both confidence and skill level regarding nutrition among Midwest high school coaches. Out of an estimated 2,700 possible invited coaches from two Midwest states in the US, 113 coaches completed the questionnaire. The questionnaire's first two sections consisted of demographics, and questions concerning confidence in nutritional knowledge. The third section 81 nutrition knowledge questions separated into categories: nutrient content, recovery, fluid, weight maintenance, and supplements. Coaches reported moderate overall confidence in their ability to give nutritional advice ($P=.0016$). The overall knowledge score was 58.7% (± 9.7). The highest score was obtained in the recovery subcategory, and the lowest score was in the supplements category. In conclusion, Midwest high school coaches would benefit from creating a working relationship with a dietitian.

Keywords: sport nutrition skills; nutrition training; sports nutrition; high school coaches

Introduction

Athletic performance is enhanced by following the recommended nutrition and diet guidelines for one's sport, sex and age group (Academy of Nutrition & Dietetics, 2016). Collegiate athletes often receive personalized diet plans, pregame meals and body composition testing conducted by their athletic coaches and staff. Their collegiate-level coaches typically have education or training specific to coaching and team management (Poobalan, Aucott, Clarke, & Smith, 2014), and registered dietitian nutritionists (RDNs) are usually available to the athletes for individualized nutritional counseling (Rosenbloom, Jonnalagadda, & Skinner, 2002).

Collegiate athletes can have a team of individuals to support their training and performance. Coaches, assistant coaches, athletic trainers and sports dietitians are often available to collegiate athletes (National Collegiate Athletic Association, n.d.). The availability of professional resources to these athletes creates a safe environment in which athletes can train at high levels (Rosenbloom, Jonnalagadda, & Skinner, 2002). However, before competing at the higher education level athletes build skills starting at a young age and can be very competitive starting as young as age 12 (Line, 2016). Unfortunately, support systems outside of coaching staff can be lacking at these younger ages of competition.

Pre-collegiate school-based coaches are often teachers who have little to no nutritional training (Jacob, et al., 2016; Danaher & Curley, 2014; Trakman, Forsyth, Devlin, & Belski, 2016). During adolescence many nutritional behaviors are forming (Story, Neumark-Sztainer, & French, 2002), and this is when high school athletic coaches are preparing players for collegiate competition. Nutrition for sports performance is an increasingly popular topic in both scientific research and also among the popular press, however, little research has been done with adolescent athletes. Some research that has been completed has shown that most high school athletes use coaches as their main source of nutritional information (Cockburn, et al., 2014; Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, 2010; Poobalan, Aucott, Clarke, & Smith, 2014; Rosenbloom, Jonnalagadda, & Skinner, 2002; Wiens, Erdman, Stadnyk & Parnell, 2014). Surveys have shown a large discrepancy between what RDNs recommend for adolescent athletes and what coaches recommend (Jacob, et al., 2016; Danaher & Curley, 2014; Trakman, Forsyth, Devlin, & Belski, 2016).

Information Sources Used by Athletes for Nutrition

High school athletes count on their coaches to provide them with their training schedules and sport-related strategies. However, another large part of athletic performance is nutrition. High school athletes face unique challenges when strategizing approaches to nutrition. The Academy of Nutrition and Dietetics' (Academy) 2016 position statement specifically addresses the nutritional needs of athletes. The Sports Dietitian Association (SDA) of Australia created a position statement on recommendations for adolescent athletes, recognizing that adolescent athletes are a high risk group for nutritional deficiencies and other nutrition related risks (SDA, 2014).

There is a multitude of information available to athletes on the subject of nutrition and how it impacts performance and recovery. Regrettably, many commonly used sources of information are less than reputable; in the United States, misinformation of nutrition recommendations is common among student athletes who may receive most of their nutritional knowledge from popular sports and health magazines, parents and coaches (Hornstrom, Friese, Ellery, & Pike, 2011). In a separate 2006 questionnaire based study on supplement use in high school athletes (n=139), 38% of participants listed the coach as their main source of nutritional information (Scofield, & Unruh, 2006).

How athletes get their nutrition information and how this could be related to nutrition skills as measured by a nutrition knowledge survey has been studied outside of the United States. A survey based study completed in 2010 included an examination of the nutritional knowledge of Iranian college level athletes; it aimed to assess which factors determine adequate nutritional knowledge (Jessri, Rashidkhani, & Zinn, 2010). The questionnaire, developed in New Zealand, was shown to be psychometrically valid and reliable and suitable for use in athletic groups (Zinn,

Schofield, & Wall, 2005). The multiple choice nutrition questions were separated into five categories including: nutrient content, recovery, fluids/hydration, weight control and supplements. All questions included an “unsure” answer for participants to indicate they do not have sufficient knowledge to answer the question. The male athletes (n=109) scored 28.22 ± 15.6 out of 88 (32% correct) while female athletes (n=98) female scored 38.72 ± 16.7 out of 88 (44% correct) on the general nutritional knowledge questionnaire (Jessri, Rashidkhani, & Zinn, 2010). A large majority of the study participants (89%) listed the coach as their main source of nutrition information.

Coaches have been listed as a main source of nutritional knowledge by athletes in questionnaire based studies (Jacob et al., 2016; Trakman, Forsyth, Devlin, & Belski, 2016). However, previous surveys have shown that coach nutritional knowledge does not meet adequate knowledge levels. In one study, varsity coaches at a Canadian university (n=5) completed a nutritional knowledge survey (Danaher & Curley, 2014). Coaches were first asked to rate their own nutritional knowledge on a scale of one to ten and answered questions on nutritional topics relevant to athletes such as pre-competition, fluid needs, dietary supplementation and weight management. The questionnaire was a combination of a modified version of the previously mentioned New Zealand nutrition questionnaire (Zinn, Schofield, & Wall, 2005) and other similar questionnaires. All coaches in this study scored low in the nutritional knowledge section of the questionnaire. The section on pre-competition nutrition had the highest composite score (68%). Earlier research had determined a score of 70-75% correct on the nutrition portion of the questionnaire would determine adequate nutritional knowledge (Torres-McGehee, et al., 2012); however, this study did not describe how the cut point was determined.

In another survey based study coaches revealed below adequate knowledge about the current nutrition issues relevant to adolescent athletes (Cockburn, et al, 2014). The study was conducted in the United Kingdom comparing the relationship between coaches who give nutrition advice to athletes, and nutritional knowledge of those coaches. The first section of this questionnaire contained demographics and questions asking coaches if they imparted nutrition advice to athletes. The nutrition knowledge portion of the questionnaire was a modified version of the New Zealand standardized questionnaire. Researchers distributed this questionnaire to 163 eligible coaches (Zinn, Schofield, & Wall, 2005). The average of correct questions answered by coaches on the questionnaire was $60 \pm 10\%$ which falls below the “adequate score” (70-75% correct) (Torres-McGehee, et al., 2012). When researchers applied negative scoring (subtracting a point for each incorrect answer while adding a point for each correct answer) to the questionnaire, the mean score was 35% correct.

The high school sports coach has many responsibilities and holds the trust of their athletes (NFHS, n.d.). Previous survey results have shown that coaches are the main sources of nutritional information for high school athletes (Cockburn, et al., 2014; Jacob, et al., 2016; Jessri, Rashidkhani, & Zinn, 2010; Poobalan, Aucott, Clarke, & Smith, 2014; Rosenbloom, Jonnalagadda, & Skinner, 2002; Wiens, Erdman, Stadnyk, & Parnell, 2014). While licensed RDNs are the most appropriate sources of nutrition information for athletes, they are not as accessible as the coach. Athletes without direct access to an RDN trust their coaches to answer questions concerning nutrition for training. However, previous research has shown a large discrepancy between what sports dietitians recommend for adolescent athletes and what coaches recommend (Jacob, et al., 2016; Danaher & Curley, 2014; Trakman, Forsyth, Devlin, & Belski,

2016). A study was designed to address this concern. Specific research questions investigated were:

- 1) Is there a relationship between high school coach confidence level in nutrition skills and their score on a nutrition questionnaire?
- 2) Are scores on High School Coach Nutrition Skills questionnaire related to age, sex, education level, or experience?
- 3) What are the primary sources for nutrition information for surveyed high school coaches?

Method

Participants

A cross-sectional study was used to recruit high school athletics coaches residing in two Midwestern states who are members of the High School Coaches Association of their state. Each member was invited to participate in an electronic survey. Once the study procedure and protocols were approved by the Institutional Review Board of North Dakota State University (Appendix C), permission to send out the survey was sought out and given by two state High School Coaches Associations.

Instrumentation

The electronic questionnaire (see Appendix B) was distributed to participants through Qualtrics (Provo, Utah). After the participant received the URL, they were directed to the informed consent form where instructions on survey completion were provided (Appendix C).

The first section of the questionnaire consisted of ten demographic questions including age, sex, education level and number of years coaching. The second section contained eight multiple choice questions concerning confidence in nutritional knowledge. A five-point Likert

scale was used to assess confidence in nutritional knowledge: 1 strongly disagree, 2 disagree, 3 neither agree or disagree, 4 agree, 5 strongly agree. Participants rated their confidence on their nutrition knowledge about the following topics: overall nutritional knowledge, carbohydrates, fats, protein, nutrition for recovery, fluid needs, weight management and supplements. The third section contained 81 nutrition questions to assess nutrition skill level. The multiple choice nutrition questions were separated into five categories: nutrient content, recovery, fluids, weight maintenance and supplements. In the nutrients section, coaches responded to 46 questions, 34 of which asked them to categorize different foods as high or low in carbohydrate, protein, fat and saturated fat. In the fluids section coaches responded to eight questions on timing and type of fluid for optimal hydration during athletic events/training. In the recovery section, coaches responded to 11 questions, eight of which were about selecting an appropriate snack after an event/training. In the weight maintenance section, coaches responded to 15 questions, four of which were about proper strategies for weight gain, while 11 concerned weight loss. Seven questions in this section were about choosing the proper snacks for different management goals. The supplement section consisted of nine questions, four of which asked coaches to determine when supplements should be prescribed.

Participants were not able to return to a section after completion of any section. All questions included an “unsure” answer for participants to indicate they did not have sufficient knowledge to answer the question; this also eliminated the possibility of guessing which allowed for the differentiation of the coaches who were correct, incorrect, or had no knowledge. Answers were assigned a +1 score for the correct response and 0 score for an incorrect or unsure response for the purpose of determining the total mean percent correct score. To complete the analysis the answers were assigned to three separate codes. One code was used for the correct answer, one

code was used for an incorrect answer and one code was used for an answer of unsure. The scoring system was validated using Pearson's Product-Moment Correlation technique (Zinn, Schofield, & Wall, 2005).

Procedure

This cross-sectional study and questionnaire was based on a previously validated and published questionnaire (Zinn, Schofield, & Wall, 2005). The High School Coach Nutrition Skill Questionnaire, created for the current study, is a modified version of an older iteration which was assessed for content validity and reliability, and it is quantitative in nature (Zinn, Schofield, & Wall, 2005). The design of the Zinn, et al. study was fixed and the main objective to determine if coaches' level of confidence in their ability to give nutritional advice matched their nutrition skill level that are relevant to high school athletes. Construct validity was confirmed using a between-groups analysis of variance with five different population groups: university staff (n=230), dietitians (n=96), nutrition students (n=25), business students (n=30) and fitness students (n= 60) (Zinn, Schofield, & Wall, 2005). The reliability of the questionnaire was confirmed using test-retest analysis (Zinn, Schofield, & Wall, 2005). This questionnaire was shown to be psychometrically valid and reliable and suitable for use in athletic groups (Zinn, Schofield, & Wall, 2005).

For the current study, some questions were modified slightly to ensure cultural translation from common New Zealand terminology to Midwest United States terminology. The questionnaire featured five different sections on nutrition (nutrients, fluids, recovery, weight control and supplements). The updated questionnaire was pilot tested for face validity. A group of 50 university students majoring in coaching or exercise science were asked to complete the nutrition section of the questionnaire. Thirty-seven students opted to take the questionnaire. The

students scored an average of 60% correct. The scores ranged from 41% to 82%. The students scored best in the recovery section with an average of 68% correct; in the nutrients category they scored 66%, fluids category 63%, the weight management category 49%, supplements category 30% correct. These results are consistent with previous studies using the Zinn questionnaire. Students who took the questionnaire were asked to write comments if any questions needed more clarification. The only comment was regarding the nutrients section: “Do you mean to include empty carbs.” No differences between sex or major were calculated because students were instructed not to write their names to keep the information anonymous.

After face validity was confirmed, the questionnaire was approved by the NDSU Institutional Review Board (IRB) (see Appendix C). The electronic questionnaire (see Appendix B) was distributed to participants through Qualtrics (Provo, Utah). The questionnaire was administered three times to high school coaches in two different states in order to optimize the participation rate during a three week period in May of 2017. The questionnaire was launched, and in the initial week it received 60 responses. Participants were not able to return to a section after completion of any section. After the participant received the URL, they were directed to the informed consent form where instructions on survey completion were provided.

The final High School Coach Nutrition Skills Questionnaire included a demographic, nutrition confidence, and finally a nutrition skills section. The multiple choice questions were separated into five categories: nutrient content, recovery, fluids, weight maintenance and supplements. All questions included an “unsure” answer for participants to indicate if they did not have sufficient knowledge to answer the question. Participants were instructed to choose this selection to eliminate the possibility of guessing. This allowed for the differentiation of the coaches who perceive self-correct, incorrect or insufficient knowledge. Answers were assigned a

+1 score for the correct response and 0 score for an incorrect or unsure response for the purpose of determining the total mean percent correct score. To complete the analysis the answers were assigned to three separate codes. The scoring system was validated using Pearson's Product-Moment Correlation technique (Zinn, Schofield, & Wall, 2005). Previous research had determined that a score of 70-75% correct on the nutrition skills portion of the questionnaire would be representative of adequate nutritional knowledge (Torres-McGehee, et al., 2012). However, the Torres-McGehee article did not describe how determination of "adequate nutritional knowledge" was set.

Analysis of the Data

All analyses were conducted with SAS Institute Inc. (Statistical Analysis Software, 9.2, 2011, Cary, NC). Coaches' demographic data and their total and nutrition skills subcategory mean scores were calculated using the scoring system described earlier. Descriptive statistics (frequencies, percentiles, means and standard deviations) were performed on all data. Statistical significance was set at an alpha level of $p \leq .05$. The Likert scales for confidence level in nutrition skills were scored such that higher scores reflected greater confidence in ability to give nutrition advice. Likert scores were summed then converted to mean percentages of confidence to facilitate comparisons between confidence levels and scores on both the total and subsections nutrition skills questionnaire. Level of confidence was compared to nutrition skills scores both in total and also by each subcategory using Analysis of Variance (ANOVA). Years of experience, sex, age and education were compared to nutrition skills scores both in total and by subcategory using ANOVA.

Results

Characteristics of Participants

Surveyed high school coaches (n=175) responded to the survey. Of those responses, 113 surveys were completed and 62 were left incomplete and not included. With the 113 survey responses out of 2,700 possible the response rate was approximately 4%. Demographic information for the 113 participants shows that majority of the participants were between the age of 30 and 49 years old (Table 1). The majority of the participants were male, making up 74% (n=83) of the sample. Of the 113 coaches, most had a bachelor's degree, 56% (n=63), or a master's degree 37% (n=42). Two respondents reported "other" for education, reportedly from a technical college. Therefore, for analysis "other" and "GED/vocational" were combined (n=8). Of the 113 coaches, 34% (n=39) had over 20 years of experience as a high school coach. Further demographic characteristics can be viewed in Table 1.

Table 1

Sex, age, education and years of experience among 113 high school coaches

Variable	N	%
Sex		
Male	83	74
Age		
18-19	0	0
20-29	18	16
30-39	28	25
40-49	36	32
50-59	21	19
60 & up	10	10
Education		
GED/Vocational/Other	8	7
Bachelor's degree	63	56
Graduate degree	42	37
Years of Coaching		
less than 1 year	0	0
1-5 years	17	15
6-10 years	21	19
11-15 years	24	21
16 to 20 years	12	11
> 20 years	39	34

Self-Reported Nutrition Training

Of the 113 respondents, 35% (n=40) reported that they had completed some type of formal nutrition training within the last five years. The 63% (n=71) that indicated other types of training provided answers including: conventions, daycare requirement training, personal research, online course from NFHS and clinics (see Table 2).

Table 2

A sample of coaches' (n=113) reported completion of nutrition training in last 5 years

Variable	N	%
Course for college credit	13	11
One-on-one training with a registered dietitian nutritionist	1	1
Accredited online training	4	4
Nutrition session at conference	22	19
No nutrition training in the last 5 years	7	6
Other	71	63

Self-Reported Source of Nutrition Information

The sample of coaches were asked where they sourced nutrition and health information. They rated frequency of use on a Likert scale of one to five, with five being most frequent (see Figure 1). Five coaches responded “other,” written in answers included coach trainings and N/A.

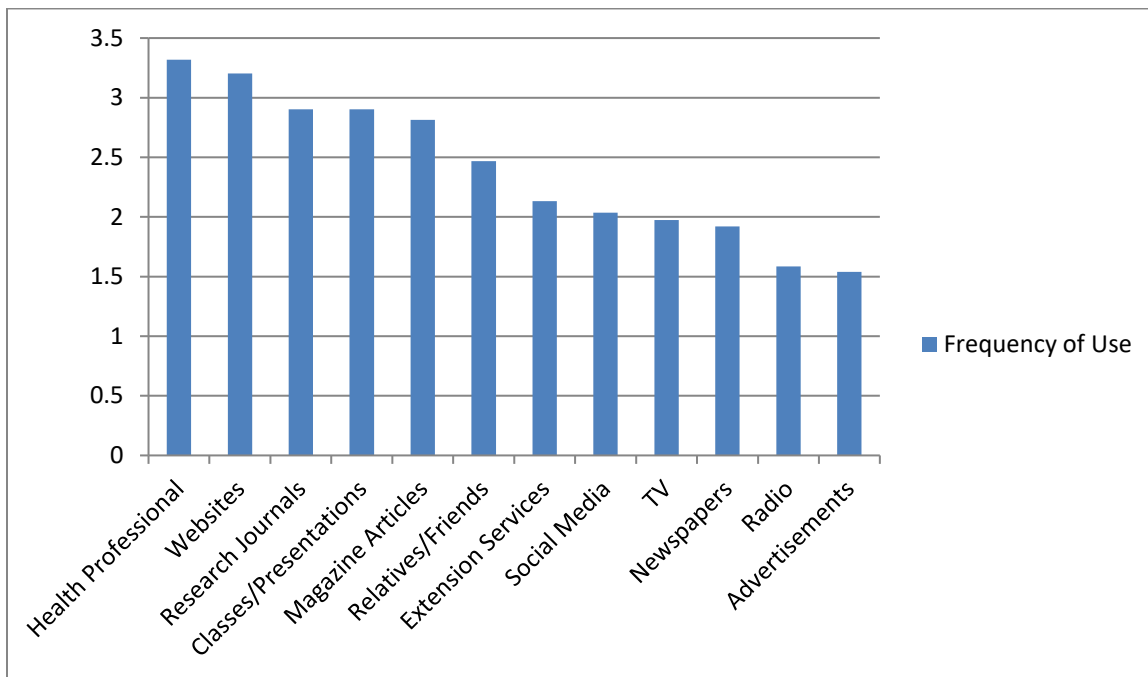


Figure 1. A sample of high school coaches (n=113) reported sources of nutrition and health information from 1 (never) to 5 (most frequent).

Self-Reported Confidence in Ability to Give Nutritional Advice

Coaches were asked to report their level of total and subcategory confidence concerning their ability to give nutritional advice to their athletes using a five point Likert-type scale. Subcategories included overall nutrient advice, nutrients (carbohydrates, proteins, fats), fluids, recovery, weight maintenance and supplements. Data was quantified by converting “strongly agree” to equal 5, “agree” to equal 4, “neither agree nor disagree” to equal 3, “disagree” to equal 2 and “strongly disagree” to equal 1. This data was then summed and averaged, and the number of respondents per nutrient category was reported. The majority of coaches (55%, n=62) agreed that they were confident in their ability to give overall nutrition advice to athletes with an average Likert rating of 3.5. Only 3% (n=3) of coaches responded "strongly disagree" to their confidence in their ability to give overall nutritional advice to athletes. Coaches were most confident in their ability to give nutritional advice concerning fluid intake, with 15% (n=18)

responding with "strongly agree," with an average Likert rating of 3.83. Coaches reported the least amount of confidence in the category of nutrition advice on supplement intake, with 35% (n=39) reporting "disagree," and 8% (n=9) reporting "strongly disagree," with a combined Likert rating of 2.0. The category of nutrients was split into three sections, carbohydrates, proteins, and fats. This was done to see if there was a difference in coach confidence between the individual macronutrients. Of the three, protein had the most responses of "strongly agree" (n=7) and "agree" (n=53). The overall confidence rating for both the macronutrient and weight maintenance sections was 3.3 and 3.3. Age, sex, level of experience and education were compared to overall confidence level in ability to give nutrient advice using T-tests (see Table 3). To determine overall confidence level, all subcategory confidence ratings on the Likert scale were summed and averaged in regards to demographic variable.

Table 3

Correlations among a sample of high school coaches; the impact of demographic variables on the nutrition confidence level and nutrition skills score of high school coaches (n=113)

Demographic Variable	Confidence Score	Nutrition Skills Score
Sex	P=0.4083	P=0.5674
Age	P=0.1158	P=0.1387
Education Level	P=0.1885	P=0.0047
Experience	P=0.3009	P=0.7076

Score on Nutrition Skills Questionnaire

The total mean score for all coaches was $58.7\% \pm 9.7$. Scores ranged from a high of 97% and a low of 25% correct. Coaches scored highest in recovery, fluids, and nutrients with 66%, 64% and 66% respectively. Of all the categories, coaches scored lowest in the supplement section with an average score of 25% correct. In the weight maintenance section, scores averaged 56% correct (see Table 4).

Table 4

Nutrition skills individual category ranked scores of ranked scores among 113 high school coaches

	Mean Percent Correct \pm Standard Deviation	Rank
Recovery	66.7 ± 15.1	1
Fluids	65.6 ± 18.3	2
Nutrients	63.7 ± 13	3
Weight maintenance	56.1 ± 12.7	4
Supplements	25.6 ± 22.8	5

Level of Agreement Between Confidence in Ability to Give Nutrition Advice to Athletes and Nutritional Skills Score

Coaches reported the highest average confidence level on the 5-point scale in the fluids category (M=3.83). On the nutrition skills questionnaire, fluids was the second most correctly answered (M=65.6%). The next highest reported average confidence level was the overall score (M=3.5). The overall nutrition skills score was (M=58%). The third highest reported average confidence level was in the nutrient category (M=3.3). The nutrient subcategory was the third highest ranking average score (M= 63.7%). The fourth ranked average confidence level was in

the category of weight control (M=3.3). Weight control was the fourth ranked average score (M=56%). The lowest ranking category in both nutrient score (M=25%) and confidence rating (M=2.8) was the supplement category. Though the supplements category was ranked lowest in both confidence level and actual score, it had the biggest discrepancy between confidence and score.

There was a significant correlation between coaches' average confidence level and their total score on the nutrition skills questionnaire (P=.0016). The oval in Figure 2 shows the predicted range of the nutrition scores based on the confidence level of high school coaches in this sample. There were four outliers in this correlation, three of which had high confidence levels (around 60% confident) but scored below 40% correct. There was also one outlier who had a confidence level of 40% and scored above 80% correct. There is a small correlation (P=0.0016) between coaches' confidence level and their score on the nutrition skills questionnaire (see Figure 2).

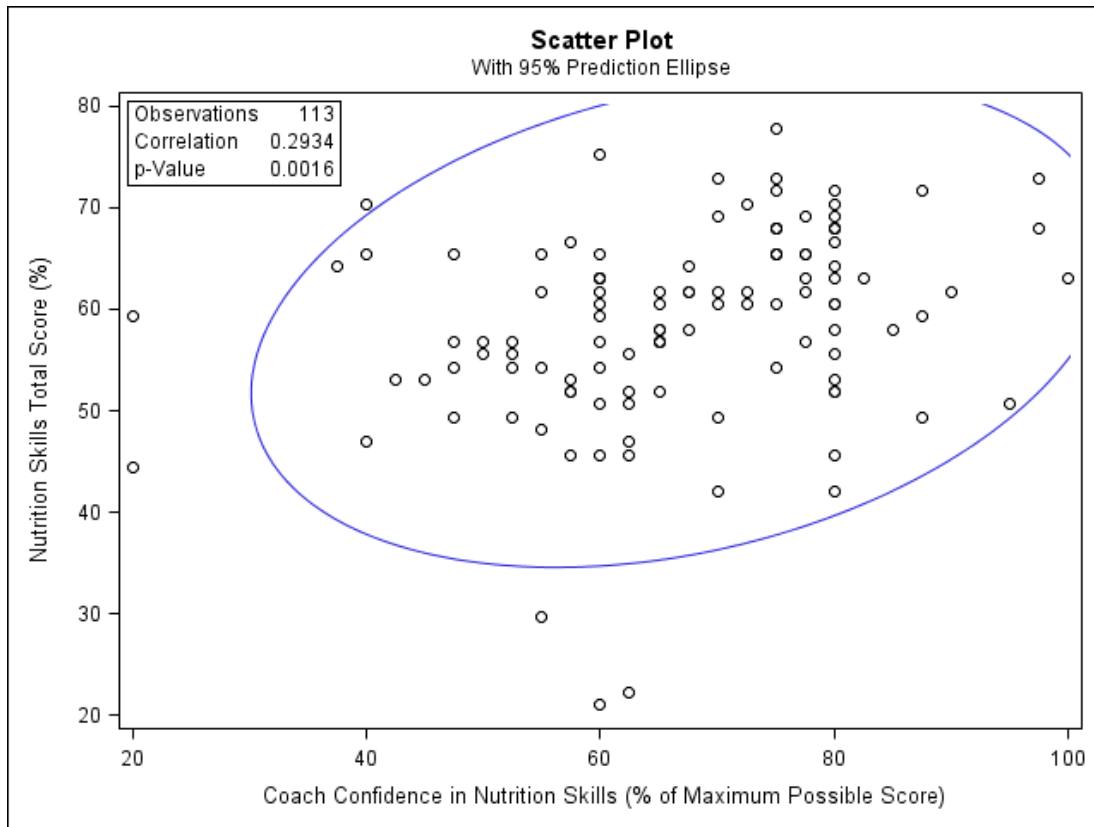


Figure 2. Correlation plot for the total nutrition skills score and the level of confidence in their nutrition skills among 113 high school coaches

Demographic Variable Impact on Nutrition Skills Score

No statistically significant differences were found for total nutrition skills scores for the demographic variables sex, age, years of experience as a coach and completion of nutrition training within the last 5 years. There was a statistical difference found for education level of coaches (P=0.0047).

Table 5 illustrates a Duncan grouping for the average nutrition skills scores when categorized by education level (see Table 5). There is a significant difference between groups with different letters. Coaches who have achieved a bachelor's degree or higher score significantly higher than coaches who have a high school diploma, vocational, or other degree (associate).

Table 5

A Duncan grouping of average scores on the nutrition skills questionnaire categorized by education level among a sample of 113 high school coaches

Duncan Grouping	Mean	N	Q5
A	59.74	63	BS
	9		
A	59.05	42	Grad
	3		
B	48.14	8	HS/VT/
	8		O

*BS=Bachelor's degree; Grad=Graduate degree; HS/VT/o=high school or vocational/two year degree

There are no significant differences found between average subsection scores for the demographic variables of sex, age or years of experience. This lack of significance could be attributed to the unequal distribution of group sizes within the demographics (e.g. 74% male). There was a significant difference found between education levels in the subsections of nutrients (P=0.013) and weight maintenance (P=0.031).

Findings included a significant difference in total nutrition skill scores between coaches with a bachelor’s degree or higher, and those who have who have a high school, vocational or other degree (associate). This information is displayed in a box plot below (Figure 3). The middle line represents the median scores while the diamond represents the mean scores; the upper and lower scores in each category are represented with the vertical bar above and below each box. There is one outlier in the graduate group, meaning that one coach who had a high level graduate degree scored lower than others with the same degree on the nutrition skills questionnaire. There is also a larger range of scores from coaches who have a high school, vocational or other degree (associate).

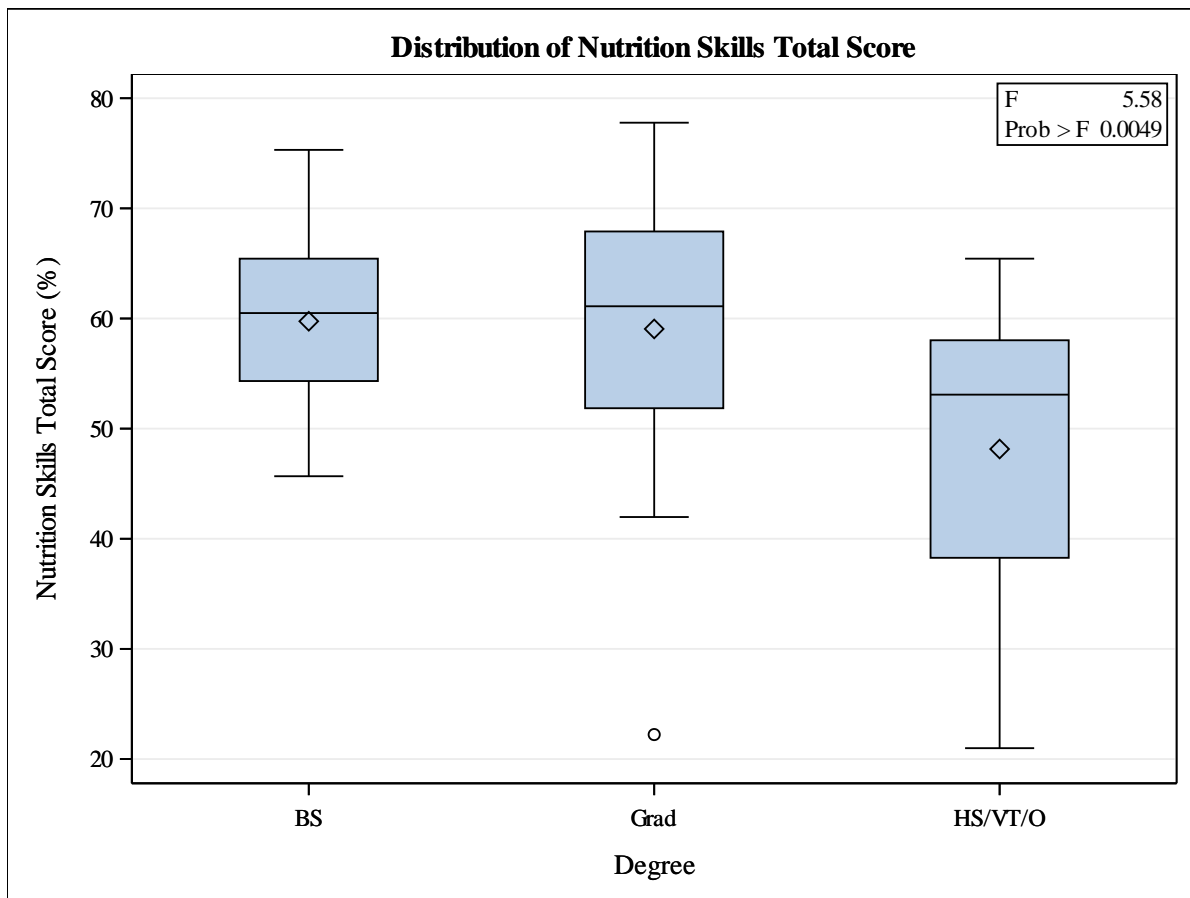


Figure 3. A box plot with total nutrition skills score as the dependent variable when compared with level of education among 113 high school coaches.

Nutrients Subcategory Score and Education Level

There is a significant difference in the scores of the nutrient subcategory between coaches with a bachelor’s degree or higher, and those who have who have a high school, vocational or other degree (associate). There is one outlier in the graduate group, meaning that one coach who had a high level graduate degree scored lower than others with the same degree in the nutrients subcategory (see Figure 4).

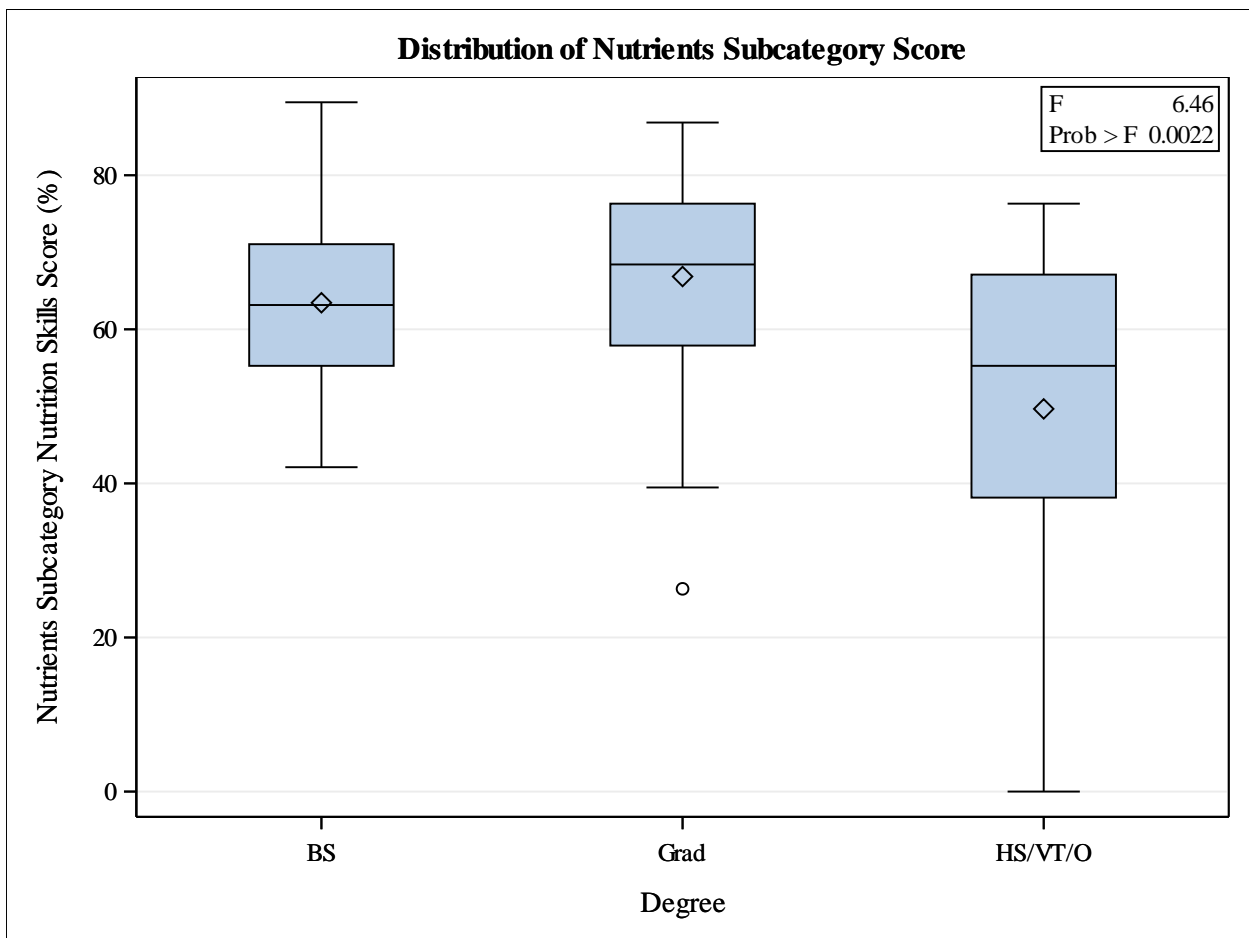


Figure 4. A box plot with nutrition subcategory score as the dependent variable when compared with level of education among 113 high school coaches.

Fluids Subcategory Score and Education Level

There is a significant difference in the scores of the fluids subcategory between coaches with a bachelor's degree or higher, and those who have who have a high school, vocational or other degree (associate). There are a few outliers in the all three education groups, meaning that those scored higher or lower than others with the same degree in the fluids subcategory. While the bachelor's and higher level graduate degree groups have more low outliers and a higher range, they each have one member with a perfect score in the fluids section of the nutrition skills questionnaire (Figure 5).

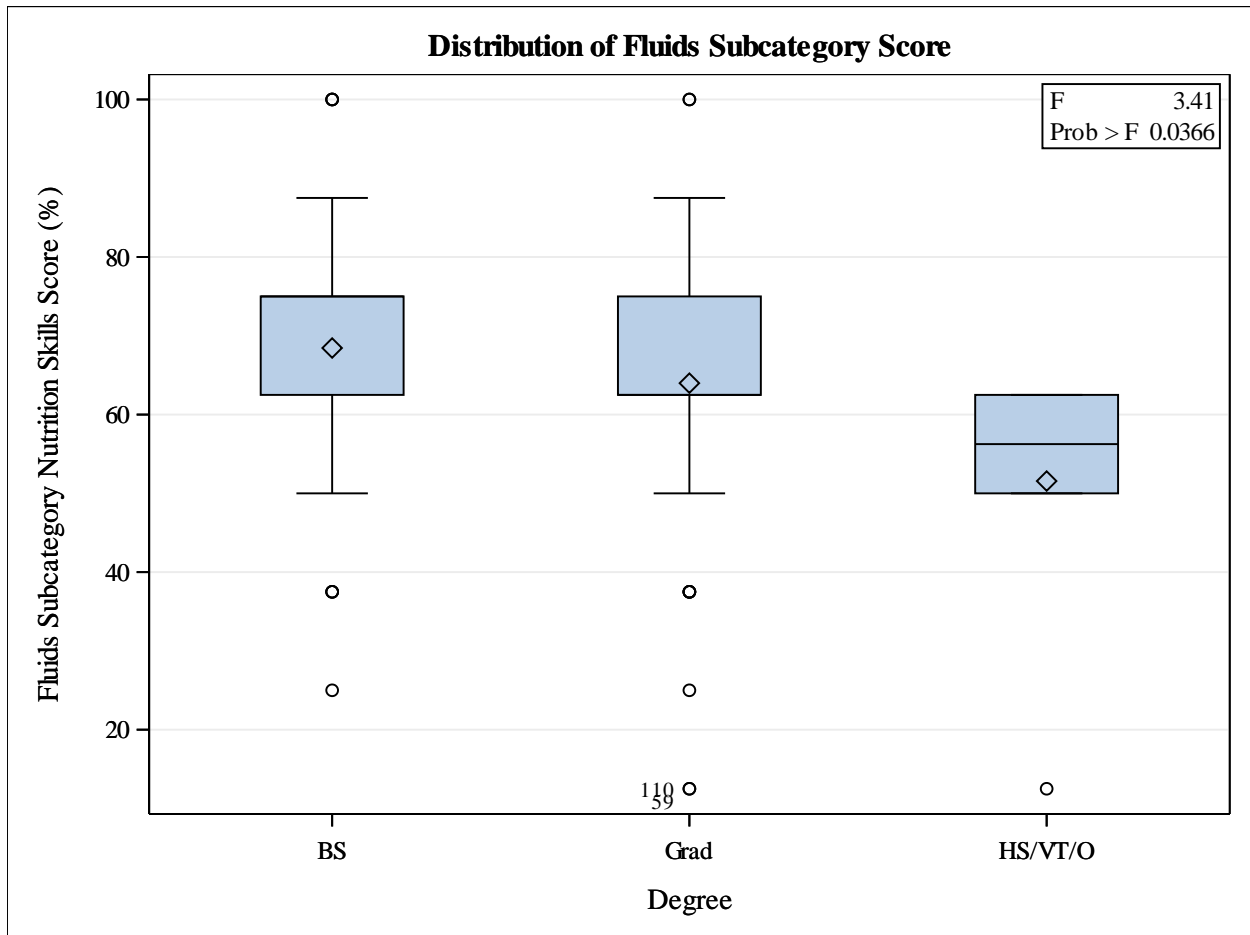


Figure 5. A box plot with fluid subcategory score as the dependent variable when compared with level of education among 113 high school coaches.

Recovery Subcategory Score and Education Level

There is not a significant difference in the average scores of the recovery section of the nutrition skills questionnaire between education levels. All three groups have a wide range of average scores; however, only the higher education category has a low outlier (Figure 6).

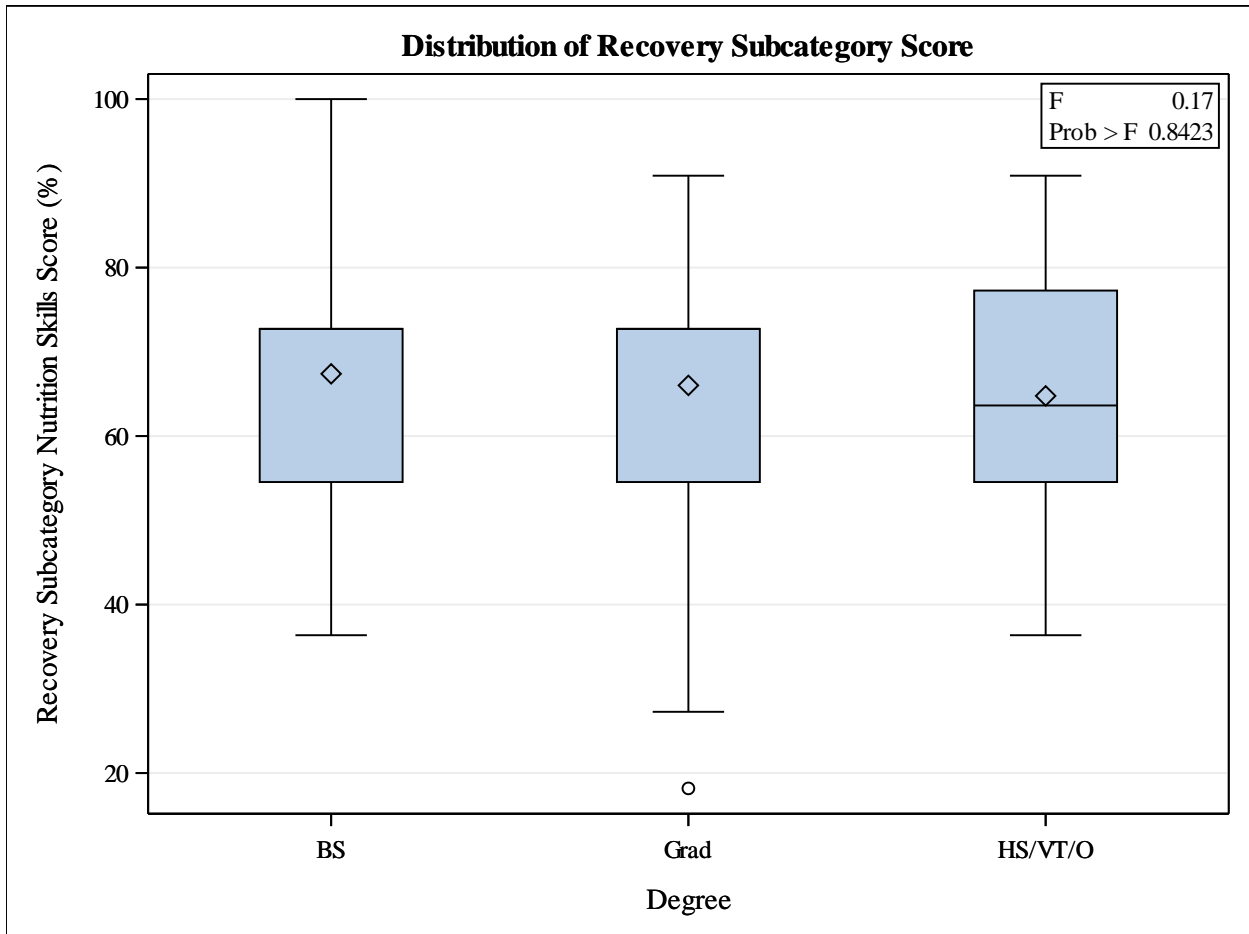


Figure 6. A box plot with recovery subcategory score as the dependent variable when compared with level of education among 113 high school coaches.

Weight Maintenance Subcategory Score and Education Level

There is a significant difference in the scores of the weight maintenance subcategory between coaches with a bachelor's degree or higher, and those who have who have a high school, vocational or other degree (associate). There is one outlier in the higher level education group, meaning that one coach with a higher level degree scored lower than others with the same degree in the weight maintenance subcategory (Figure 7).

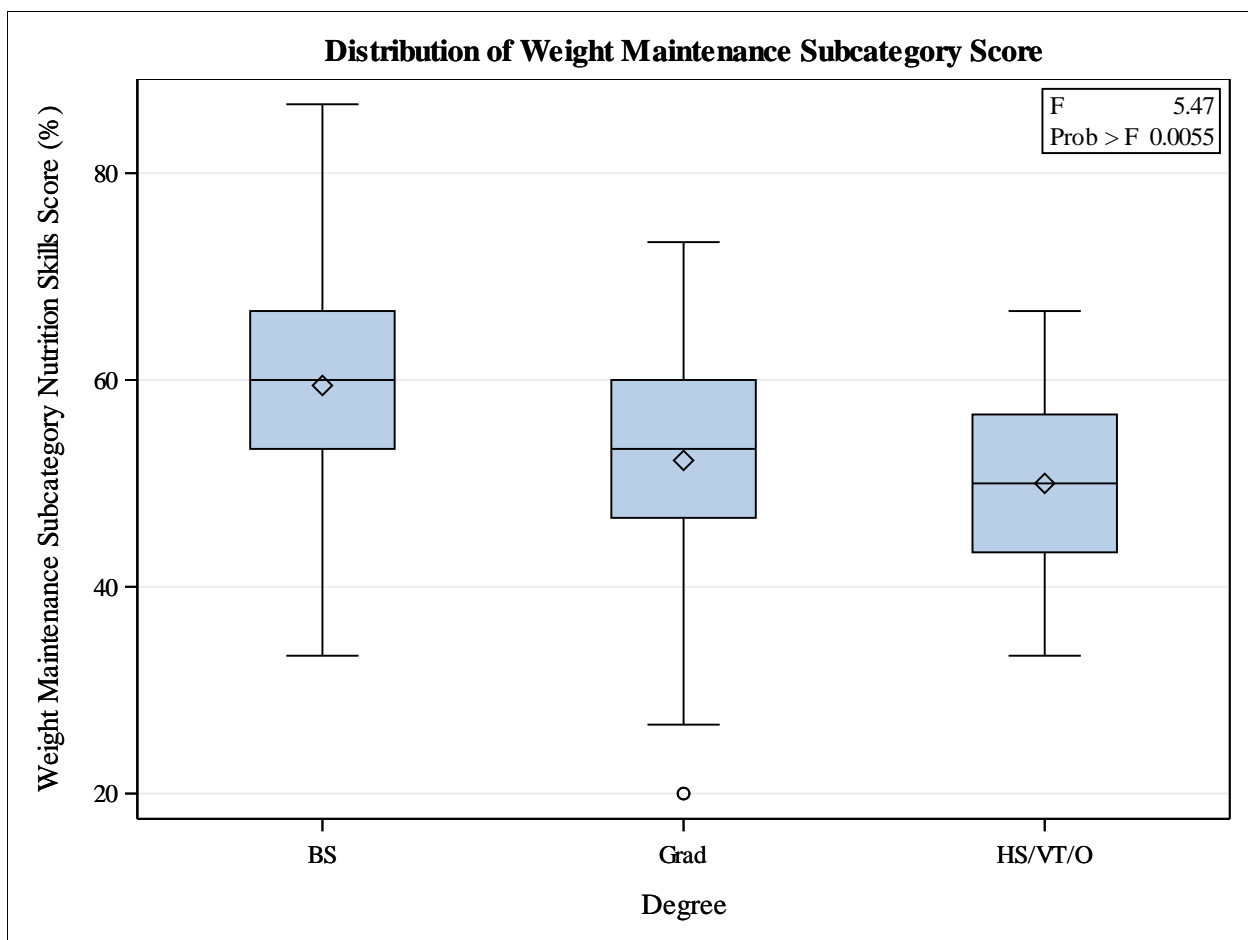


Figure 7. A box plot with weight maintenance subcategory score as the dependent variable when compared with level of education among 113 high school coaches.

Supplements Subcategory Score and Education Level

The supplements category had the lowest average score across all three groups. There is no significant difference between education levels for the average score on the supplement sub section of the nutrition skills questionnaire. The scores of coaches with a bachelor's degree had the highest range out of the three education levels (Figure 8).

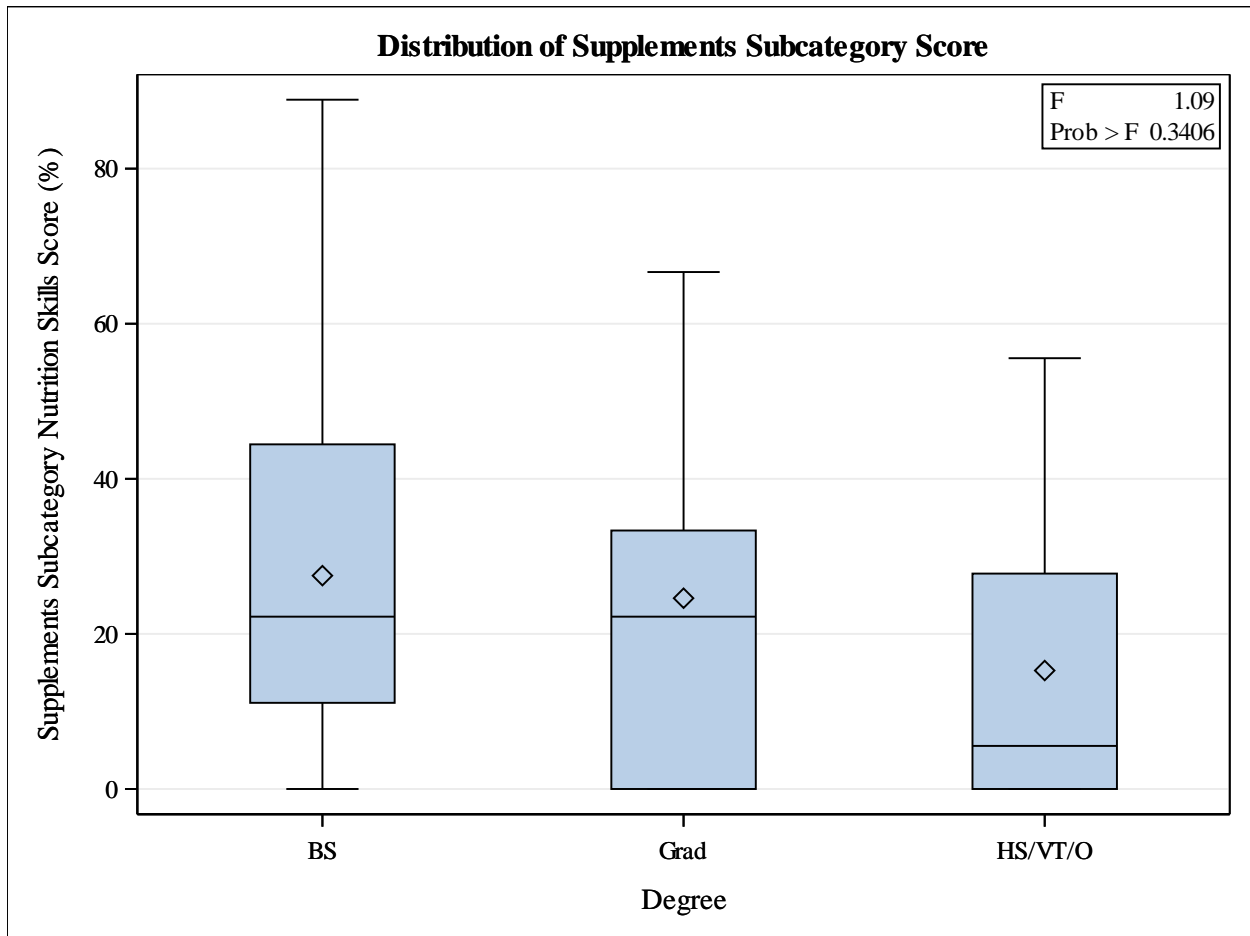


Figure 8. A box plot with supplement subcategory score as the dependent variable when compared with level of education among 113 high school coaches.

Discussion

The researchers aimed to estimate the level of confidence coaches felt about various nutrition topics and then compare that confidence level to scores on a nutrition skills questionnaire. The second aim was to determine if demographic characteristics of a sample of high school coaches impacted their score on the Nutrition Skills Questionnaire.

The overall confidence rating of the sample of high school coaches was 3.5 on a five point Likert scale. There was a weak correlation between coaches' confidence level and their score on the nutrition skills questionnaire. The majority of coaches (n=62) agreed that they were confident in their abilities. A limited level of nutrition skills was observed, with a total mean score of 58%. Previous research had determined that a score of 70-75% correct on the nutrition portion of the questionnaire would be representative of adequate nutritional knowledge (Torres-McGehee, et al., 2012). The coaches in this sample did score similarly to previous groups who had taken the survey. Two hundred and seven collegiate athletes in Iran took a modified iteration of the same questionnaire and scored an average of 38% correct. It is worth noting that a large majority of the study participants (89% of sample) listed the coach as their main source of nutrition information (Jessri, Rashidkhani, & Zinn, 2010). In a second similar study, 163 UK high school level coaches took another modified version of the questionnaire and scored an average of 60% (Cockburn, et al., 2014).

Coaches' average score was highest in the subcategory of recovery; the fluid's section average score was within 2 points. In two other studies using modified versions of the same questionnaire, the nutrients subcategory average scores were significantly higher than other categories (Cockburn et al., 2014; Jessri, Rashidkhani, & Zinn, 2010). The recovery category may have a higher rank in the current study because of the hands on nature of recovery. When a

coach attends an event with athletes that coach is able to help the athletes with the recovery process in person, this experience may increase their skill. In the current study as well, the supplements subcategory average score was lowest, as evidenced by only 26% of the questions having been answered correctly. This was similar to the other studies using modified versions of the questionnaire (Cockburn, et al., 2014; Jessri, Rashidkhani, & Zinn, 2010). Most of the questions in the supplements section concerned how creatine works and when various supplements should be recommended to athletes. The correct answer for all supplement recommendation questions was that supplements should not be recommended. The low score in this section may be an indicator that coaches are recommending supplements against the guidelines for adolescent athlete nutrition by the American Academy of Pediatrics (AAP, 2017).

The current study showed that the health professional (e.g. a doctor or registered dietitian) was the preferred source of health and nutritional information for high school coaches with 54 coaches responding that they used health professionals as a source of information on a “most frequent” or “frequent” basis. Although less than 10% of coaches surveyed scored above 70% correct (which is deemed the threshold of adequate knowledge to be giving nutritional advice), the coaches may be helping athletes make contact with health professionals by bringing them in for team talks or recommending services to their athletes. The second most utilized source of nutrition and health information was websites with 53 coaches responding they used websites as a source of information on a “most frequent” or “frequent” basis. Types of websites visited could have affected how high school coaches responded to the nutrition skills survey. In a study completed by the University of Texas in 2016, it was found that an overwhelming majority of a sample of adults (n=710) felt confident in their ability to find reliable health information on the internet, yet less than half of the sample performed basic quality checks when searching for

health information (e.g. reliability or accuracy of information) (SeÅSkin, Yeatts, Hughes, Hudson, & Bell, 2016). Research journals were listed as the third most popular resource with 44 coaches responding they used research journals as a source of information on a “most frequent” or “frequent” basis. These results are similar to those reported by the UK coach study in which coaches who read about sports nutrition knowledge read the internet (61.1%), followed by journal articles (48.9%) (Cockburn, et al., 2014). Future research should include probes for information about specific journals or magazines referenced.

In a previous study, sex has had a significant impact on scores, with women scoring an average of 43% correct and men scoring an average of 31% correct (Jessri, Rashidkhani, & Zinn, 2010). In the current study, sex had no significant effect on total score. Additionally, it was surprising that education level had no significant impact on score. However, this could be due to the small sample size. In a study comparing student athletes to professional athletes, professional athletes scored significantly higher on a validated nutrition questionnaire (Wyon, Hutchings, Wells, & Nevill, 2014). It was also noted in that study that each successive grade of athlete scored higher due to completing nutrition education.

This sample of high school coaches were all required to take the same courses to become registered coaches. With both the level of education and the state of participating coaches having no significant impact on the scores, it would seem that formal coach education is not adequately preparing high school coaches to give nutritional advice to athletes.

Implications for Research and Practice

Many reputable nutrition information sources, such as the Academy 2016 position statement, updated USDA nutrition websites (<https://www.nal.usda.gov/fnic/nutrition-athletes>), and trained professionals (e.g. RDNS), are already available for consultation in the hopes of

increasing nutritional knowledge on topics relevant to athletics. However, access to these sources may not be fully utilized by high school coaches. Current coaching accreditation processes are not required for coaches to give nutritional advice to high school athletes. Previous formula based interventions have had an impact on coaches' ability to make nutritional recommendations (Ranby, et al., 2009). The results of this study revealed moderate levels of perceived confidence concerning nutrition topics, but did not reveal adequate nutrition skills in any of the subcategories. Incorrect nutritional advice can increase athlete risks of vitamin deficiencies, dehydration and eating disorders (SDA, 2014). Adequate nutrition can improve athletic performance and decrease risk for injuries (AND, 2016). The low level of nutrition skills brings the question of coaches providing nutrition advice back to their scope of practice; should coaches be imparting any nutritional advice or should they always refer questions to a dietitian?

Future research in regards to high school coach nutrition knowledge in a larger sample is warranted. Only a few studies have been done on this topic, and all have revealed inadequate levels of nutritional knowledge among coaches.

Limitations and Conclusions

Major limitations for the study include lack of variation in the sample with nearly 74% of the participants reported as male. Additionally, this study was cross sectional, and, therefore, not able to determine trends in nutritional knowledge of coaches over time. This study was completed in the Midwest, and, therefore, results may only be applicable to the Midwest. Response bias is another concern in this study; those who chose to respond to the survey may have had more interest in nutrition than those who chose not to respond to the survey.

Future research examining nutritional skills of high school coaches may be beneficial to assess the level of nutritional advice high school athletes are receiving. This study showed that

high school coaches have varying perceived confidence levels when making nutrition recommendations to high school athletes. Level of nutrition skill may have an impact on the accuracy of any nutrition advice high school coaches may be providing.

Acknowledgements

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CHAPTER 5. CONCLUSIONS

This study was designed to examine confidence, nutrition knowledge, and personal sources of nutrition information among North and South Dakota high school coaches. Examining coach perceptions and nutritional knowledge regarding current recommendations for adolescent athletes will help to determine if there is a need for nutrition continuing education courses for high school coaches. Currently, AND and the SDA have position statements regarding athlete nutrition; however, nutritional information is often obtained from less reputable sources. This may be contributing to below adequate nutritional knowledge levels among coaches when providing information to the high school athletes. This research did not indicate that any demographic factors influenced nutrition knowledge. As noted, the High School Coach Nutrition Skills Questionnaire was developed from previously validated nutrition knowledge questionnaire. This study focused on whether high school coaches' confidence levels affected their dietary fat recommendations.

An overall goal of this study was to examine level of nutritional knowledge of high school coaches and to determine if confidence had any impact. It has been found that high school coach nutrition knowledge levels are below adequate. Currently, many coaches perceive themselves as moderately confident on nutrition topics; however, this did not impact their nutrition knowledge scores. This may be related to a high use of websites as sources of nutrition and health information. As discussed in this study, there are many factors that may act as barriers to nutrition knowledge from lack of nutrition courses in coaching degrees and certifications to the plethora of incorrect nutrition information from less than reputable sources.

The hypothesis of this study was that high school coaches' nutrition knowledge levels would fall below levels deemed adequate to give advice to high school athletes. The results of

our study fully support our hypothesis. Although the study sample's nutrition skill score did not correlate with confidence level or education level, these relationships warrant further research. Limited studies have been done on this topic. Now that a validated nutrition knowledge questionnaire has been published, a repeated survey may be beneficial to show comparisons across various coaching groups.

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APPENDIX A. RECRUITMENT EMAIL/IMPLIED CONSENT

NDSU North Dakota State University
Health, Nutrition, & Exercise Sciences
NDSU Dept 2620
PO Box 6050
Fargo, ND 58108-6050
701.231.7479

Dear Coach:

My name is Rachel Iverson Dewey. I am a graduate student in the department of Health, Nutrition, and Exercise Sciences (HNES) at North Dakota State University working with HNES professors Dr. Sherri Stastny and Dr. Brad Strand on a research project to learn about high school coach nutrition skills. It is our hope, that with this research, we will benefit current/future sports coaches as these results may guide future educational materials.

You are invited to take part in this research project. The criterion for participation in this study are that you must be 18 years of age or older and currently be coaching at a high school level. Your participation is entirely your choice, and you may change your mind or quit participating at any time, with no penalty to you; however, your assistance would be greatly appreciated in making this a meaningful study.

It should take less than 20 minutes to complete the questionnaire. To complete the survey please click on the link below:

https://ndstate.co1.qualtrics.com/jfe/form/SV_55vAVf8ohAvUcLj

Three of the first 150 responders will have the opportunity to provide their e-mail address for a chance to win a \$25 Scheels gift card. The e-mail address provided will not be used as an identifier to the survey questions.

Your identity will not be linked to your survey responses. Your information will be combined with information from other people taking part in the study. We will write about the combined information that we have gathered. You will not be identified in these written materials. We may publish the results of the study; however, we will keep your name and other identifying information private.

Should you have any questions or concerns related to this survey or research project, please contact Rachel Iverson Dewey at rachel.iverson@ndsu.edu, or telephone (701) 220-4421 or faculty advisor Dr. Sherri Stastny at Sherri.Stastny@ndsu.edu, phone # (701) 231-7479.

APPENDIX B. MODIFIED NUTRITION QUESTIONNAIRE

Note: Section titles will be deleted and questions will be sequentially numbered from start to finish in final electronic survey.

Please answer all questions to the best of your ability. You will not be able to “backtrack”:
Please note that the survey will not move ahead until an answer has been selected. If you are unsure of an answer, please select “unsure.” Thank you.

Section 1: Previous Training & Demographics

1. Have you completed any type of formal nutrition training in the past 5 years?
 Course for college credit
 One-on-one training with a registered dietitian nutritionist
 Accredited online training
 Nutrition session at conference
 -----Other (Please specify_____)

2. Sex: Male Female

3. Age:
 Under 18 years old
 18 to 19 years old
 20 to 29 years old
 30 to 39 years old
 40 to 49 years old
 50 to 59 years old
 > 60 years old

4. What is the highest educational degree you have completed or are pursuing as of today:
 GED or High School
 Vocational or Technical School Training (1 year to 18 months)
 Bachelor’s degree
 Graduate degree
 Other (Please specify_____)

5. How many years have you been involved with a school sports team as a coach?
 less than 1 year
 1-5 years
 6-10 years
 11-15 years
 16 to 20 years
 > 20 years

6. Where do you get your nutrition and health information? (Please rate on a 1 to 5 scale; 1 = never; 5 = most frequent)

TV (talk shows, etc.) 1 2 3 4 5

Radio 1 2 3 4 5

Newspapers 1 2 3 4 5

Facebook, Twitter, other social media 1 2 3 4 5

Advertisements, including "infomercials" 1 2 3 4 5

Magazine articles 1 2 3 4 5

Research Journals 1 2 3 4 5

Relatives/Friends 1 2 3 4 5

Health professional (dietitian, doctor, nurse, pharmacist in clinic or public health office) 1 2 3 4 5

Extension Service programs/materials (state or county) 1 2 3 4 5

Classes/presentations /conferences 1 2 3 4 5

Websites 1 2 3 4 5

Other Please Explain _____

Section 2: Confidence in Ability to Give Nutrition Advice

Below are 8 questions identifying the level of confidence you feel in your ability to give nutritional advice to high school athletes.

Level of Agreement

• 1 – Strongly disagree • 2 – Disagree • 3 – Neither agree or disagree • 4 – Agree • 5 – Strongly agree

1. I am confident in my ability to give correct nutritional advice to an athlete.
2. I am confident in my ability to give correct nutritional advice to an athlete concerning carbohydrate intake.
3. I am confident in my ability to give correct nutritional advice to an athlete concerning fat intake.
4. I am confident in my ability to give correct nutritional advice to an athlete concerning protein intake.

5. I am confident in my ability to give correct nutritional advice to an athlete concerning nutrition intake for recovery.
6. I am confident in my ability to give correct nutritional advice to an athlete concerning fluid intake.
7. I am confident in my ability to give correct nutritional advice to an athlete concerning weight management.
8. I am confident in my ability to give correct nutritional advice to an athlete concerning supplement intake.

Section 3: Sports Nutrition Questionnaire

Below are 19 questions identifying a variety of sports nutrition topics. Based on **your** current knowledge, please answer the questions as best you can.

Nutrients

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

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

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

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

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

	High	Low	Unsure
Avocado	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Baked beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pasta	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Polyunsaturated margarine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1% Greek yogurt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brown rice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peanuts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
White bread	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Honey	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hard yellow cheese (Such as Cheddar / Colby Jack)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

	High	Low	Unsure
Butter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Olive oil	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Whole milk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chicken leg with skin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Salmon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Milk chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peanuts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Would you *agree* or *disagree* with the following statements? (Click on one box per statement).

a. A high carbohydrate diet helps to reduce muscle breakdown in the body.
 Agree Disagree Unsure

b. A high calorie diet helps to reduce muscle breakdown in the body.
 Agree Disagree Unsure

c. A vitamin D supplement is recommended for athletes under the age of 18.
 Agree Disagree Unsure

d. Spinach and kale are good sources of iron that is available to the body.
 Agree Disagree Unsure

e. Foods and juice high in ascorbic acid (vitamin C) increase the amount of iron absorbed from food.
 Agree Disagree Unsure

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

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

Agree Disagree Unsure

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

Agree Disagree Unsure

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

Agree Disagree Unsure

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

Agree Disagree Unsure

Fluid

9. Sports drinks should be consumed (Click on one box only).

Pre-training

During training

Post-training

With meals

Unsure

10. Which fluid has the most appropriate percentage of carbohydrates to consume during an intense two-hour training session? (Click on one box only).

6-8% (Gatorade/PowerAde)

8-10% (Orange Juice)

10-15% (Reduced fat Chocolate Milk)

20-25% (Commercial fruit smoothie)

Unsure

11. Which is the most appropriate fluid to consume after an intense two-hour training session? (Click on one box only).

- Zero calorie sports drink
- Regular Sports drink
- Coke
- Water
- Coffee
- Unsure

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

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

- Agree Disagree Unsure

b. Weighing players before and after training is a good way to determine fluid requirements.

- Agree Disagree Unsure

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

- Agree Disagree Unsure

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

- Agree Disagree Unsure

e. All energy drinks such as 8-16 ounce cans of 'Monster' and 'Red Bull,' are good drinks to have 30 minutes leading up to exercise.

- Agree Disagree Unsure

Recovery

13. The most important macronutrient(s) to replace after a one-hour run is: (Click on one box only).

- Carbohydrate
- Protein
- Fat
- Carbohydrates and Protein
- Unsure

14. Which one of the following set of 2 snacks would you suggest that a player eat after training?

(i.e. 4 slices white bread, 2 tsp jam OR 1 hot dog on a bun). (Click on one box for each question).

- a. 2 slices white bread, 2 tsp Nutella, plus 1 cup skim milk **OR** 1 packet potato chips
- b. 1 peanut butter on whole wheat sandwich **OR** 2 hot dogs
- c. 3 oz. apple juice, bagel and 1 container Greek Yogurt **OR** 2 apples
- d. 4 oz. beef jerky **OR** 1 cup Greek yogurt with ¼ cup granola

15. Click on one snack (per set of 2 snacks) which provides more carbohydrate. (i.e. 3 oz. bag of marshmallows OR 3 oz. bag of peanuts). (Click on one box for each question).

- A. 3 oz. bag of marshmallows **OR** 3 oz. bag of peanut M and M's
- b. 1 small box raisins **OR** 1 hot dog
- c. 6 oz. skinless chicken breast **OR** 2 slices white bread, 2 tsp peanut butter
- d. 12 oz. serving of orange juice **OR** 3 cups of green salad
(lettuce, tomato, cucumber, low fat dressing)

16. The optimal time for a football player who is training daily to eat and replenish fluids after exercise is: (Click on one box only).

- Within 30 minutes
- Within 45 minutes
- Within one hour
- Between 2-3 hours
- Unsure

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

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

Weight gain

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

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

Agree Disagree Unsure

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

Agree Disagree Unsure

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

Agree Disagree Unsure

19. A player is eating the following meal for dinner: 5 oz. skinless chicken breast and 1 cup cooked rice. If he kept the rest of his day's diet the same and only altered his dinner meal, which option would be the preferred one to increase his lean body mass? (Click on one box only).

Eat 7 oz. chicken.

Eat the chicken with the skin on.

Eat 2 cups rice and 6 oz. skinless chicken.

Eat 4 cups vegetables

Eat the same amount, but train harder at the gym.

Unsure

Weight loss

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

a. 4 salami sticks **OR** 1 piece fruit

b. 2 packets of tortilla chips **OR** 1 small granola bar

c. 3/4 cup ready-to-eat cereal w/skim milk **OR** 1 cliff bar

d. 3.5 oz. peanuts **OR** 8 oz. fat-free chocolate milk

e. 4 oz. fat-free Greek yogurt **OR** 1 slice of bread w/butter and honey

f. handful mini pretzels with 1/2 cup nonfat chocolate milk **OR** 6 crackers with cheddar cheese

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

If a football player wanted to lose weight, he should:

- a. Exchange 1 tsp of butter on sandwiches for 1 tsp of regular margarine.
 Agree Disagree Unsure
- b. Eat more Cheddar cheese than processed American Cheese.
 Agree Disagree Unsure
- c. Eat less salami and more turkey breast.
 Agree Disagree Unsure
- d. Stop eating pasta and rice after 4pm.
 Agree Disagree Unsure
- e. Exchange yogurt, whole grain and whole fruit snacks for protein shakes.
 Agree Disagree Unsure

Supplements

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

- a. Creatine supplements would be most beneficial to a player wanting to increase peak power output.
 Agree Disagree Unsure
- b. A creatine supplement has more of an effect when natural body stores are low.
 Agree Disagree Unsure
- c. The performance-enhancing mechanism of creatine is that it aids to increase fat metabolism.
 Agree Disagree Unsure
- d. Creatine is most useful to those players wanting to increase fitness for endurance exercise.
 Agree Disagree Unsure

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

a. Multivitamin tablets should be taken by most athletes.

Agree Disagree Unsure

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

Agree Disagree Unsure

c. Vitamin C should be routinely supplemented by athletes.

Agree Disagree Unsure

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

Agree Disagree Unsure

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

Agree Disagree Unsure

Thank-you for your time. It is very much appreciated.

APPENDIX C. IRB APPROVAL



May 5, 2017

Dr. Sherri Stastny
Health, Nutrition & Exercise Sciences

Re: IRB Determination of Exempt Human Subjects Research:
Protocol #HE17246, "High School Coach Nutrition Skills"

Co-investigator(s) and research team: Bradford Strand, Rachel Iverson
Certification Date: 5/5/2017 Expiration Date: 5/4/2020
Study site(s): online
Sponsor: n/a

The above referenced human subjects research project has been certified as exempt (category #2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the protocol submission (received 5/5/2017).

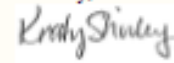
Please also note the following:

- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.

Sincerely,


Digitally signed by Kristy Shirley
DN: cn=Kristy Shirley, o=NDSU,
ou=Institutional Review Board,
email=kristy.shirley@ndsu.edu, c=US
Date: 2017.05.05 16:09:08 -0700

Kristy Shirley, CIP, Research Compliance Administrator

For more information regarding IRB Office submissions and guidelines, please consult http://www.ndsu.edu/research/integrity_compliance/irb/. This Institution has an approved Federal Wide Assurance with the Department of Health and Human Services: FWA00002439.

INSTITUTIONAL REVIEW BOARD

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