

ASSESSMENT OF THE SPORTS NUTRITION KNOWLEDGE, ATTITUDES AND BELIEFS
OF COACHES AND ATHLETIC TRAINERS AT A DIVISION I UNIVERSITY AND THEIR
PERCEIVED IMPACT OF A CERTIFIED SPORTS SPECIALIST IN DIETETICS
TO AN ATHLETIC TEAM

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ABSTRACT

THESIS: Assessment of the Sports Nutrition Knowledge, Attitudes and Beliefs of Coaches and Athletic Trainers at a Division I University and Their Perceived Impact of a Certified Sports Specialist in Dietetics to an Athletic Team

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Proper nutrition can improve performance and recovery and is essential to all elite athletic performances. As the relationship between sports nutrition and athletic performance and recovery continues to be established, many collegiate athletes are turning to their coaches and athletic trainers for dietary advice. As such it is important to know the current levels of knowledge and receptiveness of the coaching and athletic training staff to nutrition concepts and to understand their perceptions of a certified sports specialist in dietetics (CSSD) as a member of the athletic staff. Thus, the purpose of this study was to identify the sports nutrition knowledge, attitudes, beliefs and recommendations of Division I university coaches and athletic trainers and to identify their perceived use of a CSSD as a member of the athletic team. Coaches and athletic trainers (n=65) of a Midwestern Division I University were emailed an online survey that included: 1) sports nutrition knowledge (SNK); 2) sources of sports nutrition information; 3) beliefs about who is qualified to give nutrition information to athletes; and 4) perceptions of the impact of a CSSD to an athletic team. Of the 65 possible participants, 27 coaches and 9 athletic trainers responded (n=36; 55%). Overall, the mean SNK score was 61.5%±23.4%; athletic trainers (73.0%±10.4%) scored significantly higher than coaches (57.6%±14.2%) (p=0.005).

Athletic trainers were identified as the primary source of SNK (80.6%) for both coaches and athletic trainers, followed by strength and conditioning specialists (69.4%), the internet (66.7%), and CSSDs (58.3%). The most frequent recommendations given to athletes related to hydration (n=29) and nutrition timing (n=21). Only 6 participants (16.7%) did not make nutrition recommendations. Despite rating the benefit of a CSSD to an athletic team as 8.9 ± 1.8 on a 10-point scale, only half (n=18) knew a part-time CSSD was recently employed by the university. Coaches and athletic trainers clearly recognized the value of a CSSD. Although athletic trainers have a basic SNK, the CSSD should be the primary source of nutrition education for athletes.

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TABLE OF CONTENTS

	PAGE
ABSTRACT	ii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS.....	v
CHAPTER 1: INTRODUCTION	1
Problem Statement.....	3
Purpose.....	4
Research Questions.....	4
Rationale.....	5
Assumptions.....	5
Definitions.....	6
Summary.....	7
CHAPTER 2: REVIEW OF LITERATURE.....	8
Introduction.....	8
Nutrition Knowledge of Coaches and Athletic Trainers.....	9
Nutrition Knowledge	9
Sources of Nutrition Knowledge	13
Perception of the Impact of Sports Nutrition.....	14
Board Certified Specialist in Sports Dietetics in the NCAA	15
Role of CSSD.....	15
Benefit of CSSD to the Collegiate Team	15
Nutrition Recommendations by Coaches and Athletic Training Staff	17

	PAGE
Summary	18
CHAPTER 3: METHODOLOGY	19
Institutional Review Board	19
Subjects	19
Instruments	20
Letters of Permission and Consent	21
Method	21
Data Analysis	22
Summary	22
CHAPTER 4: RESULTS	23
Participants	23
RQ #1: Sports Nutrition Knowledge of Coaching and Athletic Training Staff.....	24
Sports Nutrition Knowledge	24
Comparison of Total Sports Nutrition Knowledge Score.....	25
Comparison of Sports Nutrition Construct Scores.....	26
Macronutrient Construct	26
Micronutrient Construct.....	28
Nutrition Timing Construct.....	30
Hydration and Electrolyte Balance Construct.....	32
Nutrition Problem Construct.....	34
Summary	35

	PAGE
RQ #2: Sports Nutrition Resources and Opinions of Coaching and Athletic Trainers	36
Summary	41
RQ #3: Sports Nutrition Recommendations Given by Coaches and Athletic Trainers	41
Summary	42
RQ#4: Perceptions of the Coaching and Athletic Training Staff Regarding a CSSD	42
Summary	45
Summary	46
CHAPTER 5: DISCUSSION.....	48
Sports Nutrition Knowledge of Coaching and Athletic Training Staff	48
Macronutrient.....	51
Nutrition Problem	52
Summary.....	53
Sports Nutrition Attitudes and Beliefs of Coaching and Athletic Training Staff.....	53
Summary	56
Sports Nutrition Recommendations Given by Coaches and Athletic Trainers.....	57
Summary	58
Perceptions Regarding the Use of a Certified Sport Specialist in Dietetics	59
Summary.....	60
Summary	61
CHAPTER 6: CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH	62
Conclusions.....	62
Limitations of the Study.....	64

	PAGE
Recommendations for Further Research.....	65
REFERENCES	67
LIST OF APPENDICES.....	70
Appendix A: Institutional Review Board Documents	70
A-1: IRB Letter of Exemption	71
A-2: CITI Completion Certificate.....	73
Appendix B: Survey Instruments.....	74
B-1: Survey	75
Appendix C: Letters of Consent and Permission.....	87
C-1: Letter of Permission to Use the Survey	88
C-2: Letter of Permission to Conduct the Study.....	89
C-3: Letter of Information.....	90
Appendix D: Recruitment Materials.....	91
D-1: Initial Recruitment Letter.....	92
D-2: Letter of Thanks/Encouragement to Participate	93
D-3: Final recruitment Letter	94

LIST OF TABLES

		PAGE
Table 1	Mean Sports Nutrition Knowledge Score of Coaches and Athletic Trainers, Overall and by Construct (n=36)	24
Table 2	Sports Nutrition Knowledge and Construct Percent Correct Score by Position....	25
Table 3	Responses to Macronutrient Construct by Question.....	27
Table 4	Responses to Micronutrient Construct by Question	29
Table 5	Responses to Nutrition Timing Construct by Question	31
Table 6	Responses to Hydration Construct by Question	33
Table 7	Responses to Nutrition Problem Construct by Question	35
Table 8	Types of People Approached to Obtain Sports Nutrition Information	37
Table 9	Other Sources Used for Sports Nutrition Information	38
Table 10	Confidence in Nutrition Knowledge of Athletic Trainers, Coaches, and Strength and Conditioning Coaches	39
Table 11	Types of People Approached to Obtain Sports Nutrition Information	40
Table 12	Perception of the Importance of Nutrition for Sports Performance.....	40
Table 13	Sports Nutrition Recommendations Made by Coaches and Athletic Trainers	42
Table 14	Perception of the Benefit of a CSSD to an Athletic Team	43
Table 15	Coaches and Athletic Trainers Knowledge of the Employment of a CSSD.....	44
Table 16	Anticipated Use of a CSSD.....	45

CHAPTER 1

INTRODUCTION

Proper nutrition is essential to athletes, as it can improve both performance and recovery (Rodriguez, DiMarco, & Langley, 2009). Sports nutrition is a dynamic area of science and practice that continues to flourish in both the scope of support it offers athletes and the strength of evidence that underpins its guidelines (Thomas, Erdman, & Burke, 2016). As sports nutrition continues to evolve, athletes turn to many different sources to obtain advice regarding their diet – including their coaches and athletic trainers – who may not be trained in sports nutrition (Andrews, Wojcik, Boyd, & Bowers, 2016). Ultimately, since nutrition knowledge is a modifiable determinant of dietary behaviors that can impact an athlete’s performance, it is vital that athletes receive nutrition information from a qualified source (Trakman, Forsyth, Devlin, & Belski, 2016).

In the United States, the premier professional sports nutrition credential is the Board Certified Specialist in Sports Dietetics (CSSD) (<https://www.scandpg.org/sports-nutrition/be-a-board-certified-sports-dietitian-cssd/>). To become a CSSD, an individual must: 1) become a registered dietitian nutritionist (RDN), 2) maintain that credential for a minimum of two years, 3) document 1,500 hours of specialty practice as a RDN, and 4) successfully pass a board certification exam (<https://www.scandpg.org/sports-nutrition/be-a-board-certified-sports->

[dietitian-cssd/](#)). A CSSD should be the primary source of sports nutrition information for athletes (Torres-McGehee., Pritchett, Zippel, Minton, Cellamare, & Sibia, 2012).

Many collegiate athletes, particularly at smaller schools, do not have access to a CSSD. As a consequence, research indicates they turn to their coaches and athletic trainers for sports nutrition advice (Botsis and Holden, 2015; Torres-McGehee et al., 2012). Unfortunately, research also indicates that, while athletic trainers and strength and conditioning coaches often have “adequate nutrition knowledge,” only one out in three coaches meet that threshold (Torres-McGehee et al., 2012; Botsis and Holden, 2015; Jacob et al., 2016). Despite their lack of sports nutrition knowledge, however, the majority of coaches surveyed believe proper nutrition could help improve athlete performance (98%) and help prevent injury (79%) (Cockburn et al., 2014).

Athletes with regular access to a CSSD have been shown to score higher on sports nutrition knowledge surveys and have greater confidence in, and curiosity about, sports nutrition (Spronk, Heaney, Prvan, & O’Conner., 2015; Sceery, 2017; Wallinga, Takahashi, Kohnke, Koszewski, Hingst, & Socha, 2013). In addition, regular access to a CSSD has been shown to improve the nutrient intake of athletes (Rossi, Landreth, Beam, Jones, Norton, & Cholewa, 2017), which can have a positive impact on their athletic performance, recovery, and career length (Rossi et al., 2017; Thomas et al., 2016). As a valuable member of the athletic staff, a CSSD can address any nutritional needs as they arise (Valliant, Pittman, Wenzel, & Garner, 2012). Despite the benefits a CSSD can offer to student athletes, and, collectively, to the team, only 84 Division I National Collegiate Athletic Association (NCAA) schools currently employ a full-time CSSD (http://www.sportsrd.org/?page_id=1176).

According to Torres-McGehee et al. (2012), for a CSSD to be effective, they must develop a working relationship with the entire athletic staff. In addition, they must understand the current nutrition beliefs of those around them as they provide food and nutrition education and counseling to the athletes, coaches, athletic trainers, and CSCS. To that end, it is vital to understand the perceptions and attitudes held by the coaching and training staff regarding nutrition and the role of the CSSD. Due to the relationship between adequate nutrition and athletic performance, it is important to understand the current nutrition knowledge level of coaches and athletic trainers, to identify the nutrition-related recommendations that are being made by coaches and athletic trainers, and to understand the perspective of college coaches and athletic trainers regarding working with a CSSD as they strive to improve the athletic success of their team.

Problem Statement

Proper nutrition, essential to all elite athletic performances, can improve performance and recovery (Rodriguez, et al. 2009). Unfortunately, athletes often seek nutrition advice from collegiate coaches and athletic training staff who are often not equipped to provide factual information (Torres-McGehee et al., 2012). Coaches, in particular, have been found to be less reliable sources of nutrition information than athletic trainers and CSCS (Torres-McGehee et al., 2012). Because many athletes turn to their coaches and athletic trainers for nutrition advice (Botsis and Holden, 2015), it is necessary to identify the nutrition knowledge of the coaching and training staff, and to determine what nutrition recommendations the coaching and training staff are giving to their student-athletes. In addition, as more universities add a CSSD to their sports team staff, it is important to understand the opinion of the athletic staff about the role a CSSD

can have on their team. Thus, examining the nutrition knowledge level of the coaches and athletic trainers, and their perception of the value of the CSSD to athletic teams, is warranted.

Purpose

The purpose of this study was to identify the sports nutrition knowledge, attitudes, beliefs and recommendations of coaches and athletic trainers at a Division I university, and to identify their perceived use of a Board Certified Sports Specialist in Dietetics (CSSD) as a member of the athletic team.

Research Questions

The following research questions were examined in this study:

RQ#1: What is the level of sports nutrition knowledge of the coaching and athletic training staff at a NCAA Division I university?

RQ#2: What are the sports nutrition-related attitudes and beliefs of the coaching and athletic training staff at a NCAA Division I university?

RQ#3: What nutrition recommendations are being given by the coaching and athletic training staff at a NCAA Division I university to their student-athletes?

RQ#4: What are the perceptions of the coaching and athletic training staff regarding the use of a certified sports specialist in dietetics (CSSD) as a member of the university's athletic team?

Rationale

Because so many collegiate athletes report turning to their coaches and athletic training staff for nutrition advice, it is important to evaluate their current level of nutrition knowledge to determine if the athletes are potentially receiving inaccurate information. In addition, as more universities employ a CSSD to assist their teams, assessing the perceptions of the coaches and athletic trainers regarding the value a CSSD brings to the athletic staff becomes increasingly relevant. In this study, a survey was used to assess the knowledge and perceptions of the coaches and athletic training staff. The results of this study may provide the evidence needed to help university officials understand that a full-time board-certified sports nutrition expert is needed to help the athletes learn about the important role of nutrition and athletic performance.

Assumptions

The researcher made the following assumptions in the implementation of the study and in the interpretation of the data:

1. The coaches, athletic trainers, and strength and conditioning coaches (who were categorized as coaches in this study) answered the survey questions honestly;
2. The survey instrument adequately reflected the totality of sports nutrition knowledge;
3. The survey instrument was valid and reliable;
4. The participants could read and understand the questions on the survey instrument; and

5. The information obtained from the coaches and athletic trainers who responded to the survey was representative of NCAA Division I coaches and athletic trainers.

Definitions

For the purpose of this study, the following definitions were used:

1. Athletic Trainer- an individual who is qualified to treat sports related injuries under the guidance of a physician. A certified athletic trainer must have obtained either a bachelor's or master's degree in athletic training from an accredited program and passed a certification exam (<https://www.nata.org/about/athletic-training>).
2. Certified Specialist in Sports Dietetics (CSSD)- an experienced registered dietitian who has completed the required hours and passed a certification exam to become a Board Certified Specialist in Sports Dietetics, and thus be a certified expert in sports nutrition (<https://www.scandpg.org/sports-nutrition/be-a-board-certified-sports-dietitian-cssd/>).
3. Certified Strength Conditioning Specialist (CSCS)- professionals who train athletes to improve their athletic performance. At minimum, they must have completed at least a bachelor's degree, typically in exercise science or physical therapy, maintain a CPR/AED certification, and pass a registration exam (<https://www.nscs.com/cscs-exam-prerequisites/>).
4. National Collegiate Athletic Association (NCAA)- The organization responsible for organizing and legislating collegiate athletics (<http://www.ncaa.org/about/resources/media-center/ncaa-101/what-ncaa>)

5. Nutrition- the consumption of food and drink that provide necessary energy and nutrients (<https://medlineplus.gov/definitions/nutritiondefinitions.html>).
6. Registered Dietitian/Nutritionist (RDN)- A certified expert in nutrition who has received a bachelor's degree in dietetics, completed an accredited supervised practice program, and passed a national registration exam (<https://www.eatrightpro.org/about-us/what-is-an-rdn-and-dtr/what-is-a-registered-dietitian-nutritionist>).
7. Sports Nutrition- nutrition practices that are geared to promote health, fitness and sports performance (<https://www.scandpg.org/sports-nutrition/>)
8. Passing Score - For the purposes of this study, a “passing” score for the sports nutrition knowledge survey was determined to be 70% or greater; although a score of 70% would be considered passing, it is not deemed as adequate knowledge for the dissemination of sports nutrition information to athletes.

Summary

As the relationship between nutrition and athletic performance, including recovery after an event, continue to be established, there is an increased need to identify the sports nutrition knowledge of coaches and athletic trainers to determine if they are providing accurate nutrition advice. In addition, it is important to identify the perceptions of the coaching and athletic training staff toward having a CSSD as a member of the athletic staff. It is anticipated that the results of this study can provide evidence for universities to justify the addition of a full-time board certified specialist in sports dietetics to their athletic staff.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this study was to identify the sports nutrition knowledge, attitudes, beliefs and recommendations of coaches and athletic trainers at a Division I university, and to identify their perceived use of a Board Certified Sports Specialist in Dietetics (CSSD) as a member of the athletic team. This chapter will provide an overview of the: 1) sports nutrition knowledge of coaches and athletic trainers, 2) primary sources of sport nutrition information used by coaches and athletic trainers, 3) perceptions of the impact of sports nutrition on athletic performance of coaches and athletic trainers, 4) current role of a CSSD in the NCAA; 5) potential impact of a CSSD to an athletic team, and 6) current sports nutrition recommendations made to athletes by coaches and athletic trainers.

Introduction

In 2019, there were over 460,000 NCAA athletes, the highest number ever (<http://www.ncaa.org/student-athletes>). To maximize their performance, it is essential that athletes properly fuel their body, as optimum athletic performance and recovery are promoted by adequate energy intake and proper nutrition (Rodriguez, et al. 2009).

As more athletes become cognizant of the role of nutrition and athletic performance, they frequently turn to collegiate coaches and the athletic staff for answers to nutrition questions.

However, research shows that coaches do not possess adequate sports nutrition knowledge and, as such, are frequently unable to provide correct information (Torres-McGehee et al., 2012; Botsis and Holden, 2015). Because so many athletes report turning to their coaching staff and athletic trainers for nutrition advice (Botsis and Holden, 2015), it is important to understand the sports nutrition knowledge level of coaches and athletic trainers and the type of sports nutrition recommendations that are being made by the coaches and athletic training staff. In addition, as more Universities add a board-certified specialist in sports dietetics (CSSD) to their staff to aid their sports teams, it is important to understand the athletic staff's perception of how the CSSD can be integrated as a member of their team.

Nutrition Knowledge of Coaches and Athletic Trainers

Nutrition Knowledge

Collegiate athletes in various sports are participating in a competitive environment, each athlete striving to optimize their performance in various ways (Andrews et al., 2016). One commonly neglected method of enhancing their performance is through their nutrition (Andrews et al., 2016). Despite the benefits of practicing healthful nutrition habits, particularly those habits geared toward enhancing sports performance, research has consistently shown that athletes make poor nutrition choices, practice questionable eating habits, and have a below average understanding of their nutritional needs (Hornstrom, 2011). Because nutrition knowledge is one of the few modifiable determinants of dietary behavior (Trakman et al., 2016), it is critical that when athletes do seek out nutrition advice, they receive reliable information.

Botsis and Holden (2015) determined the nutrition knowledge of college coaches at an unspecified Division I NCAA campus in the southeastern United States by surveying 21 coaches of various sports. Topics included nutrition, fluids, recovery, weight gain, weight loss, and

supplementation. “Adequate knowledge” was defined as a score of 70% or higher on their instrument. Results indicated that, on average, the coaches had a less than adequate knowledge, with a mean score of 55%. With a score of 74%, only one of the 21 coaches demonstrated an adequate level of knowledge. A significant difference in sports nutrition knowledge was observed between those who coached both males and females (mean score 60%) compared to those who coached only one gender (only males, mean score of 52%; only females, mean score of 53%). No correlation was seen between years of coaching experience and nutrition knowledge. The researchers concluded that it would not be appropriate to assume that a collegiate coaching staff has adequate nutrition knowledge.

Torres-McGehee et al. (2012) conducted a study to: 1) identify common sources of nutrition information for athletes, coaches, athletic trainers, and CSCS, 2) measure the nutrition knowledge among this population, and 3) determine each groups’ confidence in their nutrition knowledge. The researchers surveyed 479 individuals, including 185 athletes, 131 coaches, 192 athletic trainers, and 71 CSCS. The survey included questions about demographics, nutrition knowledge, previous nutrition training, nutrition resources available, and perceived nutrition knowledge and habits. The nutrition knowledge section included 20 multiple choice questions that were divided into four categories: 1) micro- and macronutrients, 2) supplements and performance, 3) weight management and eating disorders, and 4) hydration. After completing each nutrition knowledge question, participants indicated how confident they were in their answers using a Likert scale. In this study, a score of 75% or more was defined as “adequate.” Of the participants examined, the CSCS had the highest nutrition scores followed by the athletic trainers. The results also indicated that, in general, respondents were overconfident in their sports nutrition knowledge, even when their information was incorrect. The researchers concluded that,

overall, coaches and athletes had an inadequate nutrition knowledge and that, although the athletic trainers and CSCS, on average, had an adequate knowledge, the authors recommend that these individuals take caution when making nutrition recommendations

Couture, Lamarche, Morissette, Provencher, Valois, Goulet, & Drapeau (2015) evaluated the sports nutrition knowledge and described the nature and quality of the nutrition recommendations of 47 French-Canadian coaches from five high schools in Quebec. The coaches were divided into categories based on the 'leanness' of their sport. "Lean" sports included gymnastics, swimming and cheerleading, while "non-lean" sports included basketball, football, tennis, and badminton. The questionnaire included 83 questions that assessed the coaches' sports nutrition knowledge and practices regarding nutrition recommendations. Despite having a mean nutrition knowledge score of 68.4%, a majority of the coaches considered themselves knowledgeable in sports nutrition. No significant difference was detected by gender, although the female coaches tended to have higher scores on questions related to weight management. While there was no association seen with nutrition knowledge and number of years coaching, the degree of education proved to be an important factor influencing coaches' sports nutrition knowledge. Additionally, while the level of coaching (i.e., regional vs national and international level) did not impact overall knowledge, coaches in higher competition levels answered more questions correctly in the weight management section. Coaches were found to be primarily making recommendations regarding hydration, and protein consumption. The coaches' primary source of nutrition information was the internet.

Marinero (2008) examined the overall nutrition knowledge of certified athletic trainers. This study utilized a 33-question survey that was distributed to 1000 randomly chosen athletic trainers across the nation. The survey contained 24 sports nutrition knowledge questions and 9

demographic questions. The sports nutrition questions were divided into 8 constructs: macronutrients (6 questions), micronutrients (6 questions), nutritional concerns related to injury (2 questions), pre-event nutrition (2 questions), hydration (2 questions), eating disorders (2 questions), ergogenic aids (2 questions), and body composition (2 questions). Valid responses were received from 280 of the 1000 potential participants, with slightly more females responding to the survey than males. This study considered a “passing” nutrition knowledge score to be 70% or greater. The majority of athletic trainers (n=210; 75%), received a “passing” score, with the overall mean of $76.2\% \pm 12.8\%$. The maximum score received was 100% and the minimum score received was a 25%. When scores were examined by construct, participants received passing scores on all constructs but 2. Participants passed in the macronutrient ($74.1\% \pm 22.6\%$), micronutrient ($86.0\% \pm 15.2\%$), nutrition related to injury ($86.4\% \pm 24.6\%$), hydration ($83.4\% \pm 27.8\%$), body composition ($76.3\% \pm 29.9\%$), and ergogenic aids ($70.5\% \pm 32.2\%$) constructs. Participants did not receive passing scores on the pre-event nutrition ($56.6\% \pm 39.3\%$) or the eating disorders construct ($60.5\% \pm 21.7\%$). Athletic trainers who encountered athletes with a potential eating disorder indicated they referred the athlete to a more qualified individual, but often would not refer an athlete who had questions about pre-event nutrition questions. There were no significant differences in results based on age, gender, ethnicity, route to certification, the possession of an allied health certification, years practicing, or number of nutrition courses taken. Athletic trainers who had only received a bachelor’s degree ($74.0\% \pm 12.6\%$) scored significantly lower than those who had received a terminal degree ($84.2\% \pm 13.8\%$) or the highest degree achievable in the field. There was also a significant difference found for those participants who held an additional certification in athletic performance ($81.3\% \pm 9.2\%$) as opposed to those who did not ($75.0\% \pm 13.2\%$).

Sources of Nutrition Knowledge

Because athletes often indicate their coaches are their primary source of sports nutrition information (Botsis and Holden, 2015), it is important to identify what resources coaches use to learn about sports nutrition. Danaher & Curley (2014) found that most of the coaches they surveyed had no formal training in nutrition, but that most had access to a nutrition specialist in some form. Similarly, Zinn, Schofield, & Wall (2006) identified a lack of nutrition training among coaches, with over half of the coaches who reported giving nutrition advice to their athlete indicating they had no training in nutrition.

Cockburn et al. (2014) conducted a study of 163 hockey and netball coaches in the United Kingdom to identify their sports nutrition knowledge, if they provide nutrition advice, and what factors contributed to their sports nutrition knowledge. Results indicated that only one out of every four (25.2%) coaches had received some formal nutrition training. Despite their lack of sports nutrition knowledge, the majority of coaches believe that sports nutrition could help improve athlete performance and help prevent injury. The coaches' primary source of sports nutrition information was the internet (61.1%), followed by journal articles (48.9%), magazines (44.3%), lectures/seminars/courses (26.0%) and sponsors (1.5%). While there are many high-quality sports nutrition resources on the internet, there are also many questionable resources, which is cause for concern.

In contrast, Torres-McGehee et al. (2012) found that coaches use more reliable sources of sports nutrition information, such as a registered dietitian, athletic trainers, and CSCS. Athletic trainers and CSCS also tended to use reliable sports nutrition resource such as RDNs, academic journals, college nutrition courses, and physicians.

In sum, the sources of nutrition information used by coaches and athletic trainers are varied. Ensuring coaches and athletic trainers have access to reliable and valid sports nutrition information should be a concern of all athletic departments.

Perception of the Impact of Sports Nutrition

It is well known that nutrition can play a role in the advancement of an athlete's performance, both in and beyond college athletics (Zinn et al., 2006). The Academy of Nutrition and Dietetics, the Dietitians of Canada, and the American College of Sports Medicine have published several joint position statements over the years in support of the role of nutrition and sports performance, with the most recent position statement emphasizing the role of well-chosen nutrition strategies in the performance of, and recovery from, sporting activities (Thomas et al., 2016).

Parks, Sanfilippo, Domeyer, Hetzel, & Brooks (2018) acknowledged that in many programs the athletic trainer plays a vital role in providing nutrition information to athletes. These authors suggested that certified athletic trainers can serve as observers, educators, referral sources, and advocates for the well-being of student-athletes, and that through these means the athletic trainer can work in concert with the CSSD to achieve their overall goals. These researchers suggested that, while athletic trainers are able to provide general nutrition information and perform other supporting tasks, the CSSD is able to provide specific information tailored to each athlete, their sport and their individual needs.

The role of coaches must be examined when looking at the perceptions of nutrition in sports. The majority of coaches were shown to believe that sports nutrition could help improve athlete performance and help prevent injury (Cockburn et al., 2014). Since coaches are recognized as a major source of information and influence for young athletes regarding food and

supplement choice (Jacob et al., 2016), it is important to ascertain a more comprehensive understanding of their position on the role of nutrition in their athlete's performance and achieving their overall goals.

Board Certified Specialists in Sports Dietetics in the NCAA

Role of the CSSD

There are varying levels of employment for the CSSD in the NCAA, with some universities having no formally employed nutrition specialist for their athletic teams, while other universities employ part-time specialist or full time CSSDs for their sports teams (Torres-McGehee et al., 2012). A recent study found that, of the 579 participants surveyed, 58.2% had access to a dietitian in some capacity. Of these, 21.0% indicated a dietitian was employed full time and 28.2% employed a dietitian part time in athletics (Torres-McGehee et al., 2012).

Within the NCAA there is great variance in the employment of a CSSD. While all eight Big Ten Conference universities have a sports dietitian available full time, other conferences, like the Mid America Conference, have no full-time dietitians on staff exclusively for their athletic teams (Burns, Schiller, Merrick, & Wolf, 2004; Judge et al., 2016; http://www.sportsrd.org/?page_id=1176). Currently, only 84 of the NCAA Division I universities employ one or more full-time CSSDs in their athletic program.

Benefit of the CSSD to the Collegiate Team

Although not all schools have invested in the full-time employment of a CSSD, there is evidence that those who do have a CSSD on staff see notable benefits. Athletes at schools with access to a sports dietitian were found to have elevated likelihood of seeking out nutrition

information, had increased nutrition knowledge and were more confident their decisions regarding nutrition (Sceery, 2017; Wallinga et al., 2013).

While the student athletes with access to a dietitian are showing signs of improved nutrition outcomes, there is some risk for students who do not have access to such reliable resources. Universities without a CSSD might be placing their student-athletes at risk for receiving hydration information from less reliable sources, putting the health and well-being of their athletes at risk compared to schools with a CSSD that have the capacity to focus on proper diet and nutrition education for athletes (Judge et al., 2016). This is especially important since the athletes' knowledge about nutrition, both general and sport specific, may impact their food choices and subsequent dietary intake.

Likewise, athletes' beliefs about nutrition and level of knowledge may determine the importance placed on food choices (Birkenhead & Slater, 2015). Student athletes with access to a CSSD have the opportunity to address their individual needs which vary on a sport, position, and individual level (Thomas et al., 2016). Beyond this the CSSD can also benefit the team through group education. As one study demonstrated a 90-minute nutrition education with tri-weekly reinforcement sessions during team dinners was an effective intervention to improve nutritional status (Rossi et al., 2017). Valliant et al. (2012) provided an educational intervention conducted by a registered dietitian for collegiate volleyball players. Results indicated significant changes in total energy and macronutrient consumption from the baseline to the intervention, with 66% of these changes maintained at the end of the study. These researches concluded that registered dietitians with an expertise in sports nutrition are qualified professionals who should be the primary source for athletes and coaches regarding diet information for their respective programs.

Nutrition Recommendations by Coaches and Athletic Trainers

Despite the fact that many coaches lack formal training in nutrition, they are still considered an important source of information about sports nutrition, and coaches still make sports nutrition recommendations primarily centered on carbohydrate and protein intake and hydration (Jacob et al., 2016). An example of the types of recommendations being made by individuals with no formal qualification regarding sports nutrition is seen through CrossFit trainers who commonly recommend both the Paleo and Zone diets, and make recommendations about fluid intake, sugar intake, and generally clean eating (Maxwell et al., 2017). These recommendations have limited support in the literature on their impact of athletic performance and the content of the paleo diet varies greatly from the current guidelines for sports nutrition (Maxwell et al., 2017). This illustrates the how variable the sports nutrition information received from undertrained individuals can be.

Danaher & Curley (2014) examined coaches at a Canadian university. This study collected quantitative and qualitative data and through a structured interview format. The 23-question survey included demographic information, nutrition recommendations made by coaches, coaches' experience with eating disorders, and nutrition topics the coaches wanted to know more about. This study found that despite low nutrition knowledge, coaches still make some recommendations regarding nutrition, supplement use, and weight management (Danaher & Curley, 2014).

If coaches and athletic trainers make unsubstantiated recommendations, their incorrect advice can affect overall performance and introduce unnecessary risk to the athletes. As Judge et al. (2016) pointed out, misinformation about hydration status can result in heat exhaustion and other such illnesses related to inadequate thermoregulation. As hydration is a common topic for

recommendations to be made on, it is imperative that accurate information is disseminated (Couture, 2015). Additionally, inappropriate recommendations regarding carbohydrates may result in inadequate glycogen stores, thus decreasing the athlete's energy stores and impacting overall sports performance (Shapiro et al. 2015). These are just a few examples of how inaccurate information can be deleterious to a sports team.

Summary

Athletes have unique nutrition needs that must be met to adequately fuel their bodies for optimal performance. Many athletes rely on their coaches and athletic trainers for nutrition advice and recommendations, even though these individuals may have varied abilities to provide reliable information. One important factor in determining the reliability of the information provided to athletes is the source of the sports nutrition recommendations given to them. Additionally, the perception of nutrition's impact on sport performance may affect the prioritization of both athletes and coaches in obtaining reliable information and implementing it. For some universities the CSSD is already a reliable resource. While not all universities have access to a nutrition specialist for their athletes, those that do have shown to benefit. Without a CSSD there is a potential for unsubstantiated recommendations about a variety of topics within sports nutrition being made, some of which may be harmful to the athlete. The CSSD is can be an integral member of the interdisciplinary team, providing reliable information, and easing the burden of other members of the team by taking the responsibility for the nutrition needs of the athletes.

CHAPTER 3

METHODOLOGY

The purpose of this study was to identify the sports nutrition knowledge, attitudes, beliefs and recommendations of coaches and athletic trainers at a Division I university, and to identify their perceived use of a Board Certified Sports Specialist in Dietetics (CSSD) as a member of the athletic team. This chapter will describe the methods used to conduct this study.

Institutional Review Board

This study was approved as exempt by the Ball State University Institutional Review Board IRB as protocol # 1370085-1 on January 2, 2019 (Appendix A-1). The researcher conducting this analysis completed the Collaborative Institutional Training Initiative (CITI) training in order to ensure the protection of all participants (Appendix A-2).

Subjects

The population for this study was a census of the coaches, certified athletic trainers, and certified strength and conditioning coaches (CSCS) from the 18 NCAA-sanctioned sports teams that competed during the 2018-2019 academic year at one Division I university in the Mid-American Conference. The population included 65 individuals who were either head coaches (n=20), assistant coaches (n=34), CSCS (n=2), or athletic trainers (n=9). All participants were

required to be 18 years of age or older and an official member of the university coaching or athletic training staff for one of the 18 sanctioned sports. Graduate assistants who functioned in a coaching capacity were not included in the study population. A sample size calculator, using a 95% confidence level and a confidence interval of five (<https://www.surveysystem.com/sscalc.htm#one>), indicated 56 responses were needed to obtain results that were representative of the population.

Instruments

The *Sports Nutrition Knowledge Survey* (Appendix B) used in this study was based on the survey used by Shapiro (2016) with the addition of four questions from the survey used by Trakman et al. (2018). The online survey, written using the Qualtrics™ platform, included four sections: 1) sports nutrition knowledge; 2) sources of sports nutrition information; 3) beliefs about who is qualified to give nutrition information to athletes, including the participants own qualifications; and 4) perceptions of the impact of a CSSD to an athletic team. The sports nutrition knowledge section consisted of 23 questions from five constructs: 1) macronutrients (5 questions), 2) micronutrients (4 questions), 3) nutrition timing (4 questions), 4) hydration (4 questions), and 5) nutrition problems (5 questions).

Beliefs about the qualifications of professionals were assessed using a 5-point Likert scale, ranging from 1 “no knowledge” to 5 “expert knowledge.” A 10-point Likert scale was used to assess the participant’s perception of the importance of sports nutrition and the benefit of having a CSSD on staff, ranging from 1 “not beneficial at all” to 10 “extremely beneficial.” Additionally, respondents were asked to identify the type of information they would like to

obtain from a CSSD from a list of potential topics. Participants were given the option of “other” and were provided a space to write in additional topics.

Face, construct, and content validity of the survey was previously established by a group of experts that included three registered dietitians, including one CSSD; one Associate Dean to the Athletic Department; and two graduate students in nutrition and dietetics. Reliability of the survey was previously established through the use of a pilot study involving 28 students in a nutrition assessment class.

Letters of Permission and Consent

Permission was received by Trakman et al. (2018) to use four questions from their survey (Appendix C-1). A letter of permission to conduct the study was received from the Associate Dean of the Athletic Department (Appendix C-2). Before the participants could access the survey, they were asked to read a summary of the goals and benefits of the study and to provide their consent before they could continue (Appendix C-3).

Methods

Outreach for the data collection was done in accordance with the method described by Dillman et al. (2009) to increase the response rate. The Dillman method involves a series of at least three communications with the study participants. On Thursday January 24th, the Associate Dean of the Athletic Department distributed a survey to all the coaches and athletic trainers at the selected Division I university via email (Appendix D-1). The email included a brief summary of the purpose of the study, the potential benefits for those who completed the study, and the link to the online survey. Once the participant followed the link, they were provided with a more detailed description of the study and had access to the letter of consent (Appendix C-3).

Five days later a second email was sent to all of the coaches and athletic trainers to thank them for their participation and to encourage anyone who had not yet completed the survey to consider completing it at this time (Appendix D-2). A third and final email reminder that, once again, thanked those who had already participated and encouraged those who had not yet completed to survey to do so, was sent out to all participants six days later on February 4th, 2019 (Appendix D-3).

Data Analysis

Data was downloaded directly from Qualtrics into SPSS v.25 for Windows (SPSS, 2018) for analysis. Descriptive statistics (frequency counts and percents) were run on all variables to determine the overall prevalence of specific survey questions. An overall nutrition knowledge score (number/percent correct out of 23), and scores from each of the five constructs (number/percent correct of out 4 or 5), were calculated by giving each correct answer a value of one and summing the total number of correct questions. One-way analysis of variance (ANOVA) was used to compare differences, both overall and by profession (i.e., coach, or athletic trainer). Statistical significance was set at $p \leq 0.05$.

Summary

This study surveyed coaches and athletic trainers at a Division I NCAA university. The survey examined sports nutrition knowledge, beliefs, and attitude in college coaches and athletic trainers. Additionally, perceptions toward a CSSD, and desired practices involving the CSSD, were assessed. These results can be used to understand the gaps in knowledge of coaches and athletic trainers, and the areas of interest regarding sports nutrition.

CHAPTER 4

RESULTS

The purpose of this study was to identify the sports nutrition knowledge, attitudes, beliefs and recommendations of coaches and athletic trainers at a Division I university, and to identify their perceived use of a Board Certified Sports Specialist in Dietetics (CSSD) as a member of the athletic team. This chapter describes the results of the study.

Participants

Forty of the 65 coaches and athletic trainers eligible to participate in the study initiated taking the survey (61.5% response rate). Of these, 10% (n=4) did not complete the survey. Of these four participants, three discontinued the survey shortly after they began, and the fourth did not provide informed consent. Thus, a total of 36 participants (55.4% response rate) completed the survey, including 27 coaches (48.2% response rate), and 9 (100% response) athletic trainers. This number fell short of the goal of 56 respondents, resulting in a confidence interval of 11. Thus, the results of this study should be considered preliminary.

Six of the 27 coaches (22.2%) and four of the nine athletic trainers (44.4%) reported having 0-5 years of experience in their field, 11 coaches (40.7%) and 3 athletic trainers (33.3%) reported having 6-10 years of experience, and 10 coaches (37.0%) and 2 athletic trainers (22.2%)

reporting having 11 or more years of experience. To protect the anonymity of the coaches and athletic trainers, the gender, race/ethnicity, or age of the participants was not obtained.

RQ #1: Sports Nutrition Knowledge of Coaching and Athletic Training Staff

The first research question examined the current sports nutrition knowledge of the coaching and athletic training staff. Participants answered 23 sports-nutrition knowledge questions that encompassed five constructs (i.e., macronutrient (n=5), micronutrient (n=5), nutrition timing (n=4), hydration and electrolyte balance (n=4), and nutrition problems (n=5)).

Sports Nutrition Knowledge

Overall, the mean sports-nutrition knowledge score of the coaches and athletic trainers, combined (n=36), was 14.1 ± 3.4 out of 23, equivalent to answering 61.5% of the answers correctly (Table 1), a score that equates to a D- on the typical college grading scale.

Table 1: Mean Sports Nutrition Knowledge Score of Coaches and Athletic Trainers, Overall and by Construct (n=36)

Variable	Number of Questions	Mean Correct \pm SD	Percent Correct \pm SD
Sports Nutrition Knowledge Total Score	23	14.4 ± 3.4	61.5 ± 14.8
Sports Nutrition Construct			
Nutrition Problems	5	3.1 ± 1.2	76.7 ± 23.7
Nutrient Timing	4	2.2 ± 1.0	64.6 ± 27.0
Micronutrient	5	2.4 ± 1.1	61.1 ± 23.4
Hydration/Electrolyte Balance	4	2.0 ± 1.1	56.3 ± 23.4
Macronutrient	5	2.4 ± 1.1	48.3 ± 24.1

By construct, the respondents correctly answer three-quarters of the nutrition problems questions (3.1 ± 1.2 ; 77%) and more than half of the nutrient timing (2.2 ± 1.0 ; 65%),

micronutrient (2.4 ± 1.1 ; 61%) and hydration and electrolyte balance questions (2.0 ± 1.1 ; 56%). The respondents correctly answered fewer than half of the macronutrient questions (2.4 ± 1.1 ; 48%) (Table 1).

Comparison of Total Sports Nutrition Knowledge Score

The data was analyzed with SPSSv25 to identify if there were differences in the sports nutrition knowledge of the coaches and athletic trainers, both overall and by individual construct scores. Overall, the athletic trainers ($73.0\% \pm 10.4\%$) scored significantly higher than the coaches ($57.6\% \pm 14.2$) ($F=8.803$; $p=0.005$) on the 23 question sports nutrition knowledge survey (Table 2).

Table 2: Sports Nutrition Knowledge and Construct Percent Correct Score by Position

Score	Position	N	df	Mean % \pm SD %	F	p-value
Sports Nutrition Knowledge	Coach	27	1,34	57.6 ± 14.2	8.803	0.005
	Athletic Trainer	9		72.9 ± 10.4		
Macronutrient	Coach	27	1,34	43.7 ± 21.5	4.376	0.044
	Athletic Trainer	9		62.2 ± 27.3		
Micronutrient	Coach	27	1,34	60.0 ± 25.4	.238	0.629
	Athletic Trainer	9		64.4 ± 16.7		
Nutrition Timing	Coach	27	1,34	62.0 ± 27.2	0.961	0.334
	Athletic Trainer	9		72.2 ± 26.3		
Hydration and Electrolyte Balance	Coach	27	1,34	50.9 ± 23.5	6.442	0.016
	Athletic Trainer	9		72.2 ± 15.0		
Nutrition Problem	Coach	27	1,34	71.1 ± 23.7	6.967	0.012
	Athletic Trainer	9		93.3 ± 14.1		

Comparison of Sports Nutrition Construct Scores

In addition to having a higher overall sports nutrition knowledge score, the athletic trainers also scored higher in each of the five sports nutrition constructs, with a significant difference noted for the macronutrient ($F=4.276$; $p=0.044$), hydration and electrolyte balance ($F=6.442$; $p=0.016$), and nutrition problem ($F=6.967$; $p=0.012$) constructs (Table 2).

Macronutrient Construct

The macronutrient construct was calculated by summing the number of correct responses to five questions that addressed carbohydrate, protein and lipid sports nutrition concepts (Table 3). Overall, the athletic trainers ($n=9$) correctly answered $62.2\% \pm 27.3\%$ of the macronutrient questions, significantly higher than the $43.7\% \pm 21.5\%$ that were correctly answered by the coaches ($n=27$) ($F=4.376$; $p=0.044$) (Table 2).

The first macronutrient question was a true or false statement that read: “Protein eaten in excess of bodily needs can lead to fat gain.” Nineteen participants (52.8%) correctly selected the option “true,” while 9 individuals (25.0%) answered false and 8 (22.2%) selected “unsure” (Table 3).

The second macronutrient question was a multiple-choice question that asked: “Which of the following is the most critical goal of sports nutrition?” All 36 participants responded, with 17 (47.2%) correctly selecting the option “choosing adequacy of total calories (energy availability)” as the main goal of sports nutrition. Of the remaining participants, 6 (16.7%) selected availability of glycogens stores, 2 (5.6%) selected adequate protein intake, 8 (22.2%) selected maintenance of ideal body composition, and 3 (8.3%) selected unsure (Table 3).

The third macronutrient question was a multiple-choice question that asked: “The recommended minimum amount of daily carbohydrate for athletes actively training is?” For this

question, only 7 (19.4%) correctly selected 5g/kg body weight. Other responses included 6 (16.7%) selecting 4g/kg body weight, 3 (8.3%) selecting “6 g/kg body weight,” two selecting “7 (5.6) g/kg body weight,” and 18 (50%) selected “unsure” (Table 3).

Table 3: Responses to Macronutrient Construct by Question

Question	Correct Answer	Frequency	Valid Percent
Excess protein can lead to fat gain	True	19	52.8%
	False	9	25.0%
	Unsure	8	22.2%
The most critical goal of sports nutrition	Adequate calories	17	47.2%
	Glycogen Availability	6	16.7%
	Adequate protein	2	5.6%
	Ideal body composition	8	22.2%
	Unsure	3	8.3%
Minimum daily carbohydrate for actively training athletes	4 g/kg body weight	6	16.7%
	5 g/kg body weight	7	19.4%
	6 g/kg body weight	3	8.3%
	7 g/kg body weight	2	5.6%
	Unsure	18	50.0%
Increased protein is the main change needed when muscle gain is desired	True	15	41.7%
	False	21	58.3%
Intermittent sprint sports require more of which nutrient	Carbohydrate	23	63.9%
	Protein	5	13.9%
	Fat	2	5.6%
	Unsure	6	16.7%

The fourth macronutrient question was a true or false statement that read: “Increasing protein in the diet is the main dietary change needed when only muscle gain is desired.” The

correct response, “false” was correctly selected by 21 of the respondents (58.3%), while the incorrect response, “true,” was selected by 15 respondents (41.7%) (Table 3).

The final macronutrient question asked: “Sports with several intervals of high intensity sprints (i.e., basketball, soccer, tennis) require more of which nutrient, both for the activity and recovery?” The majority of respondents (n=23; 63.9%) correctly selected “carbohydrate”, while five (13.9%) selected “protein”, two (5.6%) selected “fat”, and six (16.7%) indicated they were unsure of the correct answer (Table 3)

Micronutrient Construct

The micronutrient construct was calculated by summing the number of correct responses to five questions that addressed sports-related vitamin and mineral concepts (Table 4). Results indicated the athletic trainers (n=9) correctly answered $64.4\% \pm 16.7\%$ of the micronutrient questions, while the coaches (n=27) correctly answered $60.4\% \pm 25.4\%$ of the questions. There was no difference in the percent of questions answered correctly between the athletic trainers and coaches ($F=0.238$; $p=0.629$) (Table 2).

The first micronutrient question was a four-part question that asked: “Which of these foods is a good source of dietary iron? Select all that apply.” Each of the four options counted as one question, with each option worth one point. The responses “4 ounces red meat (beef, venison, etc.)” and “½ cup cooked black beans” were accepted as correct responses. Overall, 58.3% (n=21) of the respondents correctly selected 4 ounces of red meat and 52.8% (n=19) correctly selected ½ cup cooked black beans as being a good source of iron. Nearly half of the respondents (47.2%; n=17) incorrectly indicated that “4 ounces of fish (i.e., cod, tuna, salmon)” was a “good” source of dietary iron (i.e., provides at least 10% of the Daily Value). Four

participants (11.1%) incorrectly selected “1 cup fat-free milk or yogurt” as being a good source of iron (Table 4).

The last micronutrient question asked about the relationship between exercise and vitamin supplementation. Over half of the participants (52.8%; n=19) correctly selected the option “Exercise increases the need slightly, but supplementation is not necessary if total calories are adequate.” Five participants (13.9%) incorrectly selected “exercise increases the need substantially, making vitamin supplementation necessary,” 3 (8.3%) incorrectly indicated that “exercise increases the need substantially, but supplementation is not necessary,” 2 participants (5.6%) incorrectly indicated that “exercise increases the need slightly, making vitamin supplementation necessary,” and 7 respondents (19.4%) indicated they were “unsure” which option was the correct answer (Table 4).

Table 4: Responses to Micronutrient Construct by Question

Question	Correct Answer	Frequency	Valid Percent
Which of these foods is a good source of dietary iron? Select all that apply.	Red meat	21	58.3%
	Black Beans	19	52.8%
	Fish	17	47.2%
	Milk or yogurt	4	11.1%
What effect does exercise have on an athlete’s vitamin requirements?	Increases need substantially, making vitamin supplementation necessary	5	13.9%
	Increases need substantially, but supplementation is not necessary	3	7.5%
	Increases the need slightly, but supplementation is not necessary if total calories are adequate	19	80.6%
	Increases the need slightly, making vitamin supplementation necessary	2	5.6%
	Unsure	7	19.4%

Nutrition Timing Construct

The nutrition timing construct was calculated by summing the number of correct responses to four questions that addressed pre-competition and post-event recovery feeding (Table 5). Overall, the athletic trainers (n=9) correctly answered $72.2\% \pm 26.3\%$ of the nutrition timing questions, while the coaches (n=27) correctly answered $62.0\% \pm 27.2\%$ of the questions. There was no difference in the percent of questions answered correctly between the athletic trainers and coaches ($F=0.961$; $p=0.334$) (Table 2).

The first nutrition timing question asked: “Which pre-competition goal is not associated with carbohydrate intake directly before exercise?” The correct answer “adding to glycogen stores” was selected by 14 of participants (38.9%). Of the other options, 3 participants (8.3%) selected “avoiding hunger during competition,” 3 (8.3%) selected delaying fatigue, 8 (22.2%) selected “minimizing gastrointestinal distress” and 8 (22.2%) selected “unsure” (Table 5).

The second nutrition timing question asked about which foods would be most effective for the restoration of muscle glycogen after exercise. The correct answer “chocolate milk” was chosen by 28 participants (77.8%). Of the other options, 5 participants (13.9%) selected a “banana”, 1 (2.8%) selected “granola bar”, and 2 (5.6%) selected “unsure” (Table 5).

The third nutrition timing question was a multiple choice question that asked, “Before competition, athletes should aim to consume foods that are high in ____?” The correct response “fluids and carbohydrates” was selected by 8 participants (22.2%). Of the remaining options, “fluids, fiber and carbohydrate” was selected by 5 participants (13.9%), “fluids and carbohydrates” was selected by 21 participants (58.3%), and 2 participants (5.6%) selected “unsure.”

The final nutrition timing question focused on the optimal timing of a post-event meal for the restoration of muscle glycogen. The correct answer, “within 2 hours post exercise”, was selected by 30 participants (83.3%). Of the remaining options, “3-4 hours post-exercise” was selected by 2 participants (5.6%), “timing of the meal is not relevant to glycogen restoration” was selected by 1 participant (2.8%), and “unsure” was selected by 3 participants (8.3%) (Table 5).

Table 5: Responses to Nutrition Timing Construct by Question

Question	Correct Answer	Frequency	Valid Percent
Which pre-competition goal is <i>not</i> associated with carbohydrate intake directly before exercise?	Avoiding hunger	3	8.3%
	Delaying fatigue	3	8.3%
	Minimizing GI distress	8	22.2%
	Adding to glycogen stores	14	38.9%
	Unsure	8	22.2%
Which the following would be most effective in aiding post-exercise recovery of muscle and glycogen stores?	Granola bar	1	2.8%
	Chocolate milk	28	77.8%
	Banana	5	13.9%
	Energy drink	0	0%
	Unsure	2	5.6%
Before competition athletes should aim to eat foods high in:	Fluids, fat and carbohydrate	8	22.2%
	Fluids, fiber and carbohydrate	5	13.9%
	Fluids and carbohydrate	21	58.3%
	Unsure	2	5.6%
The optimal timing for consuming a post event meal to restore glycogen would be:	Within 2 hours post exercise	30	83.3%
	3-4 hours post exercise	2	5.6%
	Meal timing is not relevant to glycogen restoration	1	2.8%
	Unsure	3	8.3%

Hydration and Electrolyte Balance Construct

The hydration/electrolyte balance construct was calculated by summing the number of correct responses to four questions that addressed fluid consumption and electrolyte intake (Table 6). Overall, the athletic trainers (n=9) correctly answered $72.2\% \pm 15.0\%$ of the hydration questions, significantly higher than the $50.9\% \pm 23.5\%$ that were correctly answered by the coaches (n=27) ($F=6.442$; $p=0.016$) (Table 2).

The first hydration question asked about the symptoms associated with a significant loss of electrolytes during heavy exercise. Almost all (94.4% ; n=34) of the participants correctly selected “muscular cramps, heat illness,” while 2 participants (5.6%) selected “drop in blood pressure, increased production of urine.” No one selected the foils “stress fracture, swelling,” “dyspnea (difficult or labored breathing), indigestion” or “unsure” (Table 6).

The second hydration question asked about the current recommendations for fluid intake during physical activity for athletes. Of the available options, slightly more than one-third (36.1% ; n=13) selected the correct answer “drink to a plan, based on body weight changes during training sessions performed in a similar climate.” Half (50% ; n=18) of the coaches and athletic trainers incorrectly selected “drink 50-100mL (1.7- 3.3 fluid ounces) every 15- 20 minutes” while one participant (2.8%) selected “drink sports drinks (e.g. PowerAde) instead of water when exercising. Four individuals (11.1%) selected “unsure” (Table 6).

The third hydration construct question was a multiple-choice question that asked, “If an athlete loses one pound of fluid during an exercise session how many ounces of fluid should he or she drink post-exercise?” One-third (36.1% ; n=9) of the respondents correctly selected “16- 24 fluid ounces,” while 3 participants (8.3%) selected “6-8 fluid ounces,” 4 participants (11.1%)

selected “9-15 fluid ounces,” and 9 participants (25.0%) selected “25-36 fluid ounces.” One out of five participants (19.4%; n=7) indicated that they were “unsure” (Table 6).

Table 6: Responses to Hydration Construct by Question

Question	Potential Answers	Frequency	Valid Percent
Significant losses of electrolytes during heavy exercise may lead to symptoms such as...	Drop in blood pressure, increased urine	2	85.6%
	Stress fracture, swelling	0	0%
	Dyspnea, indigestion	0	0%
	Muscular cramps, heat illness	34	94.4%
	Unsure	0	0%
Regarding fluid intake during physical activity, current recommendations encourage athletes to:	Drink 50-100mL every 15- 20 minutes	18	50.0%
	Drink to a plan, based on body weight changes during training in a similar climate	13	36.1%
	Drink sports drinks instead of water	1	2.8%
	Suck on ice cubes rather than drinking	0	0.0%
	Unsure	4	11.1%
If an athlete loses one pound of fluid during an exercise session how many ounces of fluid should he or she drink post-exercise?	6-8 fluid ounces	3	8.3%
	9-15 fluid ounces	4	11.1%
	16-24 fluid ounces	13	36.1%
	25-36 fluid ounces	9	25.0%
	Unsure	7	19.4%
Best method to determine fluid loss due to sweat during exercise?	Monitor urine color	9	25.0%
	Pre-post practice weigh-ins	21	58.3%
	Thirst	2	5.6%
	Unsure	4	11.1%

The final hydration question asked, “What measure is the best method to determine the amount of fluid loss due to sweat during an exercise session in which the athlete did not drink or

go to the bathroom?” More than half of the coaches and athletic trainers (58.3%; n=21) chose the correct answer “pre-post practice weigh-ins.” One out of every four participants (25.0%; n=9) incorrectly selected “monitoring urine color, while 2 participants (5.6%) chose “thirst”, and 4 participants (11.1%) indicated they were “unsure” of the correct answer (Table 6).

Nutrition Problem Construct

The nutrition problem construct was calculated by summing the number of correct responses to five questions that addressed various sports nutrition-related maladies (Table 7). Overall, the athletic trainers (n=9) correctly answered 93.3% \pm 14.1% of the nutrition problem questions, significantly higher than the coaches (n=27) who correctly answered 71.1% \pm 23.7% of the questions (F=6.957; p=0.012) (Table 2).

The first nutrition problem question was a true or false question that asked: “In most sports, it is normal for a female athlete to have irregular or missing menstrual cycles during the competitive season.” Over half of the respondents answered correctly selected “False,” (52.8%; n=19), while 8 participants (22.2%) incorrectly selected “True,” and 9 participants (25.0%) indicated they were “Unsure” (Table 7).

The second nutrition problem question was a multiple-choice question that asked: “A concern for student-athletes who are under-eating (calorie deficit) is _____,” with available options including “an underlying eating disorder,” “female athlete triad,” “all of these are concerns,” and “unsure.” The correct answer, “all of these,” was selected by the majority of coaches and athletic trainers (88.9%; n=32). One individual (2.8%) incorrectly selected “an underlying eating disorder” and 1 individual (2.8%) incorrectly selected “female athlete triad.” Two participants (5.6%) indicated they were “unsure” of the correct answer (Table 7).

The third, fourth and, fifth nutrition problem questions were combined into one question that asked: “Which, if any, of these symptoms are associated with inadequate nutrition? Select all that apply.” The symptoms presented included “poor recovery”, “unintentional weight loss,” and “muscle cramping.” The majority of coaches and athletic trainers correctly indicated that “poor recovery” (88.9%; n=32), “unintentional weight loss” (80.6%; n=29) and “muscle cramping” (72.2%; n=26) were all associated with inadequate nutrition (Table 7).

Table 7: Responses to Nutrition Problem Construct by Question

Question	Potential Answers	Frequency	Valid Percent
It is normal for a female athlete to have irregular or missing menstrual cycles during the competitive season.	True	8	22.2%
	False	19	52.8%
	Unsure	9	25.0%
A concern for student-athletes who are under-eating (calorie deficit) is.	An underlying eating disorder	1	2.8%
	Female athlete triad	1	2.8%
	Over-training Syndrome	0	0%
	All of these are concerns	32	88.9%
	Unsure	2	5.6%
Which, if any, of these symptoms are associated with inadequate nutrition? Select all that apply.	Poor recovery	32	88.9%
	Unintentional weight loss	29	80.6%
	Muscle cramping	26	72.2%

Summary

In sum, results indicate that athletic trainers have a significantly higher sports nutrition knowledge when compared to the coaches. When using a ‘passing’ threshold of 70% correct to define “adequate” sport nutrition knowledge, the athletic trainers had adequate knowledge, but the sports nutrition knowledge of coaches remained below a ‘passing’ score. The athletic trainers

scored significantly higher than the coaches on the macronutrient, hydration and electrolyte balance and nutrition problem constructs.

RQ#2: Sports Nutrition Resources and Opinions of Coaching and Athletic Training Staff

The second research question examined the sports nutrition resources and opinions of the coaching and athletic training staff. To answer this question, the researcher collected data about the type of professionals and non-human resources used by the coaches and athletic trainers to obtain nutrition information, their opinions of the level of sports nutrition knowledge held by individuals, and their opinion of the importance of nutrition for performance.

The participants were presented with a list of people/professionals (i.e., Athletic Trainer, Coaches, Friends, Parents, Personal Physician, Registered Dietitian Nutritionist (RDN/CSSD), CSCS', Team Physician, and Other) and were asked to identify who they had *approached* to obtain nutrition information (Table 8). Athletic Trainers were identified as the most frequently approached person/professional by the majority of respondents (80.6%) to obtain sports nutrition knowledge, followed by CSCS (69.4%), registered dietitian nutritionists (58.3%), coaches (33.3%), friends (27.8%), team physician (22.2%), personal physicians (19.4%), and parents (5.6%). Three participants (8.3%) selected 'other' option and, of these, one specified "the internet" as an additional source while a second individual specified "classes."

Table 8: Types of People Approached to Obtain Sports Nutrition Information

Variable	N (%)
Athletic Trainer	29 (80.6%)
Strength and Conditioning Specialist	25 (69.4%)
Registered Dietitian Nutritionist	21 (58.3%)
Coaches	12 (33.3%)
Friends	10 (27.8%)
Team Physician	8 (22.2%)
Personal Physician	7 (19.4%)
Parents	2 (5.6%)
Other	3 (8.3%)

The coaches and athletic trainers were asked “Which of these resources have you *used* to obtain nutrition information? Select all that apply.” A list of common sports nutrition resources was provided to the coaches and athletic trainers (i.e., academic journals, college nutrition courses, conferences/annual meetings/team meetings, the internet, magazines, social media, mobile apps, and other) (Table 9). Results indicated 14 participants (38.9%) used academic journals, 13 (36.1%) used college nutrition courses, 16 (44.4%) used conferences/annual meetings/team meetings, 24 (66.7%) used the internet, 8 (22.2%) magazines, 13 (36.1%) used social media (i.e. Facebook, Instagram, Twitter), and 6 (16.7%) used a mobile App (i.e. MyFitnessPal) to obtain sports nutrition information. One participant responded to the ‘other’ option and cited the U.S. Olympic Training Center as a reference source.

Table 9: Other Sources Used for Sports Nutrition Information

Variable	N (%)
Internet	24 (66.7%)
Academic Journals	14 (38.9%)
Conferences/Annual Meetings/Team Meetings	16 (44.4%)
College Nutrition Course	13 (36.1%)
Social Media (i.e., Facebook, Instagram, Twitter)	13 (36.1%)
Magazines	8 (22.2%)
Mobile App (i.e., MyFitnessPal)	6 (16.7%)
Other	1 (2.8%)

To identify the coaches' and athletic trainers' confidence in the sports nutrition knowledge of their peers, including other coaches, athletic trainers, and strength and condition specialists, each participant was asked to describe their confidence in the sports nutrition knowledge of these professionals using a 5-point Likert scale that ranged from "1-No Knowledge" to "5-Expert." Of these three groups (i.e., coaches, athletic trainers, and strength/conditioning specialists), the strength and conditioning coaches were identified by their peers as having the greatest sports nutrition knowledge (3.8 ± 0.8), followed by athletic trainers (3.2 ± 0.8), and coaches (2.6 ± 0.9). There was no difference in the self-reported sports nutrition knowledge between groups ($F=2.17$; $p=0.150$). However, when the respondents were asked to state their confidence in their peers' sports nutrition knowledge, the coaches perceived their sports nutrition knowledge was significantly higher (2.8 ± 0.9) than the athletic trainers perceived the coaches' knowledge to be (2.1 ± 0.8 ; $F= 4.21$; $p=0.048$) (Table 10).

Table 10: Confidence in Nutrition Knowledge of Athletic Trainers, Coaches, and Strength and Conditioning Coaches

Variable	N	df	Mean* ± SD	F	P
Athletic Trainers		1,32		2.17	0.150
Coach	25		3.1 ± 0.9		
Athletic Trainer	9		3.6 ± 0.5		
Total	34		3.2 ± 0.8		
Coaches		1,34		4.21	0.048
Coach	27		2.8 ± 0.9		
Athletic Trainer	9		2.1 ± 0.8		
Total	36		2.6 ± 0.9		
Strength & Conditioning Specialist		1,34		1.31	0.261
Coach	27		3.7 ± 0.9		
Athletic Trainer	9		4.1 ± 0.3		
Total	36		3.8 ± 0.8		

* 1= "No Knowledge" and 5= "Expert"

Participants were asked to rank their own sports nutrition knowledge on the same 5-point Likert scale. The overall mean score was 2.8 ± 0.9 , with coaches giving themselves a mean score of 2.6 ± 0.9 and the athletic trainers giving themselves a mean score of 3.2 ± 0.7 . There was no difference in the self-reported confidence in sports nutrition knowledge of the coaches and athletic trainers ($F=2.683$; $p=0.111$) (Table 11).

Table 11: Coaches and Athletic Trainers' Confidence in their Sports Nutrition Knowledge

Personal Sports Nutrition Knowledge	df	N	Mean* \pm SD	F	p
Coach	1,33	26	2.7 \pm 0.9	2.683	0.111
Athletic Trainer		9	3.2 \pm 0.7		
Total		35	2.8 \pm 0.9		

**1 = No Knowledge" and 5= "Expert"*

The coaches and athletic trainers were asked to rank the importance of nutrition for sports performance on a 10-point Likert scale, where 1 was "Not Important" and 10 was "Extremely Important." Overall, both coaches and athletic trainers rated nutrition as highly important, with an overall mean score of 9.0 ± 1.2 . The coaches rating of the importance of nutrition was 9.0 ± 1.3 , while the athletic trainers rating of the importance was 9.1 ± 1.0 . There was no difference in the perception of the importance of nutrition to sports performance based on position ($F=0.103$; $p= 0.750$) (Table 12)

Table 12: Perception of the Importance of Nutrition for Sports Performance

Position	N	df	Mean \pm SD	F	p
Coach	27	1,33	9.0 \pm 1.3	0.103	0.750
Athletic Trainer	8		9.1 \pm 1.0		
Total	35		9.0 \pm 1.2		

Summary

The most common sports nutrition resources used by coaches and athletic trainers included other athletic trainers, strength and conditioning specialist, RDNs, and the internet. On average, coaches and athletic trainers perceive the sports nutrition knowledge of coaches, certified athletic trainers, and CSCS as midway between “No Knowledge” and “Expert,” although CSCS were rated the highest. Coaches rated their nutrition knowledge higher than the athletic trainers perceived the coaches’ nutrition knowledge to be. Participants also rated their personal sports nutrition knowledge as mid-way between “No Knowledge” and “Expert.” Both coaches and athletic trainers rated nutrition as highly important for sports performance.

RQ #3: Sports Nutrition Recommendations Given by Coaches and Athletic Trainers

The third research question evaluated the type of nutrition recommendations coaches and athletic trainers have made to their student-athletes. Participants were asked to indicate if they provided sports nutrition advice for any of four specified categories (i.e., “Macronutrients (Ex: carbohydrate, fat, and protein)”, “Micronutrients (Ex: vitamins, minerals)”, “Nutrition Timing (Ex: when and what to eat/drink pre-, post-, and during events)”, “Hydration”, and “Nutrition Problems (Ex: female athlete triad, cramping, unintentional weight loss).” Those who did not make sports nutrition recommendations were given the option of “None; I do not make sports nutrition recommendations.”

Results indicated that 81% (n=29) of the coaches and athletic trainers give hydration advice and more than half of the coaches and athletic trainers provided nutrition timing (58% (n=21) advice. Fewer respondents gave macronutrient (36%; n=13) and micronutrient (17%;

n=6) advice. Six coaches and athletic trainers indicated they did not provide sports nutrition advice to their athletes (Table 13).

Table 13: Sports Nutrition Recommendations Made by Coaches and Athletic Trainers

Variable	N (%)
Hydration	29 (80.6%)
Nutrition Timing	21 (58.3%)
Macronutrients	13 (36.1%)
Micronutrients	6 (16.7%)
None; I don't make any sports nutrition recommendations	6 (16.7%)

Summary

The majority of coaches and athletic trainers indicated they make hydration-related sports nutrition recommendations to their athletes. Slightly more than half indicated they make nutrition timing recommendations. Few coaches and athletic trainers gave recommendations related to macro- and micronutrients.

RQ #4: Perceptions of the Coaching and Athletic Training Staff Regarding a CSSD

The fourth research question investigated the perceptions of coaches and athletic trainers regarding having access to a Board Certified Specialist in Sports Dietetics (CSSD) as a member of the athletic staff. After briefly defining the position, participants were asked to identify their perception of the benefit of a CSSD to an athletic team using a 10-point Likert scale (1= Not important; 10= Extremely Important”). This question was deemed important because the

university where this study was conducted had hired a part-time CSSD for the first time in the fall of 2018; this survey was conducted in January of 2019.

With an overall mean score of 8.9 ± 1.8 , the results indicate that both the coaches (8.6 ± 2.0) and athletic trainers (9.9 ± 0.3) believed access to a CSSD was extremely important and would benefit the athletic team. There was no difference between coaching and athletic trainers ($F=3.259$; $p=0.080$) (Table 14).

Table 14: Perception of the Benefit of a CSSD to an Athletic Team

Position	N	Df	Mean \pm SD	F	p
Coach	26	1, 32	8.6 ± 2.0	3.26	0.080
Athletic Trainer	8		9.9 ± 0.3		
Total	34		8.9 ± 1.8		

Participants were asked if their university currently employed a CSSD. Half of the participants (50.0%; $n=18$) indicated “Yes” and slightly less than one-third indicated “No” ($n=11$; 30.6%). One out of five (19.4%; $n=7$) indicated they were “Unsure.” Participants who stated a CSSD was employed by their university ($n=18$) were then asked if they thought the position was full or part time. The majority of participants (88.9%; $n=16$) correctly selected “Part-time,” while 1 participant (2.8%) selected “Full-time,” and 1 (2.8%) selected “Unsure” (Table 15).

Table 15: Coaches and Athletic Trainers Knowledge of the Employment of a CSSD

Variable	N	Yes	No	Unsure
Does your university currently employ a CSSD?	36	18 (50%)	11 (30.6%)	7 (19.4)
If yes, is the CSSD full-time or part-time?	18	16 (88.9%)	1 (5.6%)	1 (5.6%)

+

Participants were then asked “If [the participant] had access to a sports dietitian/nutritionist, which of these topics would you like that person to address? Select all that apply.” Results indicate a tremendous interest in most of the topics that were listed. In order of the percent of positive responses, the most common topics included: “Basic sports nutrition knowledge for training/ competition” (92%), “Making healthy choices” (92%) and “Weight management strategies” (92%), followed by “Eating on the road” (89%), “Meal timing” (89%), and “Nutrition guidelines” (83%). Other topics in which more than half of the coaches and athletic trainers indicated would be of interest for a CSSD to address included: “Recipe Selection” (78%), “Hydration strategies” (72%), “Special nutrition needs (e.g. food allergies)” (72%), “Workshops requested by athletes” (69%), and “Recovery from injury” (67%). The only topic that received interest from less than half of the respondents was “Receive counseling for medical needs (e.g. diabetes)” (47%).

The option “Other” was also provided so participants could fill in a text box. Five participants provided the following comments: “Any/all,” “fad diets and whether or not they are appropriate,” “Making healthy decisions as freshman/being on campus,” “Meal timing and frequency,” and “Recovery/reducing inflammation, recipe ideas, what to eat on the road and when going out to eat.”

Table 16: Anticipated Use of a CSSD

Variable	Frequency
Basic sports nutrition knowledge for training/ competition	33 (91.7%)
Making healthy choices	33 (91.7%)
Weight management strategies	33 (91.7%)
Eating on the road	32 (88.9%)
Meal timing	32 (88.9%)
Nutrition guidelines	30 (83.3%)
Recipe selection	28 (77.8%)
Hydration strategies	26 (72.2%)
Special nutrition needs (e.g. food allergies)	26 (72.2%)
Provide workshops requested by athletes	25 (69.4%)
Recovery from injury	24 (66.7%)
Receive counseling for medical needs (e.g. diabetes)	17 (47.2%)

Summary

Coaches and athletic trainers believe that a CSSD can be impactful to sports performance. Despite this belief, only half of the participants were aware of the availability of a CSSD at their university. Those who did know a CSSD was available were aware the position was part time. Coaches and athletic trainers had many topics they viewed as valuable for the CSSD to address with their athletes, including basic sports nutrition knowledge, weight management strategies, making healthy choices, eating on the road, and meal timing.

Summary

Thirty-six coaches (n=27; this number includes one strength and conditioning coach) and athletic trainers (n=9) completed the survey to evaluate the sports nutrition knowledge, attitudes, beliefs and recommendations of coaches and athletic trainers at a MAC Division I university, and to identify their perceived use of a certified sports specialist in dietetics (CSSD) as a member of the athletic team. All participants were employed during the 2018-19 competitive season.. Defining “adequate” as a score of 70% or higher, results of the *Sports Nutrition Knowledge Survey* indicate the coaches do not have adequate sports nutrition knowledge. The athletic trainers in this study had a higher sports nutrition knowledge score, receiving 70% or higher on three of the five constructs and an overall mean score above 70%.

Coaches and athletic trainers reported turning to other athletic trainers, CSCSs, and RDNs for sports nutrition advice. The internet was the most commonly used reference material by both coaches and athletic trainers. Coaches and athletic trainers generally perceive the sports nutrition knowledge of athletic trainers, coaches, CSCSs and their own knowledge as “average,” with strength and condition specialists having the greatest sports nutrition knowledge. The importance of nutrition for sports performance was generally rated very high by both coaches and athletic trainers, and the majority of coaches and athletic trainers made recommendations regarding sports nutrition for their athletes. The primary topic coaches and athletic trainers made recommendations on was hydration.

When asked about the benefit of a certified specialist in sports dietetics (CSSD) athletic trainers and coaches rated the CSSD as highly beneficial to athletic performance. Only half of the participants knew a CSSD was employed at the university, but the majority of those who knew a CSSD was on staff were aware that the position was part time. The coaches and athletic

trainers were almost unanimous in selecting basic sports nutrition knowledge for competition/training, weight management strategies, making healthy choices, eating on the road, and meal timing as the most important topics for a CSSD to present to their athletes.

CHAPTER 5

DISCUSSION

The purpose of this study was to identify the sports nutrition knowledge, attitudes, beliefs and recommendations of coaches and athletic trainers at a Division I university, and to identify their perceived use of a Board Certified Sports Specialist in Dietetics (CSSD) as a member of the athletic team. This chapter includes a discussion of the results of the study.

Sports Nutrition Knowledge of Coaching and Athletic Training Staff

Out of 23 questions, the mean sports nutrition knowledge score of the coaches and athletic trainers who completed this survey was 14.1 ± 3.4 , equivalent to answering 61.5% of the questions correctly. Applying a score of 70% as “passing,” these results indicate that, on average, the coaches and athletic trainers did not attain a passing score. The passing rate chosen for this study is consistent with similar studies in which passing rates of 70% to 75% were used to categorize sports nutrition knowledge as “adequate” or “passing” (Botsis & Holden, 2015; Jacob et al., 2016; Marino, 2008; Shapiro, 2015; Torres-McGehee et al., 2012). These results are noteworthy as the survey instrument was developed with the use of the joint position statement published by the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine. Thus these results are reflective of the standards established for use by all practitioners of sports medicine, and not the researchers or dietitians alone.

The coaches in the present study had a significantly lower (13.3 ± 3.3 ; $57.7\% \pm 14.2\%$) sports nutrition knowledge score than the athletic trainers (16.8 ± 2.4 ; $73.0\% \pm 10.4\%$) ($p = 0.005$). With an average score of 73%, equivalent to a grade of C- on a typical grading scale, while the athletic trainers in this study demonstrated a “passing” sports nutrition knowledge score, this score indicates they lack sufficient sports nutrition knowledge to be giving nutrition recommendations to athletes. These results support the observation by Torres-McGehee (2012) who reported that athletic trainers scored significantly higher ($77.8\% \pm 10.3\%$) than coaches ($65.9\% \pm 14.3\%$) on a sports nutrition knowledge survey. The results of the present study also support the findings of Marinaro (2008) who reported the mean sports nutrition score of athletic trainers to be $76.2\% \pm 12.8\%$ (equivalent to C grade), with the majority of athletic trainers (75%) receiving a score of 70% or more correct.

Cockburn et al (2014) reported that coaches in the UK also had inadequate sports nutrition knowledge with a mean sports nutrition knowledge score of $35.4\% \pm 14.8\%$. This finding corroborates those of the current study in that the sports nutrition knowledge of coaches was well below 70% and was, overall, inadequate. Botsis et al. (2015) came to the same conclusion as the coaches in their study had a mean score sports nutrition score of 55%. Additionally, Couture et al. (2015) found that French-Canadian high school coaches also had an inadequate sports nutrition knowledge, with a mean overall score of 68.4%. This number was not affected by the competition level of the teams the coaches lead, but those with teams in higher level of competition did have higher scores within the weight management section. The nature of collegiate sports makes them more competitive than high school, but despite an elevated level of competition, coaches in the current study had inadequate overall sports nutrition knowledge.

The results of the present study support the observation of Parks et al. (2018) who indicated that, while athletic trainers have a higher level of sports nutrition knowledge than coaches, athletic trainers should work in collaboration with a registered sports dietitian for best results. Additionally, a position statement by the National Athletic Trainers' Association recommends that athletic trainers include a registered dietitian among their support team, especially one who has specialized in sports (Buell et al., 2013).

One reason why the athletic trainers demonstrated a higher overall sports nutrition knowledge score may be as a consequence of their required level of education required to become an athletic trainer, as opposed to the requirements to become a coach. Athletic trainers are required to receive a bachelor's degree from an accredited program, which includes supervised clinical work (Marino, 2008), and must fulfill specific competencies, which include nutrition topics, before they are able to practice (Uzelac, p. 7, 2016), while the educational requirements to be a coach are much less regulated (Marino, 2008).

The present study was unable to examine the knowledge of strength and conditioning specialist due to the small sample size at the university where the study was conducted. While the individual was included in the study, they were categorized as a "coach," potentially affecting the overall mean score of the coaches slightly. The highest score received by an individual classified as a "coach," however, was 19.0 (82.6%), equivalent to a grade of B-. Thus, although the mean score of the coaches may have been impacted by categorizing strength and conditioning specialists as "coaches," this categorization likely did not have a gross impact on the results. The results of this study indicate that the coaches who responded do not have adequate sports nutrition knowledge to make sports nutrition recommendations to their athletes. Coaches would benefit from additional education and support from a sports nutrition specialist.

When analyzed by construct, the highest scores were obtained in the Nutrition Problem construct (76.7%), while the lowest scores were obtained in the Macronutrient construct (48.3%). Significant differences existed between coaches and athletic trainers for the Macronutrient ($p=0.044$), Hydration ($p=0.016$), and Nutrition Problem ($p=0.012$) constructs, with the athletic trainers consistently scoring higher than the coaches.

Macronutrients

The Macronutrient construct had the lowest overall score of the five constructs. Athletic trainers scored significantly higher ($62.2\% \pm 9.1\%$) than the coaches ($43.7\% \pm 4.1\%$). This finding supports that of Torres-McGehee et al. (2012) who found that the combined construct for micronutrients and macronutrients was the lowest scoring construct overall. Interestingly, a systematic review by Trakman et al. (2016) showed that coaches were more aware than athletes of the energy density of macronutrients, could identify good sources of carbohydrates, and could distinguish between healthy and unhealthy fat sources. These results, when considered together indicate that, although coaches may have some general nutrition knowledge, they lack knowledge specific to performance and sports in general. Marinaro (2008) also found that athletic trainers did have adequate knowledge when looking at the macronutrient construct, with athletic trainers having a mean score of $74.1\% \pm 22.6\%$, higher than found in the present study, where the macronutrient mean score of athletic trainers was well below 70%.

In the present study, the Macronutrient question with the lowest score was: “The recommended minimum amount of daily carbohydrate for athletes actively training is ____?” The correct answer, “5 g/kg body weight,” was correctly answered by only 19% of the participants. Half (50%) of the participants selected “Unsure.” This question indicates confusion regarding the importance of carbohydrates for athletes. Adequate carbohydrates have been

shown to prolong intermittent strenuous activities, and inadequate carbohydrate can result in increased fatigue, and decreased levels of concentration and skill (Thomas et al. 2016). Thus, having an adequate understanding of how much carbohydrate is appropriate for an athlete to consume can have a distinct impact on performance. The low scores for the macronutrient construct indicate that more sports nutrition education is needed for both coaches and athletic trainers.

Nutrition Problem

The Nutrition Problems construct had the highest score of all the constructs. There was a significant difference between participants by position ($p=0.012$), with athletic trainers having a higher score ($93.3\% \pm 14.1\%$) than the coaches ($71.1\% \pm 23.8\%$). Both groups had a passing score for this construct. Shapiro et al. (2015) reported similar findings when looking the sports nutrition knowledge of collegiate athletes. Although Shapiro et al. (2015) reported that the Nutrition Problems construct was the highest scoring construct among the athletes, the reported score of 9.6 ± 3.8 (64%) was below passing. The current study finds that coaches and athletic trainers have a higher knowledge base of nutrition problems than the athletes in the study by Shapiro et al. (2015).

Additionally, although Cockburn et al. (2014) did not have a specific nutrition problem construct, they did find in the area of weight management that coaches only obtained a mean score of $18.5\% \pm 33.6\%$. These findings are in contrast to the current study's findings, which indicated that nutrition problems, the topic in which weight control would fall, was the strong suit for the majority of participants. Furthermore, Marinaro et al. (2008) had several constructs that fell within the parameters of nutrition problems, including eating disorders, body composition, and nutrition related to injury. The athletic trainers surveyed by Marinaro et al.

(2008) obtained mixed score for these constructs, receiving passing scores for nutrition related to injury ($86.4\% \pm 24.6\%$) and body composition ($76.3\% \pm 29.9\%$), but not on eating disorders ($60.5\% \pm 21.7\%$). These results act as an effective reminder of the width and breadth of various nutrition topics, which require much education and training to master. Thus, while athletic trainers may be proficient in certain areas, they are likely not able to devote the time and effort into achieving the appropriate education to deal with all necessary portions of nutrition.

Summary

Overall, the results of this study demonstrate that the sports nutrition knowledge of the coaches who participated in this study is inadequate. Although the athletic trainers in this study had a significantly higher sports nutrition knowledge score than the coaches, their mean knowledge level score was only average, indicating that neither coaches nor athletic trainers are adequately equipped to make sports nutrition recommendations. It is noteworthy that athletic trainers have a significantly higher sports nutrition knowledge than coaches, and, if they worked in tandem with a CSSD to disseminate and reinforce accurate information, the sports nutrition knowledge of the athletes could be enhanced.

Sports Nutrition Attitudes and Beliefs of Coaches and Athletic Trainers

Coaches and athletic trainers in the present study indicated the professionals they most commonly approached for sports nutrition information were other athletic trainers (81%), followed by strength and conditioning specialists (69%), and registered dietitian nutritionists (58%). These results are in contrast with those of Cockburn et al. (2014) who reported that 84% of the coaches did not approach any professional for sports nutrition information, and, of those who did, they most commonly approached a sports nutritionist (67%), physiotherapist (50%), or

a team trainer (38%). Torres McGehee et al. (2012) reported that 17% of the coaches in their study approached athletic trainers as their primary resource for sports nutrition information, followed by registered dietitians (13%), and strength and condition specialists (9%). The results of the present study complement those of Torres-McGehee et al. (2012), although the strength with which coaches approach athletic trainers (81% vs. 15%), registered dietitians (58% vs. 13%), and strength and condition specialists (69% vs. 9%) for nutrition advice differs.

In contrast to coaches, Torres-McGehee et al. (2012) reported that athletic trainers approach registered dietitians (19%) and physician (7%) as their primary source of nutrition information. The results of the present study complement those of Torres-McGehee et al. (2012), although the strength with which the athletic trainers approach registered dietitians (58% vs. 19%), and team physicians (22% vs. 7%) for nutrition advice differs. It is possible that the results of the present study were influenced by the recent hiring of a part-time board-certified specialist in sports dietetics (CSSD) by the athletic department. It is noteworthy that, in the present study, a registered dietitian was amongst the highest rated professionals who were approached by coaches and athletic trainers for nutrition information because the part-time CSSD had only been on staff in the athletic department for less than five months at the time the survey was conducted.

The coaches and athletic trainers in the present study were asked to evaluate the resources they most commonly used for sports nutrition knowledge. The most frequently utilized resource was the internet (i.e., Google, podcasts, blogs) (67%), followed by conferences/annual meetings/team meetings (44%), and academic journals (39%). These results support those of Cockburn et al. (2014) who found that 61% of the coaches used the internet as a primary resource for sports nutrition information, followed by 49% who used journal articles, 44% who

used magazines, and 26% who used lectures/seminars/courses. This is also consistent with the study done by Couture et al. (2015) in which 55% of surveyed high school coaches used the internet as their primary resource. In contrast, Torres-McGehee (2012) found academic journals to be the primarily non-human resource used by athletic trainers (20%) and strength and conditioning specialists (19%). In contrast to the results of the current study, Torres-McGehee et al. (2012) reported that the coaches and athletic trainers did not turn to the internet or conferences/annual meetings/team meetings as a primary resource for nutrition information. It is likely that coaches and athletic trainers in the current study, and ones like it, use the internet frequently due to its ease of accessibility. It is hypothesized that having access to reliable sports nutrition information from a CSSD would help coaches and athletic trainers distinguish between reliable and inaccurate information.

Participants were asked to quantify their “confidence” in the sports nutrition knowledge of athletic trainers, coaches, and strength and conditioning specialists. Then participants were then asked to quantify their “confidence” in their own sports nutrition knowledge. For each question the individuals were ranked on a 5-point Likert scale where 1 was “No knowledge” and 5 was “Expert.” The overall results indicated the coaches and athletic trainers had greatest confidence in the sports nutrition knowledge of strength and conditioning specialists (3.8 ± 0.9) and athletic trainers (3.2 ± 0.8); coaches (2.6 ± 0.9) received the lowest score. This trend remained when the data was analyzed by position (i.e., coaches vs. athletic trainers), with athletic trainers rating the sports nutrition knowledge of coaches significantly lower than the coaches rated themselves ($p=0.048$). These results indicate the coaches believed they have more sports nutrition knowledge than the athletic trainers believe the coaches have.

Overall, the participants rated their own sports nutrition knowledge as a 2.8 ± 0.8 . When examined by position, the athletic trainers had a numerically higher confidence in their own sports nutrition knowledge (3.2 ± 0.7) than coaches (2.7 ± 0.9), although this difference was not significant. This finding supports those of Torres-McGehee et al. (2012) who found that athletic trainers rated their sports nutrition confidence as high, even when they were incorrect. In the current study athletic trainers rated themselves midway between no knowledge and expert knowledge, showing that they felt confident in their own knowledge, but were seemingly aware of their limitations.

Finally, participants rated the importance of nutrition for performance on a Likert scale, with 1 being “Not at all important” and 10 being “Very important.” The mean rating among both coaches and athletic trainers was 9.0 ± 1.0 , indicating strong agreement that nutrition is very important for performance. There was no difference in the importance of nutrition to performance by position (coach vs. athletic trainer). These findings support those of both Torres-McGehee et al. (2012) and Cockburn et al. (2014), who also found coaches were highly aware of the importance of nutrition for performance.

Summary

In general, the results of the second research question point out that both coaches and athletic trainers most frequently turn to other athletic trainers and the internet as their primary sources of nutrition information, followed by a registered dietitian. When ranking the sports nutrition knowledge of various positions, the coaches and athletic trainers generally ranked the strength and condition specialists as being the most qualified, while coaches were considered the least qualified. When ranking their own sports nutrition knowledge, both coaches and athletic trainers gave themselves scores that were midway between no knowledge and expert. Overall,

the coaches and athletic trainers strongly believed that nutrition is important for sports performance. With their self-reported modest sports nutrition knowledge, and the acknowledgement that nutrition is important for sports performance, it would seem that a board-certified specialist in sports dietetics could have a strong impact on the athletic coaches, athletic trainers, and athletes at this MAC university.

Sports Nutrition Recommendations Given by Coaches and Athletic Trainers

The third research question examined the current recommendations being made by coaches and athletic trainers. Based on a list of five specific sports nutrition constructs, participants were asked to indicate if they made recommendations or gave advice to the athletes about any of these constructs. Almost all (83%) of the coaches and athletic trainers indicated that they have given sports nutrition recommendations to their athletes; fewer than one in five (n=6; 17%) indicated they did not give sports nutrition recommendations to the athletes. The topic that coaches and athletic trainers provided the most recommendations for was “hydration” (n=29; 81%), followed by “nutrition timing” (n=21; 58%) and “macronutrients” (n=13; 36%). This is in contrast to the study by Danaher et al. (2014), in which the participants indicated they most frequently made recommendations based upon supplementation and body weight and composition.

Although in the current study hydration was the most common topic for which coaches and athletic trainers made recommendations, it was the construct with the second lowest score out of the five constructs measured on the sports nutrition knowledge score, with coaches and athletic trainers scoring a combined score of $56.3\% \pm 23.4\%$, although when separated by position, the athletic trainers score significantly higher ($72.2\% \pm 15.0\%$) than the coaches. While

some might suggest these scores indicate athletic trainers are more qualified in the area of hydration than coaches, their C- score indicates a lack of correct information. The score for the coaches indicates further education on hydration, provided by a nutrition professional, is imperative to ensure the safety of their athletes.

With a mean score of $64.6\% \pm 27.0\%$, equivalent to a grade of a D, the coaches and athletic trainers, combined, scored the highest on the nutrition timing construct. By position, the athletic trainers had a passing average score of $72.2\% \pm 26.4\%$, although this score was not significantly different when compared to the coaches score of $62.0\% \pm 21.5\%$. These results indicate the coaches and athletic trainers would benefit from continuing education on nutrition timing.

The macronutrient construct was the third most common topic for which coaches and athletic trainers made recommendations, despite the topic being the lowest area of sports nutrition knowledge for both groups, with a mean of $48.3\% \pm 24.1\%$. Although athletic trainers scored significantly higher on the macronutrient construct ($62.2\% \pm 27.3\%$), they still did not achieve a passing score. These results indicate that more education about macronutrients (i.e., carbohydrates, proteins and lipids) is needed as they report they commonly make macronutrient recommendations to the athletes, despite a poor baseline knowledge. This observation supports that of Jacob et al. (2016) who reported high school coaches making recommendations on carbohydrates, protein, and hydration, despite having a mean nutrition knowledge score below what was considered adequate.

Summary

The coaches and athletic trainers in this study reported making nutrition recommendations regardless of their level of sports nutrition knowledge. The topics of hydration

and macronutrients were the most commonly discussed topics, despite the associated low nutrition knowledge scores for these constructs. Nutrition timing was also a subject frequently discussed, and although more education is needed on this construct it has the second highest mean score of all constructs investigated, indicating it is more well understood than the other topics.

Perceptions Regarding the Use of a Certified Sport Specialist in Dietetics

Overall both coaches and athletic trainers indicated that they believe a CSSD could benefit their team's performance. This rating indicates that the participants realize the value of bringing on a professional trained specifically in sports nutrition. Indeed, in the "*National Athletic Trainers' Association Position Statement: Evaluation of Dietary Supplements for Performance Nutrition*" Buell et al. (2013) recommend that a trained sports nutrition professional (e.g., a CSSD) be available as a reference for both athletic trainers and their athletes. Ultimately the positive response of coaches and athletic trainers indicate that a sports nutrition professional, such as a CSSD, would be valued, accepted and utilized by the members of the athletic team.

Only half of the participants in the present study knew their university had recently hired a part-time CSSD. Of those who were aware of the employment of a part-time CSSD, all but two participants knew the CSSD was part-time. These results indicate a concerted effort should be made to increase coaches and athletic trainers' awareness of the presence and role of the CSSD. The CSSD is more likely to have an impact if the leaders of each team are aware of the resources the CSSD can offer. To achieve this goal, the first step is to ensure coaches and athletic trainers are aware of the presence and availability of a CSSD at their university.

When asked which sports nutrition topics they would like their team to learn more about, the interest among the coaches and athletic trainers was extremely positive. The most commonly selected topics included “Basic sports nutrition knowledge for training/competition” (92%), “Weight management strategies” (92%), “Making healthy choices” (92%), “Meal timing/meal plan development” (89%), “Eating on the road” (89%), and “Nutrition guidelines” (83%). The high selection of many of topics by participants indicates that the coaches and athletic trainers see the value in learning as much as they can on a variety of relevant sports nutrition topics if given the opportunity.

These results concur with those of Danaher et al. (2014) who reported that all of the coaches surveyed were eager for increased nutrition knowledge. When asked in what areas they would like to be educated, one participant stated they would like education in any area, as they do not know where to begin. Shapiro (2015) found that athletes primarily were interested in the assistance of a CSSD in the development of meal plans (82.1%), making healthy choices (68.7%), meal timing (61.9%), and eating on the road (61.9%). When considered with the results from the current study it can be understood that athletes, and the athletic staff around them have interest in obtaining information about various nutrition topics which may enhance performance.

Summary

Most coaches and athletic trainers in the present study recognized the value of a CSSD. The awareness of the availability of a CSSD to the athletic team at the university where this study was conducted should be clearly communicated so that all teams can take maximize the availability of this resource. Coaches and athletic trainers appear eager for the CSSD to cover a variety of topics with their teams.

Summary

Coaches and athletic trainers have inadequate sports nutrition knowledge and would benefit from further education before making sports nutrition recommendations. Although athletic trainers in the present study had a significantly higher sports nutrition knowledge score than the coaches, their score indicated they do have adequate knowledge to be advising athletes about nutrition issues.

Athletic trainers and the internet were the primary sources of nutrition information used by coaches and athletic trainers in this study. The strength and condition specialists were generally viewed as the most qualified to make recommendations when compared to their peers, while coaches were considered the least qualified. When ranking their own sports nutrition knowledge both coaches and athletic trainers alike gave themselves scores that were midway between no knowledge and expert, indicating they believe themselves to have average sports nutrition knowledge. Yet, coaches and athletic trainers both strongly believed that nutrition is important for sports performance.

On average, coaches and athletic trainers do make nutrition recommendations regardless of their level of sports nutrition knowledge. The topics of hydration, nutrition timing and macronutrients are amongst the most commonly discussed.

Most coaches and athletic trainers recognize the value of a CSSD to the athletic team. Increased awareness of the CSSD as an available resource is essential for the appropriate utilization of their skills. Coaches and athletic trainers have indicated that with a CSSD available they have interest in the CSSD to cover a variety of topics with their teams.

CHAPTER 6

CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

The purpose of this study was to identify the sports nutrition knowledge, attitudes, beliefs and recommendations of coaches and athletic trainers at a Division I university, and to identify their perceived use of a Board Certified Sports Specialist in Dietetics (CSSD) as a member of the athletic team. This chapter describes the conclusion and limitations of the study, and provides a list of recommendations for future research.

Conclusions

The aim of this research was to obtain a clearer understanding of the sports nutrition knowledge, practices, beliefs, and recommendations of coaches and athletic trainers at a Division 1 university from the Mid-American Conference. Additionally, the study was designed to identify the value of a CSSD to a sports team as perceived by the athletic trainers and coaches who responded to the study. Lastly, the study sought to establish the nutrition topics perceived to be of most value to the coaches and athletic trainers, whether for their personal edification or for that of their student-athletes.

Previous research studies have suggested that, to have a “passing” level of sports nutrition knowledge, participants should have a score of 70% or greater (Botsis and Holden, 2015; Jacob et al., 2016; Marino, 2008; Shapiro, 2015; Torres-McGehee et al., 2012). In this

study, the overall mean sports nutrition knowledge score of the coaches and athletic trainers was below this “passing” threshold. When examined individually, athletic trainers, in general, had a “passing” score; in contrast, the coaches did not. Additionally, the athletic trainers scored significantly higher than the coaches on the nutrition knowledge sub-scores for macronutrient, hydration and electrolyte balance, and nutrition problem constructs. When applied to a standard grading scale, athletic trainers would have received what would conventionally be a C- grade. Despite achieving a “passing” score for their sports nutrition knowledge, it would not be advisable for athletic trainers to be actively making sports nutrition recommendations. When compared to the coaches, who would have received an F on a conventional scale, athletic trainers do have considerably more knowledge. But, when compared to a CSSD, who has had extensive training in sports nutrition, and has passed both a general registration exam and an exam specifically designed for specialization in sports, both athletic trainers and coaches are ill equipped to be managing the nutrition of their athletes. Despite this, both coaches and athletic trainers have been shown to make sports nutrition recommendations. Sports nutrition recommendations made by ill equipped individuals could be harmful to athletic performance, and even introduce undue risk to the athlete themselves especially when dealing with topics such as hydration and eating disorders. Access to a CSSD can reduce this risk by providing a reliable sports nutrition resource for both athletes and the coaching staff.

Indeed, coaches and athletic trainers themselves believe that the addition of a CSSD to the team would bring value. They recognize the value of having a nutrition professional, who could be accessible full time to their team, and would desire this individual to cover a variety of topics with their athletes. Access to a full time CSSD could enhance athletic performance,

encourage the health and wellbeing of the athletes, and be protective to athletes when with the alternative is inaccurate information.

Limitation of the Study

The results of this study have several limitations, which must be considered:

- This study was conducted at only one Division I University in the midwestern United States and may not be representative of the attitudes and opinions of all NCAA coaches and athletic trainers.
- The sample size calculator indicated that 56 respondents were needed to adequately represent the views of the population. Only 36 participants (55.4% response rate) completed the survey, resulting in a confidence interval of 11 rather than 4. Thus, the results of this study should be considered preliminary.
- The survey was offered to all coaches and athletic trainers, of both male and female sports, but due to the limited sample of each, the researcher was unable to specify if coaches of male and female sports were represented.
- Due to the small sample size of female coaches and athletic trainers at the university studied, the researcher was unable to report the gender of the participants.
- The study was conducted using an electronic survey, which has been documented as the form of survey with the lowest response rate (Dillman et al., 2009).
- Although all the available athletic trainers (n= 9) participated in the study, athletic trainers represented a smaller sample than the coaches (n=27)

Recommendations for Further Research

In consideration of the results of the current study, continued investigation into the nutrition knowledge of coaches and athletic trainers, and the benefit of a certified specialist in sports dietetics to the athletic staff and athletic performance, is warranted. The following are suggestions for further research:

- Distribute the survey to a broader range of coaches and athletic trainers throughout a colligate conference, or even across multiple conferences with greater geographical diversity.
- Determine and compare the sports nutrition knowledge of coaches and athletic trainers with and without regular access to a full time CSSD.
- Determine and compare the types of recommendations made by coaches and athletic trainers with and without regular access to a full time CSSD.
- Evaluate the sports nutrition knowledge of coaches and athletic trainers when comparing years of experience, gender, race, ethnicity and other factors.

In summary, the results of this study indicate that coaches and athletic trainers would benefit from access to a full time CSSD as their current sports nutrition knowledge is not adequate to be safely advising athletes regarding nutrition. When compared, athletic trainers do have a significantly higher sports nutrition knowledge score than coaches, but these scores are only marginally above a “passing” score. Despite these low nutrition knowledge scores, both coaches and athletic trainers actively make recommendations to their athletes regarding sport nutrition. This could in part be remedied by the introduction of a full time CSSD, which both coaches and athletic trainers have indicated they would highly value as a member of their athletic staff. A

CSSD on staff would provide athletes with access to accurate and reliable information, which coaches and athletic trainers have indicated they would like to make available to their athletes. Ultimately, the athletic department at Universities would be benefited by the addition of a CSSD to the athletic staff, to improve performance and reduce risk of serious consequences of poor advice and every effort should be made to include these professionals as a regular member of the department.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD MATERIALS

A-1 IRB Exemption Letter

A-2 CITI Certificate of Completion

A-1 IRB Letter of Exemption



Office of Research Integrity
 Institutional Review Board (IRB)
 2000 University Avenue
 Muncie, IN 47306-0155
 Phone: 765-285-5070

DATE: January 2, 2019

TO: Toni Stoermann, BS

FROM: Ball State University IRB

RE: IRB protocol # 1370085-1

TITLE: Assessment of the Sports Nutrition Knowledge, Attitudes and Beliefs of Division I University Coaches and Athletic Trainers and Their Perceived Impact of a Certified Sports Specialist in Dietetics to an Athletic Training Team

SUBMISSION TYPE: New Project

ACTION: APPROVED

DECISION DATE: January 2, 2019

REVIEW TYPE: **EXEMPT**

The Institutional Review Board reviewed your protocol on January 2, 2019 and has determined the procedures you have proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol, and you are cleared to proceed with the procedures outlined in your protocol. As an exempt study, there is no requirement for continuing review. Your protocol will remain on file with the IRB as a matter of record.

Exempt Categories:

	Category 1: Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
X	Category 2: Research involving the use of educational test (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior
	Category 3: Research involving the use of educational test (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under category 2, if: (i) the human subjects are elected or appointed officials or candidates for public office; or (ii) Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

	if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.
	Category 5: Research and demonstration projects which are conducted by or subject to the approval of Department or agency heads, and which are designed to study, evaluate or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in methods or levels of payment for benefits or services under these programs.
	Category 6: Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed which contains a food ingredient at or below the level and for a use found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

While your project does not require continuing review, it is the responsibility of the P.I. (and, if applicable, faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified or if problems related to human research participants arise in connection with this project. **Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project.** Please contact (ORI Staff) if you are unsure whether your proposed modification requires review or have any questions. Proposed modifications should be addressed in writing and submitted electronically to the IRB (<http://www.bsu.edu/irb>) for review. Please reference the above IRB protocol number in any communication to the IRB regarding this project.

Reminder: Even though your study is exempt from the relevant federal regulations of the Common Rule (45 CFR 46, subpart A), you and your research team are not exempt from ethical research practices and should therefore employ all protections for your participants and their data which are appropriate to your project.



D. Clark Dickin, PhD/Chair
Institutional Review Board



Christopher Mangelli, JD, MS, MEd, CIP/
Director
Office of Research Integrity

Appendix A – CITI Certificate of Completion



Completion Date 17-Jul-2019
Expiration Date 16-Jul-2022
Record ID 31826044

This is to certify that:

Toni Stoermann

Has completed the following CITI Program course:

Social & Behavioral Research - Basic/Refresher (Curriculum Group)
Social & Behavioral Research - Basic/Refresher (Course Learner Group)
2 - Refresher Course (Stage)

Under requirements set by:

Ball State University



APPENDIX B
SURVEY INSTRUMENT

Sports Nutrition Survey (Coaches/Trainers)

Q1

The purpose of this study, *Assessment of the Sports Nutrition Knowledge, Attitudes and Beliefs of Division I University Coaches and Athletic Trainers and the Perceived Impact of a Certified Specialist in Sports Dietetics to an Athletic Team*, is to identify nutrition resources used and the sports nutrition knowledge of NCAA Division I athletes, coaches, and trainers at a Mid-Major NCAA Division I University. To be eligible to participate in this study, you must be 18 years of age or older and employed as either a coach or trainer at Ball State University during the 2018-19 season.

Participants will be asked to complete an anonymous survey containing multiple choice questions about sports nutrition (i.e., macronutrients, micronutrients, hydration, nutrition timing, and nutrition problems), preferred sources of nutrition information, and your opinion about how you envision a full-time board certified specialist in sports dietetics (CSSD) could best assist our athletes. The survey should take less than 7 minutes to complete. All data will be collected ANONYMOUSLY; you will not be asked to provide any identifiable information other than your sport. The data will be stored on a password protected computer and flash drive for two years.

There are no anticipated risks or discomforts associated with taking this survey. This survey is completely voluntary. You are not required to answer all of the questions. You may quit the survey at any time.

For questions about your rights as a research subject, please contact the Director, Office of Research Compliance, Ball State University, Muncie, IN 47306, (765) 285-5070, orihelp@bsu.edu

Researcher Contact Information:

Toni Stoermann, tstoermann@bsu.edu

Dr. Carol Friesen, cfriesen@bsu.edu

By selecting the "I agree" button you acknowledge that you have read the information above and agree to participate in the survey by giving your informed consent. If you do not wish to participate in the survey, please select the "I do not agree" button.

I agree (1)

I do not agree (2)

Page Break

Q2 Select your affiliation with Ball State Athletics

- Student-Athlete (1)
- Coach (Head or Assistant) (2)
- Athletic Trainer (3)
- Strength and Conditioning Coach (4)

Q3 Protein eaten in excess of bodily needs can lead to fat gain.

- True (1)
- False (2)
- Unsure (4)

Q4 Which of the following is the most critical goal of sports nutrition?

- Adequacy of total calories (energy availability) (1)
- Availability of glycogen stores (2)
- Adequate protein intake (3)
- Maintenance of ideal body composition (4)
- Unsure (5)

Q5 Which pre-competition goal is not associated with carbohydrate intake directly before exercise?

- Avoiding hunger during competition (1)
- Delaying fatigue (2)
- Minimizing gastrointestinal distress (3)
- Adding to glycogen stores (4)
- Unsure (5)

Q6 Significant losses of electrolytes (such as sodium, chloride, potassium, or magnesium) during heavy exercise may lead to symptoms such as _____ or _____.

- Drop in blood pressure, increased production of urine (1)
- Stress fracture, swelling (2)
- Dyspnea (difficult or labored breathing), indigestion (3)
- Muscular cramps, heat illness (4)
- Unsure (5)

Q7 In most sports, it is normal for a female athlete to have irregular or missing menstrual cycles during the competitive season.

- True (1)
- False (2)
- Unsure (3)

Q8 Which of these foods is a good source of dietary iron? Select all that apply.

- 1 c fat-free milk or yogurt (1)
- 4 ounces red meat (beef, venison, etc.) (2)
- 1/2 c cooked black beans (5)
- 4 ounces fish (cod, tuna, salmon, etc.) (6)

Q9 What effect does exercise have on an athlete's vitamin requirements?

- Increases the needs substantially, making vitamin supplementation necessary (1)
- Increases the needs substantially, but supplementation is not necessary (2)
- Increases the needs slightly, but supplementation is not necessary if total calories are adequate (3)
- Increases the needs slightly, making vitamin supplementation necessary (4)
- Unsure (5)

Q10 The recommended minimum amount of daily carbohydrate for athletes actively training is:

- 4 g/kg body weight (1)
- 5 g/kg body weight (2)
- 6 g/kg body weight (3)
- 7 g/kg body weight (4)
- Unsure (5)

Q11 Which of the following would be most effective in aiding post-exercise recovery of muscle glycogen stores?

- Granola bar (1)
- Chocolate milk (2)
- Banana (3)
- Energy drink (Red Bull, Monster, etc.) (4)
- Unsure (5)

Q12 Increasing protein in the diet is the main dietary change needed when only muscle gain is desired.

- True (1)
- False (2)

Q13 Regarding fluid intake during physical activity, current recommendations encourage athletes to:

- Drink 50-100mL (1.7- 3.3 fluid ounces) every 15- 20 minutes (1)
- Drink to a plan, based on body weight changes during training sessions performed in a similar climate (2)
- Drink sports drinks (e.g. PowerAde) instead of water when exercising (3)
- Suck on ice cubes rather than drinking during practice (4)
- Not sure (5)

Q14 If an athlete loses one pound of fluid during an exercise session how many ounces of fluid should he or she drink post-exercise?

- 6-8 fluid ounces (1)
- 9-15 fluid ounces (2)
- 16-24 fluid ounces (3)
- 25-36 fluid ounces (4)
- Unsure (5)

Q15 A concern for student-athletes who are under-eating (calorie deficit) is:

- An underlying eating disorder (1)
- Female athlete triad (2)
- Over-training Syndrome (3)
- All of these are concerns (4)
- Unsure (5)

Q16 Before competition, athletes should aim to consume foods that are high in:

- Fluids, fat and carbohydrate (1)
- Fluids, fiber and carbohydrate (2)
- Fluids and carbohydrate (3)
- Not sure (4)

Q17 The optimal timing for consuming a post event meal to restore glycogen would be:

- Within 2 hours post exercise (1)
- Wait until you feel hungry (2)
- 3-4 hours post-exercise (3)
- Timing of the meal is not relevant to glycogen restoration (4)
- Unsure (5)

Q18 What measure is the best method to determine the amount of fluid loss due to sweat during an exercise session in which the athlete did not drink or go to the bathroom?

- Monitoring urine color (1)
- Pre-post practice weigh-ins (2)
- Thirst (3)
- Urination frequency (4)
- Unsure (5)

Q19 Sports with several intervals of high intensity sprints (i.e., basketball, soccer, tennis) require more of which nutrient, both for the activity and recovery?

- Carbohydrate (1)
- Protein (2)
- Fat (3)
- None of these (4)
- Unsure (5)

Q20 Which, if any, of these symptoms are associated with inadequate nutrition? Select all that apply.

Poor recovery (feeling stale day to day; not ready to exercise) (3)

Unintentional weight loss (4)

Muscle cramping (Charlie horse; twitchiness) (6)

SOURCES OF NUTRITION INFORMATION:

Q21

Who have you APPROACHED to obtain nutrition information? Select all that apply.

Athletic Trainer (4)

Other Coaches (5)

Friends (7)

Parents (8)

Personal Physician (1)

Registered Dietitian/Nutritionist (6)

Team Physician (10)

Other (3) _____

Q22 Which of these resources have you USED to obtain nutrition information. Select all that apply.

- Academic Journals (1)
- College Nutrition Courses (7)
- Conferences/Annual Meetings (13)
- Internet (12)
- Magazines (11)
- Social Media (8)
- Other (4) _____

Display This Question:
If Q2 != Athletic Trainer

Q23 Athletic trainers have a good knowledge about nutrition. (Rank on a scale 1=no knowledge; 5=expert)

(1) 

Display This Question:
If Q2 != Coach (Head or Assistant)

Q24 Coaches have a good knowledge about nutrition. (Rank on a scale 1=no knowledge; 5=expert)

(1) 

Display This Question:
If Q2 != Strength and Conditioning Coach

Q25 Strength and conditioning coaches have a good knowledge about nutrition. (Rank on a scale 1=no knowledge; 5=expert)

(1) 

Q26 How confident are you about your sports nutrition knowledge? (Rank on a scale 1=no knowledge; 5=expert)

(1) 

Q27 How important do you think adequate nutrition is to optimize athletic performance? (1=not at all; 10=extremely important)

(1) 

A CSSD is a board-certified specialist with expertise in nutrition for athletic training and performance, clinical sports nutrition, and nutrition operations and management.

28. How beneficial do you think it would be to have a full-time sports dietitian/nutritionist as a member of the athletic staff? (1=not beneficial at all; 10=extremely beneficial)

29. To your knowledge, does your university employ a full-time sports dietitian on staff?

- Yes
- No
- Unsure

30. If you had access to a sports dietitian/nutritionist, which of these topics would you like that person to address? Select all that apply.

- Meal timing/ meal plan development
- How to maintain adequate hydration
- Basic sports nutrition knowledge for training/ competition
- Recovery from injury

31. If you had access to a sports dietitian/nutritionist, which of these topics would you like that person to address? Select all that apply.

- Weight management strategies
- Special nutrition needs (e.g. food allergies)
- Receive counseling for medical needs (e.g. Diabetes)

32. If you had access to a sports dietitian/nutritionist, which of these topics would you like that person to address? Select all that apply.

- Nutrition guidelines
- Making healthy choices
- Recipe selection
- Eating on the road
- Provide workshops requested by athletes

33. Are there any other nutrition topics you would like a sports nutritionist to address with you or your team? Please specify: _____

34. When making sports nutrition recommendations to your athletes, what topics do you usually discuss (select all that apply):

- None; I don't make sports nutrition recommendations
 - Macronutrients (Ex. Carbs, fats, protein)
 - Micronutrients (Ex. Vitamins, minerals)
 - Nutrition Timing (Ex. When and what to eat/drink Pre-, post-, and during events)
 - Hydration
 - Nutrition Problems (Ex. Female athlete triad, cramping, unintentional weight loss)
-

APPENDIX C

LETTER OF PERMISSION AND INFORMATION

C-1 Letter of Permission to Use the Survey

C-2 Letter of Permission to Conduct the Study

C-3 Letter of Information

Appendix C-1

Letter of Permission to Use the Survey

From: GINA Trakman <G.Trakman@latrobe.edu.au>
Sent: Thursday, September 6, 2018 11:22 PM
To: Friesen, Carol <cfriesen@bsu.edu>
Subject: RE: Survey

Dear Carol,

Thank you for getting in touch. I have attached a PDF version of the A-NSKQ with the correct options highlighted - each correct options is worth 1 point . Please note we have recommended a change to the final question because the legality of glycerol has recently changed. We may also slightly modify some of the protein items, but I will get in touch if this goes ahead 😊

The questionnaire is free to use – it can be administered by paper or online. I have also attached the 'QSF' – this can be used to import the questionnaire into 'Qualtrics' so that it can be administered online.

Happy to answer any other queries!

Regards,
Gina

Appendix C-2

Letter of Permission to Conduct the Study

From: Lee, Karin <kalee2@bsu.edu>
Sent: Tuesday, December 18, 2018 9:52 AM
To: Friesen, Carol <cfriesen@bsu.edu>
Subject: Thesis Committees

Good morning Dr. Friesen-

I am willing and happy to serve on the Thesis Committees of Toni Stoermann and Kilee Kimmel. In this capacity, I am willing to send the email that includes the survey link to our Ball State student-athletes and coaches. Please contact me if you need additional information.

Dr. Karin Lee | Ball State Athletics

Senior Associate Athletics Director/ Senior Woman Administrator

Office: 765.285.5127

kalee2@bsu.edu



Appendix C-3

Letter of Information

The purpose of this study, *Assessment of the Sports Nutrition Knowledge, Attitudes and Beliefs of Division I University Coaches and Athletic Trainers and the Perceived Impact of a Certified Specialist in Sports Dietetics to an Athletic Team*, is to identify nutrition resources used and the sports nutrition knowledge of NCAA Division I athletes, coaches, and trainers at a Mid-Major NCAA Division I University. To be eligible to participate in this study, you must be 18 years of age or older and employed as either a coach or trainer at Ball State University during the 2018-19 season.

Participants will be asked to complete an anonymous survey containing multiple choice questions about sports nutrition (i.e., macronutrients, micronutrients, hydration, nutrition timing, and nutrition problems), preferred sources of nutrition information, and your opinion about how you envision a full-time board certified specialist in sports dietetics (CSSD) could best assist our athletes. The survey should take less than 7 minutes to complete. All data will be collected ANONYMOUSLY; you will not be asked to provide any identifiable information other than your sport. The data will be stored on a password protected computer and flash drive for two years.

There are no anticipated risks or discomforts associated with taking this survey. This survey is completely voluntary. You are not required to answer all of the questions. You may quit the survey at any time.

For questions about your rights as a research subject, please contact the Director, Office of Research Compliance, Ball State University, Muncie, IN 47306, (765) 285-5070, orihelp@bsu.edu

Researcher Contact Information:

Toni Stoermann, tstoermann@bsu.edu

Dr. Carol Friesen, cfriesen@bsu.edu

By selecting the "I agree" button you acknowledge that you have read the information above and agree to participate in the survey by giving your informed consent. If you do not wish to participate in the survey, please select the "I do not agree" button.

I agree (1)

I do not agree (2)

APPENDIX D

RECRUITMENT MATERIALS

- D-1 Initial Recruitment Letter
- D-2 Letter of Thanks/Encouragement to Participate
- D-3 Final Recruitment Letter

Appendix D-1

Initial Recruitment Letter

Initial Recruitment Letter

Dear Coaches and Trainers

To optimize performance, athletes must stay at the top of their game, using every resource available to gain a competitive-edge! Adequate nutrition is one key to achieving optimal performance.

To help identify the sports nutrition needs of Ball State student-athletes, we are asking all Ball State athletic coaches and athletic trainers to complete this brief (less than 5 minutes), anonymous survey. The survey asks about your sports nutrition knowledge, sources you use for nutrition information, the confidence you have in the sports nutrition knowledge of yourself and other coaches/trainers, and how you could use a full-time board-certified specialist in sports dietetics to aid our Ball State athletes. The *anonymous* information will help focus our sports nutrition efforts.

To access the survey, [click](#) or copy this link into a fresh browser:
https://bsu.qualtrics.com/jfe/form/SV_7OMUseBhOIEC7Ix

This study is approved as IRB # 1370085-1.

Thank you for your assistance.

Sincerely,

Toni Stoermann, Graduate Student
Nutrition and Dietetics
tlstoermann@bsu.edu

Carol Friesen, PhD, RDN, CD
Professor of Nutrition and Dietetics
cfriesen@bsu.edu

Appendix D-2

Letter of Thanks/Encouragement to Participate

Dear Coaches and Athletic Trainers:

If you have already completed the Sports Nutrition Survey, please accept our thanks and disregard this email.

If you have not completed the *anonymous* Sports Nutrition Survey, please consider taking a few moments to do so now. As a reminder, this brief survey (less than 5 minutes), will help focus our sports nutrition efforts. We are asking all Ball State athletic coaches and athletic trainers to complete this survey that asks about your sports nutrition knowledge, sources you use for nutrition information, the confidence you have in the sports nutrition knowledge of yourself and other coaches/trainers, and how you could use a full-time board-certified specialist in sports dietetics to aid our Ball State athletes.

The *anonymous* information will help focus our sports nutrition efforts.

To access the survey, [click](#) or copy this link into a fresh browser:
https://bsu.qualtrics.com/jfe/form/SV_7OMUseBhOIEC7Ix

This study is approved as IRB # 1370085-1.

Thank you

Sincerely,

Toni Stoermann, Graduate Student
Nutrition and Dietetics
tlstoermann@bsu.edu

Carol Friesen, PhD, RDN, CD
Professor of Nutrition and Dietetics
cfriesen@bsu.edu

Appendix D-3

Final Recruitment Letter

Dear Coaches and Athletic Trainers:

Please accept our thanks and disregard this email if you have already completed the Sports Nutrition Survey.

If you have not completed the *anonymous* Sports Nutrition Survey, please consider taking a few moments to do so now. As a reminder, this brief survey (less than 5 minutes), will help focus our sports nutrition efforts. We are asking all Ball State athletic coaches and athletic trainers to complete this survey that asks about your sports nutrition knowledge, sources you use for nutrition information, the confidence you have in the sports nutrition knowledge of yourself and other coaches/trainers, and how you could use a full-time board-certified specialist in sports dietetics to aid our Ball State athletes.

The *anonymous* information will help focus our sports nutrition efforts.

To access the survey, [click](#) or copy this link into a fresh browser:

https://bsu.qualtrics.com/jfe/form/SV_7OMUseBhOIEC7Ix

This study is approved as IRB # 1370085-1.

Thank you

Sincerely,

Toni Stoermann, Graduate Student
Nutrition and Dietetics
tlstoermann@bsu.edu

Carol Friesen, PhD, RDN, CD
Professor of Nutrition and Dietetics
cfriesen@bsu.edu