Collegiate Athletes' Knowledge of Nutrition and Sports Performance

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Abstract

This study examined Virginia Tech female collegiate athletes' knowledge and perspectives of nutrition and its relationship to sports performance. Although various studies have examined the nutritional knowledge of collegiate athletes, the knowledge and perspectives of athletes on the value of nutrition to their performance needs further study. This current study aims to investigate the nutrition knowledge and perspectives relating to athletic performance of Virginia Tech female collegiate athletes through structured interviews using a literature-based interview guide, and to assess the dietary actions and sources of nutrition information in this population. A total of ten student-athletes participated in the interview process via Zoom. Social Cognitive Theory (SCT) served as the theoretical framework for development of the interview questions and analysis of responses. Content analysis of transcribed interviews was conducted using a hybrid deductive and inductive approach. Information from the interviews fell into four broad themes related to nutrition and athletic performance, focus on balance, schedule considerations, planning ahead, and terminology confusion. This study found female collegiate athletes from Virginia Tech showed a lack of understanding of nutrition as it relates to athletic performance. Despite the fact that respondents think nutrition has a significant impact on sports performance, these participants only gave nutrition a partial significance in their daily lives.

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Introduction

It is commonly understood that appropriate nutrition is essential to maintain good health, promote wellness, and enhance athletic performance (Karpinski 2017). For collegiate athletes in particular, proper nutrition is crucial for maintaining energy levels throughout the academic year, preventing illness or injury, or recovering from it, and it serves as an ergogenic enhancer in athletic performance. The available data unfortunately shows that college athletes don't always eat right, which can have negative physiological impacts such as reduced energy availability (Logue 2018). There are a variety of plausible explanations for these substandard eating habits, one of which is insufficient nutrition education, which could alter the perspectives about proper nutrition for athletic performance.

Recent studies have demonstrated that the NCAA population of student-athletes needs nutrition education to address a lack of nutrition understanding. (Benavides 2022; Klein 2021; Danh 2020). Several studies have also shown different influences the student-athlete may encounter when learning about nutrition (Klein 2021; Sharp 2021; Coccia 2020; Wasserfurth 2020), suggesting there are both harmful, inaccurate influences, and helpful, research-based influences that they may access. Given that modern athletes show a lack of nutrition awareness, the athlete's general health and/or peak athletic performance may be impacted without an appropriate nutrition intervention.

The health of a student-athlete is at risk when nutritional knowledge is insufficient. According to studies, eating disorders, low energy availability, and bone health are probable consequences of a lack of nutritional knowledge (Wasserfurth 2020; Canbolat 2020; Gastrich 2020; Martinsen 2010). Health issues such as these can influence performance for the worse but can also be extremely detrimental when prolonged. This study will help uncover the current

knowledge of student-athletes and their perspectives on the effects of nutrition on performance and health. Interviews with Virginia Tech female student-athletes were performed to evaluate their knowledge and perspectives on nutrition and its relationship to performance.

Purpose Statement

The purpose of this paper is to expand the information relating to female collegiate athlete's nutritional perspectives. This paper will discuss a variety of factors that play a role in a female athlete's dietary knowledge. Interviews were conducted to evaluate female collegiate athlete nutrition knowledge and understanding of its relationship to sports performance and health. Findings were compared with similar evidence-based research.

Research Questions

- What are female collegiate athletes' perspectives on nutrition and athletic performance?
    - What are their perspectives on the relationship between their diet and their performance?
- What value do female athletes place on nutrition as it relates to their athletic performance?
- What are the most important sources of nutritional knowledge for female collegiate athletes?
    - What are the most important sources of general nutritional knowledge?
    - What are the most important sources for nutrition knowledge as it relates to athletic performance?

Literature Review

Research has evaluated how student-athletes interpret food as fuel and what knowledge they have about nutrition. Several factors go into affecting the performance of a student athlete. One is the knowledge of nutrition. Health literacy is a crucial component of nutrition knowledge, and as poor health outcomes are correlated with low health literacy, current data are necessary to direct community-based dietary instruction and policies affecting public health (Spronk 2014). Presenting adequate nutritional knowledge to collegiate athletes needs to become a priority within universities. According to Heaney, "several studies have shown that the competency level in nutrition knowledge is very minimal or below average among both student-athletes and professional athletes" (Heaney 2011).

Nutrition is an important concept for student-athletes to pay attention to, as it drives performance and is needed for overall health. The major objective of the training diet is to maximize the functional and metabolic responses to a periodized exercise program that trains the athlete while also providing nutritional support to keep them healthy and injury-free. It helps better enable him or her to meet the performance requirements of their sport (Thomas 2016). Therefore, supporting the collegiate athlete population with nutritional knowledge is crucial for them to maintain steady performance levels.

Collegiate Female Dietary Habits

A dietary habit is a habitual decision among individuals or groups of people regarding what foods they intake (Saroja 2021). A study by Klein and colleagues used a validated questionnaire on dietary practices distributed to National Collegiate Athletic Association (NCAA) athletes. This study found that less than half of the collegiate female participants

indicated eating breakfast. It also aimed to evaluate the athletes' understanding of sports nutrition. The questionnaire was completed by 331 male and female student-athletes. In its findings, it found that home-cooked and dining hall meals tend to have a more adequate balance among females. Females were found to have a lower intake of protein bars/shakes and higher consumption of fruit and vegetable intake when compared to their male counter partners (Klein 2021).

Due to growing sport involvement, the development of diagnostic tools, and the expansion of scientific studies, the awareness of health issues in female athletes, such as insufficient calorie intake, menstruation abnormalities, and musculoskeletal injuries have grown more common (Canbolat 2020). A study by Canbolat and Çakıroğlu looked into eating patterns and eating problems in female collegiate athletes. In terms of the number of meals and snacks throughout the day, females were more likely to only eat two meals with the addition of two snacks. Those females who ate three meals generally only had one snack (Canbolat 2020). When females did skip meals the most frequent justification was the lack of time and/or schedule constraints (Canbolat 2020, Klein 2021).

The majority of female athletes claimed that they consume water during exercises when asked about their eating habits connected to sports. Similarly, most females reported eating between one and two hours after workouts, practices, and/or competition. Females indicated that they normally eat mostly foods high in carbohydrates, proteins, and fruits and vegetables before and after workouts or practices (Klein 2021).

Female Athlete Nutritional Requirements

The distribution of macronutrients that athletes should eat is determined by the type of exercise, exercise frequency, and exercise intensity of each individual athlete (Benavides 2022). The first component, carbohydrates, are extremely important for all collegiate athletes. Consumption of carbohydrates will help maintain high rates of carbohydrate oxidation, reduce ratings of perceived exertion, increase endurance capacity, delay the onset of fatigue, and prevent hypoglycemia (Fink & Mikesky 2017). There are multiple dimensions to the carbohydrate recommendations for athletes.

When talking about pre-fuel requirements, it is recommended to consume 1 to 4 grams of carbohydrates/kg body weight during the 1 to 4 hours before exercise. Pre-fuel is the concept of food intake prior to exercise or physical activity. The purpose of carbohydrates before exercise is to maintain blood glucose, sustain carbohydrate oxidation, spare muscle glycogen, and activate reward centers in the brain. In addition, carbohydrate consumption during exercise is crucial and is also referred to as ‘intra-fuel’. Intra-fuel is the idea of food intake during physical activity. For general exercise, 30 to 60 grams of carbohydrates per hour is recommended for intense exercise lasting more than an hour. Endurance athletes require up to 90 grams of carbohydrates per hour for a duration of longer than two and a half hours. Finally, 1-1.2 g of CHO/kg/hour should be consumed every hour for the first 4-6 hours post-exercise. This concept is post-fuel which means food intake after exercise. Overall, the carbohydrate intake ranges between 45-65% of calorie intake (Fink & Mikesky 2017).

Additionally, fats are another large component of the dietary intake of collegiate athletes. Fats are important as they are fuel for contracting muscles, aid with the absorption of fat-soluble vitamins serve as insulation of vital organs, help develop cell-membrane structure, regulate body

temperature, and promote immune function. The dietary needs of athletes are 20–35% of total calories (7–10% saturated) (Fink & Mikesky 2017).

Furthermore, there are protein needs among athletes that differ from non-athletes. The RDA for protein is 0.8 g per kg body weight for healthy, sedentary individuals. Depending on the athlete's sport, athletes should consume between 1.2 and 2.0 grams of protein per kilogram of body weight every day (Fink & Mikesky 2017). In terms of percentage of total calories, female athletes should have 15-30% of their daily calories come from protein (Bytomski 2018). Athletes with higher protein needs include those who are very young and still in their growing period, and older adults who have increased protein needs due to aging. Athletes participating in a new training program also have increased protein needs, as do those who are recovering from injury or surgery, or are experiencing illness. Those who have different dieting lifestyles such as vegetarians, vegans, and/or those looking to lose weight by limiting calories are also in need of higher protein intake. The consumption of at least 20 grams of protein post-exercise is recommended for muscle recovery and muscle protein synthesis (Fink & Mikesky 2017).

Finally, it's crucial for athletes to drink enough water and replenish their electrolytes in order to be healthy and active. In terms of hydration, eight 8-ounce glasses of water, or 2 liters, have been suggested as the general population's recommended daily intake to stay hydrated. There is no established benchmark for fluid replenishment for athletes because fluid loss varies widely. Generally, 10 to 20 minutes before exercise 7 to 10 ounces is recommended for athletes. During exercise athletes are recommended to consume 7 to 10 ounces every 10 to 20 minutes or match their fluid loss and lose less than two percent of their body weight. Athletes are instructed to consume at least 16 ounces of fluid for every pound lost after exercise (Fink & Mikesky 2017). After exercise, fluids should include sodium, chloride, and other rehydrating nutrients

(Karpinski 2017). Without adequate fluid intake can cause dehydration. In a study by Thomas et al. (2016) it was found that dehydration, either before, during, or after exercise can impair optimal athletic performance (Thomas 2016).

Athletes Understanding of Macronutrients

There tends to be a wide variety of nutritional knowledge among athletes, and they may have opposing views on nutrition information as it relates to performance. In a study by Rosenbloom, among all the female athletes, 54% of the women knew carbohydrates and fat are the main energy sources for activity (Rosenbloom 2002). Yet, it’s also been shown that there is misunderstanding about carbohydrate requirements; most athletes mistakenly felt that carbohydrates should be reduced in their diet (Dunn 2007). Females' average reported daily carbohydrate intake fell below the range of 6 to 10 g CHO/kg/d for sports nutrition (Vargas 2013).

Furthermore, about 75 percent of both men and women were aware that eating carbohydrates wouldn't make them gain weight (Rosenbloom 2002). Although it is good that three-quarters of athletes understand the appropriate effect of dietary carbohydrates, there is a relatively large percentage of student-athletes who think carbohydrates make an individual fat and 46% of female athletes didn’t know the two main energy sources for activity (Rosenbloom 2002).

Inadequate intake of these nutrients by athletes who are unaware that carbohydrates and fats are the main energy sources for working muscles can cause early exhaustion and a reduction in performance in sports with high aerobic energy demands (Rosenbloom 2002). Many female athletes, whether intentionally or unintentionally, limit their intake of carbohydrates to less than

6–10 g/kg of body weight, the amount required for the maintenance of glycogen stores (Riviere 2021). This may impact their performance and put them at risk for relative energy deficiency in sport (RED-S).

RED-S is a condition in which athletes experience prolonged low energy availability (EA) and are more susceptible to illness, infection, exhaustion, nutrient deficiencies, as well as musculoskeletal, endocrine, gastrointestinal, renal, psychological, cardiovascular, and performance problems (Riviere 2021). Energy availability is the energy available for the body to perform all other functions after the cost of exercise is subtracted. It also equates energy intake with requirements for optimal health and function.

The performance of college athletes is also greatly influenced by protein sufficiency. Some college athletes may not understand the connection between protein and athletic performance, causing low protein intake (Mercer et al. 2020). Athletes need to be aware of the function of protein in muscle development and maintenance, and its use as fuel under conditions of carbohydrate deficit during exercise. College athletes must consume adequate energy to spare protein, as protein is essential for performance (Rosenbloom 2002). Energy sources are only one of the categories female collegiate athletes struggle to comprehend. Coaches and their staff play an important role in the knowledge and dietary behaviors of female collegiate athletes.

Coaches and Staff Nutritional Knowledge

Coaches and various other staff play a significant role in athletes' dietary habits, but they may not be able to provide adequate learning techniques or sufficient knowledge for the athlete's nutritional success outside of the physical sport. It has been established that most coaches and players lack the appropriate knowledge of sports nutrition. In contrast, most staff in strength and

conditioning and athletic trainers are sufficiently knowledgeable to talk about nutrition (Torres-McGehee 2012). Sports performance may suffer as a result of this. In addition to nutritional knowledge, coaches and staff who work with athletes should receive training on disordered eating and how to identify symptoms, considering poor knowledge can result in disordered eating.

A study by Botsis and Holden looked into the nutritional knowledge of college coaches. This study included 21 Division I National Collegiate Athletic Association (NCAA) coaches, 16 males and 5 females. Coaches were asked to complete a multiple-choice questionnaire that included the six categories of nutrition, fluid, recovery, weight gain, weight loss, and supplements. Results showed that college coaches lack adequate nutritional understanding in all facets of sports nutrition, with a mean score on the test of 55%. Only one contestant scored about 70% (Botsis & Holden 2015).

Furthermore, a study done by Danaher and Curley investigated college coaches' knowledge of sports nutrition and recommendations for eating well. The study consisted of five individuals who completed a nutritional knowledge questionnaire and a moderately structured interview. Despite the results indicating a lack of nutrition expertise, all coaches gave their athletes nutrition advice about fluid requirements, dietary supplements, and weight management—topics that could be harmful to athletes' health (Danaher & Curley 2014).

Coaches and Staff as Influencers

As a student-athlete, individuals involved with the athletic program serve as a significant part of an athlete's nutrition and nutritional knowledge. Jacobson identifies that the most prevalent sources of dietary support are “coaches, athletic trainers, and sports conditioning

specialists who work closely with athletes" (Jacobson 2001). By encouraging healthy eating, coaches can improve their players' performances; however, they must possess the necessary expertise to do so (Dunn 2007). The coaching and athletic staff are frequently looked to by athletes to close this knowledge gap. Despite being professionals in their disciplines, these staff members frequently lack the dietary knowledge necessary to meet the deficiencies and needs of the athletes (Riviere 2021). In addition to those people, dietitians help assist athletes in understanding the importance of nutrition in their sport and in selecting the right foods and fluids to achieve peak performance (Rosenbloom 2002).

Supplement use is also common among athletes. A study including 203 participants by Froiland and colleagues found that male athletes were more likely to get their information about supplements from a store nutritionist, other athletes, friends, or a coach. While female athletes were more likely to get it from family members. While men reported supplement use to enhance strength, speed, and power, or to put on weight or muscle, female athletes were more likely to take supplements for their health or because of a poor diet (Froiland 2004). It is crucial that dietetic professionals who work with athletes are knowledgeable in the subject of nutrition and athletic performance including the efficacy of supplements, and with the rapidly evolving information on the subject. In addition to trainers, coaches, and dietetic professionals, the media plays a strong role in a collegiate athlete's nutritional knowledge.

Influences of Media

Today, social media channels are rapidly growing as well as their use by users from all demographics. Therefore, these social media apps are continuing to play a larger impact on people's perspectives and knowledge. There are multiple media channels through which people

seek information, including television, advertisements, newspapers, and social media. Social media platforms are rapidly growing and expanding in the number of diversity of users. Currently, social media has a growing impact on athletes' knowledge and resources (Coccia 2020).

A study by Zuniga and colleagues examined how Division I collegiate athletes currently use nutrition information resources, their eating patterns, and their knowledge of sports nutrition, and determined the need for the creation of easily available and reliable sources of nutrition information. There were 8 different sports represented with a total of 72 participants. Participants completed a questionnaire regarding nutrition resources utilized, dietary habits, and nutritional knowledge relating to sports. The results found that the likelihood that athletes would use a mobile app for nutrition resources is high, although they expressed a preference for themes related to nutrition over features like a food diary. College athletes were intrigued about utilizing a mobile app as an information source despite having little experience with sports nutrition and getting their nutrition information from unreliable sources (Zuniga 2017).

A six-week research intervention, performed by Coccia and colleagues, evaluated the feasibility and efficacy of the social media app, Twitter, to convey nutrition information to student-athletes. This intervention consisted of 50 male and female athletes from Division I NCAA programs. The authors created a 5-item multiple-choice quiz to test participants' nutrition knowledge of the 2010 Dietary Guidelines of Americans recommendation for vegetables, fruits, dairy products, fat, and whole grain consumption. Self-efficacy was assessed using five indicators with likeliness ratings ranging from one to four. Throughout the six weeks, two study-related nutrition accounts generated "prompts" that participants were required to react to. Each week's "tweets," "retweets," "replies," and "favorites" were recorded. Twitter response and

results from a post-test that assessed satisfaction with the intervention's content served as indicators of the intervention's feasibility. The findings indicated that an intervention provided only through social media may be practical for student-athletes and may enable them to change food behaviors, boost nutrition knowledge, and lower body mass index (Coccia 2020).

Another study done by Sharp et al. (2021) using the photo and video sharing social networking service, Instagram, provided insight into the types of posts that generated the greatest interest and activity. In this study, nutritional professionals, who worked with college student-athletes provided nutritional information through the Instagram app. Daily checks for postings made in particular research-defined categories were conducted over a period of five weeks, with 15 profiles selected on a random basis. The cumulative number of postings and favorites for each category were computed. The food-themed posts received the most likes and responses, while the macronutrient topic area received the least. On Instagram accounts representing college athletics' nutrition, posting once a week and sticking to certain categories seems to increase interest (Sharp 2021).

In addition, Bourke et al. (2019) was able to provide research relating to social media and how it ties in with nutritional knowledge. The appeal tends to be a major factor when engaging a collegiate athlete audience about nutrition. Sharing information, personal connections, and experiences by real individuals are seen as more relevant, personalized, and valuable than generic nutrition advice (Bourke 2019). There are many more individuals located on social media than there are 'in-person' resources. Athletes talked about how social media gives people a wider view on dietary recommendations by enabling them to check numerous sources and make their own decisions (Bourke 2019). In addition, social media offers easy access without having to set up appointments with a sports dietitian (Bourke 2019).

Interpersonal Factors of Nutrition

In a study by Quintiliani et al. (2012), interpersonal factors were explored among college students. There were three domains explored: work, school, and home. The study found that within the home domain, if local grocery stores sold food that was thought to be less healthful, the neighborhood was seen to have a detrimental impact on nutrition behaviors. College students also indicated that relatives encourage unhealthy food habits (Quintiliani 2012). Family was considered to be the least beneficial and influential, considering individuals extended time spent away from home while at college (Vilaro 2018).

Outside of school, friends were thought to have a persuasive impact on students' unhealthy eating habits (Quintiliani 2012). Additionally, social eating has been linked to less healthy nutritional consumption, perhaps as a result of environmental cues that encourage unhealthful eating behaviors (Biswas 2016). With the exception of when peers believed healthy eating was important, higher intake of sugar-sweetened beverages by peers was linked to higher consumption of sugar-sweetened beverages by oneself (Watts 2018).

Consequences of Poor Nutritional Knowledge

As time goes on, society continues to paint a picture of the ideal female body image. A wide and growing variety of nutritional information is put out into the world. Celebrities share their weight loss secret, not knowing how it can be detrimental to the general population. It's critical to realize that low energy availability can happen either with or without an eating issue. Interestingly, it's believed that women are more prone to eating disorders and low energy availability than men (Wasserfurth 2020). Research on body image, low energy intake, and eating disorders mostly focuses on female athletes. The well-researched "female triad," which

describes the relationship between low energy availability and its effects on female athletes' menstrual cycles and bone health, also supports the higher female susceptibility to eating disorders, low energy availability due to society's view, and poor nutritional understanding (Wasserfurth 2020).

Eating disorders are defined as psychological disorders that are characterized by severe eating anomalies (Rosen 2013). Athletes should be advised to seek professional psychiatric treatment if they exhibit severe symptoms of disordered eating. Providing psychiatric assistance can be advantageous for the athlete's general mental health as well as the prevention and treatment of disordered eating behaviors (Henriksen 2019). Strength/power athletes, athletes who skipped meals, and athletes who utilized nutritional supplements had greater rates of eating disorders (Canbolat 2020). Although nutrition knowledge is more widely available, athletes have demonstrated a better overall understanding of nutrition when compared to normal students. Myths like "carbs cause weight gain" or "during certain times is when food intake is most appropriate" are still lingering around (Wasserfurth 2020). Disordered eating can also be caused by other circumstances, such as the emergence of bodily dissatisfaction or the notion that the individual must be "slim to win" (Martinsen 2010). To reduce the likelihood of disordered eating, prevention initiatives need to be implemented. In order to avoid eating disorders, low energy availability, and the signs of RED-S, an understanding of the dietary perspectives and knowledge of female athletes is vital (Gastrich 2020).

Theoretical Framework

It is believed that collegiate student-athletes, specifically females, lack nutritional knowledge. It's unclear how nutrition information impacts collegiate athletes' diets or what role it serves as an explanation of their diet patterns. Conceptual ambiguity regarding the nature of

information and behaviors, and specifically nutrition knowledge and eating behaviors, has contributed significantly to the uncertainty in this domain. In response, this project evaluates in some detail crucial themes related to influences in diet behaviors. The basic premise is that changes in consumers' health and performance require "nutrition knowledge," but it is not a sufficient asset among female athletes. Numerous nutritional influences, viewpoints, and motivators are examined in this project. Environmental and intra-personal elements have an impact on athletes' behaviors. The usefulness of nutrition information is likely to also depend on the objectives and attitudes of the consumer and society at large.

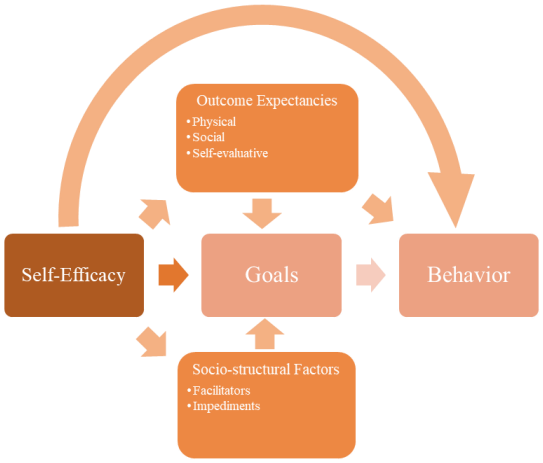
Although theories about education did not start in earnest until the early 20th century, Socrates, Plato, and Aristotle were among the first Greek philosophers to express interest in how people learn. They investigated whether knowledge and truth might be discovered either internally (rationalism) or by observation of the outside world (empiricism) (Fairbanks 2021). There is reason to believe that nutritional knowledge is a key factor in affecting an athlete's perspectives, which then affects their health and sports performance. From an educational background, there are several well-established theories that resonate with how an individual learns and understands knowledge.

The educational theory of cognitivism was developed in the 1950s and defines learning as depending on both internal mental processes and external stimuli (information or data) (Fairbanks 2021). With this understanding, it can be believed that athletes follow this well-established theory when obtaining nutritional knowledge. Collegiate athletes have multiple external and internal factors that go into shaping their nutritional perspectives. Although external factors can be shown to shift and adjust an individual's internal thinking.

Based on the theory of cognitivism there is a more widely used and well-established theory, social cognitive theory (SCT). The social cognitive theory (SCT) was used as the framework for this project. Social cognitive theory holds that forethought plays a significant role in influencing human motivation and behavior. Expectations related to the results of taking a given action are included in this anticipatory control mechanism. The theory identifies a number of important variables that affect behavior (Luszczynska 2015).

The first variable is perceived self-efficacy, or people's confidence in their ability to carry out a certain activity necessary to achieve a desired result. The second fundamental variable in SCT is outcome expectations, which is concerned with how people see the potential results of their actions. SCT also incorporates goals, perceived barriers, and facilitators in addition to these two variables. Figure 1 depicts these concepts and shows how they interact during the behavior modification process.

Figure 1: Social Cognitive Theory- Behavior Change Process



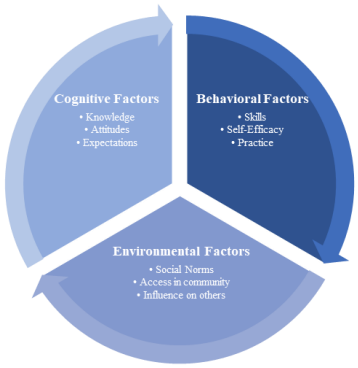
Adapted from *Predicting and Changing Health Behavior-Research and Practice with Social Cognitive Models* (p.226), by M., Conner and P. Norman, McGraw-Hill Education. Copyright 2015 by McGraw-Hill Education.

According to the social cognitive theory, environmental, behavioral, and cognitive factors all have an influence on learning (Bandura, 1991). Each component of the theory impacts one

another in any direction. Self-efficacy is a key factor of the social cognitive theory (SCT). Female collegiate athletes all have personal and environmental factors that influence their nutritional behaviors and perceptions. Athletes' social and personal lives generally shape how they behave during the competitive collegiate years. Combined, these factors have a major influence on an individual's self-efficacy.

The three components that make up the social cognitive theory (SCT), behavioral, environmental, and cognitive or personal factors, determine human behavior (Figure 2). Cognitive influences include perceptions, beliefs, thoughts, and feelings. Processes that assist in triggering and maintaining motivational results are considered personal influences. The three main cognitive elements are knowledge, attitudes, and expectations. Behavioral factors include skills, practice, and self-efficacy. Lastly, environmental factors involve social norms, access in community, and influence of others. This paper has the intentions to extend knowledge of female athletes' nutritional perspectives relating to the factors within the social cognitive theory.

Figure 2: Social Cognitive Theory Behavior Determinants



Adapted from Social Cognitive Theory by SBCC Implementation Kits, (https://sbccimplementationkits.org/sbcc-in-emergencies/social-cognitive-learning-theory/). Copyright 2016-2020.

Methodology

The purpose of this project was to gain a richer understanding of how female collegiate athletes perceive nutrition as it relates to performance and health. A qualitative research design was used to obtain the feelings and perspectives of competitive, collegiate female athletes.

Research Design

Semi-structured interviews were conducted with ten female collegiate athletes. The interview questions were developed using the SCT framework as a guide, and included questions within each of the three categories that influence behavior outlined in this framework (behavioral, personal, environmental factors). Questions were developed based on findings in the literature and areas of interest for this project.

Participants

Prior to contacting participants for this study, approval was received from the Virginia Tech Institutional Review Board (IRB #22-1157, Appendix A). All subjects signed informed consent prior to participating in any research procedures. In addition, approval was obtained from the Virginia Tech Athletic Department to gain consent to use Virginia Tech athletes as the participants (Appendix B). Participants were obtained through convenience sampling. Convenience sampling is a technique where participants are chosen based on their immediate availability. This accessibility typically refers to closeness in terms of location (e.g., students at the researcher's own college or nearby colleges), but it may also refer to other accessible factors like known contacts (Frey 2018). An appearance at several female athletic team weightlifting sessions was made to solicit participation in the study. An announcement of volunteers needed

for participation in the study, and an opportunity to learn about the study was made at the end of the weightlifting sessions.

Interested participants were asked to meet in a private office room to go over the consent form (Appendix C). After reviewing the consent form with the participants, all necessary signatures were obtained. Inclusion criteria included athletes who have completed a full year of college. Therefore, those who were considered freshmen, were not able to participate. This criteria ensured sufficient background related to nutritional perspectives as a collegiate athlete. By attending different weight lifting sessions for sport teams, athletes from various sports were recruited to the study.

Conducting Interviews

After convenience sampling and acquisition of written consent, an initial email or text, whichever the participant preferred was electronically distributed to the participants. The email or text provided a brief introduction and confirmed the intention to collaborate for the interview (Appendix D). Through this email or text, dates and times were electronically set up with each individual to organize a time to meet in-person or via Zoom, whichever the participant preferred. All of the participants chose to meet via Zoom.

The interviewee's audio was recorded and transcribed through Otter AI (Liang, S. Mountain View, CA). The interview process took between 10 - 20 minutes, depending on the individual’s responses. Before the main questions, a sequence of demographic questions were asked, including age, race, year in school, degree, eligibility, sport, and sport’s career intentions. Twenty-two questions, some with multiple components, were asked during the interview process (Appendix E). These research questions were based on the three Social Cognitive Theory

domains of behavioral, environmental, and personal factors. Once each interview was completed, the recording was transcribed with Otter AI, the transcribed data was reviewed and corrections were made if the app did not accurately pick up a statement. There was no compensation offered to participants in this study.

Anticipation of Coding

Coding of interview transcripts was conducted using Taguette (Rampin et al., 2021), a free online coding software, after all interviews were complete, analyzing the unique responses when given the same questions. A hybrid approach was used for coding the interview transcripts. An initial code list was developed based on the social cognitive theory within the 3 domains of the SCT (cognitive, environmental, and behavioral). New codes were generated as appropriate when coding each subsequent interview. The software facilitated the process of categorizing the various codes and grouped similar codes together. Broader themes were created from the categorized codes to describe the collective information derived from all the interviews and are described within the ‘Results’ section.

Results

In total, 10 Virginia Tech female athletes participated in this study. All participants’ interviews were coded and thoroughly analyzed. Athletes from 3 different sports teams represented the 10 female athlete participants: Lacrosse (4), Swimming and Diving (3), and Spirit Squad (3). A full breakdown of the sports represented along with other demographic and sport related descriptors can be found in Table 1. Of these 10 participants, all exhibited different education backgrounds.

Table 1: Athlete Description & Demographics

Athlete Description	Females (n=10)
Age	
19	4
20	3
21	1
22	2
Year in School	
Freshman	-
Sophomore	6
Junior	1
Senior	1
Graduate	2
Ethnicity	
White	9
Hispanic & White	1
Sport	
Women's Lacrosse	4
Women's Swimming & Dive	3
Women's Spirit Squad	3
Participation in Sport	
All	4
Majority	3
Half	-
Little	3
None	-
Degree	
Hospitality & Tourism Management	1
Sport Media & Analytics	1
Masters of Public Health	1
Psychology	1
Advertising	1
Human Nutrition Food & Exercise: Dietetics Route	1
Criminology & Psychology	1
Public Relations w/ minor in Business & Organizational Leadership	1
Bachelor's Degree: Criminal Justice; Graduate Degree: Human Nutrition Food & Exercise	1
Bachelors of Public Health	1
Courses Relating to Nutrition *(Some with Multiple Responses)*	
Food Prep Lab	1
Social Inequities and Health & Justices	1
Biology	2
Foods Nutrition & Exercise	3
Behavioral Therapy & Health Promotion	1
Public Health	1
A lot	1
None	3
Years of Eligibility Remaining	
0	2
1	1
2	5
3	2
Transfer Status	
Yes	2
No	8
Future Career in Sport	
Yes	1
No	8
Unsure	1

Within the interview question guide, there were 10 questions that asked the participants to rank their response on a scale of 1 to 10 (1=least, 10=most; or 1=not at all, 10=all the time). In total, there were 11 scale-based questions asked. The mean scores of all 10 participants for these questions are presented in Table 2.

Table 2: Scale-Based Personal, Behavioral, Environmental Questions

Scale Based Questions		
On a scale of 1 to 10 (1=least, 10=most) ….	Mean (n=10)	STD
What value do you place on nutrition in your daily life?	6.85	(±0.78)
How important do you think nutrition is to your athletic performance?	9.35	(±0.74)
How would you rank your knowledge of nutrition?	6.7	(±0.75)
How would you rank your knowledge of nutrition as it relates to athletic performance?	7.05	(±0.57)
How important is it to you to gain knowledge on nutrition as it relates to athletic performance?	8.35	(±1.4)
How often do those apps influence your nutritional perspective? (1=not at all, 10=all the time)	4.05	(±1.7)
How confident are you that you can choose a healthy diet?	8.3	(±0.98)
How confident are you that you can choose a healthy diet that can enhance your athletic performance?	7.95	(±1.1)
How confident are you that you can stick to a performing-enhancing diet while others around you lack a quality diet?	7.05	(±1.7)
How confident are you that you can cook a meal that would be defined as nutritious?	8.6	(±1.5)
How confident are you that you can choose certain foods to meet your carbohydrate and protein recommendations after exercise?	7.4	(±1.9)

In addition, there were five interview questions that related to the influences on their nutritional knowledge and behaviors. The questions related to who and what affected their nutritional perspectives. Though there were only 10 participants, some participants listed multiple answers to the questions. (See Table 3)

Table 3: Nutritional Perspective & Influential Surroundings

Nutritional Perspective & Influential Surroundings	
In regard to nutritional perspective…	Females (n=10)
Who or what influences your attitudes relating to sports performance the most?	
Virginia Tech Athletic Coaches	4
Virginia Tech Strength & Conditioning Coach	2
Virginia Tech Athletic Trainer	2
Virginia Tech Nutritionist	4
Peers	1
Self & Feelings	1
Other Nutritionist	-
Other Strength Coach	1
Who on the sports staff do you mainly let guide your nutrition? Or do you do it yourself?	
Virginia Tech Nutritionist	7
Personal (Themselves)	5
Virginia Tech Athletic Coaches	1
Hokie Fuel Instagram	1
Where do you get your information from outside of the sports staff?	
School Classes	2
Online	1
Social Media (Tik Tok, Instagram, etc.)	2
Books	1
Friends	1
Oasis Refueling Center Signs	1
Other Nutritionist	1
Nowhere	2
Which social media apps influence your nutritional perspectives the most?	
Tik Tok	6
Instagram	6
MyFitnessPal	2
Are there any other media channels that guide your nutritional perspective? If so, what are they?	
Internet	1
Social Media (Tik Tok, Instagram, YouTube)	4
No	5

Furthermore, there were five questions within the interview that tested the female athlete’s knowledge relating to nutrition. These questions had a specific numerical answer. Table 4 summarizes the female athlete's knowledge related to sports nutrition.

Table 4: Nutritional Knowledge & Attitudes

Nutritional Knowledge & Attitudes	
Questions test individuals' nutritional knowledge	Females (n=10)
Do you know the recommended percentage range of calories in an athlete's daily diet that should come from carbohydrates, fats, and protein?	
45-65% CHO; 20-35% FATS; 15-30% PRO * (All 3 Components) 2 Components Correct; 1 Component Incorrect 1 Components Correct; 2 Component Incorrect 0 Components Correct; 3 Components Incorrect No Idea	0 1 (G) 2 (G) 4 (G) 3
When talking about carbohydrates, how many grams per kg of body weight an athlete should consume 1 to 4 hours prior to exercise?	
1g to 4g/kg of BW * No idea	0 10
When talking about carbohydrates, how many grams should an athlete consume each hour of exercise?	
30-60grams/hour * 20 grams No Idea	1 (G) 1 (G) 8
When talking about carbohydrates, how many grams per kg of body weight an athlete should consume 4 to 6 hours post-exercise?	
1-1.2 grams/kg/hour * 80 grams No Idea	0 1 (G) 9
Do you know the optimal grams of protein an athlete should consume 1 to 2 hours post-exercise?	
20-30 grams* 50 grams No Idea	5 (5; G) 1 (G) 4
What macronutrient food do you use as an energy source for your athletic performance? ***(Some listed more than one)***	
Carbohydrates Fats Protein No idea	9 1 3 1
(*) Indicates Correct Answer (G) Indicates Guess	

Themes/Coding

The original code list was based on the Social Cognitive Theory (SCT), and contained 50 codes under the 3 SCT domains. Throughout the coding process new codes were created as appropriate. Only 43 of the 50 original codes were used when reviewing the first interview. At the end of coding all 10 interviews, there were 54 additional new codes created, resulting in a

total of 97 codes (Appendix F). The 97 codes were categorized into four broad themes, Focus on Balance, Schedule Considerations, Planning Ahead, and Terminology Confusion.

Theme 1- Focus on Balance

Interviewees were asked if they considered themselves healthy eaters or not and were asked to explain why. All female athletes defined themselves as healthy eaters, but had slightly different reasons as to why. The female athletes were asked, "Do you consider yourself a healthy eater? Why or why not?" The responses of the athletes to this question shared a common theme of needing balance when trying to cultivate a healthy diet. Focus on balance means individuals aim for a variety of foods in certain amounts and ratios to meet the needs for calories, proteins, minerals, and vitamins. This variety and balance was a focal point within many individual's responses. Each had a slightly different understanding of a healthy diet and how they apply it to their lives, as illustrated in the following examples.

Participant #1: "I try to eat like all categories of food with every meal that I get."

Participant #2: "I feel like all my meals are very balanced. I like to have a good amount of protein, a good amount of fat, a good amount of carbohydrates."

Participant #4: "So I think especially in season I try my best to get every single food group I have difficulties with. Eating smaller meals and then snacking, getting my full calorie intake like what I should be eating."

Participant #8: "So I just try to get all the main food groups when I eat throughout the day. So some kind of fruit, vegetable, protein, carbs, all that. I like cooking a lot. So that also

helps. I definitely am a balanced eater for breakfast, lunch, dinner and then like snacks in between. I've just always had a pretty good relationship with food and in terms of balance."

In addition, the female athletes were asked the follow up question of "How do you define healthy eating?" This follow up question uncovered the same theme of balance focused. Here are three examples from interviewees that defined healthy eating with the balance focused theme.

Participant #8 stated: "I define healthy eating as having a balanced diet and what I mean by this is eating breakfast, lunch, and dinner, intuitive eating, and making sure you're hitting each important food group."

Participant #9 answered the same question stating: "I would define it as a good balance of the main food groups: carbs, fats, proteins on a more consistent basis while also sprinkling in the things you really enjoy eating in moderation."

Participant #2: "I feel like getting a good balance of everything. I feel like everything's good in moderation."

Participant #10 gave a slightly different balanced focused answer by saying: "Keeping a balanced diet, not much fast food with empty calories and fried foods."

Furthermore, the question, "What do you think about when you're choosing the food for meals in general?" had responses with two additional themes, but mainly the theme of balance focus. Below are three samples of what participants responded to this question.

Participant #1: "In general, I think about just balance, and not seeing each meal as a source of food."

Participant #6: “Thinking about macronutrients in a good way, not too many of one or not too little of another. So a good ratio.”

Participant #8: “I really try to think about balance. When I make dinner, I’m like okay, what’s my protein, what’s my carb, what’s my vegetable.”

Theme 2- Schedule Considerations

Schedule considerations was another common theme that emerged throughout the interview process. There were multiple questions answered that had this common theme within the response. Schedule consideration can be expressed as events throughout the day that were put into thought when the individuals were making decisions around nutrition. One of the questions was “What actions do you take nutritionally that helps your athletic performance?” Here are six examples of interviewee’s responses to the question with the schedule consideration theme.

Participant #1 answered with: “Making sure I’m getting protein and carbs after lifting or after we have a heavy workout or practice and stuff like that.”

Participant #2: I really think about what I’m going to eat more towards practice time. So making sure I’m waking up, eating enough to fuel my body to be able to actually get me through a practice.”

Participant #5: “Knowing when practice is and figuring out how long before my practice I can eat that makes me feel like the best and also what kind of things I should be eating, if it’s a small snack before a big game or a big meal the night before an early practice.”

Participant #6: “I’m definitely getting proper fueling throughout the day before performances or games and hydration. I think that’s one of the most important parts.”

Participant #8: “I try to just always make sure that I eat well before practice, like it’s digested, eat after practice, eat breakfast, get a snack in between, lift and practice, when there’s time or lift and film, just always making sure that I have enough energy to compete at the highest level for my sport.”

Participant #10: “Trying to eat more clean foods going into competition, not eating fried foods, more fruits and vegetables closer to competition.”

In addition, there was another question with the common theme of schedule considerations. That question was, “What do you think about when you’re choosing the food for meals in general?” This question had a split between two themes: balance focus and schedule considerations. Here are two examples of those that answered the question along the theme of schedule considerations.

Participant #2: “Kind of thinking a little bit more heavy on the carbs before I’m doing stuff and I think a little bit more heavy on the protein in the afternoons. I will try to get more carbs because I’m going to need the energy. I try to make my plates after workouts have a little bit more protein.”

Participant #3: “I think about just what I have to do that day or what’s coming up. You know, if it’s pre practice, it’s definitely a different meal.”

Theme 3- Planning Ahead

Furthermore, there was another theme revealed within the responses of the question "What actions do you take to make sure you have a healthy diet?" Planning ahead references how individuals planned in advance on what they would eat, but also planning what they would purchase and have at home to consume. This theme can be described within the responses illustrated below.

Participant #2: "I definitely meal plan and plan what I'm going to eat throughout the day since we're so busy. I definitely try to plan out what I'm going to eat before or after practice before or after class."

Participant #6: "Planning grocery shopping is one that I think has really helped. And I love fruits and veggies. That's one personal thing, but I try to incorporate as many as I can."

Participant #8: "Just trying to make sure that I have all the food in my house that will hit all those groups. So grocery shopping and making a list when I do that, or it's really nice that the SAPC (Student Athlete Performance Center), I'll go there and they have everything I need to hit all those groups for breakfast, lunch and dinner."

Participant #9: "Just making sure I know that I have the self-control of a five-year-old so like if I don't buy it I won't eat it. So I go to the store with a plan in mind".

Theme 4- Terminology Confusion

Lastly, there was a final theme that appeared throughout the interview process. That theme is terminology confusion. Some participants expressed confusion and perplexity about the nutritional terminology when answering some interview questions. Much of the terminology confusion came from the question, "What macronutrient food do you use as an energy source for

your athletic performance?" Below are three examples of participants' responses to the term macronutrient.

Participant #3: "I don't know what a macronutrient is."

Participant #5: "Don't even know what a macro is if I'm being honest."

Participant #8: "Is an apple a macronutrient?"

Discussion

The responses of participants to the scale-based personal, behavioral, and environmental questions about the value they placed on nutrition, their knowledge, and their self-efficacy as it relates to eating a healthy diet was revealing (Table 2). Athletes expressed a strong belief that nutrition impacts athletic performance. This question received the highest rating with a mean score of 9.35 (± 0.74), which shows that participants understand the importance of nutrition to their sports performance. Yet, the value they placed on nutrition within their daily life received a moderate mean score (6.85, ± 0.78). Athletes notice the importance of nutrition but do not take advantage of it to the fullest extent which is concerning.

Although female athletes don't significantly value nutrition within their daily life, they expressed high interest and importance in gaining knowledge as it relates to athletic performance. This expressed desire for further nutritional knowledge relating to sports performance is remarkable. Having sufficient nutritional knowledge relating to their sport can help these female athletes improve their well-being and athletic performance.

Individuals ranking their knowledge of nutrition and knowledge of nutrition relating to athletic performance was not high. Self-assessed knowledge of nutrition in general was slightly lower when comparing it to their self-assessed nutrition knowledge related to athletic performance. Athletes believe they have better nutritional knowledge when it relates to athletic performance. This suggests that athletes may gather more nutritional information within the athletic environment such as through sport coaches, nutritionists, and other staff. Athletes may have more sources coming from the athletic department than from those outside affecting their nutritional knowledge in general.

The five questions regarding confidence from Table 2 exhibited scores of high self-efficacy. Respondents were confident with the ability to choose a healthy diet but not as confident in their ability to choose a healthy performance-enhancing diet. Lower confidence was shown with choosing a healthy diet revolving around athletic performance. This is contradictory, considering individuals self-assessed themselves as more knowledgeable about nutrition relating to athletic performance rather than nutrition in general. It's possible that their nutritional knowledge relating to sports performance does not correlate with their ability to put their knowledge into action.

Individuals were evaluated on their confidence to stick to a performance-enhancing diet while others around them lack a quality diet. Though the mean of 7.05 (±1.7) expressed relatively high confidence, the standard deviation also was high. Meaning some individuals exhibit higher self-control and willpower than others. The lack of self-control could come from internal dedication or external implications such as peer pressure or wanting to 'fit in.' As a student-athlete there are several stressors that could cause self-control to fluctuate.

Female athletes exhibited high confidence in their ability to cook a meal that would be defined as nutritious (Mean 8.6, ±1.5). Having the confidence of cooking may be due to the enjoyment individuals receive from cooking. This suggests that these athletes have adequate cooking skills and may suggest a high self-efficacy of their ability and willingness to cook for themselves. Their cooking skills may correlate with their ability to choose a healthy diet, as well. The better someone is at cooking, the better confidence they may have in choosing a healthy diet.

Lastly, participants expressed high confidence with their ability to choose certain foods to meet their carbohydrate and protein recommendations after exercise. Interestingly, only five individuals were able to correctly guess the optimal grams of protein athletes need post-exercise. When talking about carbohydrates, all but one had no idea how many grams per kilogram of body weight were needed post-exercise. The one individual that guessed was also incorrect. This suggests individuals do not know sufficient nutritional information regarding post-exercise macronutrients, but they believe that they can confidently guess these numbers in their dietary practices.

This study found that Virginia Tech (VT) athletic coaches and nutritionists had the greatest influence on female athlete's nutrition and sports performance perspective. Both VT athletic coaches and nutritionists were identified by four individuals as a significant influencer. Coaches may be a significant influencer due the close connections these athletes hold with them. Coaches are also the ones these female athletes are exposed to the most out of every staff member which could be why they are so influential. Regarding who within the sports staff mainly guides the participant's nutrition, nutritionists were seen as the highest influencer with a total of seven respondents. Just behind the nutritionist, five participants indicated that they provided their own guidance for nutrition practices. Nutritionists are seen to be an influential

person to these female athletes. This may be because individuals understand the sufficient credentials nutritionists hold about nutrition and food.

This information relating to coach agrees with findings by Jacobson and Riviere (Jacobson 2001 & Riviere 2021). Although, it disagrees with Jacobson's and Riviere's considering their studies found that coaches are the ones that are the most influential along athletic trainers and strength and conditioning coaches, not listing nutritionists. The study by Rosenbloom agrees with this study and found that athletes do turn to nutritionists when seeking nutritional knowledge (Rosenbloom 2002).

Participants were asked where they get their nutritional information from outside of the sports staff and these responses were diverse. There were eight different responses that were shared; social media: 2, school classes: 2, and nowhere: 2, were the most popular. In addition, one individual said another nutritionist and one other said their friends. Therefore, this shows a slim number of individuals who get their nutritional information from people other than the sports staff. Outside nutritional information is insignificant considering how diverse responses tended to be.

In terms of social media platforms, individuals showed equal and significant engagement with Instagram and TikTok. Some participants listed multiple social media platforms. The app MyFitnessPal was mentioned and illustrates that some athletes track their food intake daily. When asked about other media platforms that influenced individuals' nutritional perspective, respondents either said there were none or the same social media platforms were validated. One participant did mention the internet. This suggests that TikTok and Instagram are the main social media influencers of respondent's nutritional perspectives.

In addition to social media, individuals were asked on a scale of 1 to 10 (1=not at all, 10=all the time) how often those apps influence their nutritional perspective. The average score was 4.05 (±1.7). The majority of individuals seem to not let these social media platforms persuade and guide their nutritional perspectives. This may be due to the influence they receive from the athletic staffing within their sport. These findings of social media influence significance disagrees with Coccia's, Sharp's, and Bourke's studies on how social media apps can be assessed easier, increasing engagement and influence (Bourke 2019 & Coccia 2020 & Sharp 2021).

Participants were also asked a series of knowledge and attitude questions from Table 4. Individuals were asked what the recommended range of calories in an athlete's diet should be for carbohydrates, fats, and protein. They were asked to indicate whether they were "guessing." One individual was able to 'guess' and get two of the three macronutrients correct. The two components that the individual guessed correctly were the percentage of carbohydrate and protein intake. While two individuals managed to 'guess' one component correctly, four individuals 'guessed' all three components incorrectly. The remaining three respondents admitted they had no idea what the answer was. Every answer that was correct were guesses the individuals were making. Not one individual had a firm and confident answer. This data indicates that the majority of female athletes are not confident about what percentage of calories should go towards the three macronutrient groups.

Individuals were then asked a series of three questions regarding carbohydrate intake in relation to exercise. In regard to carbohydrate intake prior to exercise all ten individuals had no idea and provided no guesses. All of the female athlete participants did not have sufficient knowledge relating to pre-exercise carbohydrate intake associated with their personal

bodyweight. Lack of knowledge of the recommendations for pre-exercise carbohydrate intake can impact maintenance of blood glucose levels, inhibiting optimal performance.

In addition to pre-exercise fuel, the female athlete participants also lacked adequate knowledge relating to carbohydrate intra-fuel. One individual guessed incorrectly and one correctly guessed a number within the range, while the rest had no idea. Without proper intra-fuel with carbohydrates blood glucose levels can be depleted. This insufficient knowledge can be detrimental to these athletes' performance and how they function during competition.

The final question was asked relating carbohydrate needs for post-exercise. Majority of individuals had no idea and one individual guessed incorrectly, using incorrect units while presenting their answer. The female athlete participants lacked sufficient nutritional knowledge relating to post-exercise. The absence of this information can be causing these athletes to not be able to replenish their glycogen levels to the fullest. It can also delay recovery time and inhibit proper restoration of muscle glycogen.

Overall, relating to carbohydrates, Vargas' study may agree with this study's findings on carbohydrates (Vargas 2013). Vargas found that females fall short of adequate intake of carbohydrates, which may be result from insufficient carbohydrate knowledge that was emphasized in this study. Knowledge and adequate dietary practices may have a strong correlation.

Regarding protein, athletes were asked what the optimal grams of protein an athlete should consume one to two hours post-exercise. Interestingly, six individuals managed to guess the answer and five of those athletes guessed correctly within the 20-to-30-gram range. The one individual that guessed incorrectly provided the answer of 50 grams. The remaining four

individuals claimed to have no idea of the answer. Therefore, 50% of individuals managed to correctly guess the optimal grams of protein post-exercise, which could mean these athletes may be hitting the optimal grams of protein intake post-exercise, stimulating muscle protein synthesis (MPS). Although half got this correct, all of them were guesses which also means they may not be applying this concept to their training.

The last question asked which macronutrient food do they use as an energy source for their athletic performance. Some participants listed more than one macronutrient source. The most popular macronutrient food group that was answered was carbohydrates. The second macronutrient group mentioned was protein. One individual listed fats and one individual had no idea. Almost all individuals had a good understanding that carbohydrates are the main and best source for energy in athletic performance. It’s concerning the respondents who did not list carbohydrates as a main source of energy and this shows lack of sufficient nutritional information relating to sports performance.

The open-ended questions brought out multiple themes within the responses. The two questions of “Do you consider yourself a healthy eater? Why or why not?” and “How do you define healthy eating?” had the same “Focus on Balance" theme. Individuals described themselves as healthy eaters, defining healthy eating as having a balanced dietary pattern. In many cases, individuals were describing both questions in interchangeable ways. Considering all participants defined themselves as healthy eaters suggests that these female athletes have high self-efficacy about their nutrition. The Focus on Balance theme also partially arose in the question regarding what individuals think about when choosing their foods for meals in general, i.e., balancing their choices among the food groups. In conclusion, the female athletes in the

study focused on consuming a variety of foods in proper amounts when choosing food for meals, which is an important aspect of a healthy diet.

The theme “Schedule Considerations" also arose many times. The two questions, “What actions do you take nutritionally that helps your athletic performance?” and “What do you think about when you’re choosing the food for meals in general?” generated responses related to the impact of busy schedules on their ability to follow nutrition guidelines. Respondents provided answers around the events happening in the future or the past. These events included athletic practices, classes, weight training, and future competition, all of which presented challenges when choosing food for their meals in general and action they take nutritionally to help their athletic performance. Individuals are aware of how impactful nutrition can be on their athletic performance, and appear to be cognizant of choosing foods for their meals to help prepare them for what they have coming up or what already occurred. Being able to apply this consistently to their lives can be challenging, due to busy schedules.

The theme "Planning Ahead" was repeated by multiple respondents, and was related to scheduling considerations. In response to the question “What actions do you take to make sure you have a healthy diet?”, individuals indicated how they try to plan out their diet before and after class and practice. Multiple participants also mentioned the action of going grocery shopping to help meal plan and get food for that week. Some noted that they try to have a plan in mind before going into the grocery store. Respondents highlighted the need for organization and dedication to maintain a healthy diet that supports athletic performance.

Lastly, “Terminology Confusion” was a theme that recurred with several questions. This theme appeared prominently in the question “What macronutrient food do you use as an energy

source for your athletic performance?" Multiple individuals did not know what a macronutrient was and often asked what the term was or asked if a certain food was a macronutrient. This highlights the need for planned nutrition education for female athletes, particularly as they are asked to apply dietary recommendations for maximum athletic performance to their daily diets.

Conclusion

Nutritional knowledge and credible sources of nutrition information are essential for enhancing eating behaviors that help athletes develop positive training responses. In the present study, Virginia Tech female collegiate athletes exhibited inadequate nutritional knowledge. Though respondents believe nutrition impacts athletic performance significantly, these participants only partially value nutrition within their daily lives. Participants believed they had better nutritional knowledge relating to athletic performance when compared to nutritional knowledge in general.

Athletes partially value nutrition for their performance and feel that they can prepare diets that meet nutrition requirements, but experience challenges such as a lack of knowledge and busy schedules. These athletes noticed that nutrition is extremely important for their athletic performance and have the strong desire to gain nutritional knowledge as it relates to sports performance. The majority of people identified as influencing nutrition knowledge and attitudes comes from athletic coaches and nutritionists. Therefore, it is crucial for these coaches and nutritionists to effectively and accurately communicate nutritional information to their athletes. Athletic coaches should be educated more on nutrition as it pertains to athletic performance in order to be a reliable source of information. Nutritionists should incorporate nutrition more prominently in the training of athletes, and intentionally communicate nutrition information with

athletes. There is need for further research related to athlete's nutritional knowledge and the impact coaches and nutritionists can have on their ability to apply nutrition recommendations to their dietary behaviors.

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Appendix A: IRB Approval

VIRGINIA TECH.

Division of Scholarly Integrity and Research Compliance
Institutional Review Board
North End Center, Suite 4120 (MC 0497)
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-3732
irb@vt.edu
http://www.research.vt.edu/sirc/hrpp

MEMORANDUM

DATE: March 16, 2023

TO: Carlin Rafie, Angela Suzanne Anderson, Kelly Corinne Murphy, Madison Slagle

FROM: Virginia Tech Institutional Review Board (FWA00000572)

PROTOCOL TITLE: Collegiate Athletes’ Knowledge of Nutrition and Sports Performance

IRB NUMBER: **22-1157**

Effective February 10, 2023, the Virginia Tech Human Research Protection Program (HRPP) determined that this protocol meets the criteria for exemption from IRB review under 45 CFR 46.104 (d) category(ies) 2(ii).

Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit an amendment to the HRPP for a determination.

This exempt determination does not apply to any collaborating institution(s). The Virginia Tech HRPP and IRB cannot provide an exemption that overrides the jurisdiction of a local IRB or other institutional mechanism for determining exemptions.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

https://secure.research.vt.edu/external/irb/responsibilities.htm

(Please review responsibilities before beginning your research.)

PROTOCOL INFORMATION:

Determined As: **Exempt, under 45 CFR 46.104(d) category(ies) 2(ii)**
Protocol Determination Date: **March 16, 2023**

ASSOCIATED FUNDING:

The table on the following page indicates whether grant proposals are related to this protocol, and which of the listed proposals, if any, have been compared to this protocol, if required.

Appendix B: VT Athletic Department Approval

Virginia Tech Athletics Department
Protocol on Student-Athlete Participation in Research

Research Subcommittee:

Danny White – Senior Associate Athletics Director, Student-Athlete Services/University Affairs

Bridget Brugger McSorley – Senior Associate Athletics Director, Strategic Affairs

Mark Rogers – Chief Medical Officer and Head Team Physician

Mike Goforth – Associate Athletics Director, Sports Medicine (Chair)

Zack Maust – Research Coordinator, Sports Medicine

Ally Onyon – Senior Director, Sports Nutrition

*Head Coach(s) of student-athletes/teams requested to be represented in proposed research

Summary:

Virginia Teach Athletics Department receives numerous requests for student-athletes and teams to participate in research. As part of the university community, we would like to foster research opportunities within the community in a safe, productive, and ethical manner. In order to protect our student-athlete's welfare and privacy, we require that all proposed research projects be sent to our research subcommittee for review and approval before having any contact with our coaching staff or student-athletes. The subcommittee will not review any applications without an IRB approval.

Procedure:

All research projects that wish to involve Virginia Tech student-athletes as subjects must be reviewed by the research subcommittee. A representative from the research team should complete the attached research application for review and send to Mike Goforth at ab8631@vt.edu. The subcommittee will meet to review the application. The representative will then be notified of the subcommittee's decision.
It is recommended that representatives complete an application at least 30 days in advance of their proposed research start date.

Goals of the review process:

- Protect the student-athlete welfare while fostering a research environment within the community
- Protect the safety of each student-athlete and the team overall
- Protect the privacy of the student-athletes involved
- Ensure only ethical research is being conducted on our student-athletes

The Virginia Tech research subcommittee and the proposed research team assume:

- Consent for participation and approval may be removed at any time.
- Confidentiality is of highest priority.
- IRB approval will be obtained prior to subcommittee review.
- Any source of funding or conflict of interest must be disclosed up front.

1

- Student-athletes must be clearly informed that participation is at their own free will and will not be coerced into participating. Playing time is in no way connected to participation.

Virginia Tech Athletics Research Application Form

Principal Investigator: Carlin Rafie **Date:** 2/13/23

Research Topic:

Knowledge of Nutrition and Sports Performance

Title of Proposed Research:

Collegiate Athletes' Knowledge of Nutrition and Sports Performance

Description of Project:

This study examines nutritional perspectives and knowledge relating to sports performance in female collegiate athletes. This study will review the nutritional perspectives and knowledge relating to sports performance. The study will consist of 10 female Virginia Tech collegiate athletes from any women's sports team. Consent forms will be given prior to conducting interviews with the participants. Individual interviews will be performed with all 10 individuals to test the athlete's knowledge and perspectives relating to nutrition. The interviews will be conducted either in person or via Zoom. The interview will last roughly 30 minutes depending on the participant's answers. The questions are based on the theoretical framework of the Social Cognitive Theory (SCT). Interviews will be coded using the SCT and used in the results section.

Briefly describe your interest in using student-athletes as your research participants:

I am interested in using student-athletes as my research participants because it is convenient for me as a student-athlete. I also believe athletes are great for participants as they are the ones who should have a larger focus on their nutritional habits considering their participation in athletics.

2

Other pertinent information to be shared with Athletics Department:

N/A

Please attach the following:

IRB Letter of Approval (including approval date and approval expiration date)

Copy of the Informed Consent Form

Any known conflict of interests

Expected commitment and inconveniences for student-athlete participants

(For Athletic Department Use only)

- The Athletic Department approves this research to be conducted on its student-athletes.
- The Virginia Tech Athletic Department DOES NOT approve this research to be conducted on its student-athletes for the following reasons:

(Senior Associate Athletic Director, Student-Athlete Services/University Affairs) (Date)

(Senior Associate Athletic Director, Strategic Affairs) (Date)

(Associate Athletics Director, Sports Medicine) 2/24/23 (Date)

(Research Coordinator, Sports Medicine) 2/24/23 (Date)

Personal Meeting

(Senior Director, Sports Nutrition) 2/24/23 (Date)

(Sport(s) Representative, Coaching Staff) 2/15/2023 (Date)

3

Appendix C: Consent Form

INFORMED CONSENT FORM

Consent to Participate in a Research Study Virginia Tech OMALS Program

Collegiate Athletes' Knowledge of Nutrition and Sports Performance

Principal Investigator: Carlin Rafie

Co-Investigator: Madison Slagle

Introduction

You have been asked to participate in a research study that is part of the requirement for a Master's degree in Agriculture and Life Sciences for Madison Slagle. Before you agree to participate in this study, it is important that you read about and understand the study and the procedures it involves. The investigator will also explain the project to you in detail. If you have any questions about the study or your role in it, be sure to ask the investigator. If you have more questions at a later time, Dr.Rafie and Madison Co-Investigator will be happy to answer them for you. You may contact the investigator(s) at:

Dr. Rafie: crafie@vt.edu

Madison Co-Investigator: 319-350-7364 madisonslagle@vt.edu

Purpose of this Study

The reason for this study is to examine nutritional perspectives and knowledge relating to sports performance in female collegiate athletes. You have been asked to participate because you are a female student-athlete at Virginia Tech. This study will review the nutritional perspectives and knowledge relating to sports performance. The study will consist of 10 female Virginia Tech collegiate athletes.

Description of Procedures

If you decide to take part in this study, you will be asked to meet via zoom or in person for approximately 30 minutes and answer a series of personal questions relating to your nutrition. This interview process will take about 30 minutes to complete depending on your answers. The audio from the Zoom call will be recorded to produce a transcription of our conversation and ensure that all of your responses are accurately captured. Any information about you will be kept confidential. To protect your privacy, if you'd like to use a different name for the purpose of this study you are welcome to do so.

What are the risks?

We estimate that the potential risks of this study are minimal. However, you may experience some psychological discomfort when answering questions about your eating habits or social behavior.

What are the benefits?

It is not anticipated that you will not experience any direct benefits from this study. Nevertheless, your participation in this research will help investigators identify nutritional knowledge, attitudes, and beliefs of female athletes and the primary influencers on them. This information may be useful in developing future programs to promote student-athlete education and training.

How will my privacy be protected?

We will assign you a participant ID# that will be used to identify all data related to your study participation. If you choose to use your name during the interview, the name will be redacted in the final transcript. The information gathered will be accessible only by the investigators and it will be kept on the investigators' password protected computers. All recordings information from this study will be destroyed immediately after finalization of the transcripts. Data from the research project will be destroyed after the required retention period. Your personal information will never be used in any presentations or publications of this research.

Consent to Participate

If you want to participate in this study, *Collegiate Athletes' Knowledge of Nutrition and Sports Performance*, you are required to sign below as an indication of your willingness to participate:

I have read and understand the information in this form. I have been encouraged to ask questions and all of my questions have been answered to my satisfaction. I have also been informed that I can withdraw from the study at any time. By signing this form, I voluntarily agree to participate in this study.

_____	_____
Printed Name of Participant	Date
_____	_____
Signature of Participant	If desired, Chosen Name
_____	_____
Signature of Witness	Date

Appendix D: Initial Email/Text

Hello, Participant

This is Madison Slagle. I'm the one who came into the weight room and announced my study proposal on 'Collegiate Athletes' Knowledge of Nutrition and Sports Performance'. I'm starting to set up interviews and have obtained your consent to proceed. I was wondering if we could discuss times to schedule you for an interview testing your nutritional knowledge?

Appendix E: Interview Questions

Demographic Beginning Questions

- Age/Ethnicity
  - How old are you?
  - What year in school are you?
  - What ethnicity are you?
- Sport
  - What sport do you play at VT?
  - How much did you participate in your team's competition?
- Degree
  - What is your current degree in?
- Courses taken relating to nutrition
  - What course are you taking or have ``already taken relating to nutrition?
- Years of eligibility remaining
  - How many years of eligibility do you have remaining?
  - Are you a transfer student?
- Plan to make their sport a career
  - Do you plan to make your sport a career after college?

Main Questions

<u>Cognitive Factors (Knowledge, Expectations, Attitudes)</u>

1. Do you consider yourself a healthy eater? Why or why not?
   a. How do you define healthy eating?
2. On a scale of 1-10 (1=least, 10=most), what value do you place on nutrition in your daily life?
3. On a scale of 1-10 (1=least, 10=most), how important do you think nutrition is to your athletic performance?
   a. What actions do you take nutritionally that helps your athletic performance?
4. What college school course(s) have you taken that are related to nutrition?
5. On a scale of 1-10 (1=least, 10=most), how would you rank your knowledge of nutrition?
6. On a scale of 1-10 (1=least, 10=most), how would you rank your knowledge of nutrition as it relates to athletic performance?
   a. On a scale of 1-10 (1=least, 10=most) how important is it to you to gain knowledge of nutrition as it relates to athletic performance?
7. Do you know the recommended percentage range of calories in an athlete's daily diet that should come from carbohydrates, fats, and protein? If so, what is it?
8. When talking about carbohydrates, do you know how many grams per kg of body weight an athlete should consume 1 to 4 hours prior to exercise? If so, what is it?
9. When talking about carbohydrates, do you know how many grams per kg of body weight an athlete should consume each hour of exercise? If so, what is it?
10. When talking about carbohydrates, do you know how many grams per kg of body weight an athlete should consume 4 to 6 hours post-exercise? If so, what is it?

11. Do you know the optimal grams of protein an athlete should consume 1 to 2 hours post-exercise? If so, what is it?
12. What macronutrient food do you use as an energy source for your athletic performance?
13. What do you think about when you're choosing the food for meals in general?

Environmental Factors (Social Norms, Access in Community, Influence on Others)

14. In regard to your nutritional perspective…
   a. Who or what influences your attitudes relating to sports performance the most?
   b. Who on the sports staff do you mainly let guide your nutrition? Or do you do it yourself?
   c. Where do you get your information from outside of the sports staff?
15. Which social media apps influence your nutritional perspectives the most?
   a. On a scale of 1-10 (1=never, 10=all the time), how often do those apps influence your nutritional perspective?
16. Are there any other media channels that guide your nutritional perspective? If so, what are they?

Behavioral Factors (Skills, Practice, Self-Efficacy)

17. What actions do you take to make sure you have a healthy diet?
18. On a scale of 1-10 (1=least, 10=most), how confident are you that you can choose a healthy diet?
19. On a scale of 1-10 (1=least, 10=most), how confident are you that you can choose a healthy diet that can enhance your athletic performance
20. On a scale of 1-10 (1=least, 10=most), how confident are you that you can stick to a performing-enhancing diet while others around you lack a quality diet?
21. On a scale of 1-10 (1=least, 10=most), how confident are you that you can cook a meal that would be defined as nutritious?
22. On a scale of 1-10 (1=least, 10=most), how confident are you that you can choose certain foods to meet your carbohydrate and protein recommendations after exercise?

Appendix F: Excel Code List

Original Code List	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6	Participant 7	Participant 8	Participant 9	Participant 10
Age	Age	restrictiveness	course details	conscious of dietary issu	dietary changes	hydration	eating frequently	loves cooking	volume	fast food
Year in school	year in school	meal planning	food relationship	incorporating variety	MyFitnessPal	grocery shopping	vitamins	professor dedication	family influence	nutrient dense
Ethnicity	ethnicity	practice influence	younger self	peer influence		intuitive eating	credible source	SAPC		school influence
Sport	sport	timing	response to 'macronutrient'	performance evaluation		fruit & veggie focus		everyone needs different		
Participation in sport	participation in sport	guessing	friend influence	physical feeling						
Degree	degree	gender difference		partially correct						
eligibility remaining	eligibility remaining	percentage distribution								
transfer status	transfer status	dietary restrictions								
nutritional courses	future career status	willpower								
future career status	definition of healthy eating									
correct	explaination of healthy eater									
incorrect	self-defined healthy eater									
no idea	actions									
valuable	nutritional importance									
low value	nutritional actions for performance									
high value	nutritional knowledge									
protein	knowledge relating to performance									
carbohydrates	macro energy source									
training	no idea									
friend influence	incorrect									
parent influence	pre carbohydrates									
aunt uncle influence	hourly carbohydrates									
coaching staff influence	post carbohydrates									
trainer influence	protein									
strength & conditioning coach	optimal protein									
snapchat	general meal thoughts									
instagram	nutritionist influence									
twitter	balance									
youtube	personnel influence									
confident	nutritional guide									
semi-confident	outsider influencers									
routine	tik tok									
organized	social media influence scale									
random	confidence choosing healthy diet									
unorganized	cooking nutritious									
courses relating to nutrition	carb & protein recommendation									
nutritionist influence	courses relating to nutrition									
social media	value of nutrition									
other media	actions for healthy diet									
nutritional guide	importance scale									
value of nutrition	percentage distribution									
macro energy source	coaching staff influence									
definition of healthy eating	social media									
explaination of healthy eater	other media									
self-defined healthy eater	semi-confident									
actions	self-control of peer pressure									
nutritional importance										
nutritional actions for performance										
nutritional knowledge										
knowledge relating to performance										

Red= Not Used

Green= New