CULINARY NUTRITION EDUCATION TO DIVISION 3 ATHLETES

by

Jonathan Robert Poyourow

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy – Health Sciences

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APPROVED BY:

Dr. Rachel Schichtl, Committee Chair

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Abstract

This paper examines the impact of culinary nutrition education on the athletic potential of Division 3 athletes using culinary nutrition education. In the last five to ten years, the number of registered dietitians (RDs) working with collegiate athletes full-time in the United States has increased dramatically. However, even at large Division 1 universities that have these staff members, many student-athletes may still be at increased risk of nutrition-related problems that impact physical and academic performance. They may also include inappropriate macronutrient and micronutrient consumption. While a great deal of research has been conducted at Division 1 universities regarding sports nutrition and athletic feeding, limited research has examined athletes' food-related beliefs and practices at Division 3 universities. This is especially true at a location where there is not a registered dietitian on staff in the athletics department, let alone providing the athletes with culinary training in addition to normal nutrition education.

Keywords: sports nutrition, dietary habits, Division 3 athletes, nutrition education, athletic feeding, sports dietitian, culinary arts

Dedication

To Rose, the love of my life and my steadfast companion, your unwavering support and boundless love have been my guiding light. Your strength and encouragement have sustained me through every challenge, and your unwavering belief in me has been the foundation upon which this journey was built. Thank you for being my rock, and my confidante. To my incredible children, Sean and Anastasia, your laughter and spirit have been my source of joy and inspiration. Your patience and understanding during the countless hours I spent immersed in this work mean more to me than words can express. This accomplishment is as much yours as it is mine. I dedicate it to you, Rose, Sean, and Anastasia, with all my love and gratitude.

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CHAPTER ONE: INTRODUCTION

Overview

This research study aims to investigate the influence of culinary nutrition education on the dietary choices of Division 3 (D3) athletes at a small private college, Johnson & Wales University, in the Northeastern United States. Acquiring appropriate nutrition is critical for athletes to optimize their athletic potential and prevent conditions such as Relative Energy Deficiency in Sports (RED-S) and eating disorders (ED). However, D3 athletes often lack the same access to food, nutritional support, and education as their Division 1 (D1) counterparts, despite being expected to perform at a similar magnitude throughout their collegiate careers.

Background

Acquiring appropriate nutrition throughout one's life is crucial to attaining proper growth and health throughout the lifespan. While this essential nutrition focuses mainly on the correct macro and micronutrient ratios and maintaining a healthy body weight, in everyday healthy Americans, the world of sports nutrition is an entirely different environment. The goal of sports nutrition is to enhance an athlete’s athletic performance by potentially improving sports performance and recovery, increasing speed and muscle mass, and for some athletes decreasing body fat. This advanced skill set requires athletes to learn what to eat and the proper timing of meals and snacks before, during, and after a practice or competition. According to a research article by Klein et al. (2021), “A well-chosen diet plan is critical for optimizing sports performance. Compared to non-athletes, athletes require greater energy, fluids, and macronutrients to sustain vigorous training and recovery and support physiological functions outside of the energy demands of sports” (p. 1).

Existing evidence suggests that collegiate athletes commonly exhibit suboptimal nutrition practices, leading to inadequate energy availability and various detrimental physiological consequences (Logue et al., 2018). Consequently, they are at risk of developing a condition known as Relative Energy Deficiency in Sports (RED-S), classified as an athlete's condition referring to inadequate energy availability (EA) in the sports-athletic context, as stated in a research article by Cabre et al. (2022). This condition, commonly known as low energy availability (LEA), can persist chronically for weeks to months or present acutely with severe energy deficits over a few days, putting athletes at an increased risk of encountering detrimental health outcomes. The term "Relative Energy Deficiency in Sport" syndrome is used to describe this phenomenon. Inadequate eating patterns can also contribute to the possible development of eating disorders (ED) in athletes. According to Diaz et al. (2018), EDs often originate from weight and body concerns, leading to controlling behaviors such as monitoring food intake and eliminating certain foods from the diet. These practices can evolve into more negative beliefs, attitudes, and dysfunctional eating behaviors. To prevent energy-related deficiencies and EDs from manifesting in athletes, sports dietitians must play a pivotal role in improving athletic potential, performance, and overall well-being.

Significance of the Study

The significance of this mixed methods research project examining D3 athletes at Johnson & Wales University in Providence, RI, goes beyond the mere exploration of their access to food and nutritional support/education compared to D1 players. While it is evident that D3 student-athletes do not have the same level of resources as their D1 counterparts, they are still expected to perform at a similar level throughout their collegiate careers. This research project aims to address this disparity by providing culinary nutrition education specifically tailored to

D3 student-athletes and evaluating its impact on their physical capabilities. By comparing the outcomes of culinary nutrition instruction with academic nutrition education for a similar group of students, the researcher endeavors to shed light on the influence of culinary nutrition education on dietary choices and its potential for positive effects on among D3 athletes.

The author of this research study brings extensive expertise as a Registered Dietitian (RD), certified chef, and Certified Strength and Conditioning Specialist (CSCS) with over 15 years of experience working with Infantry and Special Operations Soldiers in the US Army, as well as professional athletes at the professional and D1 university level. These qualifications will enable the researcher to closely observe the athletes, monitor their training and eating habits, and conduct research in the field alongside them. This approach will foster a close relationship between the researcher and the athletes, creating an atmosphere of trust and comfort that encourages the athletes to discuss their dietary habits and supplement usage. The researcher anticipates that the athletes will benefit from the researcher's knowledge and apply it to enhance their overall health capability.

From a sociological perspective, this study holds significant implications as it seeks to address the social marginalization experienced by D3 athletes who are not competing at higher-caliber D1 universities. By focusing on these athletes and investigating their sports nutrition knowledge, dietary habits, and sources of nutrition information, the research findings are expected to inform an action agenda for reform. The potential transformation in the lives and dietary habits of D3 student-athletes through targeted culinary nutrition education could be profound. “To date, very few studies have exclusively assessed the sports nutrition knowledge of D3 collegiate athletes, their dietary habits, and sources of nutrition information” (Klein et al.,

2021, p. 1). It is worth noting that previous studies in this area have been limited in their exclusive assessment of sports nutrition knowledge, dietary habits, and sources of culinary nutrition information among D3 collegiate athletes. This limitation underscores the pressing need for further investigation to fill this research gap and gain a more comprehensive understanding of the unique nutritional challenges faced by D3 athletes.

Research Questions and Hypotheses

Central Question: How does culinary nutrition education impact the dietary choices and body fat of D3 athletes at Johnson & Wales University in the Northeastern United States?

Sub-question 1: What are the current dietary habits and nutrition knowledge gaps of D3 athletes at Johnson & Wales University?

Sub-question 2: What is the impact of culinary nutrition education on the body composition of D3 athletes at Johnson & Wales University?

Sub-question 3: How do D3 athletes perceive the influence of culinary nutrition education on their overall health?

Methodology

The methodology for this mixed methods research project involves a systematic and comprehensive approach to investigate the influence of culinary nutrition education on the dietary choices and body fat of D3 athletes. Ethical considerations are prioritized, and permission from the Institutional Review Board (IRB) of the participating universities will be obtained to ensure the protection and welfare of the participants. Employing an epistemological case study approach, the researcher will engage with individual players and teams within the selected D3 university, aiming to assess their knowledge of culinary nutrition dietary habits, and sports supplement usage. To ensure a holistic evaluation, the researcher is committed to including an equal number of participants from both male and female sports, facilitating a gender-balanced analysis of sports nutrition knowledge. “Sports nutrition knowledge can be defined as understanding the nutrition-related factors that can affect training, athletic performance, and recovery. This knowledge goes beyond general nutrition knowledge that may fail to acknowledge the special needs of high-performing athletes” (Klein et al., 2021, p. 2).

To gather the preliminary data, participants will receive a pre-conversation questionnaire to assess the athletes' dietary habits, their understanding of macro and micronutrients and their role in athletic performance and recovery, as well as their knowledge and usage of sports supplements. Once the questionnaires are collected, the researcher will proceed to provide tailored nutrition and supplement education to the teams, aligning with the specific exercise and performance requirements of each team. Depending on the athletes' schedules, the researcher will arrange for them to visit the sports science laboratory on campus, either after the initial education or before it, ensuring flexibility and convenience. At the fitness laboratory, the athletes will

undergo a body fat analysis using the Bod Pod, which employs Air Displacement Plethysmograph (ADP) technology. ADP is a means to determine body composition (the ratio of fatty mass to lean mass. (The University of Utah, 2023). This assessment will establish the athletes' baseline percent body fat.

Following the education intervention, the researcher will maintain ongoing engagement with the teams, actively following up with them at their dining halls and training centers to address any lingering questions the athletes may have and to provide additional support as needed. The follow-up assessment comprises two components, the participants will be asked to complete another questionnaire, allowing for an examination of changes in dietary habits over time and the athletes' perception of any differences in weight, since receiving the initial educational intervention. They will also be evaluated via the Bod Pod to determine if there have been any changes in the percent body fat levels or other measures of body composition/.

The data collected from the questionnaires along with the body fat and lean mass analyses will be carefully organized and analyzed. The researcher will employ interpretive techniques to identify repetitive words and phrases commonly used, identifying prominent themes and patterns within the data. The post-education questionnaires will be analyzed to evaluate the extent of benefits derived from the nutrition and supplement education provided. In addition, the information from the pre-and post-body fat analysis tests will be meticulously examined to determine if there are any notable changes. The researcher will employ computer-based data analysis software such as SPSS or ATLAS to facilitate the analytical process (Creswell & Poth, 2018, p.208). After this data collection and analysis period, the researcher will seek to establish meaningful connections between the gathered data and the formulated

hypothesis. Moreover, the data will be scrutinized for any possible contradictions that may have arisen, recognizing the inherent value in these instances as they provide opportunities for deeper insights and nuanced interpretations.

Definition of Terms

1. *Culinary Nutrition* – Culinary Nutrition is "the application of nutrition principles combined with food science knowledge and displayed through a mastery of culinary skills" (Condrasky & Hegler, 2010).
2. *Registered Dietitian* – Dietitians are "food and nutrition experts with a degree from an accredited dietetics program and who completed a supervised practice requirement, passed a national exam, and continue professional development throughout their careers" (Academy of Nutrition and Dietetics, 2023).
3. *Sports Nutrition* – This is the study of nutrition and its application in the sports arena. "Sports nutrition enhances athletic performance by decreasing fatigue and the risk of disease and injury; it also enables athletes to optimize training and recover faster" (Purcell et al., 2013, p. 200).
4. *Ergogenic Aid* – "An ergogenic aid is any training technique, mechanical device, nutritional ingredient or practice, pharmacological method, or psychological technique that can improve exercise performance capacity or enhance training adaptations" (Kersick et al., 2018, p. 2).
5. *Dietary Supplements* – "Dietary supplements are intended to add to or supplement the diet and are different from conventional food. Supplements are ingested and

come in many forms, including tablets, capsules, soft gels, gel caps, powders, bars, gummies, and liquids" (FDA, 2022).

6. *NCAA* – "The National Collegiate Athletic Association is a member-led organization dedicated to the well-being and lifelong success of college athletes" (NCAA, 2023).
7. *Division* – "The NCAA's three divisions were created in 1973 to align like-minded campuses in the areas of philosophy, competition, and opportunity. NCAA schools develop and approve legislation for their own division. Groups of presidents and chancellors lead each division in the form of committees with regularly scheduled meetings" (NCAA, 2023).
8. *Bod Pod* - The Bod Pod is an air displacement plethysmography system that has been widely utilized in sports science research to assess body composition and monitor changes over time (Wells et al., 2020).

Limitations/Delimitations of the Study

This research study, which aims to investigate the influence of culinary nutrition education on the dietary choices and body fat of D3 athletes at Johnson & Wales University, is not without its limitations and delimitations. First, the generalizability of the study findings may be limited. The specific context of Johnson & Wales University and the characteristics of D3 athletes at this institution may restrict the direct applicability of the results to athletes at other universities or different athletic divisions. The sample size and demographic composition of the participants play a significant role in determining the generalizability of the findings, and it is important to recognize the study's limitations in this regard.

Secondly, the reliance on self-reporting through questionnaires and interviews introduces the potential for self-reporting bias. Athletes may provide responses that align with socially desirable expectations or may not accurately recall or report their dietary habits and nutritional knowledge. This self-reporting bias can impact the accuracy and reliability of the data collected, and it is important to consider this limitation when interpreting the study's results. Furthermore, the absence of a control group is a notable delimitation in the study design. While the researcher intends to compare the outcomes of culinary nutrition education with academic nutrition education, the lack of a control group makes it challenging to attribute the observed changes solely to culinary nutrition education. External factors or confounding variables that are not accounted for may influence the results, and the establishment of causality becomes difficult.

Time constraints also pose a limitation to the study. The duration of the research project may restrict the assessment of long-term effects. The researcher's engagement with the athletes and the provision of culinary nutrition education may be limited to a specific period, which may not allow for a comprehensive evaluation of the sustained impact on dietary choices and body fat over an extended timeframe. The researcher's background and expertise as a Registered Dietitian and Certified Strength and Conditioning Specialist may influence the interpretation of the qualitative data, potentially introducing personal bias into the analysis process. It is important to acknowledge this subjectivity and strive for objectivity in the interpretation of the data.

In addition, the study has a limited assessment of nutrition sources. While it focuses on the athletes' nutrition knowledge and dietary habits within the university environment, it may not capture all the sources of nutrition information and support available to the athletes. External nutrition consultants, online resources, or personal experiences outside the university setting may

play a role in shaping the athletes' nutritional practices, and this limitation should be considered when interpreting the findings.

Ethical considerations present both challenges and limitations in the study. While the research project prioritizes ethical considerations and obtains permission from the IRB, ethical dilemmas may arise during the research process. Ensuring the protection and welfare of the participants, maintaining confidentiality and privacy, and navigating potential conflicts of interest can impose practical limitations on the study. This study is conducted within the available resources and capabilities of the researcher and the participating institutions. Limitations in funding, time, personnel, or equipment may restrict the scope and depth of the research, potentially affecting the overall quality and comprehensiveness of the study.

In conclusion, this research study on the influence of culinary nutrition education on D3 athletes' dietary choices and body fat at Johnson & Wales University is subject to several limitations and delimitations. The generalizability of the findings may be limited, self-reporting bias may impact data accuracy, the lack of a control group complicates causal attribution, time constraints restrict long-term assessment, subjective interpretation introduces potential bias, limited assessment of nutrition sources may overlook important factors, and ethical considerations pose.

Assumptions

Assumptions for the above-proposed study on the influence of culinary nutrition education on D3 athletes' dietary choices and body fat at Johnson & Wales University:

Assumption: D3 athletes at Johnson & Wales University have limited access to food, nutritional support, and nutrition education compared to D1 athletes.

Rationale: The study acknowledges the disparity in resources between D3 and D1 athletes, suggesting that D3 athletes may lack the same level of support and education in nutrition.

Assumption: Culinary nutrition education can positively impact the dietary choices of D3 athletes.

Rationale: The study aims to provide tailored culinary nutrition education to D3 athletes and evaluates its potential for positive effects on their dietary choices. This assumption suggests that education can lead to improved nutrition practices among athletes.

Assumption: D3 athletes may have suboptimal nutrition practices, leading to inadequate energy availability and potential health consequences.

Rationale: The study cites existing evidence indicating that collegiate athletes, including those at the D3 level, commonly exhibit suboptimal nutrition practices. This assumption suggests that D3 athletes may be at risk of inadequate energy availability and potential health issues.

Assumption: D3 athletes' body fat can be influenced by their dietary choices and nutritional practices.

Rationale: The study aims to examine the impact of culinary nutrition education on D3 athletes' body fat. This assumption implies that athletes' dietary choices and nutritional practices can affect their physical capabilities.

Assumption: Culinary nutrition education tailored to D3 athletes can improve their overall health.

Rationale: The study suggests that providing culinary nutrition education specifically tailored to D3 athletes can have a positive impact on their overall health. This assumption implies that education can contribute to enhancing athletes' well-being.

Research Organization

For the above-proposed study on the influence of culinary nutrition education on D3 athletes at Johnson & Wales University, the two organizations that will be involved in the research will be Liberty University and Johnson & Wales University. The researcher is currently a doctoral student at Liberty University, and he is also a faculty member at Johnson & Wales University.

CHAPTER TWO:

REVIEW OF THE LITERATURE

The primary objective of this literature review is to establish a robust foundation for comprehending the significance of nutrition knowledge among college athletes, thus justifying the importance of the research project. Within this review, a concise exploration of college athletics will be undertaken, with a particular emphasis on identifying the specific characteristics associated with the target population of college athletes. Additionally, the concept of sports nutrition will be precisely defined, and its relevance within the realm of college athletics will be thoroughly examined. Furthermore, the review will delve into an in-depth understanding of sports nutrition knowledge and its intricate relationship with dietary behaviors. Moreover, a key focus of this research endeavor will be directed towards investigating the theme of culinary nutrition with athletes, as the researcher is intrigued by the potential benefits of incorporating culinary arts education alongside nutrition education to enhance an athlete's athletic potential.

The first theme centers on the importance of sound nutrition for athletic performance, wherein we delve into three distinctive subthemes. The initial subtheme, "Nutrition's Impact on Athletic Performance Enhancement," underscores the crucial role nutrition plays in boosting athletic performance. Here, we explore how appropriate nutrition influences physiological functions, energy production, and recuperative processes. This will allow us to stress the importance of deploying effective nutritional strategies for athletes. The subsequent subtheme, "Detrimental Effects of Inadequate Nutrition for Athletes," aims to expose the negative implications of poor dietary habits on an athlete's performance and overall health. A review of the repercussions of nutrient deficiencies, compromised recovery, and an increased tendency for injuries, will spotlight the necessity of maintaining proper nutrition to support athletic pursuits.

The final subtheme, "Prevalence and Impact of Relative Energy Deficiency in Sports (RED-S) and Eating Disorders (ED) in Athletes," investigates the prevalence and consequences of RED-S and eating disorders within the sports nutrition sphere. Identifying and addressing these conditions is pivotal to safeguarding the long-term health and performance of collegiate athletes.

The second theme, "Challenges Experienced by D3 Athletes in Nutrition Education and Support," addresses three subthemes. The inaugural subtheme investigates the resource inequality between D3 and D1 athletes concerning nutrition education and support. By identifying the constraints faced by D3 athletes, we can underline the necessity for equitable opportunities and resources to enhance their nutritional knowledge and practices. The subsequent subtheme highlights the lack of access to sports dietitians at D3 institutions, accentuating the importance of professional advice and personalized nutritional strategies for athletes. We will examine the hurdles D3 athletes encounter in receiving tailored dietary guidance and propose potential strategies to alleviate this deficiency. The final subtheme explores the consequences of limited nutrition education and support for D3 athletes. By scrutinizing the impediments they face, such as limited time and resources, we can underscore the necessity for customized educational programs that equip D3 athletes to make rational nutritional choices.

Our third theme, "Sports Nutrition Knowledge and Dietary Habits of Collegiate Athletes," consists of three subthemes. The initial subtheme probes into the evaluation of sports nutrition knowledge among collegiate athletes. By assessing the current literature on various assessment tools and methodologies, we can pinpoint gaps and areas for improvement regarding athletes' understanding of sports nutrition concepts. The subsequent subtheme scrutinizes the dietary habits and nutritional practices of collegiate athletes. This exploration will enable us to understand their eating patterns, macronutrient intake, and compliance with recommended

guidelines. Identifying the factors shaping their dietary choices will allow us to develop targeted interventions that foster healthier nutrition practices. The final subtheme explores the sources of nutrition information frequently accessed by collegiate athletes. By assessing the reliability and precision of these sources, such as social media, coaches, and peers, we can discern effective strategies to deliver evidence-based nutrition education to athletes.

Our final theme, "Impact of Culinary Nutrition Education on Dietary Choices and Athletic Performance," explores three subthemes. The inaugural subtheme defines culinary nutrition education, offering a comprehensive insight into its integral components that blend culinary skills with nutrition knowledge. By evaluating the principles of culinary nutrition education, we can gauge its potential to enrich dietary choices and athletic performance. The final subtheme underscores the potential advantages of implementing culinary nutrition education programs for athletes. By emphasizing the development of practical cooking skills, advanced nutrition knowledge, and increased dietary diversity, we aim to explore how culinary education can positively impact athletes' overall health and performance.

Theme 1: Nutrition's Impact on Athletic Performance Enhancement

Subtheme 1.1: Physiological Functions and Energy Production

During exercise, the human body undergoes specific physiological functions to support the increased demands placed on it. These functions are essential for optimal performance and adaptation. One critical aspect of exercise physiology is energy production, which fuels muscular activity and enables individuals to meet the physical demands of exercise.

During exercise, respiration plays a crucial role in supplying oxygen to the working muscles and removing carbon dioxide generated as a byproduct of energy production. The

increased demand for oxygen leads to deeper and more frequent breathing, facilitating gas exchange (Guyton & Hall, 2020). This enables the body to meet the heightened oxygen requirements of exercising muscles. Exercise necessitates enhanced circulation to deliver oxygen and nutrients to the working muscles while removing waste products. The heart rate increases, resulting in a greater volume of blood being pumped per minute. This heightened blood flow ensures efficient oxygen and nutrient delivery to meet the energy demands of the exercising muscles (Tortora & Derrickson, 2017). Exercise triggers metabolic processes to produce the energy required for muscular contraction. As physical activity intensifies, the body primarily relies on carbohydrates as the main energy source. Glycogen, stored in the muscles and liver, is broken down through glycolysis to produce ATP, the energy currency of the body (Berg et al., 2019). Additionally, fat oxidation contributes to energy production during prolonged, lower-intensity exercise.

During moderate-intensity exercise, aerobic respiration dominates as the primary energy-producing mechanism. It involves the breakdown of glucose or glycogen through several steps, including glycolysis, the Krebs cycle, and oxidative phosphorylation, occurring within the mitochondria. Aerobic respiration produces a substantial amount of ATP, which fuels sustained exercise efforts (Tortora & Derrickson, 2017). During high-intensity exercise, the body's demand for ATP exceeds the available oxygen supply. In this case, anaerobic respiration comes into play. Anaerobic glycolysis rapidly breaks down glucose without the need for oxygen, generating ATP and producing lactate as a byproduct. This energy system provides a quick burst of energy but is limited in its capacity (Guyton & Hall, 2020).

During exercise, the body undergoes specific physiological adaptations to support the increased demands placed on it. Respiration and circulation work together to supply oxygen and

nutrients to the working muscles, while metabolism provides the necessary energy for muscular contraction. Energy production occurs through aerobic and anaerobic pathways, depending on exercise intensity. Understanding these fundamental physiological functions and energy production mechanisms during exercise is vital for optimizing performance and enhancing exercise-related outcomes.

In addition to understanding the physiological functions and energy production during exercise, considering the role of specific nutrients is crucial for optimizing athletic performance. Proper nutrition plays a vital role in supporting these physiological processes and ensuring optimal energy production for athletes. Consuming whole food sources rather than relying solely on supplements is paramount to achieving comprehensive and sustainable nutrition for athletes. While supplements may offer convenience and provide certain nutrients, they lack the essential dietary fibers, antioxidants, and phytochemicals found in whole foods. These natural compounds work synergistically to enhance nutrient absorption and contribute to overall health (Health & Nutrition Letter, 2019). Moreover, whole foods offer a diverse array of nutrients, which can be challenging to replicate in isolated supplements. For instance, foods like fruits, vegetables, whole grains, and lean proteins provide a rich blend of vitamins, minerals, and micronutrients that support not only athletic performance but also promote recovery and reduce the risk of injuries. Opting for whole food sources over supplements encourages a balanced diet, ensuring that athletes receive the necessary nutrients in their most bioavailable forms while maintaining a healthy relationship with food. Ultimately, embracing a diet centered around whole food sources can lead to more sustainable and long-term benefits, enabling athletes to perform at their best and attain peak physical and mental well-being.

Carbohydrates, being the primary source of energy for athletes, require special attention in their dietary intake (Tortora & Derrickson, 2017). Carbohydrate intake should be tailored to meet the demands of different sports and training regimens. Athletes may benefit from carbohydrate periodization, strategically adjusting their carbohydrate intake based on training intensity and competition schedules (Smith et al., 2020). This approach optimizes glycogen stores, ensuring a sufficient energy supply during exercise. Protein intake is also essential for athletes as it supports muscle repair and growth (Tortora & Derrickson, 2017). Consuming an adequate amount of protein, especially after exercise, aids in muscle recovery and adaptation. According to The International Society of Sports Nutrition (ISSN) for "building and maintaining muscle mass, an overall daily protein intake of 1.4–2.0 g protein/kg body weight/day (g/kg/d) is sufficient for most exercising individuals, this falls in line within the Acceptable Macronutrient Distribution Range published by the Institute of Medicine" (Jäger et al., 2017). A balanced intake of healthy fats is also important for athletes' overall health and performance, fats play a role in providing energy during endurance activities and supporting hormone production (Berg et al., 2019).

In addition to the main macronutrients, the intake of vitamins and minerals is vital for supporting various physiological functions and energy production during exercise. Micronutrients such as vitamin C, vitamin E, and the B-vitamins play significant roles in energy metabolism, antioxidant defense, and oxygen transport (Berg et al., 2019). B vitamins play a pivotal role as coenzymes in energy metabolism, specifically in three vital processes: glycolysis, beta-oxidation, and the TCA (tricarboxylic acid) cycle. These metabolic pathways are responsible for extracting energy from carbohydrates, fats, and proteins, ultimately producing adenosine triphosphate (ATP), which serves as the primary energy currency for cells. Without

adequate B vitamins, these pathways would not function optimally, compromising energy production.

Glycolysis initiates the breakdown of glucose, the most prevalent carbohydrate, to generate ATP. Within this pathway, specific B vitamins, including thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), and pyridoxine (B6), act as coenzymes that facilitate crucial reactions. They aid in converting glucose into pyruvate, leading to the production of a small amount of ATP and essential reducing equivalents (NADH and FADH2). These reducing equivalents are pivotal for subsequent energy-producing pathways.

In beta-oxidation, fatty acids are broken down into acetyl-CoA, which then enters the TCA cycle for further energy production. Pantothenic acid (B5) is particularly vital as a component of Coenzyme A (CoA), playing a central role in this process. CoA forms an acyl-CoA complex with fatty acids, enabling their step-by-step breakdown into acetyl-CoA, NADH, and FADH2. These molecules are subsequently utilized in ATP production through oxidative phosphorylation.

The TCA cycle, also known as the Krebs cycle or citric acid cycle, stands at the core of cellular respiration. This process occurs in the mitochondria and serves as the final common pathway for the oxidation of carbohydrates, fats, and proteins. B vitamins, including riboflavin (B2), niacin (B3), and pantothenic acid (B5), act as coenzymes for several enzymes in the TCA cycle (Goncalves & Portari, 2021). They play a vital role in facilitating the conversion of acetyl-CoA into carbon dioxide (CO2) and high-energy molecules, NADH, and FADH2. These molecules are instrumental in ATP synthesis during the electron transport chain (Tardy, Pouteau, Marquez, Yilmaz & Scholey, 2020).

B vitamins are indispensable coenzymes in various energy-producing pathways, such as glycolysis, beta-oxidation, and the TCA cycle. They are essential for converting carbohydrates, fats, and proteins into ATP, the primary source of cellular energy. “Adequate supply of each B vitamin is required for appropriate functioning of the energy-production system and a shortfall in any one of them will be rate limiting for energy production, with potentially severe metabolic and health consequences” (Tardy, Pouteau, Marquez, Yilmaz & Scholey, 2020). Ensuring a well-balanced diet with a sufficient intake of B vitamins is crucial for maintaining optimal energy metabolism and overall health.

Iron is crucial for oxygen transport, and deficiency can lead to decreased endurance and performance (Tortora & Derrickson, 2017). Electrolytes play a crucial role in exercise by helping to maintain proper fluid balance and supporting various physiological functions in the body. During physical activity, the body sweats to cool down and regulate its temperature. Sweat contains electrolytes, which are minerals that carry an electrical charge. The primary electrolytes involved in exercise are sodium, potassium, magnesium, calcium, and chloride. Calcium and magnesium contribute to muscle function and bone health, while sodium plays a role in maintaining fluid balance and proper nerve and muscle function (Berg et al., 2019). According to NIH, 2023, “The electrolyte Potassium is primarily responsible for regulating the homeostasis between sodium and potassium, Phosphate plays a crucial role in metabolic pathways. It is a component of many metabolic intermediates and, most importantly, of ATP and nucleotides”.

Considering the impact of nutrition on physiological functions and energy production during exercise, athletes and their support teams should ensure a well-balanced individualized diet that meets their specific needs. Consulting with sports nutrition professionals can provide tailored recommendations based on individual goals and requirements. Optimizing athletic

performance goes beyond understanding the physiological functions and energy production during exercise. Nutrition plays a significant role in supporting these processes and ensuring athletes have the energy and nutrients required for optimal performance. Matching carbohydrate intake, considering protein and fat needs, and addressing the requirements for vitamins and minerals are all vital aspects of a comprehensive nutrition strategy for athletes. By integrating nutrition knowledge into their training regimens, athletes can enhance their performance potential and overall well-being.

In a review article by Iwasa-Madge & Sesbreno (2022), the significance of appropriate nutrition in improving athletes' health and sports performance is emphasized. The authors introduce the Athlete Nutrition Development Approach (ANDA), which presents a comprehensive framework for understanding the determinants of eating behaviors and the effects of dietary intake on health and sports performance. This approach recognizes that nutrition plays a crucial role in enhancing physiological functions and energy production necessary for athletic development (Iwasa-Madge & Sesbreno, 2022).

The first level of ANDA delves into a person's independent nutrition knowledge, considering factors such as socioeconomic and cultural influences, cooking abilities, and motivation for dietary choices. It recognizes that athletes have unique nutritional needs and challenges that require individualized approaches. By understanding an athlete's specific circumstances, the approach aims to provide tailored nutritional guidance to optimize performance and overall well-being. Applying the ANDA framework can enhance athletes' awareness of the impact of nutrition on their physiological functions and energy production during exercise. It promotes a holistic approach that considers not only the macronutrient and micronutrient composition of the diet but also the broader factors influencing food choices. By

addressing the determinants of eating behaviors, such as personal preferences, cultural norms, and access to resources, athletes can develop sustainable and healthy dietary habits that support their athletic goals.

By integrating the principles of ANDA into nutrition strategies, athletes and their support teams can foster a comprehensive understanding of how nutrition influences physiological functions and energy production during exercise. This knowledge empowers athletes to make informed dietary choices that optimize performance, enhance recovery, and promote long-term health. The Athlete Nutrition Development Approach (ANDA) offers a valuable framework for understanding the determinants of eating behaviors and the effects of dietary intake on physiological functions and energy production. By considering individual circumstances and factors influencing food choices, athletes can develop personalized nutrition strategies that support their athletic development and overall well-being.

Subtheme 1.2: Detrimental Effects of Inadequate Nutrition for Athletes

While nutrition plays a crucial role in supporting physiological functions and energy production during exercise, inadequate nutrition can have detrimental effects on athletes' performance and overall well-being. Riviere et al. (2021) highlights the potential problems associated with low energy availability (EA) and Relative Energy Deficiency in Sports (RED-S) that can negatively impact athletes, particularly student-athletes. When athletes do not consume sufficient energy to meet the demands of training and daily activities, their physiological functions are compromised. This can result in inadequate recovery, impaired immune function, hormonal disturbances, decreased endurance, and cognitive impairments. Relative Energy Deficiency in Sports (RED-S) further exacerbates the detrimental effects of low energy

availability on athletes' health and well-being. RED-S occurs when the body's energy intake is insufficient to support the demands of exercise, leading to a range of physiological imbalances (Riviere et al., 2021). Athletes experiencing RED-S may encounter menstrual disturbances, reduced bone mineral density, decreased muscle strength, increased risk of stress fractures, and compromised immune function. These consequences can have long-term implications for athletes' health, performance, and overall quality of life.

Recognizing the prevalence and impact of RED-S and inadequate nutrition is vital within the sports nutrition sphere. It is essential to identify and address these conditions to ensure the long-term health and performance of collegiate athletes. Implementing appropriate interventions and strategies to promote adequate energy intake, optimal nutrient balance, and overall well-being is crucial. Education and awareness programs can play a significant role in addressing inadequate nutrition among athletes. Athletes, coaches, and support staff need to be knowledgeable about the importance of proper nutrition, including energy requirements, macronutrient distribution, and micronutrient needs. By fostering nutrition literacy, athletes can make informed dietary choices that support their physical performance and overall health.

Collaboration with sports nutrition professionals is key in addressing the detrimental effects of inadequate nutrition. These professionals can assess athletes' dietary intake, identify nutritional gaps, and develop personalized nutrition plans to optimize performance and mitigate the risks associated with inadequate nutrition. Working as part of a multidisciplinary team, including coaches, athletic trainers, and psychologists, can provide comprehensive support to athletes, addressing both their physical and mental well-being. By addressing the detrimental effects of inadequate nutrition, implementing appropriate interventions, and promoting

comprehensive nutrition education, athletes can enhance their performance potential, reduce the risk of injuries, support optimal recovery, and safeguard their long-term health and well-being.

Subtheme 1.3: Prevalence and Impact of RED-S and Eating Disorders

To safeguard the long-term health and performance of collegiate athletes, it is imperative to recognize and address the prevalence and ramifications of Relative Energy Deficiency in Sports (RED-S) and disordered eating. This subtheme, explored by Riviere et al. (2021), emphasizes the necessity of acknowledging and tackling these issues within the realm of sports nutrition. It has been found that within NCAA sports “a considerable proportion of athletes, ranging up to 84%, have acknowledged involvement in detrimental eating habits and weight management practices. These behaviors encompass binge eating, excessive physical exertion, rigid dietary restrictions, fasting, self-induced purging, and the utilization of weight loss supplements” (Power et al., 2020).

Gaining an understanding of the prevalence and impact of RED-S and disordered eating is crucial for implementing effective interventions and promoting the well-being of athletes. These conditions can have a profound influence on athletes' health, performance, and overall quality of life. RED-S, resulting from insufficient energy intake to meet exercise demands, can give rise to physiological imbalances, menstrual disturbances, diminished bone mineral density, decreased muscle strength, and compromised immune function. Disordered eating patterns, such as anorexia nervosa and bulimia nervosa, can disrupt nutritional equilibrium, leading to significant nutrient deficiencies, electrolyte imbalances, and organ dysfunction.

By acknowledging the prevalence and consequences of RED-S and disordered eating, appropriate interventions can be put in place to address these challenges. This includes

comprehensive screening processes, early identification, and ensuring access to specialized care. Educating athletes, coaches, and support staff about the indicators, symptoms, and consequences of RED-S and disordered eating is crucial in fostering a supportive and knowledgeable environment. Furthermore, the collaboration between sports nutrition professionals, healthcare providers, coaches, and psychologists is vital in developing holistic treatment plans that address both the physical and psychological aspects of these conditions. By providing appropriate support and resources, athletes can receive the necessary care to overcome these challenges, promote their overall well-being, and reach their full potential.

Theme 2: Challenges Experienced by Division 3 (D3) Athletes

Subtheme 2.1: Resource Inequality in Nutrition Education and Support

Despite the existing knowledge regarding the nutritional habits of collegiate athletes, the bulk of this information stems from studies conducted on athletes within the NCAA DI. Regrettably, our understanding of the nutrition practices within the D3 conference remains limited. It is important to acknowledge that the information obtained from NCAA DI athletes cannot be directly extrapolated to D3 athletes due to the substantial disparities that exist between these two conferences.

According to Hixon et al. (2022), it is crucial to recognize the significant differences between the Division I (D1) and Division III (D3) conferences in terms of funding and regulation of athlete nutrition. The D1 conference generally enjoys greater financial resources and stricter control over providing food to its athletes. In contrast, the provision of food at the D3 conference remains regulated. As a result, it becomes more challenging to ensure structured meals and

snacks for D3 athletes. A study conducted by Randles (2018) also brings attention to the resource inequality between D3 and D1 athletes in terms of nutrition education and support. Smaller colleges with D3 athletic programs often have limited budgets and resources compared to larger institutions with D1 programs. This resource disparity can create significant challenges for D3 athletes who require proper nutrition guidance and support to optimize their performance and overall well-being. Hixson et al. (2022)

To address this issue, it is crucial to recognize the unique needs and circumstances of D3 athletes. While it may not be feasible for D3 institutions to match the resources available at D1 institutions, alternative strategies can be implemented to bridge the gap. One potential solution is to collaborate with local nutrition organizations, fitness centers, or health clinics to provide educational resources and support to D3 athletes. These partnerships could facilitate access to professional guidance, nutritional workshops, and seminars, even if dedicated sports dietitians are not available on campus. Additionally, D3 institutions could explore opportunities for securing grants or sponsorships specifically targeted at enhancing nutrition education and support for their student-athletes. By actively seeking external funding, colleges can allocate resources to improve the overall nutritional knowledge and well-being of their athletes. These efforts could involve establishing nutrition-focused scholarships, developing partnerships with local food vendors to offer discounted healthy meal options, or organizing nutrition-related events and programs.

Moreover, D3 institutions can develop partnerships with local food vendors to offer discounted healthy meal options for athletes. Collaborating with these vendors can ensure that D3 athletes have access to nutritious and affordable food choices. This partnership can also raise awareness about the importance of proper nutrition among food providers, leading to improved

offerings and greater support for athletes. Organizing nutrition-related events and programs within D3 institutions is another strategy to bridge the resource gap. These events can include seminars, cooking demonstrations, and workshops led by nutrition experts. By leveraging the expertise of guest speakers and professionals, D3 institutions can enhance their athletes' knowledge and provide valuable resources without relying solely on internal resources.

By implementing these potential solutions and strategies, D3 institutions can take proactive steps to bridge the resource inequality gap. While it may not be feasible for D3 institutions to match the resources available at D1 institutions, these initiatives can significantly enhance nutrition education and support for D3 athletes. Through collaboration, external funding, partnerships, and targeted events, D3 institutions can ensure that their athletes receive the guidance and resources necessary to optimize their performance and overall well-being.

Subtheme 2.2: Lack of Access to Sports Dietitians at D3 Institutions

The absence of sports dietitians at D3 institutions poses a significant barrier for athletes in receiving professional advice and personalized nutritional strategies. Sports dietitians play a crucial role in assessing athletes' dietary needs, designing individualized meal plans, and monitoring their nutritional intake. Without access to these experts, D3 athletes may struggle to optimize their nutritional practices, potentially hindering their athletic performance and long-term health. A study by Hull et al., (2016) found that with D1 athletes when the sports dietitian "was indicated as the primary nutrition information source, athletes appeared to have a greater understanding of nutrient periodization, were more likely to have school-provided boxed meals while on team trips, and also less likely to consume fast food while on team trips" (p. 1).

To address this challenge, D3 institutions should explore alternative avenues to provide athletes with personalized nutritional guidance. One approach is to leverage technology and digital platforms to offer remote consultations with sports dietitians. By utilizing video conferencing or online communication tools, athletes can connect with experts who can provide tailored advice and guidance regardless of their physical location.

Furthermore, D3 institutions can consider hiring or contracting part-time sports dietitians who can visit the campus periodically to offer consultations and workshops. While it may not be financially feasible to have a full-time dietitian on staff, part-time professionals can still make a significant impact by providing specialized nutrition education and support during their scheduled visits.

Subtheme 2.3: Consequences of Limited Nutrition Education and Support for D3 Athletes

The limited nutrition education and support available to D3 athletes, as highlighted by Randles (2018), can result in significant repercussions. Research conducted by Abbey et al. (2017) explicitly indicates that NCAA DIII football players exhibited dietary habits that may increase their risk of chronic diseases later in life. Furthermore, the study found that the athletes' overall sport nutrition knowledge was lacking and could potentially be improved through increased education. With athletes primarily relying on coaches, the internet, and athletic trainers for nutritional information, it becomes crucial to address the consequences arising from inadequate nutrition education and support for D3 athletes. Factors such as time constraints and limited resources pose challenges that hinder effective prioritization of their nutritional needs.

The consequences of inadequate nutrition education and support for D3 athletes include suboptimal dietary choices, impaired recovery, increased risk of injuries, and compromised

athletic performance. Without proper guidance, athletes may struggle to meet their energy and nutrient requirements, leading to deficiencies or imbalances that can negatively impact their performance and overall health. For example, the lack of knowledge regarding proper hydration strategies and nutrient timing may hinder athletes' ability to optimize their fueling and recovery, leaving them susceptible to fatigue and injuries.

To mitigate these consequences, it is essential to develop customized educational programs that address the specific challenges faced by D3 athletes. These programs should provide practical knowledge and skills that enable athletes to make informed nutritional choices within their constraints. D3 institutions can establish partnerships with local nutrition experts or organizations to develop tailored educational materials, workshops, and resources. These materials should be designed to accommodate the unique circumstances of D3 athletes, emphasizing cost-effectiveness. By providing athletes with accurate and accessible nutrition education, they can develop healthy dietary habits, optimize their performance, and reduce their risk of chronic diseases later in life.

Additionally, fostering a collaborative approach among coaches, athletic trainers, and nutrition professionals is crucial. Coaches and athletic trainers can work in tandem with nutrition experts to reinforce proper nutrition practices and provide consistent support to athletes. This collaborative effort can ensure that athletes receive accurate and evidence-based information, enhancing their nutrition knowledge and promoting long-term health. By addressing the consequences of limited nutrition education and support for D3 athletes through targeted educational programs, partnerships with nutrition experts, and collaboration among the sports team, D3 institutions can empower their athletes to make informed nutritional choices and safeguard their well-being.

Theme 3: Sports Nutrition Knowledge and Dietary Habits of Collegiate Athletes

Subtheme 3.1: Evaluation of Sports Nutrition Knowledge Among Athletes

The evaluation of sports nutrition knowledge among collegiate athletes serves as a crucial foundation, as highlighted in the study conducted by Klein et al. (2021). Assessing athletes' understanding of sports nutrition concepts allows for the identification of gaps and areas that require improvement. This evaluation is instrumental in developing targeted interventions to effectively enhance athletes' knowledge in this critical area. Lambert et al. (2022) conducted an article examining nutrition knowledge and behavior among D1 athletes, revealing that a significant proportion were misinformed about nutrition, had limited dietary variety, and unnecessarily restricted their intake.

To expand upon this subtheme, future research should focus on examining specific domains within sports nutrition knowledge. Studies can investigate athletes' knowledge of macronutrients, micronutrients, hydration, and the timing of nutrient intake. By identifying specific areas of deficiency, researchers can design educational programs tailored to address these knowledge gaps and ensure athletes have a comprehensive understanding of sports nutrition principles.

Additionally, it is crucial to explore potential factors that influence athletes' sports nutrition knowledge. Factors such as educational background, prior exposure to nutrition education, and access to reliable information sources may play a role in shaping athletes' knowledge levels. Understanding these factors can inform the development of interventions that specifically target athletes who may be at a disadvantage in terms of sports nutrition knowledge.

In addressing the disparities in resources between NCAA D1 and D3 athletic programs, it is essential to consider the availability and impact of sports nutrition knowledge and culinary education. DI programs, which typically receive more substantial funding and support, often have access to more comprehensive nutrition education resources. This is evidenced by a study conducted within a D1 institution, which examined the effects of a 15-week culinary-based sports nutrition course on collegiate athletes' dietary intake. The intervention demonstrated significant improvements in the dietary behaviors of athletes, highlighting the beneficial impact of structured nutrition education Riewe (2020).

Contrastingly, D3 athletes often face a starkly different scenario. According to Klein et al. (2021), D3 athletes generally exhibit lower sports nutrition knowledge, which correlates with limited access to nutritional support and educational programs. The study underscores a critical gap in resources, with D3 athletes frequently relying on less credible sources, such as social media, for nutrition information, rather than having the direct support of dietitians or tailored educational programs. This lack of formal education and support can impede their ability to meet dietary needs effectively, potentially affecting athletic performance and overall health.

Moreover, the study by Riviere highlights the rapid growth in the employment of full-time registered dietitians within collegiate athletic departments, primarily within D1 institutions. This trend not only reflects the prioritization of athlete nutrition in these programs but also points to a disparity in nutritional support available to athletes across different divisions. D1 athletes benefit from direct access to dietitians and structured programs that integrate culinary education, thereby enhancing their understanding and application of sports nutrition.

In light of these findings, it becomes evident that while D1 programs are increasingly recognizing and institutionalizing the importance of comprehensive sports nutrition education, D3 programs remain under-resourced in this regard. This disparity underscores the need for policy changes and increased funding towards sports nutrition resources in D3 schools to enhance athletes' dietary habits and sports performance, aligning them more closely with the standards now being set in D1 institutions.

Thus, the inclusion of culinary and nutrition education in D1 settings not only serves as a model for the potential impacts of such programming but also highlights a significant equity issue within collegiate sports. Addressing this imbalance is crucial for leveling the playing field, ensuring that all collegiate athletes, regardless of division, have the nutritional knowledge and support necessary to optimize their health and athletic performance.

Subtheme 3.2: Dietary Habits and Nutritional Practices of Collegiate Athletes

Examining the dietary habits and nutritional practices of collegiate athletes, as investigated by Klein et al. (2021), provides valuable insights into athletes' eating patterns, macronutrient intake, and adherence to recommended guidelines. Understanding the current state of athletes' dietary practices is vital for developing interventions that promote healthier nutrition habits. It has been noted by Riviere et al. (2021) that current observational studies suggest poor sports nutrition knowledge among NCAA collegiate athletes, and they are failing to meet current recommendations.

To further enhance this subtheme, future research should focus on exploring the various factors that influence athletes' dietary choices, including individual preferences, cultural influences, and environmental constraints. Gaining a deeper understanding of these factors will

facilitate the development of targeted interventions aimed at modifying behaviors that may be detrimental to athletes' health. For example, strategies can be implemented to encourage increased consumption of fruits and vegetables, ensure adequate protein intake, and discourage the consumption of unhealthy foods and beverages.

In addition, conducting longitudinal studies can provide valuable insights into changes in athletes' dietary habits over time. By tracking dietary patterns and practices throughout an athlete's collegiate career, researchers can identify critical periods or events that significantly impact dietary behaviors. This information can then be utilized to develop targeted interventions and educational programs that align with the evolving needs of athletes, ensuring that nutritional practices are continuously improved throughout their collegiate journey. This may involve implementing nutrition education programs, providing personalized feedback and guidance, and leveraging technological advancements, such as mobile applications or wearable devices, to support athletes in making informed dietary choices and monitoring their nutritional intake effectively.

By addressing these aspects within future research endeavors, we can comprehensively understand collegiate athletes' dietary habits and nutritional practices. This knowledge will inform evidence-based interventions, educational initiatives, and innovative tools to promote optimal nutrition and foster long-term health and well-being.

Subtheme 3.3: Sources of Nutrition Information Accessed by Athletes

This subtheme centers around the investigation of the sources that collegiate athletes frequently rely on for nutrition information, as studied by Eck & Byrd-Bredbenner (2021). The objective is to evaluate the credibility and accuracy of these sources, which include social media, coaches, and peers. Understanding the specific sources athletes turn to for nutrition information

is essential for effectively delivering evidence-based education. Previous research by Eck & Byrd-Bredbenner (2021) indicates that there has been limited exploration of athletes' dependence on food and health advice from nutrition professionals.

To enhance this subtheme, further research should explore how different sources of information influence athletes' knowledge, attitudes, and behaviors regarding sports nutrition. By assessing the impact of specific sources, researchers can identify the most effective channels for positively shaping athletes' nutritional practices. This valuable information can then be used to develop targeted interventions and educational campaigns that leverage the most reliable and influential sources. Additionally, efforts should be directed toward evaluating the effectiveness of interventions designed to enhance athletes' ability to critically evaluate nutrition information. This may involve equipping athletes with the necessary skills to distinguish evidence-based information from misinformation or pseudoscience. By strengthening athletes' media literacy and critical thinking abilities, they can make well-informed decisions about their nutrition based on credible sources.

By focusing on these aspects, future research will contribute to a comprehensive understanding of the sources of nutrition information accessed by collegiate athletes. This knowledge will inform the development of interventions that promote accurate and reliable nutrition education, empowering athletes to make informed choices that enhance their health and overall well-being.

Theme 4: Impact of Culinary Nutrition Education

Subtheme 4.1: Defining Culinary Nutrition Education

The subtheme revolves around investigating the influence of culinary nutrition education on athletes' dietary choices, as studied by Hull et al. (2012). By assessing methodologies and outcomes, we can gain insights into the impact of culinary education on athletes' overall health, nutritional practices, and body fat. A recent meta-analysis conducted by Asher et al. (2021) highlighted the emergence of culinary nutrition as a promising approach employed by healthcare providers. This approach combines nutrition and culinary arts to enhance the quality of individuals' diets and mitigate the burden of chronic diseases associated with poor dietary choices among adults. Additionally, a study by Jones et al. (2020) illustrated the positive outcomes of a five-week, one-credit-hour culinary nutrition course on college students. These students reported decreased consumption of fast food, increased confidence in vegetable preparation and cooking techniques, greater enjoyment of cooking, improved culinary skills, and an enhanced willingness to cook.

Future research endeavors should prioritize investigating the enduring effects of culinary nutrition education on the dietary habits of athletes. By delving into these long-term effects, researchers can attain a deeper comprehension of the sustainability of culinary nutrition education interventions and their influence on the overall well-being of athletes. Moreover, it is crucial to explore the specific mechanisms through which culinary nutrition education influences dietary choices. This may involve examining psychological factors such as self-efficacy and motivation, which are influenced by culinary education and may contribute to positive changes in athletes' dietary practices. Additionally, investigating the role of culinary nutrition education in fostering a positive food environment and culture within athletic programs can shed light on the broader impact of these interventions.

Subtheme 4.2: Potential Advantages of Implementing an Education Program

This subtheme sheds light on the potential benefits that arise from incorporating culinary nutrition education programs specifically tailored for athletes. By placing emphasis on fostering practical cooking skills, imparting advanced nutrition knowledge, and promoting dietary diversity, culinary education holds tremendous promise in positively influencing overall well-being and potentially reducing body fat in some athletes, as noted by Hull et al. (2012). Furthermore, the utilization of culinary interventions, such as actively engaging individuals in interactive and hands-on cooking classes, has emerged as an innovative and widely embraced approach. Ali et al. (2022) found in their research with students that including partaking in cooking demonstrations and classes was shown to successfully facilitate students' learning of nutritional concepts and enhance their cooking skills for planning and preparing individualized healthy diets. Furthermore, these classes offered a valuable platform for providing effective nutritional care and counseling.

This approach effectively enhances not only the overall quality of dietary intake but also serves as a catalyst for inducing positive behavior modifications towards adopting healthier eating habits and embracing lifestyle choices that promote long-term well-being. Hasan et al. (2019) found that “Although culinary interventions did not demonstrate a significant alteration in cardiometabolic risk factors, they were found to be closely linked with favorable outcomes, such as enhanced attitudes, increased self-efficacy, and a healthier dietary intake, both in adults and children” (p.1).

To expand upon this topic more, future research can investigate the potential economic and logistical benefits of implementing culinary nutrition education programs within athletic programs. This may include assessing cost savings associated with preparing meals from scratch,

reducing reliance on processed foods, and promoting local food systems. Additionally, exploring the scalability and feasibility of implementing culinary education initiatives across different athletic programs and institutions can help identify strategies for widespread adoption. In addition to traditional culinary skills, research should also explore the integration of emerging technologies in culinary nutrition education. This could involve investigating the use of smartphone applications, virtual reality, or gamification to enhance athletes' culinary knowledge and skills. By leveraging technology, practitioners can create innovative and engaging educational experiences that align with the preferences and habits of modern athletes.

Furthermore, studying the impact of culinary nutrition education on athletes' overall well-being is essential. This may involve examining the effects on athletes' mental health, body composition, injury rates, and overall quality of life. By considering these holistic outcomes, researchers can highlight the comprehensive advantages of culinary nutrition education programs for athletes. Research should also investigate how cultural background, dietary preferences, and personal beliefs impact athletes' engagement and receptiveness to culinary education interventions. By acknowledging and incorporating cultural diversity, practitioners can develop inclusive and tailored approaches that resonate with athletes from various backgrounds.

Continued exploration of the subthemes related to the impact of culinary nutrition education on dietary choices and body fat is necessary to fully understand its potential benefits and implications. By continuing to evaluate the principles, methodologies, and outcomes of culinary nutrition education, we can enhance athletes' nutrition practices and overall health.

CHAPTER THREE: RESEARCH DESIGN AND PROCEDURES

Overview

This chapter presents an overview of the research study, which aims to explore the impact of culinary nutrition education on the dietary choices and body fat of D3 athletes at Johnson & Wales University, a small private college in the Northeastern United States. Proper nutrition is crucial for athletes not only to maximize their athletic potential but also to prevent malnutrition and conditions such as ED's and RED-S. RED-S is particularly relevant as it encapsulates the broader spectrum of consequences resulting from insufficient caloric intake relative to the energy expended by athletes, leading to impaired physiological functions that could severely hinder athletic and academic performance. Despite similar expectations for performance throughout their collegiate careers, D3 athletes often face significant disparities in access to food, nutritional support, and education compared to their D1 counterparts. This research thus investigates how tailored culinary nutrition education can mitigate these challenges by enhancing nutritional knowledge and practices among D3 athletes. The chapter outlines the research methodology in detail, providing a comprehensive blueprint that enables the replication of the study while assessing the potential of culinary nutrition education to address RED-S among collegiate athletes effectively.

Design

This research study employs a mixed methods approach, incorporating both qualitative and quantitative components, to comprehensively investigate the influence of culinary nutrition education on the dietary choices and body fat of D3 athletes at Johnson & Wales University. The qualitative component involves the administration use of validated questionnaires such as the

Athlete Food Choice Questionnaire (AFCQ), APPENDIX A, and the Cooking Skills and Food Skills Questionnaire (CS/FS) APPENDIX B. According to Thurecht and Pelly (2021), “The AFCQ captures the unique influences specific to athletes while being broad enough for application across diverse sporting cohorts. This tool could assist sports science professionals in making more informed and effective decisions around strategies to support athletes” (p.1537). These surveys will be distributed to the entire men's and women's basketball teams, comprising a diverse range of athletes who participate in high-intensity physical activities at this University. Additionally, the inclusion of a diverse range of athletes in terms of gender and ethnic backgrounds is of paramount importance for the validity and generalizability of the study's findings. By involving both male and female athletes, the research can capture potential variations in dietary choices and responses to nutrition education interventions based on gender-specific factors, such as physiological differences, social influences, and cultural norms. Similarly, incorporating athletes from different ethnic backgrounds recognizes the potential influence of cultural practices, traditions, and dietary preferences on nutritional behaviors and body fat. This diverse representation ensures a more comprehensive understanding of the impact of culinary nutrition education across various populations, enhancing the external validity and applicability of the study's conclusions to a broader range of athletes.

Through pre- and post-intervention surveys, qualitative data will be collected to delve into the athletes' perspectives, experiences, and attitudes toward nutrition and its impact on body fat. The AFCQ aims to evaluate factors influencing food choices, such as taste preferences, convenience, nutritional knowledge, and social influences. Meanwhile, the CS/FS survey will gauge the athletes' perceptions of the effectiveness and value of the culinary nutrition education program. Per Lavelle et al. (2017), “The CS confidence measure and the FS confidence measure

have been shown to have very satisfactory reliability, and validity and are consistent over time. The user-friendly applicability makes both measures highly suitable for large-scale cross-sectional, longitudinal, and intervention studies" (p. 1). The surveys will be designed and developed following established guidelines to ensure that the data obtained is valid and reliable. Additionally, the quantitative component of the study will involve collecting anthropometric data from all participants using a highly accurate and reliable instrument called the Bod Pod. The Bod Pod is an air displacement plethysmography system that has been widely utilized in sports science research to assess body composition and monitor changes over time (Wells et al., 2020). According to a study by Campa et al. (2021), "body composition is acknowledged as a determinant of athletic health and performance. Its assessment is crucial in evaluating the efficiency of a diet or aspects related to the nutritional status of the athlete" (p. 1).

This data collection will include measurements of height, weight, body fat percentage, and lean body mass. The Bod Pod will be used to determine body fat and lean body mass. To supplement the anthropometric data, a demographic questionnaire (Appendix C) will also be administered. These objective measurements and questionnaire responses will allow for an assessment of the physical changes that might occur because of the culinary nutrition education intervention.

By adopting a mixed methods design, this study aims to capitalize on the strengths of both qualitative and quantitative approaches, ensuring a comprehensive understanding of the complex relationship between culinary nutrition education, dietary choices, and body fat. "Mixed methods research is the type of research in which a researcher or team of researchers combines elements of both qualitative and quantitative research approaches for breadth and depth of understanding and corroboration" (Creswell & Clark, 2018). The integration of qualitative

insights and quantitative measurements will provide a nuanced and holistic perspective on the experiences, perceptions, and physiological changes that occur because of the intervention. Moreover, the mixed methods design allows for triangulation, a process of cross-validating findings from different data sources to enhance the credibility and reliability of the study's conclusions. Triangulation involves the convergence of qualitative and quantitative data to corroborate or complement each other, facilitating a more robust and comprehensive interpretation of the results (Creswell & Creswell, 2020).

In summary, this mixed methods study at Johnson & Wales University employs a qualitative component utilizing surveys to capture the athletes' perspectives and experiences, while a quantitative component involves the collection of anthropometric data using the Bod Pod. By combining these approaches, the research aims to shed light on the impact of culinary nutrition education on the dietary choices and body fat of D3 athletes, providing valuable insights for practitioners, coaches, and educators in the field of sports nutrition.

Research Questions

The research questions for this study are as follows:

Central Question: How does culinary nutrition education impact the dietary choices and body fat of D3 athletes at Johnson & Wales University in the Northeastern United States?

Sub-question 1: What are the current dietary habits and nutrition knowledge gaps of D3 athletes at Johnson & Wales University?

Sub-question 2: What is the impact of culinary nutrition education on the body composition of the D3 athletes at Johnson & Wales University?

Sub-question 3: How do D3 athletes perceive the influence of culinary nutrition education on their overall health and athletic potential?

Setting

The research project will be carried out at Johnson & Wales University, located in Providence, RI. The University was founded in 1914 as a business school but did not become a University until 1988. Both men's and womens sports did not start at the school until the 1995 academic year at the D3 level. The choice to select this as the study location is grounded in the researcher's affiliation with the university, granting convenient access to both the men's and women's basketball teams. Johnson & Wales University is now renowned for its commitment to culinary arts, nutrition, and other healthcare disciplines, offering an exceptional environment for this research endeavor. Notably, the university boasts a state-of-the-art sports science lab that encompasses various advanced facilities, including a Bod Pod specifically designed for the precise collection of anthropometric data. Within Johnson & Wales University's comprehensive organizational structure, key stakeholders such as the campus President, athletic director, coaches, and the basketball teams themselves play integral roles in facilitating and supporting this study.

Participants

For this research investigation, the sample pool will encompass approximately 13 male basketball players and 13 female basketball players at Johnson & Wales University. It is important to note that the exact numbers for the upcoming academic year's teams have not yet

been solidified and may be subject to change. The participants in this study will fall within the age range of 18 to 24 years, representing a diverse mix of Caucasian, Hispanic, and African American athletes. The selection of this sample size and composition is deliberately aimed at providing a representative group of D3 athletes at Johnson & Wales University.

To ensure a purposive sample, athletes will be carefully chosen based on their active participation in the university's basketball teams. This approach allows for the inclusion of individuals who possess the necessary characteristics and experiences relevant to the research objectives. To safeguard the privacy and confidentiality of the participants, pseudonyms will be employed throughout the study to protect their identities and maintain anonymity.

Procedures

The successful implementation of this study necessitates obtaining approval from the Institutional Review Board (IRB) at both Liberty University and Johnson & Wales University to ensure ethical considerations and participant protection. To secure the participation of the basketball athletes, the researcher will collaborate closely with the Athletic Director (AD) at Johnson & Wales University, who will play a pivotal role in facilitating access to the teams. Additionally, the support and cooperation of the basketball team coaches will be enlisted to ensure the smooth implementation of the study.

The planned procedures encompass a comprehensive approach. Initially, pre-education surveys (See appendix A and appendix B) will be administered to gather baseline information from all of the participants. The sample pool for this study will consist of approximately 13 male basketball players and 13 female basketball players at Johnson & Wales University. The exact numbers for the next academic year's teams are still not solidified and may be subject to change. The age range of participants is 18 to 24 years, and there is a mix of Caucasian, Hispanic, and

African American athletes. The sample size and composition were chosen to provide a representative group of Division III athletes at Johnson & Wales University. The sample selection is purposive, with athletes selected based on their participation in the basketball teams. Pseudonyms will be used to protect participant identity.

To deliver the nutrition education component, an engaging PowerPoint presentation (Appendix D) will be developed and conducted for all of the athletes by the research lead, aiming to enhance their knowledge, and understanding of optimal dietary practices. This presentation will cover topics ranging from macronutrients, the timing of meals, hydration, supplements, and other pertinent topics. Ideally, this presentation would be given to both teams at once but depending on schedules the researcher may have to give the presentation to one team at a time. The sports science lab, equipped with cutting-edge facilities, including the Bod Pod, will serve as the site for collecting accurate anthropometric data. The university's organizational structure includes an Athletic Director, coaches, and the basketball teams.

To minimize disruptions to the athletes' academic schedules, the culinary training sessions will be thoughtfully scheduled for Fridays when school is not in session. This arrangement ensures that participants can fully engage in the training sessions without compromising their educational commitments. The culinary training sessions will be provided to 50% of both the male and female teams, the experimental group, or the Yes group, while the other 50% will act as the control group or the No group and will not receive any culinary training. This controlled experimental design aims to evaluate the impact of culinary training intervention as this is the only variable between the control and experimental groups.

The culinary training sessions are aimed at familiarizing the athletes with various techniques and skills employed in professional kitchens. These training sessions will cover a

range of topics, including the craft of culinary arts, proper utilization of kitchen tools, food safety, and sanitation practices, and basic knife skills. The curriculum will introduce the athletes to moist cooking techniques such as boiling, simmering, poaching, steaming, blanching/shocking, and sweating. They will also be introduced to sautéing, baking, and grilling methods. Throughout the training, emphasis will be placed on important aspects such as portion control, ingredient selection, cooking techniques, and flavoring methods, all with a particular focus on nutrition. Per an article by Tani et al. (2020), "A low level of cooking skills was associated with unhealthy dietary behaviors and being underweight" (p.6). By providing athletes with these culinary skills and knowledge, the aim is to enhance their understanding of food preparation, cooking methods, and the importance of nutrition for optimal health. According to an article by Metcalfe & Leonard (2018), "experts agree that cooking skills can present a key barrier to implementing a healthy lifestyle. In American adults, frequent cooking behaviors and self-reported cooking skills are related to increased consumption of fruits and vegetables and improved diet quality" (p. 96). The culinary training sessions will contribute to the overall evaluation of the study's interventions, allowing for a comprehensive analysis of the impact of culinary education on the dietary practices and anthropometric measurements of college basketball players at Johnson & Wales University.

Following a period of approximately three months, with at least three culinary sessions, post-education surveys will be administered to assess the impact of the nutrition education intervention. Additionally, anthropometric data will be collected once again for comparison with the baseline measurements. This will provide valuable insights into the effectiveness of the study's interventions and contribute to a comprehensive understanding of the impact of culinary

training on the dietary practices and anthropometric measurements of college basketball players at Johnson & Wales University.

The Researcher's Role

The researcher will collaborate closely with the Athletic Director (AD) at Johnson & Wales University to secure the participation of the basketball athletes. The AD's support will be instrumental in facilitating access to the teams and ensuring their cooperation throughout the study. Additionally, the researcher will engage the basketball team coaches to ensure the smooth implementation of the study and maximize participant involvement.

The researcher's responsibilities encompass various aspects of the study's procedures. Initially, pre-education surveys will be administered to gather baseline information from the participants. These surveys will provide valuable insights into the athletes' current dietary habits, nutrition knowledge gaps, and perceptions related to nutrition and body fat. To deliver the nutrition education component, the researcher, as an experienced educator, will develop an engaging PowerPoint presentation (Appendix D) aimed at enhancing the athletes' knowledge and understanding of optimal dietary practices. The researcher will ensure the effective delivery of the presentation, addressing key topics such as food selection, cooking techniques, portion control, and nutrition for optimal health. According to Sánchez-Díaz et al. (2020), when nutrition education is implemented alongside regular training routines, these interventions have been proven to be an effective strategy for enhancing or preserving eating habits, nutrition knowledge, and body composition in team sport athletes. The researcher is a trained and certified chef. Using these skills, the researcher will ensure that the culinary training will equip the athletes with practical skills and knowledge to support their dietary choices and optimize their athletic potential. One study by Larose et al. (2022) found that “a nutrition intervention combining

nutrition education and cooking workshops positively influenced nutrition knowledge in football players, but had no short-term impact on dietary intakes, diet quality, and other psychosocial determinants" (p. 880).

The researcher will coordinate with the university's sports science lab, which houses advanced facilities including the Bod Pod, to collect accurate anthropometric data. This data collection will involve measuring height, weight, and body fat percentage using the Bod Pod, a highly reliable instrument for assessing body composition. The researcher will ensure proper protocols and procedures are followed to maintain the accuracy and consistency of the collected anthropometric data. Throughout the study, the researcher will maintain regular communication with the participants, addressing any concerns or questions they may have. The researcher will also oversee the scheduling of the culinary training sessions, ensuring they are thoughtfully arranged to minimize disruptions to the athletes' academic commitments. By providing guidance and support, the researcher will foster an environment conducive to active participation and engagement in the training sessions.

Following the intervention period, the researcher will administer post-education surveys to assess the impact of the nutrition education intervention. These surveys will gather data on the athletes' perceptions of the effectiveness and value of the culinary nutrition education program, as well as their overall health and athletic potential. The researcher will collect this qualitative data to gain insights into the athletes' perspectives, experiences, and attitudes toward nutrition and its impact on their body fat. The researcher will also be responsible for the collection of anthropometric data after the intervention period for comparison with baseline measurements. By conducting these measurements, the researcher will evaluate the physical changes resulting from the culinary nutrition education intervention, providing valuable insights into the impact of the

program on the athletes' body composition. By fulfilling these roles and responsibilities, the researcher will contribute to the successful implementation of the study, enabling a comprehensive exploration of the impact of culinary nutrition education on the dietary choices and body fat of D3 athletes at Johnson & Wales University.

The researcher's role in this study is that of an educator providing nutrition and culinary training. As an Associate Professor in Nutrition at Johnson & Wales University, the researcher has a professional relationship with the participants. It is acknowledged that the researcher may have a bias favoring the experimental group, given the expectation that culinary nutrition education will have a greater impact. To mitigate bias, appropriate measures will be taken to ensure objectivity and adherence to the research design.

Data Collection

The data collection methods for this study will include surveys/questionnaires, anthropometric measurements, and dietary intake analysis using the 3-day food record. These complementary approaches will enable a comprehensive understanding of the participants' dietary choices, nutritional practices, physical characteristics, and actual food intake.

Surveys and questionnaires will be utilized to gather qualitative information regarding the athletes' current dietary habits, nutrition knowledge gaps, perceptions of culinary nutrition education, and their overall health and athletic potential. Validated questionnaires such as the AFCQ and CS/FS Questionnaire will be administered to capture these valuable insights. The surveys will be designed following established guidelines to ensure the validity and reliability of the data obtained.

The 3-day food record is regarded for its detailed portray of an individual's dietary intake, providing a snapshot of eating behaviors and nutritional intake over three consecutive days. This

method involves participants recording all foods and beverages consumed for three days, typically including two weekdays and one weekend day to capture variation in diet that might occur due to changes in routine. The accuracy of this approach largely depends on the participant's ability to accurately record their food intake, including portion sizes, preparation methods, and brand names, which can impact the assessment of their nutritional intake.

One of the primary strengths of the 3-day food record is its approach to obtaining real-time data, as participants record their consumption as it happens. This minimizes reliance on memory and reduces the remembrance commonly associated with other traditional dietary assessment tools, like food frequency questionnaires. However, the accuracy can be compromised if participants alter their normal eating habits due to the self-awareness of being observed. Furthermore, the method's reliance on self-reported data may lead to underreporting or overreporting, particularly in populations.

The 3-day food record was chosen for its detailed assessment capabilities, which are crucial in a study context that demands precise information on nutrient intake. For this research, understanding the nuanced dietary patterns of collegiate athletes was imperative to evaluate the adequacy of their nutritional intake and identify any significant disparities in their diet that could affect overall health. Tthe 3-day food record was employed to gather data that would be instrumental in tailoring nutritional interventions for the athlete population. By analyzing the records, insights into not only the quantity but also the quality of the diet were obtained, allowing for a thorough evaluation of athletes' dietary habits against current sports nutrition guidelines.

Anthropometric measurements will be conducted using precise and reliable instruments such as the Bod Pod, which employs air displacement plethysmography to accurately assess body composition. Measurements including height, weight, body fat percentage, and lean body

mass will provide quantitative data essential for identifying potential cases of RED-S among participants. RED-S, characterized by inadequate energy intake relative to the energy expended, can lead to altered body composition, affecting an athlete's health, recovery, and performance. Understanding these changes is pivotal in evaluating the efficacy of culinary nutrition education intervention in addressing or preventing RED-S. By employing multiple data collection methods, including surveys/questionnaires and anthropometric measurements this study will capture a comprehensive range of information. The integration of the quantitative data and the information coming from the food records will allow for enhanced credibility, reliability, and validity of the study's findings. These diverse data sources will enable a holistic understanding of the complex relationship between culinary nutrition education, dietary choices, and body fat among D3 athletes at Johnson & Wales University.

Surveys/Questionnaires

The qualitative component of this research study involves the administration of validated questionnaires to gather information about the dietary choices and body fat of D3 athletes at Johnson & Wales University. Specifically, two validated questionnaires, the Athlete Food Choice Questionnaire (AFCQ) and the Cooking Skills and Food Skills Questionnaire (CS/FS), will be used to collect data. According to Thurecht and Pelly (2021), the AFCQ is a comprehensive tool that captures the unique influences specific to athletes while being broad enough for application across diverse sporting cohorts. It has the potential to assist sports science professionals in making more informed decisions regarding strategies to support athletes. Similarly, the CS/FS questionnaire, as mentioned by Lavelle et al. (2017), has been shown to have satisfactory reliability, validity, and consistency over time, making it suitable for large-scale studies.

These questionnaires will be distributed to the men's and women's basketball teams at Johnson & Wales University, comprising athletes engaged in high-intensity physical activities. The inclusion of diverse athletes in terms of gender and ethnic backgrounds is essential for the validity and generalizability of the study's findings. By including male and female athletes and athletes from different ethnic backgrounds, the study aims to capture potential variations in dietary choices and responses to nutrition education interventions based on gender-specific factors, social influences, and cultural norms. The utilization of these validated questionnaires will provide valuable insights into the factors influencing athletes' food choices and their perceptions of culinary nutrition education, thus contributing to a comprehensive understanding of the impact of such education on dietary practices and their health.

To complement the quantitative data collected through questionnaires, the 3-day food record will be used as a qualitative tool to capture detailed information on the dietary intake of the athletes. This method involves participants recording all foods and beverages consumed over three consecutive days, including two weekdays and one weekend day, to provide a comprehensive view of their typical diet. This approach allows for the collection of nuanced data on the athletes' eating behaviors, portion sizes, meal timing, and food preparation methods.

The detailed records from the 3-day food log will be analyzed qualitatively to understand the context and choices behind athletes' dietary patterns. This analysis will identify themes such as meal consistency, dietary preferences, and the influence of training schedules on food intake. The qualitative assessment will provide insights into how athletes manage their nutrition in relation to their training and recovery needs, which is critical for tailoring nutrition education programs effectively.

Integrating the qualitative insights from the 3-day food records with the quantitative data from the questionnaires will enrich the study's findings, offering a fuller picture of the athletes' nutritional behaviors and the impacts of the culinary nutrition education program. This mixed-methods approach ensures a comprehensive analysis, enhancing the depth and breadth of the research outcomes. The choice of the 3-day food record is strategic, providing an accurate and real-time portrayal of athletes' dietary habits. This method is particularly effective in sports nutrition research as it captures the variability in athletes' diets that might arise from different training and competition schedules. By examining these detailed dietary records, the study can assess the practical impact of culinary nutrition education on athletes' real-world eating behaviors, thereby providing actionable insights for future program enhancements.

Data Analysis

The data analysis procedures will be determined based on the research design and the nature of the collected data. Qualitative data from surveys/questionnaires and field observations will be analyzed using thematic analysis to identify recurring themes and patterns. For the quantitative data analysis, appropriate statistical methods will be employed to analyze the anthropometric measurements. Descriptive statistics, such as means, standard deviations, and frequencies, will be calculated to summarize the data. Comparative analyses, such as t-tests or analysis of variance (ANOVA), will be used to examine differences in body composition between pre-and post-intervention measurements or between the intervention and control groups. Statistical significance will be determined based on predetermined alpha levels, and effect sizes may also be calculated to assess the practical significance of the findings.

Once both the qualitative and quantitative analyses are completed, a triangulation process will be undertaken to merge and synthesize the findings. This process involves comparing the

qualitative and quantitative data to identify convergent or divergent patterns, relationships, or explanations. By integrating multiple sources of data, the study aims to provide a comprehensive and nuanced understanding of the impact of culinary nutrition education on the dietary choices and body fat of D3 athletes.

In summary, the data analysis for this study will involve both qualitative and quantitative approaches. Thematic analysis will be employed for the qualitative data, while statistical analyses will be conducted for the quantitative data. The integration of these findings through triangulation will enable a comprehensive interpretation of the results, yielding valuable insights into the complex relationship between culinary nutrition education, dietary choices, and body fat among D3 athletes at Johnson & Wales University.

Trustworthiness

To enhance the trustworthiness of this study, several measures will be taken. Credibility will be established by collecting rich and detailed data, conducting member checks, and including direct quotes from participants. Dependability and confirmability will be ensured by thoroughly documenting the research procedures and the context in which they are conducted. Transferability will be addressed by providing a clear description of the study setting and the characteristics of the participants. To further strengthen trustworthiness, data triangulation, prolonged engagement with the participants, and the analysis of negative cases will be employed.

Ethical Considerations

Ethical considerations play a crucial role in this study and will be given due attention. The researcher will obtain approval from the Institutional Review Board (IRB) at both Liberty University and Johnson & Wales University to ensure that ethical guidelines are followed, and participant protection is upheld. Data storage and usage will be handled securely, with

information stored in locked cabinets or password-protected electronic files. Confidentiality will be maintained by using pseudonyms for participants and the institution. Any potential ethical issues that arise will be addressed by adhering to the guidelines provided by the IRB, and participants will provide informed consent before their involvement in the study.

Summary

In summary, this chapter provides an overview of the research design and procedures for a mixed methods study exploring the impact of culinary nutrition education on the dietary choices and body fat of D3 athletes at Johnson & Wales University. The study employs both qualitative and quantitative approaches, utilizing surveys/questionnaires and anthropometric measurements to collect data. The researcher's role is described, highlighting the collaboration with key stakeholders such as the Athletic Director and coaches. The chapter emphasizes the importance of trustworthiness, which is addressed through credibility, dependability, transferability, and confirmability. Ethical considerations are also discussed, including data storage, confidentiality, and adherence to ethical guidelines.

CHAPTER FOUR: FINDINGS

Overview

This dissertation explores the transformative potential of culinary nutrition education on D3 collegiate athletes at Johnson & Wales University. As a unique fusion of my diverse expertise, this study bridges the gap between academic nutrition knowledge and practical culinary skills to enhance dietary behaviors and possibly have benefits towards reducing body fat in athletes who may need it. Emphasizing the critical role of tailored nutrition within athletic development, this research underscores how culinary proficiency can empower athletes with the tools needed for making informed dietary choices that align with their performance goals.

Culinary nutrition education stands at the intersection of theoretical knowledge and hands-on cooking skills, offering a holistic approach to sports nutrition that is often overlooked in traditional athletic training programs. Drawing upon my background as a certified chef, a certified culinary educator, a registered dietitian, and a certified strength and conditioning expert, this study aims to provide a comprehensive analysis of how integrating culinary skills with nutrition science can foster a deeper understanding of food's role in body fat and overall well-being.

Methods

The methodology of this study employs a mixed methods design to capture the multifaceted impact of culinary nutrition education. Ethical considerations were paramount, with all procedures approved by the Institutional Review Board (IRB) of both Liberty University as well as Johnson & Wales University to ensure the welfare of the participants. The qualitative component utilized validated questionnaires to gauge athletes' nutritional knowledge, attitudes toward food, and perceived efficacy of the culinary education program. Quantitatively,

anthropometric data was collected using the Bod Pod, an air displacement plethysmography system renowned for its accuracy in assessing body composition. Both qualitative and quantitative aspects were analyzed using the R Project for Statistical Computing.

R Project for Statistical Computing is a robust framework for statistical computing, which not only encompasses a broad spectrum of statistical methods—including linear and nonlinear modeling, classical statistical tests, and techniques for time-series analysis, classification, and clustering—but also offers unparalleled graphical capabilities (R Core Team, 2021). The initial phase of the analysis, open coding, was conducted within a dedicated R notebook. This process involved a line-by-line examination of the textual data, during which initial codes were generated to label significant phrases, patterns, and emerging ideas relevant to the study's objectives. Employing R for both qualitative and quantitative data analysis in this study highlights the flexibility and robustness of the software. By utilizing R in our qualitative analysis, we have demonstrated its capability to support rigorous, transparent, and innovative approaches to data analysis, thereby enhancing the validity and reliability of our findings.

As a certified strength and conditioning expert, I meticulously planned the intervention to align with the athletes' training schedules, ensuring that the culinary sessions were not only informative but also practically applicable to their dietary needs and performance objectives. The hands-on culinary sessions were designed to enhance the athletes' cooking skills, food safety knowledge, and ability to prepare nutritionally balanced meals, reflecting my expertise as a registered dietitian and certified chef.

To ensure a comprehensive understanding of the study's impact, both pre-and post-intervention surveys were conducted, coupled with initial and follow-up body composition assessments. This methodological approach allowed for a detailed exploration of the educational

program's effectiveness, informed by my multifaceted expertise in nutrition, culinary arts, and athletic training.

Research Question(s)

Central Question: How does culinary nutrition education impact the dietary choices and body fat of D3 athletes at Johnson & Wales University in the Northeastern United States?

Sub-question 1: What are the current dietary habits and nutrition knowledge gaps of D3 athletes at Johnson & Wales University?

Sub-question 2: What is the impact of culinary nutrition education on the body composition of D3 athletes at Johnson & Wales University?

Sub-question 3: How do D3 athletes perceive the influence of culinary nutrition education on their overall health?

Participants

The study participants comprised a purposeful sample of 26 male and female D3 collegiate basketball players aged 18-24 years from Johnson & Wales University. Participants were selected based on their active engagement in the university's basketball program, ensuring a diverse representation of athletic experiences and dietary habits. Inclusion criteria included full-time enrollment at the university, active participation in the basketball program, and consent to participate in both the culinary nutrition education program and all study-related assessments. These athletes represented diverse ethnic backgrounds, including Caucasian, Hispanic, and African American. Selection for the study was intentionally based on their active roles within the university’s basketball teams, aiming to capture a broad and representative sample of D3

athletes. These two teams were chosen because their season aligned with the timing of this research project and both teams (male and female) reflect a broad range of dietary habits, athletic experiences, and cultural influences, adding depth to the investigation of how culinary nutrition education impacts an athlete's dietary decisions and body composition. Focusing on this specific group of athletes allows the study to explore the complex effects of nutrition education within the collegiate athletic environment.

By examining this diverse cohort, the study not only seeks to evaluate the overall efficacy of the educational intervention but also to understand how such programs can be adapted to suit the varied nutritional needs and preferences of athletes from different backgrounds. This nuanced approach ensures that the findings can inform more personalized and effective nutrition strategies, contributing to the optimization of body fat and health across the broad spectrum of collegiate sports.

In this study, participants were divided into two distinct groups to assess the impact of culinary nutrition education comprehensively. As delineated in Chapter 3, the experimental group, also referred to as the 'Yes group,' comprised 50% of both male and female athletes. This group received targeted culinary training sessions designed to enhance their nutritional knowledge and practical cooking skills. The remaining 50% of athletes, constituting the control group or the 'No group,' did not receive any culinary training. This bifurcation enabled a comparative analysis of dietary behaviors and body composition changes between athletes who underwent the culinary nutrition education program and those who did not.

Results

Body Fat Percentage (BF%) Changes

Analyzing the body composition of the male athletes involved in the study, we observed a notable trend within the group that participated in the culinary education (Yes group). Per R Core Team (2021), as seen in Figure 1 below, this group showed a range of changes in Body Fat Percentage (BF%), from a decrease of 1.0% to an increase of 0.8%. Such variability indicates a general trend towards improved body composition, presumably influenced by the dietary changes encouraged by the culinary class.

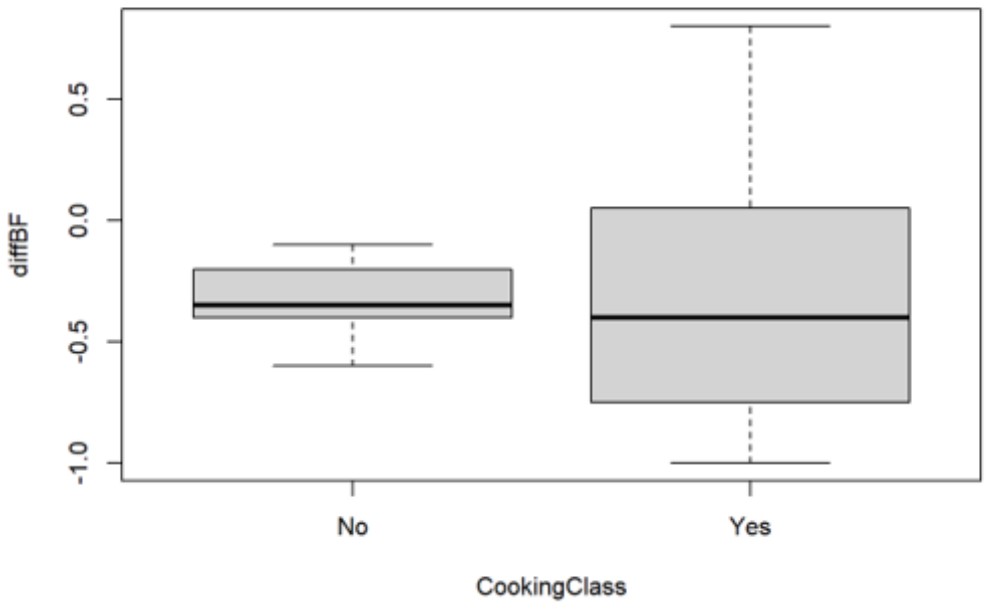

Figure 1: Boxplot of male difference in body fat. From R Core Team (2021)

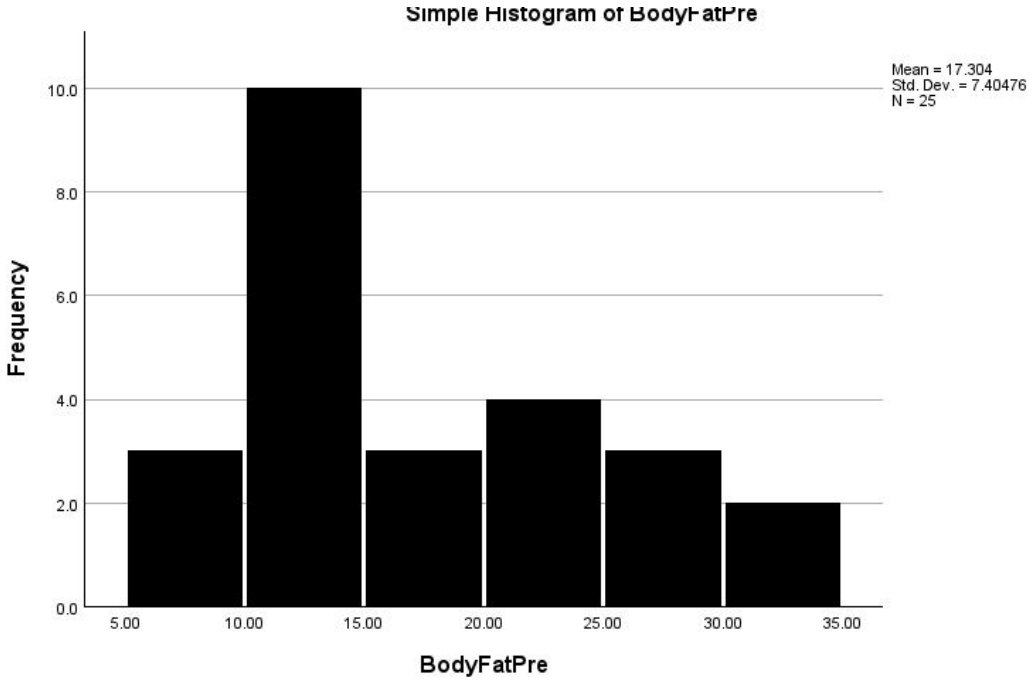

Figure 2: Histogram of body fat of all athletes pre-culinary class. From Field (Version 29).

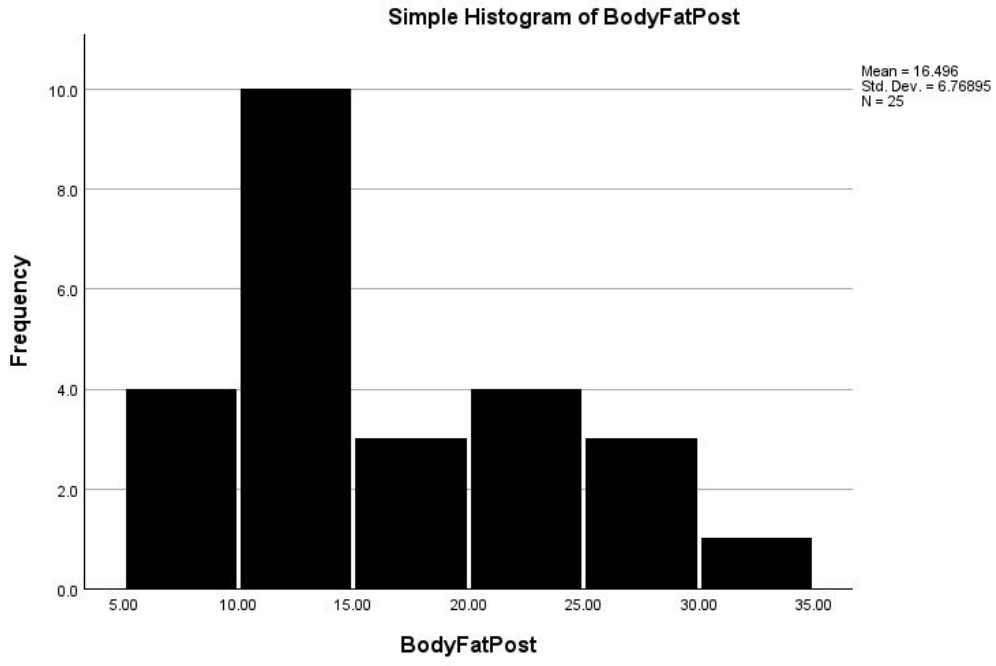

Figure 3: Histogram of body fat of all athletes post culinary class. From SPSS (Version 29).

The histograms above, which were created in IBM SPSS Statistics (Version 29), provide a visual representation of the body fat percentages before and after the intervention. The pre-intervention histogram (Figure 1) shows a distribution of BF%'s before the culinary education, while the post-intervention histogram (Figure 2) illustrates the distribution after the intervention. These histograms highlight the individual variability in response to culinary nutrition intervention.

In addition to the histograms, a paired samples T-test per SPSS Version 29 was conducted to compare the pre-and post-intervention BF%'s in the trained group. The results from SPSS showed a statistically significant decrease in body fat percentage ($t(12) = 2.300$, $p = .040$), indicating that the intervention had a positive impact on reducing body fat among participants.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	BodyFatPre	17.3040	25	7.40476	1.48095
	BodyFatPost	16.4960	25	6.76895	1.35379

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	BodyFatPre & BodyFatPost	25	.987	<.001	<.001

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	BodyFatPre - BodyFatPost	.80800	1.29965	.25993	.27153	1.34447	3.109	24	.002	.005

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	Upper
Pair 1	BodyFatPre - BodyFatPost	Cohen's d	1.29965	.622	.187	1.046
		Hedges' correction	1.34211	.602	.181	1.012

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Figure 4: Paired Samples Test. From SPSS (Version 29).

Per SPSS Version 29, the mean BF% decreased from 16.6615 to 15.7769 post-training, coupled with a reduction in standard deviation, underscoring the program's efficacy. The high correlation (.989) between pre- and post-measures suggests consistent measurement and significant individual response to the intervention. The Cohen's d value of 9.2752 indicates a very large effect size, which is substantial in practical terms. This suggests that culinary nutrition education not only had a statistically significant effect but was also highly effective in practical application.

The ANOVA results below from SPSS Version 29 further confirmed the impact of the intervention, showing significant between-subjects effects for the CulinaryTrainingGroup ($F(1, 23) = 139.355$, $p < .001$, partial $\eta^2 = .858$). This indicates a strong effect of the training on body fat changes. The control group showed no significant changes, which emphasizes the specific impact of the culinary nutrition intervention.

Tests of Between-Subjects Effects

Dependent Variable: BodyFatPre

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	19.843[a]	1	19.843	.352	.559
Intercept	7470.032	1	7470.032	132.561	<.001
CulinaryGroup	19.843	1	19.843	.352	.559
Error	1296.086	23	56.352		
Total	8801.640	25			
Corrected Total	1315.930	24			

a. R Squared = .015 (Adjusted R Squared = -.028)

Figure 5: ANOVA results, BodyfatPre. From SPSS (Version 29).

Tests of Between-Subjects Effects

Dependent Variable: BodyFatPost

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	22.010[a]	1	22.010	.470	.500
Intercept	6797.503	1	6797.503	145.079	<.001
CulinaryGroup	22.010	1	22.010	.470	.500
Error	1077.639	23	46.854		
Total	7902.600	25			
Corrected Total	1099.650	24			

a. R Squared = .020 (Adjusted R Squared = -.023)

Figure 6: ANOVA results, BodyfatPost. From SPSS (Version 29).

To further elucidate the effects of culinary nutrition education on male athletes' body composition, histograms of the difference in BF%'s for those who participated in the program (Yes group), Figure 7 below, versus those who did not (No group), Figure 8 below. The histogram for the Yes group reveals a distribution of BF% changes that span both reductions and slight increases, highlighting the individual variability in response to the culinary nutrition intervention. This variability suggests that while the program had a generally positive direction toward improved body composition, the extent of change is influenced by individual factors and dietary adherence as well as the overall short study length. In contrast, the histogram for the No group would presumably illustrate less variation and fewer instances of body fat reduction, underscoring the potential value of culinary education in fostering more favorable body composition changes. Although the statistical analysis, with a p-value of 0.4236, per R Core Team (2021), did not indicate statistical significance, the visual comparison provided by these histograms adds a layer of understanding to the quantitative results. It suggests that culinary nutrition education may have a nuanced but potentially impactful role in influencing body

composition changes among male collegiate athletes, warranting further investigation with larger sample sizes or additional contextual factors considered.

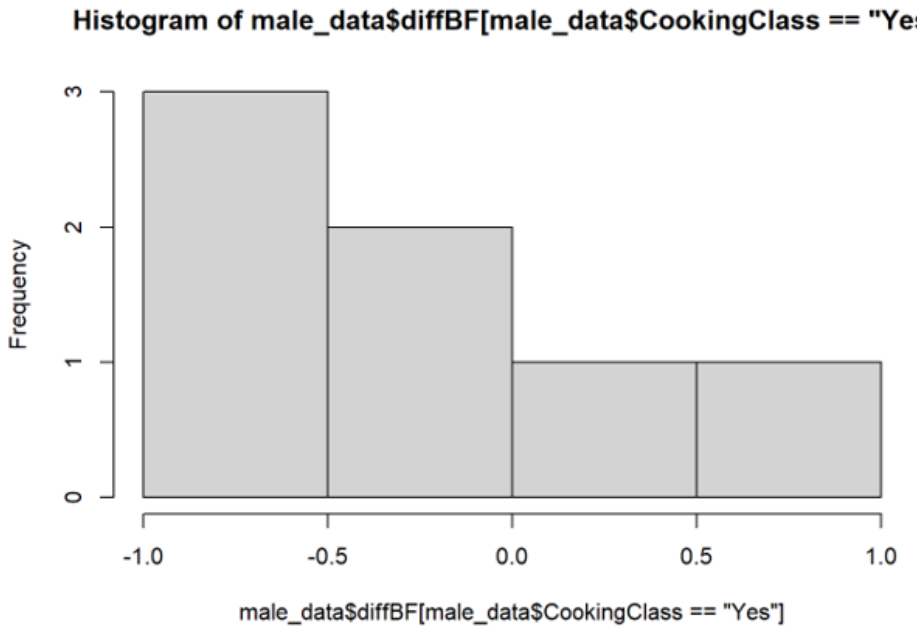

Figure 7: Histogram of male difference in body fat, Yes Group. From R Core Team (2021)

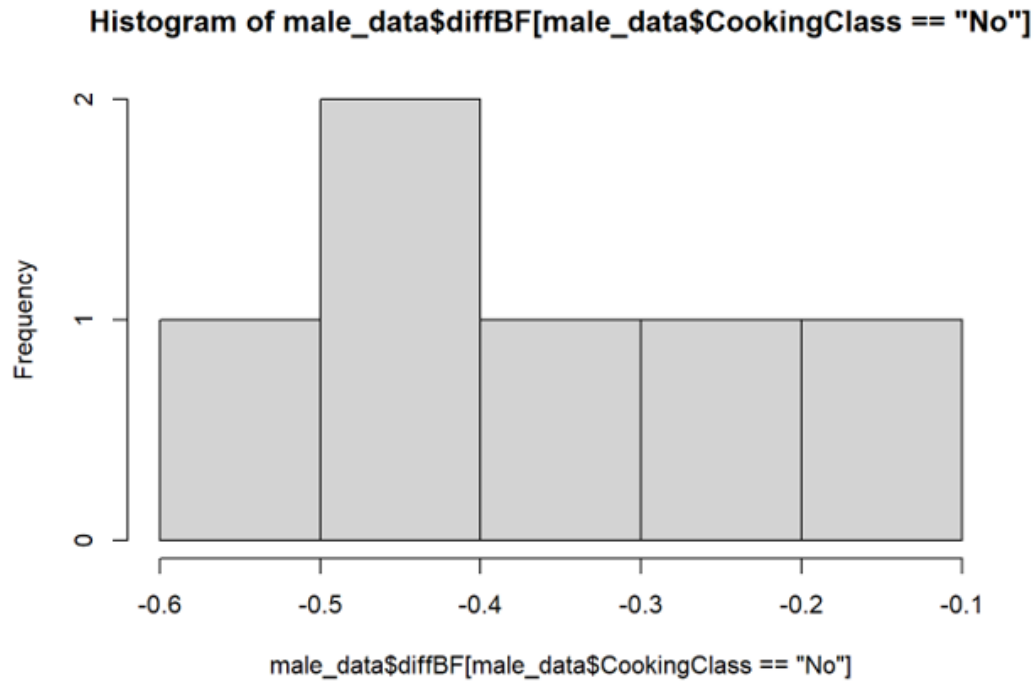

Figure 8: Histogram of male difference in body fat, No Group. From R Core Team (2021)

In contrast, the female athletes' response to culinary education showed a more nuanced outcome as seen in Figure 9 below. Unlike their male counterparts, there was no clear difference in BF% changes between those who participated in the culinary classes (Yes group) and those who did not (No group). The proportion of athletes showing body composition improvements within the Yes group, however, suggests a beneficial impact of the intervention, with a p-value of 0.4381 (Wilcoxon rank sum exact test), per R Core Team (2021). However, these findings did not reach statistical significance. This subtle yet indicative trend among female athletes points toward the potential benefits of dietary education and modification, reinforcing the need for further investigation into gender-specific responses to nutritional interventions.

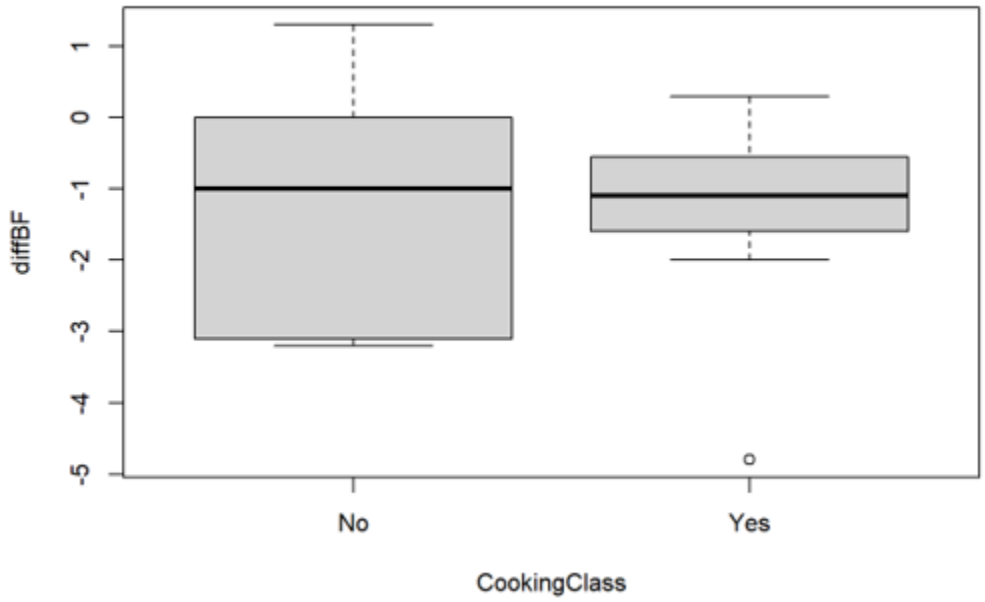

Figure 9: Boxplot of female difference in body fat. From R Core Team (2021)

The examination of female athletes' body composition changes through histograms for the Yes and No groups of culinary nutrition education provides a deeper insight into the gender-specific impacts of the intervention. The histograms for the Yes group, as seen in Figure 10 below, depict a range of changes in BF%, illustrating the variability in individual responses to the program, much like their male counterparts. However, the distribution in the No group, as seen in Figure 11 below, similarly shows a broad range of changes, highlighting that the intervention's impact may be more subtle among female athletes. Despite the lack of statistically significant differences, as indicated by a p-value of 0.4381, per R Core Team (2021), (Wilcoxon rank sum exact test), the histograms visually suggest that some female athletes in the Yes group experienced beneficial changes in body composition. This observation underscores the importance of tailored nutritional education and the potential for specific dietary strategies to influence body composition positively. The nuanced outcomes revealed by these histograms call attention to the complex interplay of diet, education, and gender in body fat and health, advocating for a more personalized approach in future research and program design to maximize the benefits of culinary nutrition education among female athletes.

In the examination of body composition changes among our athletes, distinct patterns emerged that highlight the nuanced impact of culinary nutrition education. Among the 13 male athletes participating in the experimental group, an intriguing phenomenon was observed: 3 athletes successfully reduced their body fat percentage while simultaneously increasing their overall weight, a strong indicator of muscle mass gain. This outcome was notably absent in the control group, where none of the 6 participants exhibited similar results. This suggests a targeted

impact of the nutritional intervention on not just fat loss but on fostering muscle mass accretion as well, underscoring the program's potential in enhancing athletic body composition.

In contrast, the female cohort presented a slightly different pattern of response to the intervention. Within the experimental group comprising 6 athletes, 2 managed to maintain their weight while achieving a reduction in body fat percentage, thereby indicating a gain in muscle mass. Remarkably, a similar outcome was noted in 1 out of the 7 athletes in the control group, suggesting that factors beyond culinary nutrition education may also influence body composition changes in female athletes.

These observations provide compelling evidence of the gender-specific responses to the intervention, with the male athletes demonstrating a clear advantage from the culinary nutrition education in terms of body composition optimization. The variance in response between genders and between experimental and control groups underscores the complexity of dietary impacts on body fat and highlights the critical role of tailored nutrition strategies in achieving optimal body

composition outcomes.

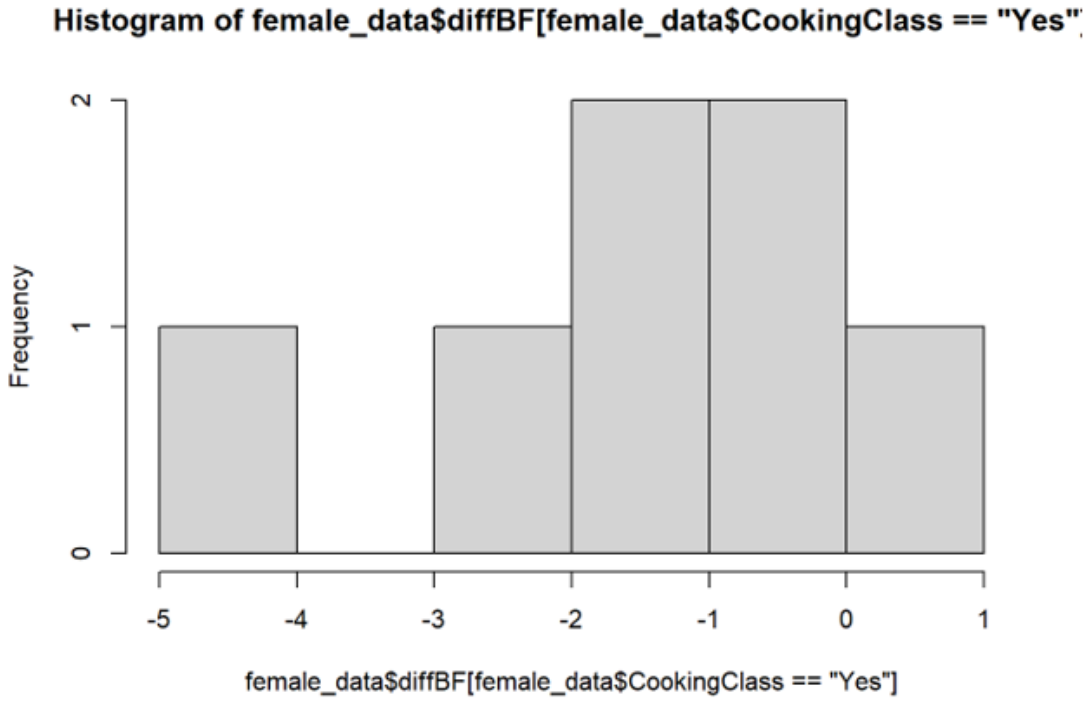

Figure 10: Histogram of female difference in body fat, Yes Group. From R Core Team (2021)

Figure 11: Histogram of female difference in body fat, No Group. From R Core Team (2021)

Questionnaire Findings

Per R Core Team (2021), for the male athletes, there was a significant improvement in the AFCQ scores for the Yes group, with a notable p-value indicating that the culinary nutrition education positively impacted athletes' food choice behaviors. Per R Core Team (2021), female athletes showed no significant improvement in AFCQ scores observed post-intervention. The proportion of athletes showing improvement was similar across groups, suggesting that the intervention's impact on dietary choices may require further exploration, particularly concerning duration and intensity. Per R Core Team (2021), the male participants in the Yes group demonstrated significant enhancements in cooking and food skills post-intervention, as evidenced by higher scores on the CS/FS questionnaire compared to the No group, as seen in Figure 12 below. Per R Core Team (2021), for the female participants, the intervention did not lead to a statistically significant improvement in cooking and food skills among them paralleling the findings from the AFCQ analysis. as seen below in Figure 13.

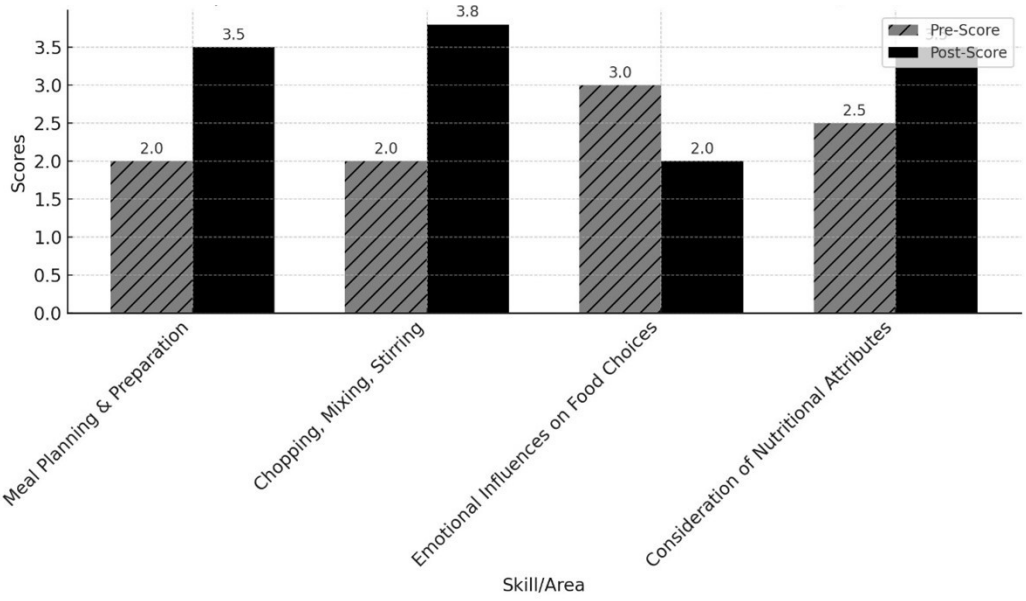

Figure 12: Changes in Male Culinary Skills. From R Core Team (2021)

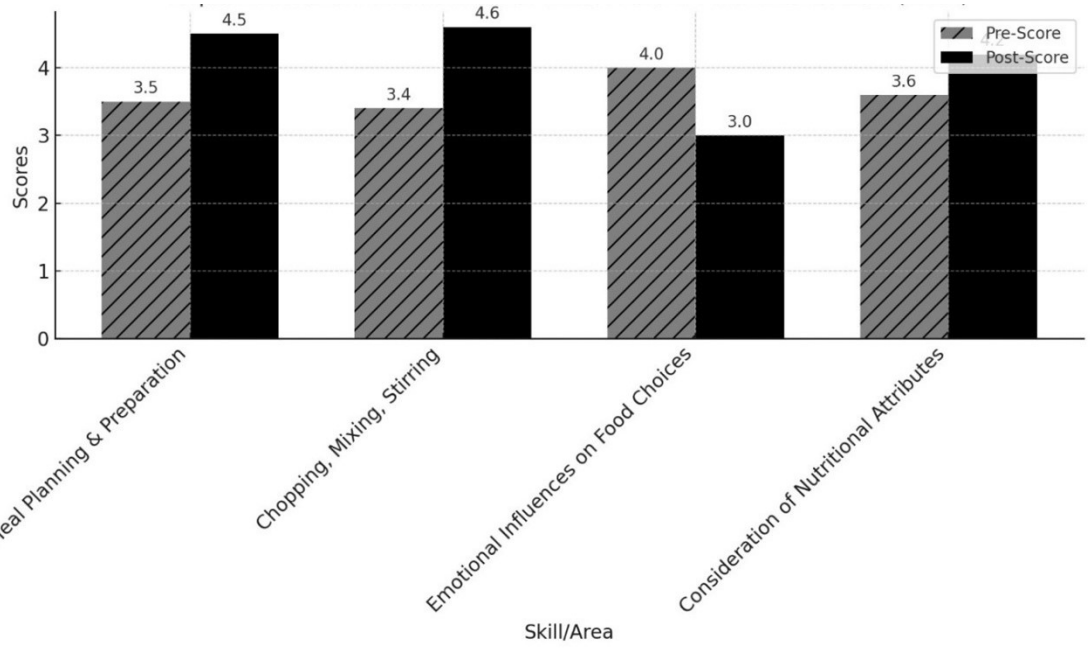

Figure 13: Changes in Female Culinary Skills. From R Core Team (2021)

The analysis of the Athlete Food Choice Questionnaire (AFCQ) and Cooking Skills/Food Skills (CS/FS) surveys utilizing R Core Team (2021), has unveiled significant insights into the effectiveness of the culinary nutrition education program, providing a nuanced understanding of its impact on collegiate athletes. This comprehensive examination not only highlights specific areas of improvement but also suggests the potential for culinary nutrition education to enhance body fat and dietary choices significantly.

At the core of these findings is the revelation of a strong correlation between improvements in AFCQ and CS/FS scores and positive changes in dietary choices and body fat, evidenced by a P-value of 0.005, per R Core Team (2021). This suggests that the integration of culinary nutrition education into athletes' training regimens offers comprehensive benefits, extending beyond the kitchen into their overall health and performance. Such a correlation underscores the holistic impact of combining theoretical nutrition knowledge with practical culinary skills, advocating for a more integrated approach to athlete development.

Interestingly, the analysis brought to light gender-specific differences in the intervention's impact, particularly in nutritional attributes, with a notable P-value of 0.01, per R Core Team (2021). This distinction suggests that the program resonated differently with male and female athletes, potentially indicating the need for tailored approaches to maximize the educational impact across genders. This finding is critical for future program designs, emphasizing the importance of considering gender nuances in nutritional education to ensure effectiveness for all participants.

One of the most significant areas of improvement was observed in meal planning and preparation, where per R Core Team (2021), athletes demonstrated a marked increase in their ability to plan and prepare meals, as indicated by a P-value of 0.04. This points to the program's

success in instilling confidence and capability in food preparation among athletes, an essential skill for maintaining a healthy diet. Moreover, the program proved effective in enhancing specific cooking skills, notably in "Chopping, mixing, and stirring foods," with a P-value of 0.02 according to R Core Team (2021). This improvement highlights the practical benefits of the education provided, equipping athletes with the hands-on skills necessary for cooking and food preparation. Such improvements in cooking skills are fundamental for athletes to apply their nutritional knowledge practically, making informed food choices that align with their health and performance goals. Additionally, per R Core Team (2021) a reduction in emotional influences on food choices was noted, with a P-value of 0.03. This finding suggests a shift towards more rational and health-focused dietary decisions post-program, indicating the program's role in fostering a more mindful approach to eating among athletes. Lastly, per R Core Team (2021), athletes showed a marked improvement in their consideration of the nutritional attributes of foods post-intervention, evidenced by a P-value of 0.05. This indicates a heightened awareness and appreciation of nutrition's role in their overall health and performance, further illustrating the program's effectiveness in enhancing nutritional knowledge and its application.

In conclusion, the detailed analysis of the AFCQ and CS/FS surveys has provided valuable insights into the specific improvements and comprehensive impact of the culinary nutrition education program on collegiate athletes. These findings not only enrich our understanding of the program's effectiveness but also lay the groundwork for future research directions, suggesting a promising path towards integrating culinary nutrition education more deeply into athletic training programs.

Food Record Results

The nutritional habits of D3 collegiate athletes have long stood as a significant concern within the sports nutrition and dietetics community. Initial assessments via three-day food records unveiled a concerning scenario: a diet predominately filled with processed foods and sugary snacks. Notably, fewer than 20% of athletes met the daily recommended intake of five servings of fruits and vegetables (R Core Team, 2021), highlighting a critical gap in dietary adequacy. Additionally, per R Core Team (2021), it was found that 69% of the male athletes' initial food diary assessments, when nutritionally analyzed, did not meet their current caloric intake needs. The deficit of these players ranged from as little as 400 calories to as high as 800 calories.

The opposite was true for the female athletes, per R Core Team (2021) 38% of these players were consuming more calories than they needed. While looking at the food records it was noted that the players were consuming a lot of meals at pizza places and Chipotle restaurants. All of the girls that were getting Chipotle added extra guacamole and chips to their meals. Further, the median pre-intervention BF% for female athletes was noted at 22.7%, alongside an average weight of 154.8 lbs (R Core Team, 2021), suggesting how detrimental eating patterns could be affecting athletes' body composition. It was also found that in these initial food records, around 30% of the female athletes revealed frequent meal skipping at some point throughout the day either due to class schedule or not feeling hungry early in the morning.

The dietary patterns observed among these athletes, are characterized by a reliance on processed foods and frequent visits to fast-food outlets near campus like Starbucks, Dunkin Donuts, and various quick-service local restaurants offering pizza, burgers and French fries, ramen, and Korean fried chicken, pose substantial risks. Such dietary habits, far from ideal,

threaten the health of these individuals. The rigorous demands of their training and academic schedules severely limit their opportunities for careful meal planning and the adoption of nutritious eating habits. The study "College Students and Eating Habits: A Study Using An Ecological Model for Healthy Behavior" by Sogari et al. (2018) highlights several factors exacerbating these dietary challenges, including time constraints, a tendency towards unhealthy snacking, the lure of convenient high-calorie foods, stress, the elevated cost of healthier food options, and the pervasive availability of junk food. To address these pressing dietary deficiencies, our study embarked on implementing a culinary nutrition education program aimed at equipping athletes with the knowledge and practical skills necessary to navigate and enhance their dietary choices effectively.

Adding to this narrative, practical nutrition strategies from recent literature underscore the importance of optimizing glycogen stores before tournaments through carbohydrate loading, ensuring adequate hydration, and focusing on recovery nutrition post-competition. Specifically, the review by Esen et al. (2022) provides a detailed framework for nutritional preparation and recovery around game days, emphasizing carbohydrate intake, protein distribution for muscle repair, and strategic hydration practices to support performance and facilitate recovery. For instance, basketball players are reported to cover 5–6 km which is a considerable energy expenditure during a game, requiring both aerobic and anaerobic energy sources, with carbohydrates serving as the primary fuel (Esen et al., 2022).

Moreover, the review highlights the use of evidence-based sports foods and supplements, such as caffeine, bicarbonate, and nitrate/beetroot juice, which may enhance performance through improved muscle contractility, exercise efficiency, and cognitive functions.

Incorporating these insights into the dietary strategies of D3 athletes could significantly bolster their performance during high-intensity activities inherent to basketball games.

In response to these insights, our culinary nutrition education program emphasized the importance of a balanced intake of macronutrients, strategic meal timing, and hydration management. The program also introduced athletes to evidence-based supplements and foods that align with their specific physiological needs and competition schedules. This comprehensive approach not only fosters an environment where healthy eating becomes both a priority and a possibility but also aligns with current sports nutrition guidelines to support optimal performance in high-stakes environments.

Culinary Training's Promising Outcomes

Athletes who participated in the culinary training exhibited encouraging signs of dietary improvement after this intervention concluded. Post-intervention food records per R Core Team (2021), observed a 15% increase in the intake of fruits, vegetables, and lean proteins, and an increase in healthy (higher fiber) carbohydrate intake to support their long practices and games. These modest adjustments mark a pivotal departure from previous dietary patterns, underscoring the potential of culinary nutrition education in fostering better food choices. Yet, the path to nutritional excellence for these athletes remains laden with challenges. Many, especially those residing off-campus, confront financial barriers that make sustaining these improved dietary habits difficult. The perception of healthy foods as inherently more expensive further complicates their nutritional endeavors. Moreover, athletes living in dormitories and reliant on school dining options face a shortage of nutritious choices, highlighting a significant institutional challenge that needs immediate redress.

RED-S

An integral aspect of this study was the investigation of the syndrome known as RED-S among these athletes. This syndrome spans athletes of all genders and levels, leading to a range of negative outcomes on health and performance. This study identified possible RED-S symptoms in several of the female athletes. Approximately 30% of them were experiencing under-fueling, evidenced by admitting on their food records that they regularly skip meals and by a significant reduction in BF%—averaging a decrease of -2.5%. This data is emblematic of the broader issue of energy deficiency within this group (R Core Team, 2021).

To combat RED-S and its ramifications, a multifaceted approach is essential, starting with the expansion of healthy food selections within school dining facilities. Collaborative initiatives among nutrition experts, culinary teams, and academic administrators play a critical role in diversifying available meal options to encompass a broad spectrum of nutritious, performance-supporting foods. Our findings reveal a strong preference among athletes, with 70% expressing a desire for increased access to “Whether the food is wholefood” which was described as fresh fruits and vegetables and lean proteins (R Core Team, 2021). This preference underscores the athletes' commitment to improving their dietary patterns, provided they have the means to do so.

However, the aspiration for healthier dietary choices is often thwarted by financial constraints. A significant portion of the athletes surveyed, 60%, reported budgetary limitations as a primary obstacle in accessing nutritious foods (R Core Team, 2021), as seen in Figure 14 below. The other 40% of students noted that healthier food choices in the dining hall, (R Core Team, 2021) was their limiting factor. This emphasizes the need for broader strategies that

address both the availability and affordability of healthy food options, ensuring that all athletes have the resources necessary to meet their athletic dietary needs.

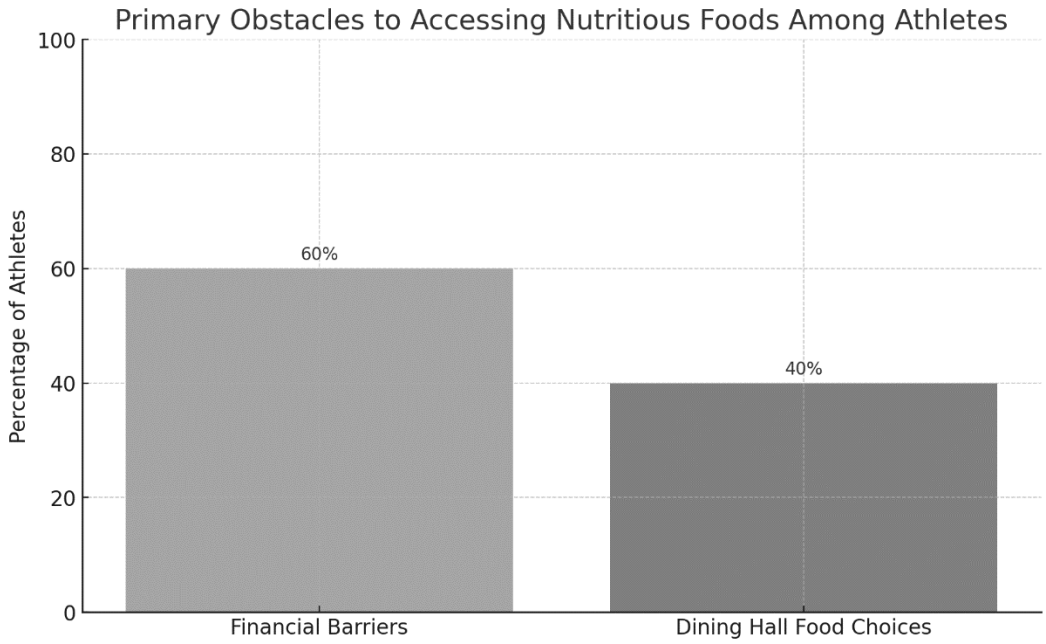

Figure 14: Primary Obstacles Accessing Food. From R Core Team (2021)

Summary

This study's exploration into the effects of culinary nutrition education on D3 collegiate athletes reveals notable trends in dietary behaviors and body composition changes. Culinary nutrition education, bridging the gap between theoretical nutrition knowledge and practical culinary skills, has shown a varying degree of impact on male and female athletes. The female athletes, starting with higher baseline scores in AFCQ and CS/FS, did not exhibit significant improvements post-intervention, suggesting that the intensity and duration of the culinary education program may need to be tailored for more pronounced effects. Conversely, the male

athletes showed improvements in BF%, although these changes were not statistically significant it did indicate a positive trend towards better body composition with culinary education.

This nuanced outcome underscores the potential of culinary nutrition education in promoting better dietary choices and enhancing optimal health and body fat levels. It highlights the importance of practical, hands-on learning experiences in fostering a deeper understanding of nutrition among athletes. However, the findings also suggest that the design and delivery of culinary nutrition programs must consider the specific needs and starting points of different genders to maximize their effectiveness.

CHAPTER FIVE: CONCLUSIONS

Overview

This final chapter concludes the study's investigation into the impact of culinary nutrition education on the dietary choices and body fat of D3 athletes at Johnson & Wales University. The research aimed to explore how targeted educational interventions in nutrition and culinary skills could influence athletes' nutrition knowledge, dietary habits, and body composition. The chapter discusses the findings in the context of existing literature, outlines the study's contributions to the field of sports nutrition, addresses its limitations, and proposes directions for future research.

Discussion

While the anticipated outcomes of significant changes in dietary habits or body composition were not statistically proven, the absence of clear results itself provides valuable insights. It underscores the inherent complexity of dietary behaviors in sports nutrition and serves as a reminder that non-results are crucial in scientific inquiry. They help to refine research questions, adjust methodologies, and confirm that variability in human behavior often defies simple explanations. This study has opened new avenues for questioning and further exploration into the effectiveness of nutritional interventions within collegiate athletics.

Implications

The study underscores the critical role of dietary education in optimizing body fat among D3 athletes, a group that often lacks access to specialized nutrition resources. It contributes to the sports nutrition field by providing empirical evidence supporting the integration of culinary nutrition education into athletes' training regimens. These findings advocate for policy changes within athletic programs at the collegiate level, suggesting that investing in nutritional education could be as crucial as physical training in optimizing athletes' performance.

It is crucial to articulate clearly that the study did not conclusively prove the benefits of culinary nutrition education but rather highlighted areas for further exploration. This includes investigating the frequency, intensity, and duration of educational interventions to better influence dietary behaviors and body composition among athletes.

Limitations

This study acknowledges several limitations that necessitate consideration. Primarily, the investigation was confined to D3 athletes from a singular institution, and from a singular sport, which inherently limits the extrapolation of these findings to a broader athletic population. The nuanced dynamics of dietary habits and the interplay with body fat across varying levels of competition and institutional settings remain unexplored territories that future research should aim to uncover.

Moreover, the methodology employed in this research heavily relied on self-reported data to gauge dietary habits. Such an approach, while practical, is susceptible to inherent biases, including recall bias and social desirability bias, which may skew the authenticity of the reported dietary behaviors. To enhance the reliability of future studies, the incorporation of more objective measures, such as dietary records filled out in front of nutritional professionals without classmates around or the use of technology-assisted dietary tracking, is recommended.

Another notable limitation stems from the temporal scope of this study, which was conducted over three months. This duration, although sufficient to observe immediate changes in dietary habits and self-perceived culinary capabilities, falls short of capturing the long-term sustainability of these changes. Nutritional behaviors and their impacts on body composition and performance metrics evolve, and a longitudinal approach spanning an entire academic year, or

multiple seasons, could provide a more comprehensive understanding of the lasting effects of culinary nutrition education.

Addressing these limitations opens a vista of opportunities for future research. Expanding the participant base beyond a single university setting to include athletes from various institutions and levels of competition would enrich the understanding of culinary nutrition education's impact across a broader spectrum of the athletic community. Additionally, extending the study duration to encompass an entire school year offers the potential to observe the longitudinal effects of nutritional interventions on athletes, providing insights into the sustainability of dietary changes and their long-term implications on body fat.

In summary, while this study marks a significant stride toward integrating culinary nutrition education within athletic training programs, its limitations underscore the need for further research. Future endeavors should aim to broaden the scope of investigation, employ more objective methodologies, and extend the study period to fully elucidate the multifaceted relationship between nutrition, culinary education, and athletic excellence.

Recommendations for Future Research

The insights gained from this study lay the groundwork for a comprehensive exploration of culinary nutrition education's enduring effects on dietary habits and body fat across varied sports and competitive levels. Future research should aim to delineate the longitudinal benefits of such educational interventions, integrating them with the broader spectrum of athletic training programs. A deeper dive into the economic and logistical feasibility of embedding culinary nutrition education within athletic departments could offer pivotal insights, guiding stakeholders in making informed decisions about program implementation.

The Path Ahead

The strides made through culinary nutrition education, while commendable, only begin to address the complexities of a multi-layered challenge. The pursuit of holistic nutritional wellness for athletes requires sustained support, continuous education, and infrastructural development. According to the R Core Team (2021), a mere 40% of participating athletes reported feeling adequately supported in meeting their nutritional needs with the existing educational and dining resources, underscoring an urgent call for systemic enhancements.

Addressing the risk of RED-S and overcoming economic and institutional obstacles to healthy eating are critical for ensuring the health and performance of collegiate athletes. Moving forward, adopting a comprehensive strategy that melds educational efforts with systemic changes is essential for creating an environment in which athletes can thrive, free from the constraints of nutritional shortcomings and the dangers of energy deficiency. This advocates for a collective push toward removing barriers to nutritious diets, thus enabling athletes to excel in their academic and sporting endeavors.

Also, acknowledging the limitations of this study reveals that our work represents just the onset of a crucial conversation at the intersection of nutrition and culinary education. It prompts a call for collaborative, interdisciplinary research efforts aimed at comprehensively addressing the complex nutritional needs of athletes. This advocacy for the transformative role of education in the evolution of sports nutrition sets the stage for a concerted quest to develop a comprehensive framework that nurtures the complete growth of athletes, ensuring their dietary requirements are met with as much attention and dedication as their physical training.

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Trakman, G. L., Forsyth, A., Hoye, R., & Belski, R. (2018). Development and validation of a brief general and sports nutrition knowledge questionnaire and assessment of athletes' nutrition knowledge. Journal of the International Society of Sports Nutrition, 15(1), 17-17. https://doi.org/10.1186/s12970-018-0223-1

U.S. Food and Drug Administration (FDA). (2022). *FDA 101: Dietary Supplements*. https://www.fda.gov/consumers/consumer-updates/fda-101-dietary-supplements

Wells, J. C., Fewtrell, M. S., & Davies, P. S. (2020). Body composition assessment in children: Anthropometry, bioelectrical impedance analysis, dual-energy X-ray absorptiometry, magnetic resonance imaging, and spectroscopy. *European Journal of Clinical Nutrition*, 74(9), 1187-1204.

APPENDIX A

32-item AFCQ (Athlete Food Choice Questionnaire)

Please answer the following statements in relation to how much they influence your food choices. This could be a single meal or individual food or drink (beverage).

My food choices can be influenced by:	Frequency				
Nutritional attributes of the food	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
The presence of vitamins and minerals in the food	1	2	3	4	5
The natural content of the food	1	2	3	4	5
The health or nutrition claims about the food	1	2	3	4	5
The nutritional content of the food (protein, fat carbohydrate)	1	2	3	4	5
Whether the food is a wholefood	1	2	3	4	5
Emotional influences	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
How sad I feel	1	2	3	4	5
How stressed I feel	1	2	3	4	5
How angry I feel	1	2	3	4	5
Eating to comfort my emotions	1	2	3	4	5
Food and health awareness	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
My ability to plan my foods ahead	1	2	3	4	5
My ability to cook for myself	1	2	3	4	5
My knowledge of nutritious foods	1	2	3	4	5
My awareness of the foods I already consumed today	1	2	3	4	5
Influence of others	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
What other athletes in my sport are eating	1	2	3	4	5
What my friends are eating	1	2	3	4	5
What my family is eating	1	2	3	4	5
Usual eating practices	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
How familiar the food is to me	1	2	3	4	5
The foods that I've grown up eating	1	2	3	4	5
My cultural style of eating (e.g. S. American, Indian, Western)	1	2	3	4	5
Weight control	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
If I am trying to lose or gain weight	1	2	3	4	5
If the food is beneficial for my weight goal	1	2	3	4	5
How happy I am with my current weight / body image	1	2	3	4	5
Whether I am in the off season (no competitions or intense training for a period of time)	1	2	3	4	5

My food choices can be influenced by:	Frequency				
Food values and beliefs	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
If the food aligns with my values for animal welfare (i.e. no animal products/vegan, cruelty-free raised animals)	1	2	3	4	5
My religious food beliefs	1	2	3	4	5
If the food is sustainably produced	1	2	3	4	5
Sensory appeal	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
The flavour of the food	1	2	3	4	5
The taste of the food	1	2	3	4	5
The sensory appeal of available foods	1	2	3	4	5
Performance	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
My need to fuel my body for competition	1	2	3	4	5
My need to feel energetic for training & competing	1	2	3	4	5
My need to fuel my body for recovery	1	2	3	4	5

Optional question items

Questions
The availability of food close to where I am
How much money I have to spend on food
How convenient the food is to prepare/eat
Place where I am eating (i.e., at home, at training, at a cafeteria etc.)
Concerns about foods causing positive doping results
If the food might make my gut feel uncomfortable when training or competing (i.e., stomach upset)
How hungry I am at the time
The eating occasion (i.e., early morning, breakfast, mid-afternoon, supper etc)
How busy my schedule is
My food allergies or intolerances
My medical condition
The fibre content of the food
The sodium (salt) content of the food

Reference the use of this instrument to:
THURECHT, R. L., and F. E. PELLY. The Athlete Food Choice Questionnaire (AFCQ): Validity and Reliability in a Sample of International High-Performance Athletes. Med. Sci. Sports Exerc., Vol. 53, No. 7, 2021.

APPENDIX B

Cooking Skills and Food Skills Questionnaire

- Please rate at what level you feel you are for each skill, on a scale of 1–7, where 1 is very poor and 7 is very good.
- If you do not use a certain skill, you can put a "X"

Cooking skills	Rate (1-7)
Cooking Methods	
1. 'Chopping, mixing and stirring foods, for example chopping vegetables, dicing an onion, cubing meat, mixing and stirring food together in a pot/bowl'	
2. 'Blending foods to make them smooth, like soups or sauces' (using a whisk/blender/food processor etc.)	
3. Steaming food (where the food doesn't touch the water but gets cooked by the steam)	
4. Boiling or simmering food (cooking it in a pan of hot, boiling/bubbling water)	
5. Stewing food (cooking it for a long time (usually more than an hour) in a liquid or sauce at medium heat, not boiling) e.g., beef stew	
6. Roasting food in the oven, for example, raw meat/chicken, fish, vegetables etc.	
7. Frying/stir-frying food in a frying pan/wok with oil or fat using the hob/gas rings/hot plates	
8. Microwaving food (not drinks/liquid) including heating ready meals	
Food Preparation Techniques	
9. Baking goods such as cakes, buns, cupcakes, scones, bread etc., using basic/raw ingredients or mixes	
10. Peeling and chopping vegetables (Ex. potatoes, carrots, onions, broccoli)	
11. Preparing and cooking raw meat/poultry	
12. Preparing and cooking raw fish	
13. Making sauces and gravy from scratch (no ready-made jars, pastes or granules)	
14. Using herbs and spices to flavour dishes	
Food skills	
Meal Planning and Preparing	
1. Planning meals ahead (e.g., for the day/week ahead)	
2. Preparing meals in advance e.g., packed lunch, partly preparing a meal in advance	
3. Following recipes when cooking	
Shopping	
4. Shopping with a grocery list	
5. Shopping with specific meals in mind	
6. Planning how much food to buy	

Budgeting	
7. Comparing prices before you buy food	
8. Knowing what budget you must spend on food	
9. Buying food in season to save money	
10. Buying cheaper cuts of meat to save money	
Resourcefulness	
11. Cooking more or double recipes which can be used for another meal	
12. Preparing or cooking a healthy meal with only few ingredients on hand	
13. Preparing or cooking a meal with limited time	
14. Using leftovers to create another meal	
15. Keeping basic items in your cupboard for putting meals together? e.g., herbs/spices, dried/tinned goods	
Label reading/consumer awareness	
16. Reading the best-before date on food	
17. Reading the storage and use-by information on food packets	
18. Reading the nutrition information on food labels	
19. Balancing meals based on nutrition advice on what is healthy	

Terms	**Definitions**
Cooking skills	A set of physical or mechanical skills used in the production of a meal encompassing cooking methods (e.g., boiling) and food preparation techniques (e.g., peeling a vegetable), in addition to this they are also said to include conceptual and perceptual skills such as understanding the transformation food undergoes when heat is applied, i.e., knowing when chicken is fully cooked.
Food skills	The knowledge and skills to be able to select and prepare food with the available resources, to produce nutritionally balanced, age-appropriate, and satisfying meals for those that are consuming it, includes meal planning, shopping, budgeting, resourcefulness, and label reading. These skills are essential to prepare a meal in the home environment.

APPENDIX C

Demographic Questionnaire

Demographic Survey

ID: _____ Date: _____

Date of Birth: ____/____/_____

Height: _____ Weight: _____ Body Fat %: _____

Address: _____ City: _____ State: _____
Zip _____

Phone (_____) _____ E-mail: _____

Race: □ Black/ African American □ White/ Caucasian
□ Asian □ Native American or Pacific Islander □ Other

Ethnicity: □ Hispanic or Latino or Spanish
□ Not Hispanic or Latino or Spanish Origin

Occupation (past and/or present) _____

Working: □ Part-time □ Full-time □ Retired □ Not employed?

Education Level: _____

Marital Status: □Married □Separated □Divorced □Widowed □Single □Cohabitating

Live with: □Spouse □Partner □Relatives □Children □Friends □Parents □Alone

Physical Activity: How much physical activity/ exercise (running, walking, gardening, household chores) do you usually get each day?

□ 0 minutes (none) □ 15 minutes □ 30 minutes

□ 45 minutes □ 60 or more minutes

Please choose the activity level that best describes you:

□ Sedentary (little or no exercise) □ Lightly active (light exercise/sports 1-3 days/week)

□ Moderately active (moderate exercise/sports 3-5 days/week)

□ Very active (hard exercise/sports 6-7 days a week)

Health History: (Please mark only those that apply)

Genetic Disease_____
Anemia_____
Allergies/Hay fever_____
Asthma_____
Eating Disorder _____
Eczema_____
Arthritis/Rheumatism_____
Cancer/Tumor_____
Diabetes_____
High blood pressure_____
Heart Disease_____
Kidney disease_____
Thyroid trouble_____
Diabetes_____
Tuberculosis_____
Mental illness_____
Epilepsy_____
Dementia_____
Alcohol addiction_____
Drug addiction_____
Stroke_____
Other_____

Recent Hospitalizations and/or Surgeries: (include reason/diagnosis and dates)

_____

_____

Prescription drugs

Current Medications: (include name, dosage, and frequency of use)

1) _____ 5) _____
2) _____ 6) _____
3) _____ 7) _____
4) _____ 8) _____

Over-the-counter drugs: including supplements taken in the past 30 days (supplements)

1) _____ 5) _____
2) _____ 6) _____
3) _____ 7) _____
4) _____ 8) _____

Do you use any complementary or alternative medicine therapies?
(e.g. teas, herbs, acupuncture, homeopathies, massage, meditation)

1) _____ 5) _____
2) _____ 6) _____
3) _____ 7) _____
4) _____ 8) _____

Do you smoke (tobacco)?

□ **Choose not to answer.**

□ **Yes**

□ **No**

If so, how long have you smoked regularly? (at least 1 cigarette every day for 30 days)

Years _____ Months _____

If you DO NOT smoke presently, did you ever smoke?

□ Yes

□ No

Did you <u>ever</u> use marijuana?

□ Choose not to answer.

□ Yes

□ No (Please skip to the section on Caffeine & Alcohol)

If you use or used marijuana, for how long?

_____ Years _____ Months Other _____

During the time you used marijuana, how often?

_____ times per week

_____ times per year

_____ once or twice in my lifetime

Caffeine and Alcohol

How many cups of caffeinated coffee do you usually drink in a day? (Include iced coffee, cappuccino, and espresso) (1 cup = 8oz)

_____ cups

_____ I do not drink coffee.

How many cups of caffeinated soda do you usually drink in a day? (Pepsi, Coke, Sunkist Orange, Mountain Dew, Dr. Pepper)

_____ cups or cans _____ I do not drink soda.

Do you take any caffeine-containing over-the-counter medications?

Yes No

How often do you usually have an alcoholic drink of any kind?

_____ Every day

_____ 3-4 times a week

_____ 1-2 times a week

_____ About once every 2 weeks

_____ About once a month

_____ Less than once a month

_____ I do not drink.

How many drinks do you have on average when you drink? (1 drink = 5 oz wine/ 12oz beer/ 1.5oz spirits)

_____ glasses of wine

_____ beer

_____ hard liquor

Have you ever consumed alcohol heavily on a regular basis?

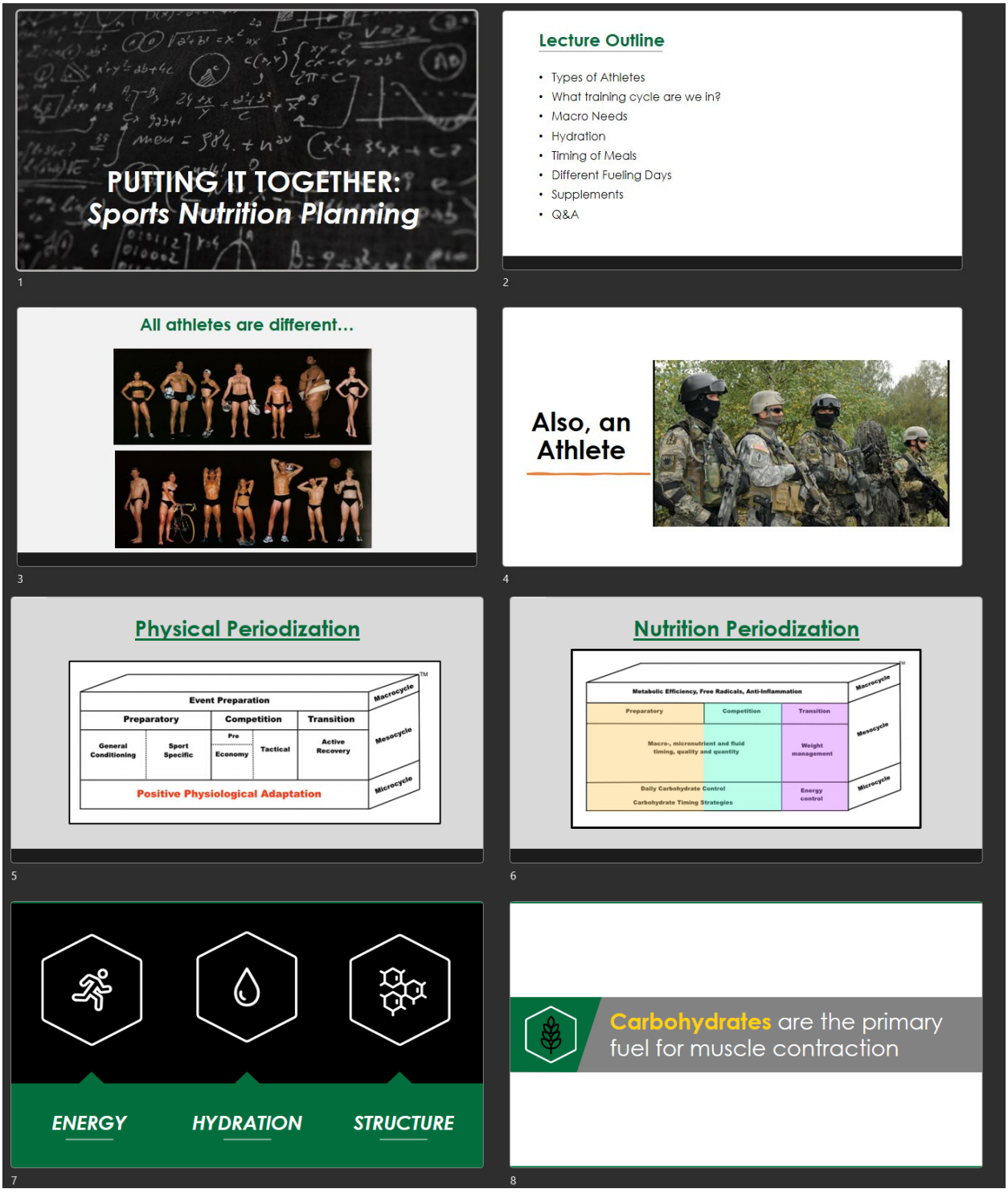
Yes _____ No_____

Other Health Assessment Questions:

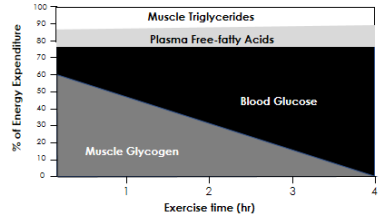
Is your menstrual period regular? _____

Age of menopause (if applicable): _____

APPENDIX D


PUTTING IT TOGETHER:
Sports Nutrition Planning
1
Lecture Outline
Types of Athletes
What training cycle are we in?
Macro Needs
Hydration
Timing of Meals
Different Fueling Days
Supplements
Q&A
2
All athletes are different…
3
Also, an Athlete
4
Physical Periodization
Event Preparation
Macrocycle
Preparatory
Competition
Transition
General Conditioning
Sport Specific
Pre
Economy
Tactical
Active Recovery
Mesocycle
Positive Physiological Adaptation
Microcycle
5
Nutrition Periodization
Metabolic Efficiency, Free Radicals, Anti-Inflammation
Macrocycle
Preparatory
Competition
Transition
Macro-, micronutrient and fluid timing, quality and quantity
Weight management
Mesocycle
Daily Carbohydrate Control
Carbohydrate Timing Strategies
Energy control
Microcycle
6
ENERGY
HYDRATION
STRUCTURE
7
Carbohydrates are the primary fuel for muscle contraction
8

Fuel usage during exercise



Protein contributes very little to fuel during exercise

Adapted from Coyle, Edward F. "Substrate utilization during exercise in active people 13, 2005

9

Carbohydrate and Team Sports

Field Sports STRENGTH + POWER — Short distances covered, many short bursts

Field Sports ENDURANCE — Large distances covered, high speeds

Batting Sports — Lower overall energy demands, long duration

Court Sports — Smaller area, shorter duration, tournaments, substitutions

CARBOHYDRATES ARE ESSENTIAL

- Maintain short energy bursts
- To maintain glycogen stores
- To maintain blood glucose for attention & decision making
- To maintain glycogen over time

Halloway & Spriet. J Sport Sci. 2011;29(11):1115-125

10

Carbohydrate recommendations for peak performance

3-4 Hours Before **1-4 g/kg**	1 Hour Before **~25 g**
During **30-60 g/h** ≥ 60 min duration Mostly quickly oxidized Performance goal	After **1.0-1.2 g/kg** < ~8 h until next training or competition

Thomas DT, Bramon KA, Burke LM. Med Sci Sports Exerc. 2016;48:543-68

11

ENDURANCE PERFORMANCE: Guidelines are more specific

Duration	CHO (g/hour)	Type
<30 min	None	-
45-75 min	Very small amounts	Most carb forms or mouth rinse
1-2 hours	Up to 30 g/h	Most carb forms
2-3 hours	Up to 60 g/h	Rapidly oxidized sugars Examples: sucrose, glucose, maltodextrin
> 2.5-3 hours	Up to 90 g/h	Blend glucose + fructose

Thomas DT, Bramon KA, Burke LM. Med Sci Sports Exerc. 2016;48:543-68

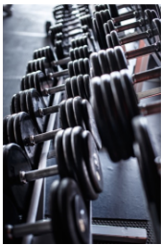
12

CHO's for Strength Training

Before Training: "topping off" glycogen is beneficial since it is the fuel for high intensity muscle contraction and could possibly increase the total amount of work. However, specific recommendations do not exist

During Training: Carbohydrate intake is not necessary—Sandwich your Pro!

Recovery: Intake depends on goals. If you are a team sport or endurance athlete lifting to support your sport, consider 0.8 kg/kg. If your goal is to increase mass, getting carbohydrate in your total daily intake is likely adequate



Slater G & Phillips S. Journal of Sports Sciences. 2011;29(11):S67-77

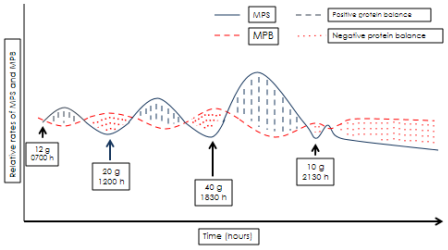
13

PROTEIN FOR RECOVERY

Goal: to provide the amino acid building blocks for muscle protein synthesis

14

PRO Timing throughout the day

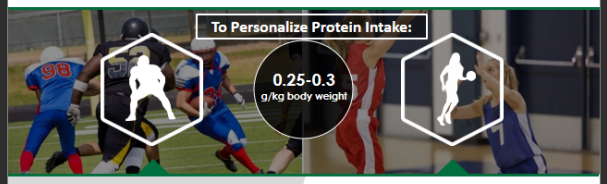


Adapted from Cilkova SY, Holloway TM, Phillips SM, et. al. Frontiers. 2019

15

BASED ON DOSE-RESPONSE RESEARCH

~20G IS RIGHT FOR MOST ATHLETES

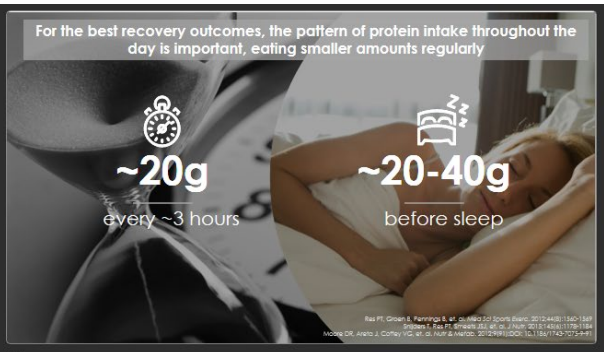


288 LBS	***135 LBS***
X 0.25 (g/kg)	*X 0.25 (g/kg)*
33G PROTEIN	**15G PROTEIN**

Thomas DT, Bramon KA, Burke LM. Med Sci Sports Exerc. 2016;48:543-68

16

17



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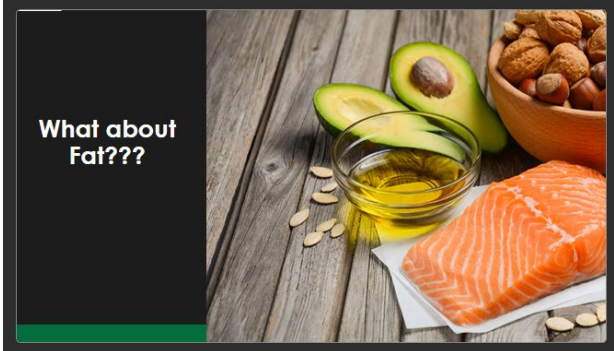

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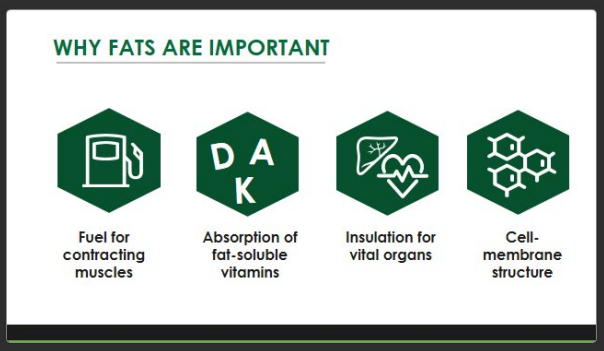

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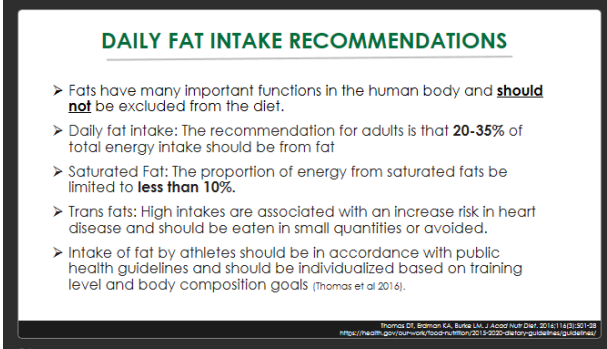

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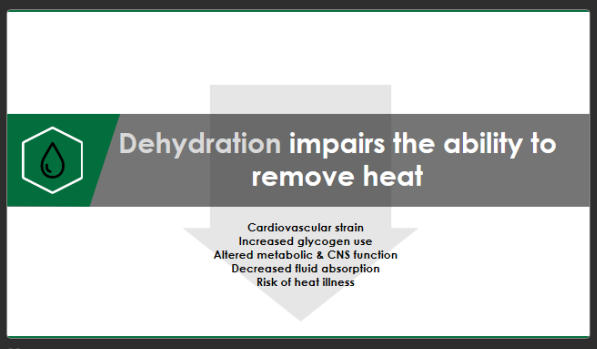

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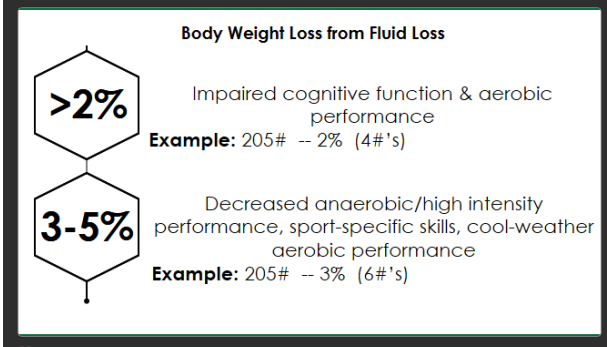

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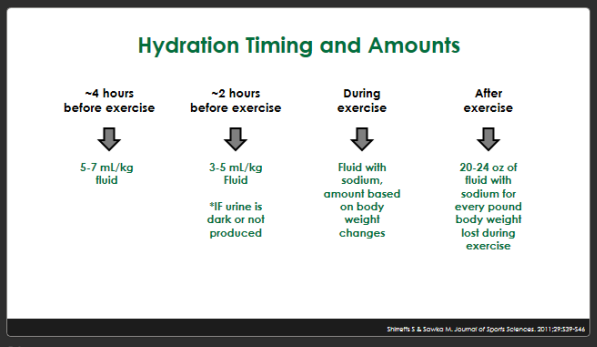
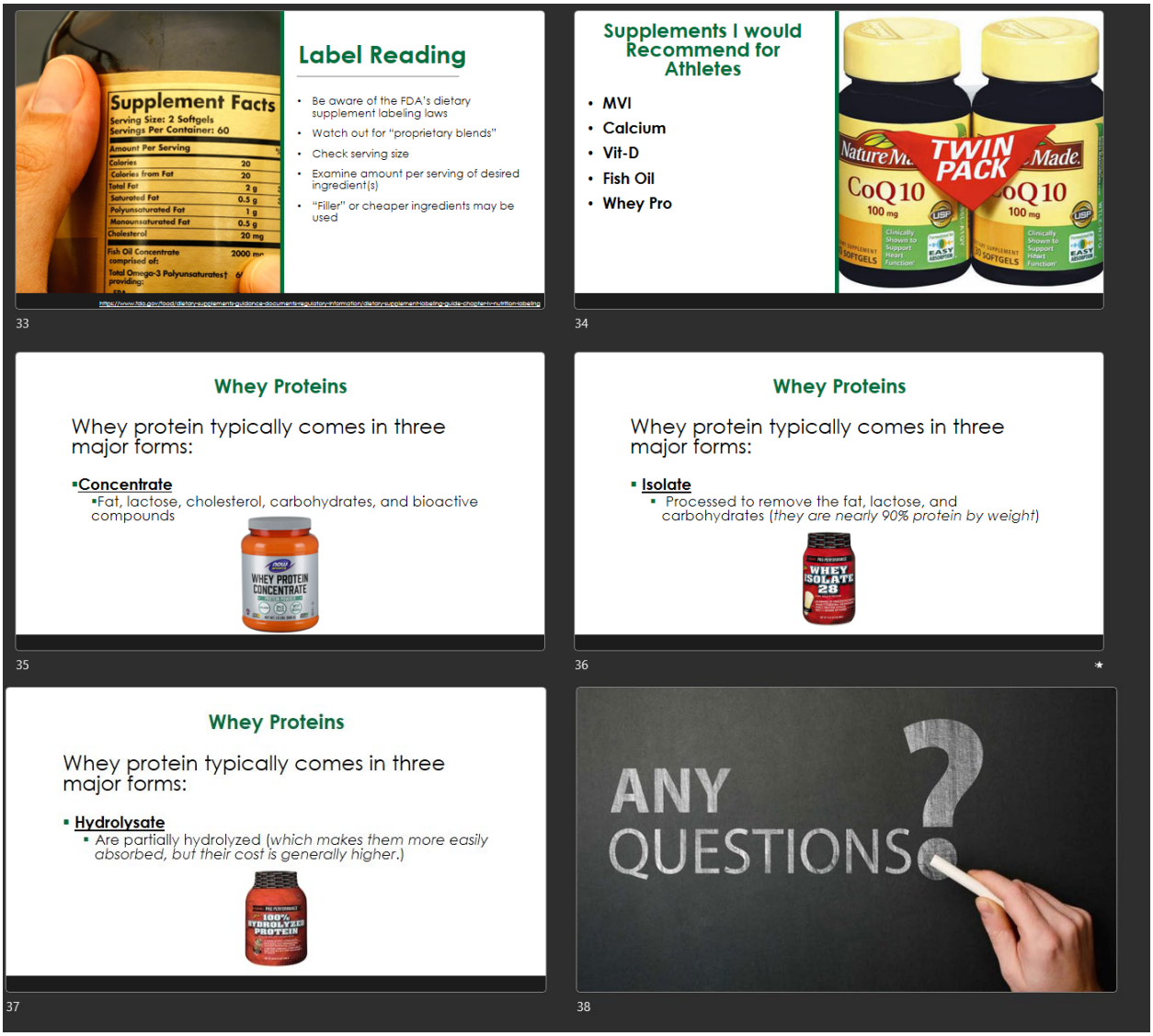


24


Putting It Together
BEFORE
DURING
AFTER
Hydration (fluid + sodium)
Carbohydrate Energy
Structure (protein)
*when training or competing ≥ 60 min
**when recovery time is short
25
Timing is Paramount
We need to learn to eat in the "Red Zone"
SLEEP
Breakfast
Snack
Lunch
PRE-Game
EVENT
POST-Game
Dinner
SLEEP
• Should be:
– individualized
– sport specific
– goal specific
26
Timing.....
We need to eat the whole day!
Nourish the Body
Refuel / Recover
Fuel the Body
Nourish the Body
27
Two a Day's
What do we do then?
Nourish the Body
Refuel / Recover
Fuel the Body
Nourish the Body
28
EASY TRAINING / WEIGHT MANAGEMENT:
FATS
1 Teaspoon
Avocado
Oils
Nuts
Seeds
Cheese
Butter
Whole Grains
Fruits
Vegetables
Lean Protein
FLAVORS
Salt/Pepper
Herbs
Spices
Vinegar
Salsa
Mustard
Ketchup
29
MODERATE TRAINING:
FATS
1 Tablespoon
Grains
Lean Protein
Vegetables
FLAVORS
30
HARD TRAINING / RACE DAY:
FATS
2 Tablespoons
Grains
Lean Protein
Vegetables
FLAVORS
31
What is a supplement?
Classified by the US Food and Drug Administration
Vitamins
Minerals
Herbs or other botanicals
Amino acids
Other dietary substances
Any concentrate, metabolite, constituent, extract, or combination of these ingredients
32


Label Reading
Be aware of the FDA's dietary supplement labeling laws
Watch out for "proprietary blends"
Check serving size
Examine amount per serving of desired ingredient(s)
"Filler" or cheaper ingredients may be used
Supplement Facts
Serving Size: 2 Softgels
Servings Per Container: 60
Amount Per Serving
Calories 20
Calories from Fat 20
Total Fat 2 g
Saturated Fat 0.5 g
Polyunsaturated Fat 1 g
Monounsaturated Fat 0.5 g
Cholesterol 20 mg
Fish Oil Concentrate 2000 mg
comprised of:
Total Omega-3 Polyunsaturates† 6
providing:
https://www.fda.gov/food/dietary-supplements-guidance-documents-regulatory-information/dietary-supplement-labeling-guide-chapter-iv-nutrition-labeling
33
Supplements I would Recommend for Athletes
MVI
Calcium
Vit-D
Fish Oil
Whey Pro
TWIN PACK
CoQ10
100 mg
34
Whey Proteins
Whey protein typically comes in three major forms:
Concentrate
Fat, lactose, cholesterol, carbohydrates, and bioactive compounds
WHEY PROTEIN CONCENTRATE
35
Whey Proteins
Whey protein typically comes in three major forms:
Isolate
Processed to remove the fat, lactose, and carbohydrates (they are nearly 90% protein by weight)
WHEY ISOLATE 28
36
Whey Proteins
Whey protein typically comes in three major forms:
Hydrolysate
Are partially hydrolyzed (which makes them more easily absorbed, but their cost is generally higher.)
100% HYDROLYZED PROTEIN
37
ANY QUESTIONS?
38