UNIVERSITY OF EDUCATION, WINNEBA

NUTRITION KNOWLEDGE AND DIETARY PRACTICES AMONG ATHLETES IN COLLEGES OF EDUCATION IN THE VOLTA REGION OF GHANA

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NOVEMBER, 2023

DECLARATION

STUDENT'S DECLARATION

I, Manche Emmanuel Kodzo, declare that this project work, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: …………………………………

DATE: ………………………………………

SUPERVISOR'S DECLARATION

We hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

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DATE: ………………………………………

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SIGNATURE: …………………………………

DATE: ………………………………………

DEDICATION

This work is dedicated to my lovely wife Edith Esther Azameti and my children Elsie Kafui Manche, Sophia Dziedzorm Manche, and Emmanuel Eyram Manche Jnr.

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I thank the Almighty God for the abundant grace, favour, strength and wisdom throughout my post graduate programme in order to come out with this piece of work. Additionally, my heartfelt appreciation goes to my strong, zealous and enthusiastic supervisors Prof. Emmanuel Osei Sarpong and Dr. Richmond Sorkpor for their inputs, directions and advice which led to the success of the study. Again, I am equally grateful to all HPERS lecturers of the University of Education, Winneba for their advice, support and encouragement throughout my study.

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ABSTRACT

Nutrition knowledge and dietary practices are tools for improving athletic performance, fostering recovery, and promoting overall health. Although, it is prudent for athletes to make informed food choices before, during and after training or competition, nutrition knowledge and dietary practices of student athletes have been understudied. The study assessed nutrition knowledge and dietary practices among athletes in Colleges of Education in the Volta Region of Ghana. The study employed a cross-sectional survey design. The population consisted of a total of 330 athletes where a census technique was used for the study. Data was collected using questionnaire. The study revealed high level of nutrition knowledge among participants (N=277, 100%). Majority of the participants always ate breakfast, drank water, and occasionally consumed fruits. Cost, time, and family feeding influenced dietary practices among majority of the participants. Additionally, there was no statistically significant difference (p =.359) in dietary practices among male and female participants. The study concluded that cost, time, and family feeding influences dietary practices among participants. Therefore, it has been recommended that management in Colleges of Education should put in measures to help athletes deal with these concerns throughout their nutritional practices.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Nutrition is a field of study that has been around for over many decades and focuses on enhancing people's health. It is important in an athlete's life in a variety of ways, including contributing to high levels of performance, recovery, and achieving and sustaining health (Ozdoğan & Ozcelik, 2011). In recent years, there has been a greater emphasis placed on the importance of proper nutrition as one of the essential components of a healthy lifestyle, and there has been an increase in the movement toward healthier diets (Barzegari et al., 2011). Nutrition provides the energy needed for normal physiological functioning of the body and more importantly, it forms the bedrock of any exercise or athletic programme (McArdle et al., 2010). A well-balanced diet promotes good health by providing adequate amounts of energy, for the body's metabolic needs at each stage of life. Diabetes, obesity, and malnutrition are all caused by a lack of balanced food and nutrition security (Hammond & Dubé, 2012).

The primary goal of nutrition plans is to obtain the appropriate and necessary nutrients in order to stay healthy, be physically prepared, and live a healthy life (Barzegari et al., 2011). As a result, in order to improve society's health, the knowledge and attitudes of its citizens must be considered (Barzegari et al., 2011). Nutrition is required for proper growth and development, and is increasingly recognised as a critical aspect in sports performance. Thus, for athletes to achieve a high level in sports, they should be mindful of their dietary behaviour and practices since it is the most important elements influencing their health and performance (Tur et al., 2004). It forms a key component of the training session or programme because it impacts virtually every process in the body, thus, athletic performance and health (Webb & Beckford, 2014).

Sports nutrition is concerned with understanding how nutrients, fluids, and supplements, together with nutrient timing influence different components of athletic performance (Trakman et al., 2016). Sports nutrition is the knowledge of how the body uses nutrients and its chemical processes for energy generation to enhance health, performance and recovery (Webb & Beckford, 2014). Therefore, athletes must be conscious of their diet since optimum athletic performance is heavily reliant on sports nutrition, as nutrient intake at certain periods is critical for maintaining not only athletic performance, but also health and recuperation (Thomas et al., 2016). Additionally, sports nutrition is taught of as the application of nutrition knowledge to a practical daily meal plan in order to supply energy for physical activity, repair processes in the body, optimise competition sports performance, and ensure health and wellbeing (Contento, 2008).

Sport nutrition knowledge on the other hand, is defined as an understanding of the nutrition-related factors that can influence training, athletic performance, and sport recovery. This knowledge extends beyond general nutrition knowledge, which may only focus on food groups, nutrient sources, and overall general health requirements but failing to recognise the unique needs of high performing athletes (Klein et al., 2021). Nutrition knowledge is a critical component in addressing athletes' optimal nutrition (Klein et al., 2021) because from fueling to recovery, optimal nutrition ensures the best platform for success in any sport (Greany, 2015; Jeukendrup & McLaughlin, 2011). On the contrary, low sports nutrition knowledge among athletes may lead to unhealthy dietary patterns, which can affect an athlete’s ability to maximise performance, recovery as well as health. Therefore, an athlete's diet should be high in carbohydrates, low in fat and low to moderate in protein taking into consideration the demands of the sport (Jagim et al., 2021).

Athletes need a high degree of nutritional knowledge to provide understanding on a balanced diet, healthy body weight, superb development, and imposing look, as well as good physical performance and health (Robbeson et al., 2015). Notwithstanding, several studies have suggested the need to address nutrition knowledge gap among college athletes since they are still exhibiting inadequate knowledge about the roles of nutrient in performance (Grete et al., 2011; Rosenbloom et al., 2002; Jacobson et al., 2001). To buttress this, Torres-McGehee et al. (2012), examined nutrition knowledge among 579 National Collegiate Athletic Association (NCAA) Division I, II, and III universities collegiate athletes, coaches, athletic trainers, and conditioning specialists and found that athletes had inadequate nutrition knowledge scores of less than 75%. Also, Merawati et al. (2019) conducted a study to assess the influence of nutritional knowledge on nutritional status and physical performance in young female athletes, it was discovered that many young female athletes are found to have a lack of nutrition knowledge, low eating behaviour, low confidence in their physical appearance and poor performance.

Having access to sufficient and reliable nutrition information is crucial because it can influence an athlete's nutrition knowledge, which in turn can influence their nutritional choices. Eventually, this could influence their physical health, athletic performance, ability to recover from exercise and risk of injury brought on by exercise (Boumosleh et al., 2021). It was also revealed that despite the availability of nutrition information sources, it is unclear if athletes have a better understanding of the role of nutrition in athletic performance (Paugh, 2005). In a cross-sectional study of 207 Iranian basketball and football college players, the players reported their coach as the primary source of nutrition information with television, radio, or the internet as the second most popular source, and a family member or friend as the third most popular source of nutrition information (Jessri et al., 2010).

In a survey conducted on nutritional habits and knowledge involving 45 male NCAA Division I collegiate football players, the top two sources of nutrition information reported by the players were strength and conditioning coaches, and teammates and/or friends and family (Hale, 2013). In another study on nutritional knowledge of youth academy athletes, it was suggested that collegiate athletes require credible sources of nutrition information and instruction, as well as adequate nutrition services such as counseling (Bird & Rushton, 2020). Furthermore, youth athletes may be ill-equipped to make accurate nutritional decisions due to a lack of exposure to high quality nutrition-related education, nutrition counselling, and qualified sports nutrition professionals, which may negatively impact their health status, physiological development, and/or sports performance (Bird & Rushton, 2020).

It is presumed that most college athletes engage in unhealthy dietary behaviours since they are transitioning from adolescence to adulthood which is an important aspect in their lives, because it is believed that adolescents engage in unhealthy dietary behaviours of which they might carry into college (Colić Barić et al., 2003). For that matter, college athletes must make informed decisions about food selection and a healthy lifestyle since the desire for food increases while physical activity decreases (Colić Barić et al., 2003). Nutrients are necessary for human survival because they help sustain proper physiological function. However, athletes require slightly more macronutrients and micronutrients for appropriate repair and recovery, energy, metabolic function, and endocrine function than non-athletes (Clark, 2013; CPSDA, 2012; Lahman-New et al., 2011). Energy is an important fuel to the body to carry out daily exercise and activities that is obtained from food with nutrients. The food consumed every day must contain carbohydrates, proteins, fats, vitamins, minerals and water (Sedek & Yih, 2014). Besides that, daily food consumption should be in accordance with the daily energy requirement. In order to have athletes meet their daily energy needs, they need to have nutrition knowledge, as good nutrition knowledge leads to healthy eating behavior, but it does not affect nutritional status (Sedek & Yih, 2014).

Proper nutrition can help restore energy levels to their optimal levels and has a positive impact on growth, development, performance, and injury prevention (Kunitz, 2018) but most of the time, college athletes engage in strenuous training in order to improve their performance during competitions and are found to be involved in unhealthy diet practices which in turn affects their health (McArdle et al., 2010). As a result, athletes need to consume adequate nutrients in order to gain enough energy during periods of high intensity and/or long duration training so as to maintain health and maximise training outcomes. This is due to the fact that, low level of energy during training/exercise can result in poor performance and an increased risk of developing health complications, as well as a delayed recovery process (Thomas et al., 2016). In addition, athletes' insufficient nutritional intake and overconsumption may result in changes in body composition and body weight (Nepocatych et al., 2017).

Generally, competitive athletes often have two main dietary goals which include eating to optimise performance and eating to achieve ideal body composition. There is no single eating regimen that can immediately boost strength, aerobic endurance, or power, but an appropriate nutrient dense diet will allow athletes to train and compete to their full potential (Baechle & Earle, 2008). Similarly, athletes at all levels, from recreational to international competitive, place enormous strain on their bodies by pushing their bodies to greater limits through a combination of physical work, energy expenditure, time and recovery periods. This require athletes to use additional energy and fuel through nutrients and, ultimately, diet (Kumari, 2019).

College athletes are burdened with both academic work and training, and for them to excel in their athletic performance, there is the need to factor sports nutrition into the training session (Andrews et al., 2016). These student-athletes train at high intensities and compete under demanding competition schedules to achieve peak performance, putting them at risk for musculoskeletal injury (Arazi & Hosseini, 2012; Torres-McGehee et al., 2012). As stated above, it might be difficult for college athletes to reach their training and/or competition performance since some consume insufficient energy. Reason been that inadequate food intake can have a detrimental influence on muscular contraction, development and repair, and heart function, resulting in lower levels of performance (Wasserfurth et al., 2020). Furthermore, even when energy requirements are satisfied, insufficient consumption of key nutrients might result in shortages, inferior performance, or an increased risk of injury and sickness (Wasserfurth et al., 2020).

An athlete's diet should be optimal in terms of both food quality and quantity in order to replenish energy reserves and avoid fatigue during training sessions as well as competitions (Gastrich et al., 2020; Lin & Lee, 2005). Athletes' nutrition knowledge, eating habits, and food consumption are all important factors in determining their athletic performance (Sedek & Yih, 2014). Riviere et al. (2021), conducted a narrative review among National Collegiate Athletic Association (NCAA) athletes and found that athletes are not fulfilling their demanding energy needs during competitions although they have access to varied nutrition information. They went on to say that a sports dietitian should be assigned to every student athlete in order to meet their nutrition needs. Paugh (2005) emphasised the importance of athletes making informed dietary decisions since they have control over what they eat in order to decrease their susceptibility to diseases. Hence, a proper nutrition education programme may help athletes make decisions about their nutritional practices, which will benefit not just the individual athlete but also the team. Additionally, Giroux (2015) demonstrated how collegiate athletes' dietary practices can be enhanced by improving nutrition knowledge. However, because they are altering training, academic work, and other responsibilities such as grounds work, they may not have enough time to concentrate on improving their dietary quality.

A study conducted by Alayna (2022) to explore and assess sports nutrition knowledge and dietary behaviour in collegiate female runners, discovered that there is poor dietary quality in the population and these trends may be related to performance, health, and injury status. In a similar study by Shriver et al. (2013), which observed insufficient calorie and carbohydrate intake, erratic meal patterns, and poor hydration monitoring in 52 Division I National Collegiate Athletic Association (NCAA) athletes of which only female athletes were sampled in this study, they concluded that effective nutrition strategies are needed to improve dietary intakes and eating habits of female college athletes.

1.2 Problem Statement

Nutrition impacts practically every activity in the body; proper nutrition affects an individual's overall health and, more significantly, increases athletic performance as well as recovery (Webb & Beckford, 2014). Nutrition is the foundation of physical performance because it supplies the chemicals required to obtain and use the potential energy in food as well as the energy for biological activities (Malsagova et al., 2021). It does not only influence on-field performance but also promotes muscle growth, prevents injury, accelerates recovery, and aids in rehabilitation (Debnath et al., 2019).

Nutrition knowledge is an important first step for athletes to improve their dietary patterns and intake, however, most athletes' nutritional practices are inadequate (Folasire et al., 2015). Despite the fact that athletes believe that nutrition is vital for their athletic performance, it has been noted that their diets fall short of the sports nutrition requirements (Manore et al., 2017; Walsh et al., 2011). Adequate nutrition knowledge can translate into positive dietary habits and food choices that affect overall health, but athletes rarely possess the nutrition knowledge expected of them (Carbone, 2021). Majority of college athletes turn to consume inadequate nutrients necessary for proper fueling during training thereby inhibiting their performance and normal body functioning as well (Collegiate and Professional Sports Dietitian Association (CPSDA), 2012). College athletes do not consume the proper amount of nutrients due to a variety of factors such as lack or inadequate information, inadequate time due to class schedules, financial constraints, and cultural beliefs, among others (Birkenhead, 2014).

A personal encounter with athletes in Colleges of Education during camping for intercollegiate games revealed that most of them ate whatever they felt like eating and also engaged in dieting and/or fasting to lose weight in an attempt to meet sport specific physique, oblivious to the fact that they must consume adequate calories in order to perform well. It has been reported that inadequate nutrients may result in adverse health outcomes, soft tissue and stress injuries (Melin et al., 2019). Again, inadequate nutrition knowledge may result in athletes consuming inadequate or inappropriate diets that may not meet their nutritional needs leading to potential nutrient deficiencies, fatigue, decreased muscle mass, increased risk of injury, and impaired recovery time (Kontele & Vassilakou, 2021). If this issue is not given the needed attention, it might affect the performance of athletes in Colleges of Education as well as the nation as whole.

There has been notable studies pointing to the significance of nutrition among athletes in Ghana. For instance, a study by Tugli et al. (2022) on the socioeconomic standards, nutritional knowledge and dietary habits of Ghanaian athletes revealed that there was no significant relationship between athletes' level of nutritional knowledge and their dietary habits, as well as no relationship between socioeconomic standard and dietary habits. Likewise, Afrifa et al. (2020) assessed the dietary intake and body composition characteristics of national football league players indicating that there was low total energy intake in this population which was due to insufficient nutritional diets. Kluboito et al. (2017) examined the effect of short-term consumption of energy drink on physiological variables and physical performance variables of athletes in University of Cape Coast revealed no significant effect of energy drink consumption on systolic blood pressure, diastolic blood pressure, heart rate and lower body strength. Abdulai (2015) assessed the nutritional status and dietary behaviour of division one league footballers in the Tamale metropolis and discovered that participants had high intake of energy giving foods but low consumption of animal proteins. Nabia (2015) assessed the energy expenditure and iron status of premier league footballers in Ghana and concluded that the mean height and weight of the footballers appeared lower when compared with that in other countries. Buxton and Hagan (2012) conducted a study to determine the prevalence of energy drink consumption among student-athletes selected from seven public universities in Ghana indicated that most of the participants consumed at least one can of energy drink in a week with the mind to replenish lost energy after training or a competition. However, there is an evident gap in nutrition knowledge and dietary practices among athletes in Colleges of Education. Considering this, the importance of nutrition in the lives of athletes in Colleges of Education has not been given the needed attention, though it is an important predictor of peak athletic performance and should be studied. This study would provide empirical evidence on the importance of nutrition in the lives of athletes in Colleges of Education so as to structure and provide nutrition intervention strategies for them.

1.3 Purpose of the Study

The purpose of the study was to assess nutrition knowledge and dietary practices among athletes in Colleges of Education in the Volta Region of Ghana.

1.4 Objectives of the study

The objectives of the study are;

1. To assess nutrition knowledge of athletes in Colleges of Education.
2. To assess dietary practices of athletes in Colleges of Education.
3. To identify the factors that influence dietary practices of athletes in Colleges of Education.

4. To explore the differences in dietary practices among male and female athletes in Colleges of Education.

1.5 Research Questions

In order to provide guidance to the goals of the study, three (3) research questions were specified. The questions that guide the study are as follows:

1. What is the nutrition knowledge of athletes in Colleges of Education?
2. What are the dietary practices of athletes in Colleges of Education?
3. What are the factors that influence dietary practices of athletes in Colleges of Education?

1.6 Research Hypothesis

H_0: There will be no significant difference in dietary practices among male and female athletes in Colleges of Education.

1.7 Significance of the Study

Athletes' athletic performance is aided by adequate nutritional intake before, during, and after competition, but an improper diet has a negative impact on their performance and health. The study would reiterate the need for nutrition knowledge among athletes in Colleges of Education which would in turn improve dietary practices/intake so as to boost their performance, recovery as well as overall health. The study would be of essence to Colleges of Education administrators, management and tutors as a whole by providing them with empirical evidence on the importance of nutrition in the lives of athletes in order to structure, and provide nutrition intervention strategies for athletes. In addition, this study would contribute to existing knowledge and provide new insight for further studies.

1.8 Delimitation of the Study

In order to get a clear framework for the study, the study was delimited to the following;

1. Volta Region of Ghana
2. Athletes in Colleges of Education
3. Quantitative approach and cross-sectional design
4. Closed ended questionnaire
5. Three hundred and thirty (330) athletes
6. Statistical Package for Social Sciences (SPSS) version 25.0
7. Independent sample t-test

1.9 Limitations of the Study

Every study has limitations, and this study is no exception. These are some of the major challenges encountered by the researcher in conducting the study.

1. The track system of Colleges of Education whereby a particular year group of students are on campus whereas others are not served as an obstacle to the smooth administration of the questionnaire.
2. The participants were required to indicate their weight and height which might not be a true representation of their actual body mass index (BMI).

1.10 Operational Definition of Terms

In order to provide a clearer way of analysing the topic; the researcher identified and defined the following key terms used throughout the study.

Nutrition: Refers to food intake to promote growth and health.

Sport nutrition: Refers to the type and quantity of various nutrients and fluids intake to improve athletic performance, recovery as well as overall health.

Nutrition knowledge: Refers to athletes' understanding of various food nutrients.

Sport nutrition knowledge: Refers to having an understanding of foods and fluids that help in sport performance.

Dietary practices: Refer to athletes' choice of food selection and consumption.

Colleges Athletes: Are students who participated in sporting activities in Colleges of Education in Ghana that specialised in training teachers for basic schools.

1.11 Organisation of the Study

The study is organised into five chapters. The first chapter focuses on the introduction which was discussed under the subheadings; background to the study, statement of the problem, purpose of the study, research objectives and questions, research hypothesis, significance of the study, delimitations and limitations of the study, operational definition of terms, and organisation of the study. The second chapter covers literature review in two perspectives, namely, theoretical, conceptual and empirical perspectives. The third chapter assess the methodologies in terms of area of study, research design, population, sample and sampling procedure, research instrumentation, pilot testing, data collection, and data analysis procedures. The fourth chapter presents the results and discussion of the findings and the final chapter looks at summary, conclusions and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter is concerned with the review of literature on assessment of nutrition knowledge and dietary practices among athletes in Colleges of Education in the Volta Region of Ghana. The researcher made sincere efforts to locate and collect the literature relevant to the study. The literature was reviewed around the following headings;

1. Theoretical Framework
2. Conceptual Framework
3. Sports Nutrition
4. Nutrition Knowledge of Athletes in Colleges of Education
5. Dietary Practices of Athletes in Colleges of Education
6. Factors that Influence Dietary Practices of Athletes in Colleges of Education

2.1 Theoretical Framework

Over the past decades, many behavioural and social science theories and models have been used when trying to understand and enhance health behaviours among the general populace and athletes as well. Theories such as the health belief model, transtheoretical model, the theory of reasoned action, the theory of planned behaviour, social cognitive theory, attitude, social influence and self-efficacy model and so on have attempted to explain health behaviour and to guide the identification, development, and implementation of interventions (de Vries et al., 1988; Ajzen, 1991; Ajzen & Fishbein, 1980; Bandura, 1977; Hochbaum & Rosenstock, 1952). The theory of reasoned action (TRA), theory of planned behaviour (TPB), social cognitive theory

(SCT) and attitude, social influence and self-efficacy (ASE) model are widely used in different contexts.

The attitude, social influence and self-efficacy (ASE) model was employed for this study since it is considered an extension of the TRA where it integrates two factors of the TRA (attitudes and subjective norms) with the self-efficacy concept from the SCT (de Vries et al., 1995; 1988). The ASE model addresses the role of socio-cultural as well as personal determinants of health behaviours. The ASE model posits that human behaviour can be predicted if one studies the intention behind it. The model is used to help people change their behaviour when it comes to health and food intake. It believes intention and behaviour are determined by cognitive factors such as attitude, social influence, and self-efficacy. These cognitive variables are the primary determinants of whether the intention to perform a new behaviour was sustained. Attitude refers to an individual's belief regarding behavioural outcomes and their evaluation of those outcomes. Social influence pertains to an individual's beliefs about what specific social sources think about a specific behaviour and the personal motivation to comply with these sources, and self-efficacy on the other hand is an individual's beliefs about his/her abilities to perform a particular behaviour. Thus, belief in one's own abilities. The model also believes that intentions predict behaviours such that one's attitude toward a behaviour is influenced by the consequences of that behaviour. Likewise, various external factors also influence these factors, thus might limit the possibility to put the intention into practice (de Vries et al., 1988).

The ASE model was used in previous studies to explain fruit intake in Austrian, Norwegian and Spanish school children of which the model fitted the data well for two of three countries, but without the direct relation from self-efficacy to behaviour. It was further revealed that the model accounted for between 51% and 69% of the variance in intention to eat fruit (Sandvik et al., 2007). In another study, self-efficacy appeared as the single most important variable in explaining intentions and behaviour regarding fruit and vegetable consumption among children (Melbye et al., 2011). Also, a study to explore psychosocial determinants of vegetables among Nepalese young adults indicated that self-efficacy did not significantly influence intention to eat two or more servings of vegetables per day (Pandey et al., 2021).

2.2 Conceptual Framework

Nutrition knowledge and dietary practices are two complex construct that are influenced by environmental and individual factors, the framework emphasises the interaction of these factors within and across these levels. All of these factors may directly or indirectly influence College athletes' nutrition knowledge and dietary practices. The environmental factors including the family and school have been found to influence nutrition knowledge which in turn, influence dietary practices. In addition, environmental factors (family and school) directly have an influence on dietary practices. However, individual factors such as self-efficacy, subjective norms, attitude, cost, and taste are factors that influence the relationship between nutrition knowledge and dietary practices.

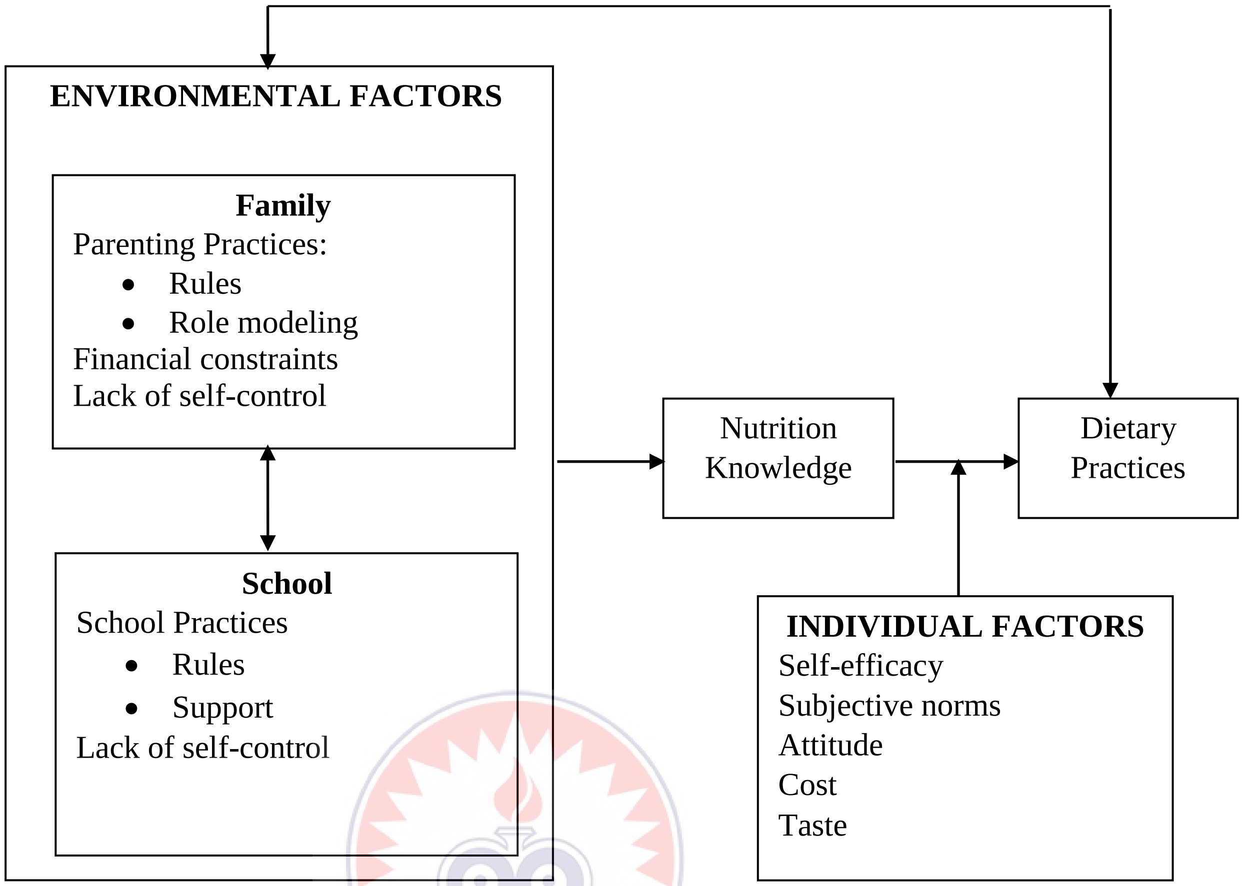

Figure 1: Conceptual framework for nutrition knowledge and dietary practices among athletes in Colleges of Education.

Source: Adapted from Verstraeten et al. (2014)

2.3 Sports Nutrition

Nutrition is very important in the life of athletes and cannot be overemphasised. Consequently, athletes need more attention because they need additional nutrients to improve their performance, recovery and health in order to avoid complications in the near future (Webb & Beckford, 2014). Nutrition is regarded as one of the pillars of athletic performance, and post-workout dietary advice are critical to the efficacy of recovery and adaptation processes (Kerksick et al., 2017). Proper nutrition and exercise are inseparable as they contribute to health, fitness, and athletic performance

(Plowman & Smith, 2014). For this reason, nutrients must be obtained from our diet since the human body does not synthesise them (Bender, 2006).

Proper nutrition is the foundation for physical performance because it provides the necessary fuel for biologic work as well as the chemicals for extracting and utilising the potential energy within this fuel. Food nutrients are also necessary for repairing existing cells and forming new tissues (McArdle et al., 2010). Proper nutrition is regarded as a significant determinant of athletic performance; aside from genetic and training limitations, no single factor plays a greater role in optimising performance than diet (Davar, 2012). Nutrition has a significant impact on the continued development of muscles, bones, and the brain (Meeusen, 2014).

The study of sports nutrition has advanced significantly over the past 50 years, and it is now well known how nutrient availability and ergogenic aids affect immunity, performance, recovery, and training adaptations (Thomas et al., 2016). Sports nutrition as a recognised academic research field can likely be traced back to the late 1960s, when a number of groundbreaking studies examining the impact of muscle glycogen and carbohydrate availability on exercise capacity and performance were conducted (Close et al., 2019). It includes a wide range of topics, including macronutrients, micronutrients, supplements, liquids, recovery meals, alcohol, energy balance, body composition, sports energy pathways nutritional requirements, special populations nutrient intake, and timing of nutrients before, during and after competition (Thomas et at., 2016; Trakman et al., 2016).

Sports nutrition has long been recognised as one of the most important requirements for athletes at all levels of competition. Athletes might benefit from a number of sports diets for performance maintenance and enhancement if only they take into consideration the recommended dietary allowance guidelines (Khan, 2017). One goal of sports nutrition is to maintain glycogen levels and prevent glycogen depletion, as well as optimise energy levels and muscle tone; hence, sports nutrition is the study and application of diet and nutrition in relation to athletic performance. It seeks to provide answers to questions like, what kinds of foods and fluids, and how much of each, should be consumed throughout the day (Kibata, 2011).

Sports nutrition is a complicated subject that requires various application strategies for each individual. Nevertheless, the fundamental principles of sport nutrition science serve as the cornerstone of nutritional understanding (Alayna, 2022). It is an invisible training that has a significant impact on peak performance in athletes. The amount, kind, and timing of food consumed are critical in maintaining athletic health, performance, and recovery (Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance, 2016). Sports nutrition involves the science and practice of consuming nutrients to optimise the performance of, and adaptation to, exercise. It encompasses matching energy and, in particular, carbohydrate intake with the fuel cost of exercise, manipulating energy and protein intake to alter body mass and body composition, and meeting body demands for other nutrients that may be altered by exercise (Burke & King, 2012).

The goals of sports nutrition vary according to the individual athlete and their exercise programme, and usually relate both to the amount of nutrients that should be consumed and the ideal timing of their intake (Burke & King, 2012). Maintaining an energy balance and a nutrient-dense diet, judicious exercise, optimal nutrition timing, and enough rest are the foundations for improving performance and/or training adaptations (Kreider et al., 2010). To a larger extent, nutrients provide energy and regulate physiologic processes during exercise, improved athletic performance is frequently linked to dietary changes. As a result, athletes devote significant time and effort to improving their training and performance only to fall short due to ineffective, counterproductive, and sometimes harmful nutritional practices (McArdle et al., 2010).

One of the ultimate goals in the field of personalised sport nutrition is the design of tailored nutritional recommendations to improve direct and indirect factors that influence athletic performance. More specifically, personalised nutrition pursuits aim to develop more comprehensive and dynamic nutritional, and supplement recommendations based on shifting, interacting parameters in an athlete's internal and external environment throughout their athletic career and beyond (Guest et al., 2019). Consequently, skeletal muscle in an athlete has the potential to respond quickly to fundamental changes to mechanical loads and nutritional availability (Hawley et al., 2011), hence, depending on the sport or playing characteristics of the individual athlete, nutrition plans must be customised in order to maximise performance in specific competitions (Deguchi et al., 2021).

Nutrition plans must be tailored to the individual athlete, with or without disabilities, based on sports or playing characteristics, in order for performance to peak in targeted competitions (Valliant et al., 2012). It is critical to investigate the extent to which body composition goals influence dietary intakes in order to inform strategies for supporting athletes and assisting athletes in maintaining adequate dietary intakes required for performance. When body composition goals are set, an energy deficit and the amount of macronutrients required for refueling and recovery are typically reduced (Jenner et al., 2018).

Appropriate dietary consumption can improve athletic performance, enhance adaptations to training as well as augment recovery from exercise (Rodriguez et al., 2007). Effective strength training and good sports nutrition should also be a part of an athlete's training programme. However, athletes easily forget these two key elements, but should take them into account when developing their training strategies (Andrews et al., 2016). A study conducted on dietary intake, body composition and nutrition knowledge of Australian football and soccer players indicated that the athletic performance of the participants was influenced by a small but significant factor called nutrition (Devlin et al., 2017). This was also shown in a study conducted on dietary intakes and eating habits of female college athletes, that proper nutrition was essential for participants to reach their full athletic potential while maintaining good health (Shriver et al., 2013).

Individuals participating in exercise training must match their training regimen with an appropriate diet, thus frequently consulting a fitness professional, as well as a complete dieting regimen with an appropriate diet. The objectives of an ideal training diet is to; meet caloric and nutrient requirements, engage in nutritional practices that promote good health, achieve and maintain optimal body composition and competition weight, encourage recovery from training sessions and physiological adaptations, and experiment with different pre-competition and competition fuel together with fluid intake to determine the body's responses (Plowman & Smith, 2014). It is of great importance to individualised nutrition plans for athletes so as to account for their own specific goals and the uniqueness of the event, performance goals, practical challenges, food preferences, and responses to what works and, ultimately, what does not work (Thomas et al., 2016).

Student athletes, regardless of level of competition, who eat poorly may be at a higher risk of injury (Tipton, 2015) hence, a good recovery approach can maximise adaptive responses to diverse mechanisms of exhaustion, enhancing muscular function, and boosting exercise tolerance (Kerksick et al., 2017). A successful intervention to recover an athlete's physical fitness is regarded vital which includes monitoring the regimen and diet, prompt admittance, and the required quality and amount of dietary components (Kerksick et al., 2017). Reason been that sports-specific nutrient requirements for athletes can vary but they are typically higher than those of non-athletes. Thus, basically, more calories, protein, carbohydrates, fluids, and specific micronutrients are required (Lahman-New et al., 2011; Rodriguez et al., 2009).

To define the proper nutrition for someone who wants to participate in a sport, one must first understand their physical characteristics, the sport type, and whether they have previously participated in this sport or others. Thus, one must understand their metabolic status and training (Verna et al., 2019). On this note, an appropriate diet is needed to be introduced into an athlete's training or workout because it is vital for improving athletic performance, conditioning, recovering from exhaustion after exercise, and avoiding injury (Aoi et al., 2006).

Athletes who desire to perform at their best must understand how to eat a healthy, balanced diet and combine it with particular sports nutrition practices appropriate to their training and competition environment (Rodriguez et al., 2009). Most athletes are engaged in supplementation however, a number of naturally occurring food ingredients have been demonstrated to have physiological effects; some of these ingredients are thought to be beneficial (when consumed in high doses or continuously) for enhancing athletic performance or preventing the disruption of homeostasis caused by strenuous exercise (Aoi et al., 2006).

To achieve the desired outcome, proper and adequate nutrition is essential for athletes, particularly football players, to replace and regenerate depleted hormones, energy reserves, nervous functions, dehydration and electrolyte transfer, maintain lean muscle mass, and to promote optimal performance. Football players must fuel appropriately through good nutrition and water due to the high intensity exhibited both in training and competition (Afrifa et al., (2020). It is critical for student-athletes to eat the right food at the right time in order to train, compete, recover, and heal, as well as think and learn. Nonetheless, for many student-athletes, nutrition quality and meeting nutritional demands are not high priorities (Shriver et al., 2013).

2.3.1 Pre-competition meal

The primary purpose of a pre-game meal is to provide enough energy to last the full game while remaining hydrated. But there are other considerations to keep in mind such as timing, hydration, and digestive considerations as well. The real pre-competition meal consists of just replenishing muscle glycogen, otherwise, athletes would not have the endurance to last during the full competition/game. Additionally, it also helps to prevent a low blood sugar level, which can interfere with an athlete's performance (Paugh, 2005). Food consumption should be timed to coincide with a competition or exercise event. Dietary intake before, during, and after an event can have an impact on one's ability to perform and recover from exercise. The pre-event meal should be high in complex carbohydrates and fluid and low in fat, fibre, and caffeine. Meals should be consumed at least 3-4 hours before the competition to avoid stomach upset, nausea, vomiting, cramps, and sluggishness (Clark, 2003).

Pre-exercise fueling boosts performance and prevents hunger during long periods of exercise. This means that athletes should consume a carbohydrate-rich meal or snack depending on the amount of time available, the duration, and the intensity of the event (Shriver et al., 2013). Carbohydrate ingestion before exercise has been shown to affect metabolic response, substrate utilisation during performance, and exercise time to exhaustion (Tokmakidis & Karamanolis, 2008). Carbohydrate feedings before endurance exercise are popular and have been found to improve performance despite rising insulin levels and decreasing fat oxidation (Ormsbee et al., 2014).

Many team sport players have conventionally prioritised carbohydrate eating the night before the game or for the pre-game meal only. Some modern players may need a cultural shift to consume enough carbohydrate to fulfil the daily calorie demands of training and match play (Burke et al., 2006). Nothwithstanding, female college gymnasts do not consume enough pre-competition carbohydrates to fulfil current literature guidelines (Olsen, 2009). Endurance athletes, on the other hand, rarely compete while fasting since this might deplete fuel resources. As a result, the time and content of the pre-exercise meal are important factors in improving metabolism and subsequent endurance performance (Ormsbee et al., 2014).

In preparation for competition, bodybuilding competitors consumed more kilocalories and carbohydrates than competitors in other classes over the full competition preparation period. These increased kilocalories and carbohydrates consumption might theoretically contribute to increased muscle mass and starting weight, as various categories impose varying expectations on competitors (Grill, 2021). Bodybuilders often take a high protein and calorie limited diet during competition preparation in order to achieve significant reductions in body fat while preserving lean body mass (Helms et al., 2014). To that purpose, appropriate caloric intakes, deficits, and macronutrient combinations should be observed while accommodating shifting requirements during competition preparation. As a result, the calorie intake with which one begins their preparation will almost certainly need to be altered over time as body mass reduces and metabolic adaptation occurs (Helms et al., 2014).

Bodybuilders use tapering tactics for the body in the week leading up to competition to enhance their competition day looks. These tactics, known as peak week, entail the modulation of macronutrients, electrolytes, hydration, and exercise. The major aims of peak week are to increase glycogen storage by storing carbohydrates optimally within muscle tissue, decrease subcutaneous fat, and reduce stomach bloating by fibre restriction (Chappell & Simper, 2018). Consuming a carbohydrate before a competition/ exercise has been shown to improve performance, and that ingesting carbohydrate within 60 minutes of exercise may also boost performance, or does not appear to hinder it (Ormsbee et al., 2014).

Several studies have found that consuming carbohydrates and protein before exercise is an effective method for improving training performance and reducing muscle damage caused by exercise (Kerksick et al., 2017). A study demonstrated that glucose ingestion 15 minutes before prolonged exercise provides an additional carbohydrate source to the exercising muscle, thus improving endurance running capacity (Tokmakidis & Karamanolis, 2008). In contrast, it has been found that feedings of pre-exercise nutrients 15 or 60 minutes before exercise had no effect on intermittent cycling performance or blood glucose levels. Therefore consuming carbohydrate within 1 hour before exercise had no effect on performance (Pritchett et al., 2008).

2.3.2 Competition meal

Whether to ingest carbohydrates as a liquid, solid, or semi solid during and immediately after exercise depends on the individual athlete. In view of that feeding tactics during continuous activity, however, need to take into consideration personal preference and gastrointestinal tolerance, and require sufficient experience, since not all people would be able to handle such high carbohydrate consumption rates (Cermak & van Loon, 2013). As a result, many of these recommendations for carbohydrate intake are made for well trained endurance athletes who are able to exercise for an extended period of time at a high absolute work load and who are accustomed to consuming substantial amounts of carbohydrates while exercising (Cermak & van Loon, 2013). It has been demonstrated that carbohydrate consumption rates vary substantially not just across events but also between competitors and greater amounts of carbohydrate ingested during an Ironman triathlon have been correlated with an improvement in performance (Pfeiffer et al., 2012).

On placebo effect from carbohydrate intake during prolonged exercise, Hulston and Jeukendrusp (2009) tested the placebo effect by recruiting ten male cyclists to perform three exercise trials consisting of 120 minutes of steady state cycling followed by an approximate 60 minutes time trial. During the 120 minutes of steady state cycling, participants ingested water, a carbohydrate solution or a non-caloric placebo solution matched for the same colour and taste as the carbohydrate solution. It was realised that time trial performance times were 11.3 % faster in the carbohydrate trial compared with water and 10.6 % faster when compared with the placebo trial. The study concluded that there was no placebo effect from carbohydrate ingestion during prolonged cycling exercise. Stellingwerff et al. (2007) similarly found that muscle glycogen utilisation changed over time after prolonged cycling activity and that, when carbohydrate was consumed, mixed muscle glycogen utilisation was reduced during the first hour of exercise compared to the placebo experiment. As a result, in the placebo experiment, there was a larger reliance on muscle glycogen as a substrate source during the early phases of exercise.

During endurance exercise, the body requires a steady supply of energy to sustain prolonged physical activity. Carbohydrates and lipids are the primary sources of energy for the body during endurance exercise. However, the relative contribution of carbohydrates and lipids to energy production during endurance exercise can vary depending on factors such as exercise intensity, duration, and the individual's fitness level as well as diet (Tarnopolsky, 2004). The sparing of liver glycogen allows for greater carbohydrate availability in the liver towards the end stages of competitive exercise, when exercise intensity is strongly increased (Cermak & van Loon, 2013).

Endurance athletes should be recommended to initiate sports drink consumption immediately at the onset of exercise to maximise the potential for glycogen sparing, along with maintaining euglycemia and high blood glucose oxidation rates late in exercise (Stellingwerff et al., 2007). As such an athlete’s training diet must include tactics for successfully refuelling between matches, which must be done every 4 to 7 days throughout the competition season, as well as conditioning activities done between matches or during pre-season preparation (Bangsbo et al., 2006).

2.3.3 Post-competition meal

According to the American College of Sport Nutrition (ACSN), the main goals of recovery should be to provide athletes with adequate fluid, electrolytes, energy, and protein to supply amino acids for muscle protein maintenance and repair, and carbohydrates to replace muscle glycogen stores and aid recovery (Potgieter, 2013).

After a workout, the body's glycogen stores are depleted, and the muscles are primed to absorb glucose and rebuild glycogen. The rate at which glycogen is replenished during the recovery period depends on various factors, including the timing and composition of the post-exercise meal. Failure to consume carbohydrates during this period can result in poor rates of glycogen regeneration until feeding occurs (Burke et al., 2006). Post-exercise nutrition is essential for replenishing endogenous substrate reserves and for skeletal muscle injury repair, and reconditioning. Post-exercise carbohydrate consumption has long been recognised as the most critical element influencing muscle glycogen production (Beelen et al., 2010).

Food consumption during post-exercise recovery is required for hypertrophy to occur. As a result, athletes must consume carbohydrate and protein after exercise in order to achieve a positive protein balance and, as well increase their adaptive response to exercise (Koopman et al., 2007). Carbohydrate and protein consumption during the early stages of post-exercise recovery has been demonstrated to improve subsequent exercise performance and may be especially beneficial for athletes who have several training or competition sessions on the same or consecutive days (Beelen et al., 2010). Nevertheless, evidence has shown that athletes are not getting the post-exercise fuel they require, even with the increase in sports dietitians and fueling stations on campuses. This issue may be due to a lack of nutrition knowledge (Quintanilla, 2020).

Rapid replacement of liver and muscle glycogen during acute post-exercise recovery is crucial for athletes who need to maximise performance throughout the day or compete twice daily. As a result, athletes are advised to consume 75-90g of carbohydrate per hour for 4 to 6 hours following intense exertion under these conditions (Cermak & van Loon, 2013). Endurance athletes often focus on carbohydrate consumption to replenish muscle glycogen, whereas resistance athletes are more concerned with protein consumption following exercise to facilitate skeletal muscle reconditioning and muscle mass gain. However, both athletes will gain from combining carbohydrate and protein consumption (Beelen et al., 2010).

Several studies have attest to the fact that post-exercise protein or amino acid ingestion is recommended to boost muscle protein synthesis, which is thought to aid in muscle repair and skeletal muscle reconditioning (Hawley et al., 2006; Koopman et al., 2007; Tipton et al., 2004; Rennie & Tipton, 2000). Post-exercise protein and/or amino acid supplementation is recommended to accelerate mixed muscle protein synthesis, limit protein breakdown, and enable net muscle protein accretion. The latter is thought to be essential to maximise skeletal muscle injury healing and facilitate muscle tissue reconditioning (Beelen et al., 2010). Consequently, a positive muscle protein balance is required to support the healing of exercise induced muscle damage and the adaptive response of the skeletal muscle to exercise training (Hawley et al., 2006). In general, protein consumption during carbohydrate rich recovery meals is advised and may assist athletes to accomplish other dietary goals, such as improving net protein balance after exercise (Burke et al., 2006).

After exercise, nutrition helps to replenish energy stores, restore fluid and electrolytes, create new proteins to offset both catabolic state and exercise induced damage, as well as boost immune system response (Ivy & Ferguson-Stegall, 2014). Increased adaptation of muscle hypertrophy resulted in ambiguous strength performance benefits in resistance training where post-exercise protein consumption was compensated by protein intake later in the day (Hoffman et al., 2009; Cribb & Hayes, 2006).

Recovery from a workout is essential to an athlete's training plan. Beneficial adaptations and performance may be impeded if carbohydrate, protein, fluid, and electrolyte recovery is inadequate (Beck et al., 2015). Water and electrolyte intake for rehydration and rebuilding carbohydrate stores, as well as protein consumption for muscle recovery, are examples of nutritional recovery strategies (Kovacs & Baker, 2014). It has been shown that consuming a protein, carbohydrate, and fat supplement immediately after exercise, as compared to 3 hours later, improved post exercise net protein balance (Levenhagen et al., 2002). Therefore, it is imperative for athletes to devise a recovery strategy to quicken the time of recovery, which could possibly reduce the risk of injury following exercise (Nédélec et al., 2013).

2.4 Nutrition Knowledge of Athletes in College of Education

Nutrition knowledge is relevant to any sports player. It consolidates the rationales to improve dietary behaviour and grant the necessary competencies to make nutrition-based food choices (Alaunyte et al., 2015; Dickson-Spillmann & Siegrist, 2011). Adequate nutrition knowledge has been defined as an awareness of nutrition practices and ideas such as adequate food intake and wellness, food intake and illness, foods representing essential sources of nutrients, and dietary recommendations and references (Miller & Cassady, 2015). For that reason, providing nutrition instruction and counseling to players of all levels may result in increased nutrition knowledge, with the ultimate goal of influencing food intake and performance (Devlin et al., 2017).

Nutrition knowledge is one of the most important strategies for assisting athletes in consuming an adequate diet. The goal of nutrition knowledge is to help athletes understand what they should eat, and how to select and prepare a wide variety of foods required for a healthy diet (Spendlove et al., 2012). Athletes have different energy intake, micro/macronutrient requirements, and hydration needs; therefore, it is critical that they are adequately educated on proper nutrition habits since most of them are unaware of how much more energy they require or what types of foods to consume (Burke, 2008). Although, there is inconsistency in results among athletes concerning nutrition knowledge, inadequate nutrition knowledge can have a substantial impact on athletes' nutritional status and performance (Janiczak et al., 2022; Sánchez-Díaz et al., 2020).

Nutrition knowledge is regarded as the concepts and processes associated with diet and disease, diet and health, and food choices that contain important nutrients. Adequate nutrition knowledge can lead to healthy eating habits and food choices that benefit overall health. Collegiate athletes must be treated as a distinct subpopulation when assessing dietary needs and nutrition knowledge. This is because, they lack the confidence to make food choices for themselves in order to maintain a healthy nutritional status (Carbone, 2021). College athletes expressed concerns about what constitutes a healthy diet and thus, lacked knowledge about nutrition (Weeden et al., 2014). In a review, athletes frequently failed to follow nutritional guidelines and have poor general and sports nutrition knowledge. This suggests that many athletes are not familiar with both general and sport-specific dietary recommendations because they do not possess the minimal nutrition knowledge necessary to pass a nutrition knowledge test (Janiczak et al., 2022).

Nutrition knowledge encompasses the broader term nutrition literacy including food preparation and cooking skills. In this light, increasing nutrition knowledge may lead to increased nutrition literacy, resulting in a better ability to access, interpret, and apply nutrition information (Velardo, 2015). Nutrition knowledge is one of numerous variables required to develop healthy eating habits, and it is particularly crucial for athletes. Accordingly, athletes' nutritional knowledge must be increased through education programmes that address issues such as correct information resource selection and the need of avoiding ingesting supplements without a prescription (Vázquez-Espino et al., 2022). Athletes need adequate nutrition knowledge to better understand the importance of food choices on performance, recovery and health (Heikkilä et al., 2018). Likewise, a study found that majority of athletes had adequate knowledge on nutrition, and there should be continuous nutrition education and counselling sessions on the importance of correct nutrition information among athletes (Kathure et al., 2022).

Nutrition knowledge is commonly reported as having an understanding of the relationship between diet and disease, knowledge of food nutrient content, and a general understanding of healthy dietary practices (McKinnon et al., 2014). A lack of nutrition knowledge may be an impediment to adopting healthy behaviours and maintaining a healthy weight (Worsley, 2002). Also it has been shown that assessment of nutritional knowledge of athletes was no better, nor did it correlate with positive dietary behaviours or attitudes (Walsh et al., 2011). Additionally, it has been demonstrated that athletes' and their coaches' nutritional knowledge is lacking (Spendlove et al., 2012; Murphy & Jeanes, 2006; Zinn et al., 2006). With this, adequate nutritional knowledge of athletes is crucial in order to cope with the difficult conditions they may experience particularly during training and competitions (Seyhan, 2018).

Given the importance of nutrition to health and performance, it is critical to address athletes' nutrition knowledge, as it might impede their potential ability and the performance of their respective teams (Giroux, 2015). Several studies have suggested that an appropriate amount of nutrition knowledge is associated with optimum nutritional behaviours (Miller & Cassady, 2015; Kolodinsky et al., 2007; Drichoutis et al., 2006). However, one potential barrier to athletes following optimal nutrition practices is a lack of nutrition knowledge, particularly knowledge about nutrition for sport (Werner et al., 2022). As reported in a cross-sectional study that athletes and coaches have a lower than average understanding of nutritional knowledge compared to athletic trainers and strength coaches. It should be noted that in the latter group, 28.6% of athletic trainers and 16.9% of strength coaches had inadequate nutrition knowledge (Torres-McGhee et al., 2012).

Athletes have misconceptions about optimal nutrition and energy requirements, and rely on a variety of resources such as coaches, dieticians, peers, family, media and independent research to inform practice (Torres-McGehee et al., 2012). Athletes receive nutritional advice from their coaches, but they lack proficiency in this area and a lack of understanding and the distribution of incorrect dietary advice is dangerous, particularly for athletes (Cockburn et al., 2014). Moreover, a lack of nutrition knowledge has been linked to inappropriate dietary fueling among collegiate athletes (Danh et al., 2020). It has been shown that athletes appear to have insufficient awareness of calorie density, micronutrients, supplements, fat sources in the diet, muscle physiology, protein supplementation for vegetarians, and weight-loss management (Trakman et al., 2016). Contributing to the issue of athletes choosing unhealthy foods, it is crucial that nutrition education be included in sports training for trainers, coaches, and athletes in order to guarantee that athletes receive sufficient and accurate information (Waititu, 2013).

Collegiate athletes' expectation about nutrition knowledge is to have appropriate dietary habits that will enhance performance and maintain a physique best associated with their sport. For that matter, a basic understanding of nutrition is pertinent to implement the principles of sports nutrition into their lives (Ozdoğan & Ozcelik, 2011). Adequate nutrition knowledge could go a long way in ensuring that athletes make informed decisions regarding nutrient intake, ultimately optimising their performance. Once they have adequate nutrition knowledge, they become well equipped to own their diet (Kathure et al., 2022). As a study has confirmed that without an adequate nutrition knowledge base, it cannot be expected that college athletes will practice appropriate nutritional habits to keep them healthy and performing optimally (Werner, 2021).

It is expected that increasing athletes' understanding through a nutrition education programme will help athletes obtain and maintain an adequate diet (Devlin & Belski, 2015) but in a 2011 systematic review of the nutrition knowledge among athletes', general and sports specific nutrition scores were mediocre with mean scores of approximately 45%-65%. There appeared to be a weak, positive correlation between nutrition knowledge and good quality dietary intake (Heaney et al., 2011). Similary, student-athletes were found to have inadequate nutrition knowledge as a result of scoring below the 75% threshold (Danh et al., 2020). In another study to assess the dietary intake, body composition, and nutrition knowledge of Australian football and soccer players, elite athletes did not have a higher degree of nutrition awareness than sub-elite players, with no differences found across the groups (Devlin et al., 2017). Again, another study shows the both nutrition knowledge and practice were poor among Taekwondo players in Nepal (Sunuwar et al., 2022).

In light of this, education programmes are routinely undertaken to increase athletes' nutrition understanding in order to motivate and stress the importance of nutrition in practice. Athletes who are confident in their nutrition knowledge believe they have a better capacity to apply this information to their everyday dietary practices, and coaches believe that an athlete's degree of nutrition knowledge is a major factor affecting dietary behaviours (Heaney et al., 2008). Nutrition education programmes are designed to improve nutrition knowledge, with the aim of supporting sound dietary intake within the community or a specific target population (Spronk et al., 2014). While knowledge is only one of the numerous components that must be present in order to modify nutrition behaviour, there is enough evidence to demonstrate that proper nutrition knowledge has a minor but critical role in influencing food consumption behaviours (Zinn et al., 2005; Worsley, 2002; Kunkel, et al., 2001).

It is important to counsel athletes on good nutritional decisions in order to help avoid low energy availability and thus, nutritional deficiencies (Jordan et al., 2020). This is because athletes may lack knowledge of macro and micronutrient requirements, especially in accordance with periodisation of exercise training, in order to adapt their diet for a well balanced nutrient rich diet (Jordan et al., 2020). Studies revealed that student athletes are often provided with various sources of information about nutrition and may even have an adequate basal level of nutritional wisdom but their intake is still characteristic of the “Standard American Diet” (Spronk et al., 2014; Heaney et al., 2011). For instance, a study by Rosenbloom et al. (2002), on 328 Division I athletes where knowledge of 237 men and 91 women was assessed using a nutrition knowledge questionnaire discovered that athletes have inadequate information/ knowledge regarding nutrition which was due to misconceptions, and that both male and female athletes had poor nutrition knowledge.

Nutritional information is relevant, as many athletes are not meeting sports nutrition guideline (Jenner et al., 2018). This is because collegiate athletes are susceptible to nutritional misinformation and strive for an unrealistic body image or performance enhancement standards (Shriver et al., 2013; CPSDA, 2012). But, previous studies have shown that athletes who have adequate nutrition knowledge are more likely to meet optimum nutrition requirements (Werner et al., 2022; Alaunyte et al., 2015; Folasire et al., 2015). It was noticed that participants who had taken a nutrition and/or health class in college outperformed those who had not taken a class on the nutrition knowledge quiz (Abbey et al., 2017). Again, it was revealed that higher nutrition knowledge has been linked to demographic factors such as female gender, higher athletic calibre, and participation in physique-oriented sports (Raymond-Barker et al., 2007).

In a comparison of nutritional knowledge and food habits of collegiate and non-collegiate athletes, it was indicated that there was no significant difference between females and males (Arazi & Hosseini, 2012). In another study to analyse nutrition knowledge and food choice of young athletes, it was revealed that there were no statistically significant gender differences in nutrition knowledge scores (Heydenreich et al., 2014). In addition, research on the nutrition knowledge scores between male and female athletes did not differ (Heikkilä et al., 2019) and likewise, there were no main effects in sport nutrition knowledge for sex (Manore et al., 2017). Besides, a study discovered that there was no significant difference between the average scores of nutritional knowledge levels of females and males (Klein et al., 2021; Saribay & Kirbaş, 2019). Moreover, Ahmadi et al. (2022) observed no significant differences in sports nutrition knowledge between male and female students-athletes on sports nutritional knowledge, attitude, and practice of adolescent athletes in Tehran.

Women, on average, have higher levels of nutrition knowledge than men, which has been attributed to women's traditional role in purchasing and preparing foods (Spronk et al., 2014). Previous research has indicated that there were gender differences in nutrition knowledge, as it was evidenced that females scored higher than males for both nutrition knowledge (Spronk et al., 2015) and university female athletes scoring significantly higher than their male counterparts in terms of nutrition knowledge (Dunn et al., 2007). In a study to explore nutrition knowledge, food choice motives and eating behaviours of triathletes, it showed a significantly greater nutrition knowledge score for females than males (Birkenhead, 2014). To evaluate Iranian college athletes' sport nutrition knowledge, it was discovered that female college athletes had a significant knowledge as compared to their male counterparts (Jessri et al., 2010). In a similar study to evaluate general nutrition knowledge in elite Australian athletes, the result indicated that females had a higher total knowledge score than male athletes scoring (Spendlove et al., 2012). Furthermore, it was demonstrated in another study that female athletes had a significantly higher sports nutrition knowledge than male athletes (Kimmel, 2019).

However, other studies reported males having good nutrition knowledge than their female counterparts in which in an assessment of the nutrition knowledge of male and female GAA players, nutrition knowledge scores were higher in males than females (Elliott, 2021). In another study to assess the nutritional knowledge, dietary habits, nutrient intake and nutritional status of university student athletes, it was indicated that males had better nutritional knowledge than females (Ali et al., 2015). Also, a study on hydration and nutrition knowledge in adolescent swimmers has shown that females had lower scores than male in nutrition (Altavilla et al., 2017).

2.5 Dietary Practices of Athletes in College of Education

Dietary practices are the number of choices that groups or individuals should make concerning which foods need to be eaten (Preedy & Watson, 2010). Athletes and active individuals who participate in physical fitness require optimal energy (Genton et al., 2010) and consumption of foods comprising of proteins, complex carbohydrates, essential fats, vitamins, and minerals are crucial for good dietary practice (Preedy & Watson, 2010). Notwithstanding, an individual's eating preferences, objectives, and needs are not constant but rather, they change over time depending on several factors including an individual's environment, sleeping patterns, physical activity levels, and access to food (Alayna, 2022).

Inadequate energy and micronutrient intake in college athletes may put them at risk of nutritional deficiencies, jeopardising their athletic performance and, as a result, national development and fame (Waititu, 2013). Inasmuch as, nutritional practices before, during, and after a workout or event should address the factors limiting performance of the exercise and the nutrients needed to restore homeostasis, repair the body, and adapt to the stimulus (Burke & King, 2012). Good dietary practice is essential in sports as it improves the quality of training, maximises performance and aids in the speedy recovery of players from injuries (Abdulai et al., 2022).

Evidence suggest that not consuming enough calories and the right type of macronutrients can impede an athlete's training adaptation, whereas athletes who consume a balanced diet that meets energy needs can augment physiological training adaptations (Hansen, 2010). Herewith, the way in which an athlete eats is crucial to achieving his or her objectives because it enables the athlete to consume a diet that will maximise performance (Kibata, 2011). Accordingly, it is imperative to critically understand how to eat for the competition, that is, what to consume before and after the competition to aid recovery. In fact, although the pre-competition meal must ensure appropriate availability of energy for optimal performance, the post-exercise meal is critical for recuperation and allowing training to continue for the future events (Verna et al., 2019).

Diets high in various nutrients are essential for keeping the immune system strong enough to meet the demands of training and competition (Pyne & Sharp, 2014). Energy intake is a crucial aspect of an athlete's diet, as it supports optimal body functions, determines macronutrient and micronutrient intake, and helps maintain body composition. For example, low iron intake can lead to iron deficiency or anemia, while inadequate calcium and vitamin D can increase the risk of bone stress injury (Sale & Elliott-Sale, 2019). Furthermore, adequate energy intake forms the cornerstone of a healthy diet with sufficient intake of macronutrients and micronutrients to meet the demands of an athlete. When dietary energy intake equals total energy expenditure, energy balance is achieved (Wasserfurth et al., 2020).

Though nutritional changes can affect body composition, it is also necessary by most athletes to improve performance (Maughan & Shirreffs, 2012; Broad & Cox, 2008; Heaney et al., 2008). The athlete's condition, the type of sport, the stage of the training period, and the level of competition all play a part in meal selection (Malsagova et al., 2021). It was discovered in a study that male team based sport participants' nutritional consumption was at the lower and upper ends of wide carbohydrate and protein guidelines, respectively (Devlin et al., 2017). With regards to this, needs-based dietary interventions for athletes in their competitive season and off-season are necessary to prevent the development of disordered eating while preserving optimum health and boosting performance (Helms et al., 2019).

Athlete nutrient requirements vary depending on the sport and the various stages of training, such as preparation, competition, off-season, and the transitions between these stages (Houtkooper et al., 2007). Athletes dietary practices have been discovered to be a crucial component of training and performance, and athletes who make knowledgeable dietary choices will have an advantage over those who choose to overlook the function of food in human performance (Hagan & Hormenu, 2014). Although it is clear that athletes would benefit from following optimal nutrition practices, evidence appears to indicate that athletes typically do not follow such optimal practices, often resulting in low energy availability, among other issues (Logue, 2018). It is therefore essential for athletic programmes to have qualified sports nutritionists on staff to guide athletes in their diet choices so as to improve athletic performance (Waititu, 2013).

Athletes must meet energy requirements and time the consumption of nutrients such as carbohydrates, protein, and fluids before, during, and after physical activity in order to support muscle maintenance, repair, and growth, meet protein synthesis and turnover requirements, and stay hydrated (Houtkooper et al., 2007). In a qualitative exploratory study where division I collegiate athletes were interviewed about their food and nutrition-related behaviours and cognitions discovered that athletes avoided energy-dense, nutrient-poor items like fast food and fried dishes in order to improve performance (Eck & Byrd-Bredbenner, 2021). In contrast, a study to determine the daily distribution of carbohydrate, protein and fat intake in elite youth academy soccer players over a 7 day training period, a common 235 trend across the research appears to be that top youth soccer players consume lower 236 energy intakes than expected daily energy requirements, thereby possibly harming 237 performances (Naughton et al., 2016).

Athletes typically undergo regular training and preparation, which includes several hours of high intensity activity over a sustained period of time (Pyne & Sharp, 2014). Concerning this, it is advisable to teach athletes flexible eating habits that recognises the value of a nutrient dense diet without attaching labels like good or bad on certain food groups or macronutrients will benefit psychological and physiological health in the long run (Helms et al., 2019). In a study, collegiate football players indicated that performing at their best was important and this meant choosing healthy, nutritious foods that were low in fat and high in protein (Long et al., 2011).

Athletes, like the rest of the population, must eat and select foods to meet dietary needs. In doing so, they face many of the same food choice decisions of non-athlete populations, but are challenged with an additional set of demands that comes with participating in sport. With this, they need to consume enough food and fluids to meet the energy demands of exercise and this can vary considerably depending on the type of sport (Rodriguez et al., 2009). College athletes may be required to seek food and resources away from school by relying on their understanding of healthy eating to select acceptable items for their diets and competition schedules. But they must comprehend the idea of nutritional timing otherwise, they may develop a restricted and/or obsessive connection with food, which may lead to weight gain (Benavides, 2022).

A study reported that the reason athletes choose the foods they do has shown that convenience, appeal of food, as well as price have been commonly reported as determinants of food choice. Most of the athletes in the study followed the food first approach to energy intake by consuming nutrients from food more often than supplementation, though the reason for doing this was unclear (Reinhard & Galloway, 2022). In another study carried out to evaluate the food selection at the London 2012 Olympic and Paralympic Games, in which 15 participants were asked to complete an online survey and rate on a likely scale menu quality, food safety, quantity and sustainability patterns, nutrition labelling, and provision for ethnic needs, dietary plans, and specific situations, indicated that the addition of allergens on nutrition labeling was considered more important than nutrient content (Pelly et al., 2014).

In a study conducted on division I male football players of which 9 players were found to have similar intakes to that of age and gender matched non-athletes, and their energy intake was significantly inadequate compared to their activity level (Cole et al., 2005). Another investigation done with male collegiate athletes found that they were not consuming appropriate amounts of each macronutrient, specifically carbohydrates and protein (Fox et al., 2011). The study concluded that lack of nourishment is relevant, particularly among collegiate athletes, as diets that do not meet recommended levels of essential nutrients may lead to increased fatigue or risk of injury (Fox et al., 2011).

In assessing dietary intakes and eating habits of female college athletes, only 9% of participants met their energy needs and 75% failed to consume the minimum amount of carbohydrates required to support their level of training (Shriver et al., 2013).

Another study to assess sports nutrition knowledge, dietary intake, and nutrition information source in female collegiate athletes found that female athletes have inadequate dietary intake (Danh et al., 2021). Also, female collegiate cross country runners' diets were deficient in several key nutrients, especially calories, carbohydrates, and Vitamin D (Alayna, 2022) but female collegiate cross country runners had been found to have positive attitudes towards nutrition (Zawila et al., 2003). Additionally, another study indicated that female athletes consume insufficient diet and therefore had low energy intakes (Wasserfurth et al., 2020).

Several studies reported gender differences concerning food intake amongst athletes. One of such study on nutrition knowledge and attitudes among Clemson University student-athletes revealed females scored higher on nutrition attitudes than their male counterparts and were more likely to buy and prepare their own food (Dunnigan, 2010). Another study demonstrated female athletes significantly having higher mean scores than male athletes in terms of dietary habits or nutrition behaviour (Fisher, 2013; Paugh, 2005). Again, in Nepal, it was discovered among Taekwondo players that males had poor nutrition practice score compared to females (Sunuwar et al., 2022). Meanwhile, a study conducted on assessment of nutritional knowledge, dietary habits and nutrient intake of university student athletes revealed that male athletes had good dietary habits whereas the female athletes had poor dietary habits (Ali et al., 2015). Furthermore, another study revealed no differences in the dietary habits scores of both male and female athletes (Montecalbo & Cardenas, 2015).

2.5.1 Carbohydrates

Carbohydrates, which are stored as glycogen in the muscles and liver, play an important role in performance and recovery. Carbohydrate for metabolism and subsequent energy production is derived from glycogen stores as well as exogenous carbohydrate, which enters the bloodstream when carbohydrates are consumed in the form of foods or beverages (Smith et al., 2015). Consumption of carbohydrates will help maintain high rates of carbohydrate oxidation, reduce ratings of perceived exertion, increase endurance capacity, delay the onset of fatigue, and prevent hypoglycemia (Fink & Mikesky, 2017). Carbohydrates are needed in greater quantities by athletes who work out for extended periods of time each day (Zawila et al., 2003).

The carbohydrate dietary guidelines for athletes will vary depending on the intensity of physical activity (Waititu, 2013). The amount and intensity of exercise determine an athlete's daily carbohydrate recommendation. Hence, it is crucial for athletes to include complex carbohydrates with a low moderate glycemic index in their diets (Potgieter, 2013). The majority of an athlete's diet should consist of refined grains, legumes, and fresh fruits in order to guarantee that they meet their needs for fiber and micronutrients and for overall health (Srilakshmi, 2006).

The majority of the energy used by endurance athletes should come from carbohydrate sources (Smith et al., 2015). Athletes engaged in endurance sports must ingest a significant amount of carbohydrates while training, according to sports nutrition requirements. However, high carbohydrate ingestion, on the other hand, may cause gastrointestinal discomfort due to its high osmolality (de Oliveira & Burini, 2011). The critical phase during activity lasting 2 hours or more is the supply of carbohydrates to the muscle, which appears to be constrained by intestinal absorption. When consumed from the start of activity and at regular intervals thereafter, carbohydrates are oxidised more quickly and often hit a plateau within 60-90 minutes

(Jeukendrup & McLaughlin, 2011).

Carbohydrate replacement is a critical issue for athletes, and solutions are increasingly available whereby cereal meals, such as rice, can aid to maintain energy levels (Ishihara et al., 2020). In order to improve performance, endurance athletes often consume considerable amounts of carbohydratess before and during training (Gibala, 2007). This is due to the fact that carbohydrate consumption improves athletic performance over time by avoiding hypoglycemia and sustaining high levels of carbohydrate oxidation. Furthermore, exogenous carbohydrate oxidation rates are likely connected to exercise performance, implying that the more exogenous carbohydrate supplied to the working muscle, the better the performance (Jeukendrup & McLaughlin, 2011).

Glycogen in addition to its role as a substrate, has important direct and indirect roles in controlling muscle response to exercise. Muscle glycogen level impacts not just our ability to exercise, but also the signaling processes that occur in response to exercise (Phillips et al., 2012). An increased pre-exercise glycogen reserves improve the ability to do repeated bouts of exercise, even if they are just 6 seconds long. So it is important to replenish glycogen stores between matches and providing appropriate nutrition for training periods demanding high intensity intermittent activity (Burke et al., 2006). Further, each player must adapt his or her daily carbohydrate intake to the fuel requirements of the training and competition schedules, including weekly and seasonal variations. As a result, high level athletes in less mobile roles, or teams or individuals with a less rigorous training and competition schedule, should be consuming a target range for carbohydrate by 5-7 g/kg per day (Burke et al., 2006).

However, carbohydrate recommendations, may change as factors such as exercise intensity change, and exercise intensity can dictate the amount of glycogen stores that remain after exercise, which in turn determines how many carbohydrates are required beforehand (Millard-Stafford et al., 2008). Despite the fact that carbohydrate consumption leads to an improved performance, an investigation on elite young soccer players' dietary practices found carbohydrate intakes that were suboptimal compared to guidelines, thereby urging nutrition guidance to focus on not just total daily macronutrient consumption but also distribution patterns throughout the day and around training (Naughton et al., 2016).

A greater consumption of 60-80 g/h of carbohydrate is ideal and that even higher intakes may be beneficial when various transportable carbohydrates are consumed (Jeukendrup & McLaughlin, 2011). In a large scale multicentre study, where 51 cyclists and triathletes from four different research sites underwent four workout sessions that included a 2 hour continuous load ride at a moderate to high intensity, it was observed that carbohydrate consumption considerably increased performance and concluded that the highest performance enhancement was obtained at ingestion rates ranging from 60-80g carbohydrate (Smith et al., 2010). In contrast, the current American College of Sports Medicine guidelines recommend a carbohydrate consumption of 30-60 g/h. This discovery is mirrored in several guidelines, which indicate that athletes should consume between 30 and 60g of carbohydrate per hour during continuous activity or workout. Hence, it is advised that carbohydrates be consumed at a rate of 30-60g during intense exercise lasting more than 1 hour in order to sustain glucose oxidation and postpone exhaustion (Jeukendrup & McLaughlin, 2011).

It is critical to determine the ideal calorie intake to balance training demands, therefore, athletes who engage in high intensity training sessions on a regular basis should prioritise adequate carbohydrate intake (Tipton & Witard, 2007). Consequently, endurance performance and endurance capacity are largely dictated by endogenous carbohydrate availability. As such, it has been well established that carbohydrate ingestion during prolonged moderate to high intensity exercise can significantly improve endurance performance. Although the precise mechanism responsible for the ergogenic effects are still unclear, they are likely related to the sparing of skeletal muscle glycogen, prevention of liver glycogen depletion and subsequent development of hypoglycemia, and/or allowing high rates of carbohydrate oxidation (Cermak & van Loon, 2013).

Carbohydrate ingestion during prolonged moderate to high intensity exercise is crucial for endurance athletes (Cermak & van Loon, 2013). Because as intensity rises, carbohydrate utilisation also increases with glycogen as the primary source of this fuel (van Loon et al., 2001). Therefore, long term glucose ingestion is believed to boost performance by conserving skeletal muscle and liver glycogen stores and maintaining high rates of carbohydrate oxidation (Cermak & van Loon, 2013). Furthermore, it is well acknowledged that athletes benefit from a high carbohydrate diet, although the consequences are not consistent. It is also obvious that many athletes are experimenting with low carbohydrate diets and reaping a variety of self-perceived benefits which is supported by an increasing number of competitive ultra-endurance athletes who frequently win events and, in some cases, establish records after adopting a low carbohydrate diet (Volek et al., 2015).

2.5.2 Proteins

Protein is essential in an athlete's diet regardless of age or athletic credentials (Tipton & Witard, 2007; Phillips, 2004). Protein is required to provide amino acids for enhanced protein synthesis. This is because increased synthesis is thought to be required for the generation of new myofibrillar proteins during resistance training and mitochondrial biogenesis during endurance training. Simply, protein needs may be related to the amount and duration of activity performed (Tipton & Witard, 2007). Protein is an essential nutrient in the diet, as it is used to produce body proteins with important structural and functional roles, as an energy source during exercise, and to support muscle mass gains that occur with exercise (Lemon, 2000).

The daily distribution of protein consumption is crucial for optimising components of training adaptations such as muscle protein synthesis (Mamerow et al., 2014; Areta et al., 2013). Consumption of protein and/or amino acids has been demonstrated to boost muscle protein synthesis rates during endurance type of exercise (Howarth et al., 2009; Gibala, 2007; Levenhagen et al., 2002). It is imperative for an athlete to make sure their diet contains an adequate amount of high quality protein to sustain the nitrogen balance. On the other hand, training capacity may suffer if increased protein intakes lead to inadequate carbohydrate intakes (Broad & Cox, 2008).

Although dietary protein's ability to stimulate muscle growth and repair may be influenced by factors such as typical physical activity, health status, body mass and composition, and age, it appears that a single meal containing 30g of high quality protein stimulates muscle protein synthesis the most in athletes as well as healthy adults (Yang et al., 2012; Layman, 2009; Symons et al., 2009). Energy balance, nutrient intake, and individual genetic composition all contribute to an athlete's response to training and food intake, and the impact of protein taken per day on performance varies and is sometimes difficult to assess (Tipton & Witard, 2007). Studies have shown that consuming protein close to a workout, such as immediately before or within an hour after, greatly increases the rate of protein synthesis in the muscles and protein accretion when compared to delayed protein consumption after exercise (Hoffman et al., 2009).

The International Society of Sports Nutrition recommends protein intake to range from 1.0 g/kg to 2.0 g/kg per day of body weight depending on intensity of exercise (Kerksick et al., 2017). Individuals who engage in resistance training typically require 1.2-2.0 g/kg of body weight per day, which is significantly higher than the current Recommended Daily Allowance (RDA) for individuals who do not engage in resistance training with the intent to gain muscle mass (Stark et al., 2012). Therefore, it is important for athletes to consume the appropriate quantity of protein because an excess will impair athletic performance and as well can result in osteoporosis, poor renal function, and other diseases (Phillips, 2004).

The impact of energy balance on protein metabolism and balance points to another possible source of worry for some athletes. Athletes who limit their energy consumption may need to be extra mindful of their protein intake. Athletes participating in weight-class sports (such as boxing and wrestling), aesthetic sports (such as figure skating, gymnastics, and diving), and sports where excess weight may be deemed to impair performance (such as horse-racing, rowing, or distance running) should be especially cautious. Nonetheless, there is no reason to think that all, or even many, of these athletes require more protein than they already consume (Boisseau et al., 2005; López-Varela, 2000).

Paying close attention to timing, composition, and consumption in conjunction with macronutrients like carbohydrate that are hidden in the specifics of the advised guidelines for protein intake for athletes, will help athletes perform at their highest level (Phillips et al., 2007). It is important to consume a moderate amount of high quality protein three times per day than the current practice of skewing protein intake toward the evening meal in boosting 24 hour muscle protein synthesis (Mamerow et al., 2014). As noted in a study, 20g of whey protein taken every 3 hours over the 12 hours recovery period following a single bout of resistance exercise was the optimum feeding pattern for fostering improved rates of muscle protein synthesis. Meanwhile, the study stressed that protein intake timing is a different variable and an important aspect in developing optimum dietary strategies to maintain and/or increase peak muscle mass in humans (Areta et al., 2013).

During a workout activity, dietary protein acts as a trigger and substrate for the synthesis of contractile muscle fibres and metabolic proteins, as well as contributing to structural changes in athletes' ligament apparatus and bone tissue (Phillips & van Loon, 2011). A study conducted on dose-response association between protein consumption and muscle protein synthesis rates after exercise revealed that fractional synthetic rate of mixed muscle protein increased with protein administration, reaching a maximum following ingestion of 20g intact egg protein comprising roughly 8.6g essential amino acids. It was highlighted that, athletes should consume this quantity of protein five or six times each day to enhance muscle protein synthesis rates throughout the day (Moore et al., 2009). It is recommended to consume 20-25g of a high quality dietary protein shortly after exercise to optimise post-exercise reconditioning (Moore et al., 2009). Another study, also revealed that to enhance the muscle protein synthesis response during acute post-exercise recovery, it is typically recommended to consume 20-25g of a high quality protein immediately following an exercise session (Beelen et al., 2010).

An increased demand for protein in a group of persons participating in strength exercise may result from a greater requirement for protein to sustain protein synthesis increases (Phillips, 2004). The key parameter in promoting muscle protein synthesis is largerly dependnet on extracellular amino acid concentration, rather than intracellular amino acid concentration and that the relationship between the two is overstated. This demonstrated a plateau in muscle protein synthesis with increased amino acid supply, meaning that bigger protein meals would only boost muscle protein synthesis up to a degree (Bohé, et al., 2003). In a study on acute response of net muscle protein balance reflects 24 hour balance after exercise and amino acid ingestion, it was demonstrated that before and after resistance training, ingestion of two 15g boluses of essential amino acids produced identical anabolic responses (Tipton et al., 2003).

Although exercise increases muscle protein balance, in the absence of food intake, net protein balance remains negative. In other words, nourishment is necessary for good muscle reconditioning and for muscular growth to occur. As a result, it is not surprising that there is a significant link between exercise and diet (van Loon, 2014). Accordingly, athletes engaged in resistance exercise may require protein intake in excess of the recommended dietary allowance as well as that required for endurance exercise because additional protein, specifically essential amino acids, is required along with sufficient energy to support muscle growth. Because of more efficient protein usage, the quantity of protein required to maintain muscle mass may be reduced for people who regularly practice strength exercise (Phillips et al., 2007).

Protein consumption before and after a workout has been shown to improve physical performance, training session recovery, lean body mass, muscle hypertrophy, and strength (Stark et al., 2012). Protein consumption before or during exercise increases post-exercise muscle protein synthesis rates due to increased amino acid availability to the muscle during the early phases of post-exercise recovery. However, there have been indications in recent years that protein consumption during exercise may directly boost performance during competition (van Loon, 2014). A study discovered that a long term pre-exercise protein ingestion would result in enhanced improvements in muscle protein mass as a result of resistance training since pre-exercise ingestion of the same protein plus carbohydrate supplement used before did improve muscle protein balance (Tipton et al., 2001).

Protein metabolism during and after exercise is influenced by gender, age, exercise intensity, duration, and type, caloric intake, and carbohydrate availability (Tipton & Witard, 2007). When protein is consumed after a single bout of exercise, muscle protein synthesis rates increase significantly and for a considerably longer amount of time than in a typical postprandial muscle protein synthetic response (Moore et al., 2009). An increase in calorie intake, including a reasonably high amount of protein, is likely to be the major goal for athletes looking to grow muscle mass. Thus, a relatively high protein intake may be recommended in the context of retaining consumption of other vital nutrients for athletes interested in losing bulk and suffering negative energy balance (Tipton & Witard, 2007).

Burd et al. (2011) found that high and low intensity resistance exercise to voluntary exhaustion increased feeding mediated rates of myofibrillar protein synthesis at 24 hours post exercise more than feeding at rest. It is worth noting that the increased sensitivity of myofibrillar protein synthesis to protein consumption during resistance exercise lasts at least 24 hours. Tipton et al. (2001) also noted that consuming 6g of essential amino acids and 35g of sucrose before exercise was more efficient than consuming the same mixture immediately after exercise in stimulating post exercise muscle protein synthesis. Similarly, Koopman et al. (2004) conducted a study to assess whole-body protein turnover following 6 hours of continuous moderate intensity exercise and reported that protein changes utilisation was not enhanced during prolonged exercise compared to rest. On the other hand, Burd et al. (2011) has shown that following a resistance type exercise session, baseline muscle protein synthesis rates and the muscle protein synthetic response to food intake are raised for up to 24 hours.

Muscle protein synthesis facilitates muscular plasticity which is regulated by two main anabolic stimuli; food intake and physical activity (van Loon, 2014). Indeed, alterations in protein metabolism caused by exercise are mechanically connected to fuel metabolism control and may impact the adaptive response to continuous training. It is however suggested that experienced endurance athletes have no increased dietary protein demand (Gibala, 2007). However, the argument has been made that frequent exercise, particularly in elite athletes with extremely rigorous training programmes, raises protein needs above those of inactive people (Tipton & Witard, 2007).

Several groups of individuals of which athletes are no exception, are at risk of consuming insufficient protein due to factors such as insufficient caloric intake, dietary restrictions, or increased demands for protein synthesis. Therefore, it is important for individuals in these groups to ensure they are consuming sufficient protein in their diet in order to support their overall health and athletic performance (Tarnopolsky, 2004). Adequate energy minimises the body's dependency on amino acids as fuel, allowing it to utilise protein for non-energy producing tasks. Regardless, 0.87 g/kg per day proved to be insufficient for athletes in energy balance for nitrogen balance maintenance. As a result, when endurance athletes restrict their calorie intake or fail to consume enough energy to establish energy balance, a greater focus should be made on protein consumption. As such, endurance athletes need a protein consumption of 1.5 g/kg (Gaine et al., 2006).

2.5.3 Fats

Over the course of development, fat has been crucial, if not the only source of fuel for the human body (Volek et al., 2015). It serves as an energy source for all athletes and active people (Potgieter, 2013). Dietary fat is an important component of an athlete's diet because it provides necessary fatty acids and aids in the absorption of fat soluble vitamins. It is also important for providing appropriate calorie intake to match the increase in expenditure caused by physical exercise (Puglisi, 2018). Fats are another large component of the dietary intake of collegiate athletes as they are fuel for contracting muscles, aid with the absorption of fat-soluble vitamins serve as insulation of vital organs, help develop cell-membrane structure, regulate body temperature, and promote immune function (Fink & Mikesky, 2017).

Fat is the predominant fuel for moderate intensity exercise, with maximal fat oxidation being reached at approximately 59%-64% of VO2max in endurance trained athletes and 47%-52% of VO2max in untrained individuals (Achten & Jeukendrup, 2004). It is worthy to note that, fat oxidation decreases to almost zero by an intensity of about 90% of VO2max. This implies that consumption of high fat diets in which more than 60% of the energy is derived from fat turns to decrease fat oxidation rates during exercise, even if the diet is consumed for only 2-3 days (Achten & Jeukendrup, 2004). Fat intake of 35% of total calories may be most prudent for endurance athletes, allowing for appropriate caloric intake and super compensation of intramuscular triglyceride reserves while leaving room in the diet for carbohydrate for glycogen replenishment (Puglisi, 2018).

Triglycerides is the major component of dietary fat which is made up of a glycerol molecule esterified to three fatty acid molecules (Puglisi, 2018) that is stored in adipose tissue and muscle cells which is used as fuel by the body during periods of low glucose availability, such as during exercise (Yeo et al., 2011). It was demonstrated that increased intramuscular triglyceride concentrations result in a readily accessible fat substrate in the working muscle (Shepherd et al., 2013; Tarnopolsky et al., 2007). Further, dietary fat intakes of 35% or more of total energy have been demonstrated to compensate intramuscular triglyceride reserves after exercise, perhaps increasing this glycogen sparing adaption (Larson-Meyer et al., 2002; Décombaz et al., 2001).

The general recommendations for fat for all athletes are the same; thus 20-35% of total energy intake (Potgieter, 2013). But, consuming a high fat diet while engaging in daily exercise may therefore boost the typical training induced improvements in fat oxidation, decrease carbohydrate usage, and postpone the onset of exhaustion during prolonged exercise (Hawley et al., 2011). Nonetheless, it appears doubtful that fat oxidation can withstand the rigours of professional endurance athletes' high intensity training (Hawley et al., 2011).

Fat oxidation contributes significantly to energy generation during low to moderate intensity exercise, with the absolute amount of fat oxidised being mostly determined by the contracting musculature's mitochondrial volume. Although muscle and liver glycogen stores are critical to the success of intense aerobic exercise, fat oxidation plays an important role in sparing or providing an alternate substrate to carbohydrate at exercise intensities of up to 60-65% of maximal oxygen uptake in untrained individuals and 75-85% of maximal oxygen uptake in trained individuals (Stepto et al., 2002). A pilot study in which five athletes followed a high fat ketogenic diet for 10 weeks revealed that athletes' body weights reduced by an average of 4kg showing higher whole body fat oxidation during exercise once again. The study concluded that active weight reduction, along with increased sensations of exhaustion and difficulties completing high intensity exercise, most certainly contributed to the athletes' poor performance (Zinn et al., 2017).

The human body may utilise fat as its major fuel during submaximal activity while also freeing itself from required high rates of liver and muscle glycogen utilisation (Volek et al., 2015). Glycogen sparing through greater utilisation of fat as fuel has been described as an instrumental adaptation that favours athletes in the setting of low carbohydrate, high fat diets. But high fat ketogenic diets may need a large amount of adjustment time and as a result, it is usual for people to feel exhaustion and a lack of energy during the first few weeks of adjusting to a ketogenic diet, which may jeopardise training and performance during the competitive season (Puglisi, 2018). In a study, fat oxidation and glycogen utilisation were measured in a 3-hour submaximal run for endurance athletes consuming a high fat, low carbohydrate ketogenic diet or high carbohydrate diet. It was discovered that fat oxidation in the low carbohydrate group was 1.54g/min as compared to 0.67g/min in the high carbohydrate group and muscle glycogen did not differ between groups, at rest or after the 3 hours run (Volek et al., 2009).

Dietary fat restriction may make it difficult for athletes, particularly those competing in endurance sports, to satisfy their energy demands. It is of great importance that athletes should focus on consuming proper amounts of calories in order to optimise performance (Thomas et al., 2016) since athletes are at high risk of injury, sickness, and weariness when their calorie intake is disrupted (Manore, 2009). If dietary fat is reduced, energy restriction may also result in dehydration and insufficient intake of nutrients, particularly fat-soluble vitamins, as well as an increased proclivity to adopt disordered eating patterns (Manore, 2009).

Athletes need fat, and consuming less than 15% of their calories from fat might reduce their intake of nutrients and energy, which will affect how well they workout (Waititu, 2013). If dietary fat intake is significantly restricted, it may result in chronic depletion of intramuscular triglycerides, particularly in endurance athletes who complete high volume training programmes. This persistent depletion may interfere with the glycogen sparing effects of increased fat utilisation with exercise and appropriate dietary fat intake (Larson-Meyer et al., 2002; Décombaz et al., 2001). More so, athletes who consume too little fat risk reducing circulation levels of the hormones insulin and testosterone, which are critical in athletes looking to gain lean body mass (Gibney et al., 2013).

Many athletes try to lose weight and fat mass, but this might have a detrimental impact on performance throughout the preparation and competition stages. Although both low fat and high fat, low carbohydrate diets can help weight reduction, long term studies have demonstrated that high fat, low carbohydrate diets generate higher weight and fat loss (Hooper et al., 2015). To optimise fat loss, more stringent low carbohydrate, ketogenic diets rich in fat may be more successful than high carbohydrate, low fat diets (Volek et al., 2009; Yancy Jr. et al., 2004). Therefore, low carbohydrate, high fat diets appear to be a potentially beneficial technique for changing body composition in trained individuals without compromising strength and power. And if a high fat, low carbohydrate diet improves body composition, it stands to reason that the amount of force compared to body weight will rise (Volek et al., 2016).

Since exercise can boost both lipid oxidation and muscle mitochondrial oxidative capacity, it is critical to better understand the molecular processes behind lipid-induced insulin resistance, as well as the function of exercise in preventing and treating this disease (Kiens, 2006). Evidence shows that, a diet high in omega-3 fatty acids, low in saturated fats, and zero to very low in trans fats may lead to better health outcomes and lengthen life (Naghshi & Sadeghi, 2021). Likewise, it was demonstrated that a single session of exercise totally altered the fatty acid induced reduction in insulin sensitivity. Thus, lipid induced insulin resistance in people may be reversed by a physiological intervention such as exercise (Schenk & Horowitz, 2007).

2.3.4 Micronutrients

Micronutrients are needed in minute amounts which interact to regulate energy metabolism, neurological function, muscular contraction, oxidative function, bone and blood health, fluid and electrolyte balance, and immunological function (Deakin, 2020). As stated above, nutrient consumption influences athletes' sports performance and general health, as well as their physical and psychological wellbeing (Driskell, 2006). Micronutrients such as vitamins and minerals, play an important role in generating energy via numerous metabolic pathways and are typically absorbed sufficiently from food alone, with athletes with inadequate or restricted diets having the most worry for micronutrient shortages (Thomas et al., 2016).

Micronutrients can be consumed by athletes in the form of whole foods or supplements to improve their athletic performance. Although recommended intakes for vitamins and minerals differ, the International Society of Sport Nutrition (ISSN) recommends that a sufficient nutrient-rich diet consisting of a variety of foods provide adequate amounts of micronutrients (Potgieter, 2013). Micronutrient studies on athletes show that where there is an adequate intake of energy-giving foods like carbohydrates and fat, micronutrient recommendations are met. Micronutrient intake of the major minerals and vitamins ranged between 120% and 366% of the recommended intakes in a study of Canadian athletes (Lun et al., 2009).

Athletes that planned to supplement micronutrient, it is worthy to note that supplementation is rather reserved for individuals/patients who have clinical pathology as a result of micronutrient insufficiency (Thomas et al., 2016). On the contrary, micronutrient needs are likely to rise during increasing physical activity compared to sedentary state (Lukaski, 2004). Hence, athletes may be at danger of micronutrient deficiencies if they eat inadequate meals and consume largely refined carbohydrates, overtrain, or exercise in severe ways or situations (Driskell, 2006). Also, because of the increased calorie expenditure associated with exercise, highly active athletes may be at greater risk of micronutrient deficiencies (Misner, 2006).

Utilising recommended intake levels for micronutrients in conditions of high physical activity should be approached with caution but these suggested values may not cover the increased demands of athletes (Whiting & Barabash, 2006). It has been suggested that daily supplementation of vitamins outside of a sufficient diet to improve exercise performance or capacity might not be beneficial (Daries, 2012). So, athletes who take vitamins and/or mineral supplements on a regular basis should not exceed the suggested nutritional intakes and that the efficacy of these nutritional recommendations in the promotion of physical activity must be evaluated (Lukaski, 2004).

Vitamin have their own distinct function, but in general, vitamins function as components of enzymes, antioxidants, hormones that affect gene expression, and a component of cell membranes (Nix, 2009). Physical activity increases the metabolic needs for vitamins and minerals related with energy metabolism. Prolonged aerobic activity increases red blood cell bulk and the demand for nutrients involved in red blood cell formation and haemoglobin synthesis (Deakin, 2020). Consequently, athletes/physically active people should eat a varied diet to optimise vitamin, mineral, and other nutrient intakes and therefore avoid the need for nutritional supplements (Lukaski, 2004). Therefore, athletes require more calories, protein, vitamins, and minerals to fuel their increased physical activity and maintain their overall health and performance (Misner, 2006).

Strenuous exercise increases the load on metabolic pathways, resulting in free radical generation and cellular deoxyribonucleic acid damage. Despite the increased requirement for energy generation during exercise, gut micronutrient absorption is reduced, and micronutrient loss from perspiration, urine, and faeces is increased (Beavers & Serra, 2015). Further, exercise causes oxidative stress by increasing oxygen consumption by 10 to 15 times and producing lipid peroxide byproducts which damage cell membranes. However, antioxidants, such as vitamins A and E, serve to protect against these oxidative damage by lowering free radical generation, at the end reducing inflammation, and boosting immunological function (Thomas et al., 2016).

Some athletes, such as teenage ballerinas, gymnasts, long distance runners, and wrestlers, may not eat enough micronutrients because they restrict their food consumption to fulfil weight limitations for aesthetic or competitive reasons (Lukaski, 2004). If in case an athlete wishes to utilise micronutrient supplements as a precaution without having a documented deficit, a multivitamin/multimineral supplement at the suggested dosage is likely to be both safe and sufficient for maximum sports performance. But dietary intervention to rectify poor micronutrient intakes is favoured over supplementation because using food instead of supplements gives the extra benefit of increased nutritional density and bioavailability without the danger of severe side effects associated with supplement usage (Deakin, 2020).

Athletes should be wary of micronutrients supplementation as a study conducted on vitamins, minerals and race performance in ultra-endurance runners, revealed that ultra-endurance runners who used vitamin and mineral supplements regularly in four weeks before the event did not finish quicker than athletes who did not take these supplements (Knechtle et al., 2008). Thus, vitamin and mineral consumption appears to have little and/or no influence on performance (Knechtle et al., 2008). A similar study, demonstrated that taking a liquid multivitamin/mineral supplement for eight weeks did not increase anaerobic exercise performance (Fry et al., 2006). In another study on dietary supplements and sports performance, it was found that calcium, magnesium, iron, zinc, copper, and selenium supplementation does not improve athletic performance in well nourished athletes (Williams, 2005).

Minerals help with a variety of metabolic tasks in the body, such as building tissue and activating, regulating, transmitting, and controlling metabolic processes (Nix, 2009). In terms of specific micronutrients, calcium is essential for the formation and maintenance of healthy bone tissue in both athletes and non-athletes (Castell et al., 2009). Calcium is a key nutrient for the development of bones and the maintenance of bone health (Desbrow et al., 2014). It is also needed for growth, maintaining optimal blood calcium levels, regulating muscle contractions, nerve conductions and blood clotting (Rodriguez et al., 2009).

Calcium and iron are particularly important in athletes of which low calcium consumption causes a negative calcium balance and an increased risk of low bone mineral density, which increases the risk of stress fractures. Also, common conditions including amenorrhoea, delayed menarche, or menstrual irregularities, occur among female athletes, when combined with low energy diets and low calcium intakes, raises the risk of stress fractures and osteopenia and osteoporosis later in life (Deakin, 2020). Athletes, especially females who are participating in weight control sports, require optimal calcium diet for bone health (Williams, 2005). They are at the greatest danger of calcium shortage, since they frequently have lower amounts of oestrogen which has a protective impact on bone (Beavers & Serra, 2015).

Many athletes, obtain calcium from dairy products (Smith et al., 2015). The main food sources of calcium include milk and milk products (Whitney & Rolfes, 2011). Calcium absorption requires sufficient vitamin D status, hence it is important to ensure that both micronutrients are present in adequate amounts in the diet of athletes. A special attention should be paid to adequate calcium intake if the energy intake of athletes is low (Rodriguez et al., 2009). Again, athletes have been reported as having too low a calcium intake. Due to this it has been suggested that improving athletes' nutrition knowledge could be one way in which to increase their calcium intake, because athletes often have poor knowledge regarding nutrient sources (Desbrow et al., 2014).

Antioxidant nutrients such as vitamins A, E, and C play an important role in preventing oxidative damage to cell membranes (Watson et al., 2005). Besides, vitamin D is a necessary vitamin gained through food and synthesis in the skin via sunshine exposure. But to lower the risk of skin cancer, people are generally recommended to avoid excessive sun exposure. Vitamin D has been shown to have important roles in the cardiovascular, immunological, and musculoskeletal systems (Moran et al., 2013). Also, it is an essential mineral that promotes bone health and muscular function. Hence, approriate levels of vitamin D are associated to muscular strength and postural stability which is critical for maintaining balance and reducing falls, particularly in older persons (Rejnmark, 2011).

Vitamin D is required for adequate calcium absorption, serum calcium and phosphorous regulation, and bone health regulation. Athletes who restrict their energy intake or consume high carbohydrate diets with low micronutrient density are most at risk of micronutrient deficiencies (Manore, 2000). It is evident that athletes who compete indoors, live at high altitudes, have a dark complexion, have a high body fat percentage, train early in the morning or late in the evening, or use clothes, equipment, or sunscreen are most at risk for vitamin D insufficiency (Thomas et al., 2016; Daries, 2012).

Athletes or not, good vitamin D status is critical to a variety of core physiological processes, making it critical for all persons to achieve enough amounts (Ogan &

Pritchett, 2013; Moran et al., 2013). Evidence suggests that vitamin D helps athletes and other active groups maintain physical performance (Moran et al., 2013). It is widely recognised for its involvement in calcium homeostasis and bone health (Todd et al., 2015; Moran et al., 2013; Ogan & Pritchett, 2013), and may protect against overuse ailments such as stress fractures (Moran et al., 2013). To a larger extent, it has also been discovered that vitamin D plays an important role in signalling gene response, protein synthesis, hormone production, immunological response, and cell turnover and regeneration (Todd et al., 2015; Ogan & Pritchett, 2013).

Due to its numerous functions, it is possible that low vitamin D levels increase the risk of overuse and inflammatory injuries, as well as susceptibility to frequent upper respiratory tract infections and other ailments. These negative repercussions may have an impact on sports training and performance, as well as the long term risk of chronic illness (Halliday et al., 2011).

Obtaining appropriate 25 hydroxyvitamin D levels should be an aim for all athletes, despite of the limited data supporting a favourable effect of vitamin D on performance (Ogan & Pritchett, 2013). Nevertheless, it is critical to understand how the dietary recommended intakes were produced and how they may be utilised for all micronutrients (Whiting & Barabash, 2006).

Vitamin C is a natural anti-oxidant that can help reduce the oxidative stress caused by exercise and promotes a healthy immune system by promoting white blood cell production. The B vitamins ensure optimal energy production as well as muscle tissue building and repair, and the requirement for these vitamins rises in direct proportion to energy expenditure (Nande et al., 2009). Vitamin C is a vital nutrient that may mitigate the negative consequences of exercise induced reactive oxygen species, such as muscle injury, immunological dysfunction, and exhaustion. However, reactive oxygen species, on the other hand, may facilitate the positive training adaptations that vitamin C inhibits (Braakhuis, 2012).

Athletic performance can be harmed by vitamin C insufficiency or even borderline vitamin C status. Thus, all physically active people should attempt to maintain adequate vitamin C status by eating enough of fruits and vegetables high in ascorbic acid or by taking vitamin C supplements or eating foods with vitamin C added (Keith, 2006). The recommended dietary allowance for vitamin C for adults is 75 mg for women and 90 mg for men yet, these values may not be enough for athletes participating in severe, extended physical activity events and training. As a result, an appropriate daily doses for these athletes may vary from 100 to 1000 mg (Keith, 2006).

Athletes commonly utilise antioxidant supplements to minimise oxidative stress, but it appears that providing sportsmen with mega doses of antioxidant supplements to minimise oxidative stress and, consequently, performance is an incorrect assumption. When eaten in sufficient amounts, vitamin C reduces oxidative stress and seems to reverse training induced adaptations via lowering mitochondrial biogenesis or perhaps changing vascular function (Braakhuis, 2012). In a study on oral vitamin C, athletes who consumed oral vitamin C supplements during training perform as well as those who do not workout at all. The study further revealed that vitamin C treatment dramatically reduced endurance capacity and these negative effects may be due to its ability to inhibit the exercise induced expression of critical transcription factors involved in mitochondrial biogenesis (Gomez-Cabrera et al., 2008).

A study conducted on high dose vitamin C supplements demonstrated that a single high dose antioxidant vitamin C pills eliminated the favourable effects of athletic training on muscle repair and strength, as well as the advantages of exercise in decreasing the risk of chronic illness. In addition, an antioxidant rich diet based on common foods, on the other hand, appears to improve the advantages of exercise (Adams et al., 2014). Likewise, it was demonstrated that a little quantity of vitamin C, delivered by five servings of fruit and vegetables per day, may be sufficient to minimise oxidative stress but not to the point where effective training adaptations are impaired. However, short term intakes of vitamin C one to two weeks may aid athletes during times of elevated stress (Braakhuis, 2012).

Iron is an important micronutrient for athletic performance because it is required for oxygen transport and energy production (Alaunyte et al., 2015). Iron plays a central role in sports performance because, as part of the body’s main iron-containing protein haemoglobin, it is an essential part of oxygen transport (Miller, 2013; Shaskey & Green, 2000). Iron is required for the formation of haemoglobin and myoglobin, which accept and transport oxygen throughout the body; it also serves as a cofactor for many enzymes involved in metabolism (Whitney & Rolfes, 2011).

Iron is a necessary nutrient for adequate oxygen transport to the body's tissues since it is a functional component of haemoglobin and myoglobin (Williams, 2005). Iron is a nutrient that is required not only for the effective transport of oxygen to active muscles, but also for the creation of energy at the mitochondrial level (Peeling et al., 2008). It is important for athletes because it is required for the delivery of oxygen to all tissues, including skeletal muscles, especially during exercise (Hinton et al., 2004). It is an essential vitamin for both male and female athletes since it transports oxygen in the form of haemoglobin in the blood and myoglobin in the muscles (Akabas & Dolins, 2005).

These iron functions are crucial to athletic performance; yet, athletes are frequently iron deficient as a result of iron losses during training via hemolysis, hematuria, sweating, and gastrointestinal bleeding (Peeling et al., 2008). Athletes' suboptimal iron status can lead to impaired athletic performance and exercise capacity (Koehler et al., 2012). Suboptimal iron status is associated with disturbances in oxygen transport, production of adenosine triphophate and synthesis of deoxyribonucleic acid, all of which are further related to negative effects on endurance performance (Desbrow et al., 2014). Furthermore, inadequate iron intake reduces aerobic capacity by inhibiting energy production, increasing reliance on anaerobic metabolism and lowering performance (Hinton, 2014).

The iron intake of majority of male athletes, exceeds that of nutrition recommendations and on the other hand, female athletes are adviced to obtain sufficient amounts of iron from easily absorbable sources (Petrie et al., 2004). The eating habits of athletes, especially young female athletes, can be highly restrictive or unvaried which can lead to insufficient iron intake (Shaskey & Green, 2000). Therefore, it is recommended that foods rich in vitamin C are consumed together with foods containing nonheme iron (cereal) in order to increase iron absorption (Heikkilä, 2020).

Evidence suggest that inadequate iron status can affect haemoglobin and red blood cell formation, resulting in anaemia and a reduction in athletic performance (Schümann et al., 2007). In a study to compare the iron status in highly active and sedentary young women, it was discovered that highly active women consumed more dietary energy and total iron than sedentary women. In spite of having greater total dietary iron intakes and comparable heme iron intakes, highly active women had lower iron status than sedentary women. And that, sedentary women had lower levels of store iron and functional iron than active women (Woolf et al., 2009). In another study, it was revealed that iron supplementation for six weeks significantly raised serum ferritin and endurance capacity in trained men and women. Furthermore, increases in serum ferritin were similarly linked to lower respiratory exchange ratios during submaximal exercise (Hinton & Sinclair, 2007).

Despite their relative scarcity in the diet and the body, magnesium, zinc, and chromium play critical roles in regulating whole-body metabolism, including energy utilisation and work performance. Adequate amounts of these micronutrients in the diet are required for physically active people to ensure the capacity for increased energy expenditure and work performance (Lukaski, 2000). Zinc is a mineral that is required for several physiological activities, including immunological function, growth and development, and wound healing. It is also beneficial to sportsmen since it aids in muscle function and recuperation (Giolo De Carvalho et al., 2012).

Zinc supplementation during exercise activates the antioxidant system by increasing serum superoxide dismutase and serum glutathione peroxidase activities and also glutathione levels. Among athletes, zinc supplementation particularly in periods of intense exercise, may uphold the antioxidant system and contribute to their performance. Therefore, zinc supplementation among athletes in physiologic doses may be beneficial to their health and performance as well (Kara et al., 2010). Nonetheless, a study on evidence of zinc deficiency in competitive swimmers shows that top swimmers investigated had a zinc shortage, and that salivary zinc was insufficient to assess zinc nutritional status (Giolo De Carvalho et al., 2012).

2.6 Fluids

Replenishment of water is the main constituent of the human body, and it plays an essential role in circulatory function, chemical reactions involved in energy metabolism, elimination of waste products, and maintenance of the body temperature and plasma volume (Aoi et al., 2006). When the body temperature rises due to an intense exercise or a high ambient temperature, sweating occurs in order to radiate heat (Kenny et al., 2003; Buono & Wall 2000; Kondo et al., 2000). Fluid needs increase with temperature and activity, and numerous studies have confirmed that performance can be impaired when athletes are dehydrated and that endurance athletes should drink beverages containing carbohydrate and electrolyte during and after training or competition (von Duvillard et al., 2004). Proper hydration during training or competition will enhance performance, avoid ensuing thermal stress, maintain plasma volume, delay fatigue, and prevent injuries associated with dehydration and sweat loss (von Duvillard et al., 2004).

One of the most important factors influencing athletic performance is hydration status. Reason been that, when the body has all the water it needs to function properly including transporting nutrients and oxygen to the working muscles, regulating body temperature, and preventing muscle fatigue (Smith et al., 2015). Replenishing water and electrolytes before, during, and after exercise is critical for maintaining homeostasis and athletic performance (Aoi et al., 2006). Athletes need to drink substantial amounts of fluids before, during, and after the activity to stay hydrated and maintain a healthy balance of electrolytes since they lose fluids and electrolytes through sweating during exercise (Sawka et al., 2007). Again, after exercise, fluids should include sodium, chloride, and other rehydrating nutrients (Karpinski & Rosenbloom, 2017).

Hydration levels are an important component of exercise performance (Kraft et al., 2012). Numerous studies have confirmed that performance can be impaired when athletes are dehydrated and that endurance athletes should drink beverages containing carbohydrate and electrolyte during and after training or competition. Drinking during competition is desirable compared with fluid ingestion after or before training or competition only (von Duvillard et al., 2004). Majority of athletes appeared dehydrated before the start of training and/or competition. However, it must be borne in mind that fluid losses greater than 2% of body weight should be avoided in order to maintain performance and work capacity (Desbrow et al., 2014; Petrie et al., 2004).

Athletes lose sodium, calcium, and iron loss through sweating. With this, it is critical for athletes to drink enough water throughout the day, not just during training and recovery, in order to ensure and maintain adequate hydration status (Cotunga et al., 2005). A study in 2014 found that athletes consumed insufficient water, which might lead to dehydration. It was advised that appropriate provision be made for fluids in the form of water, fruits, juice, and other sports beverages, particularly those containing salt. This is because drinking sodium containing fluid replacement beverages helps the body retain water and aids in hydration by enhancing fluid absorption from the intestines into the muscles (Hagan & Hormenu, 2014).

The primary goal of fluid consumption during exercise is to maintain hydration and thermoregulation, which benefits performance. Athletes should strive to maintain proper hydration levels and limit fluid losses during exercise to no more than 2% of their body weight (Beck et al., 2015). Likewise, adequate hydration with electrolyte replenishment is extremely important for athletes to maintain health while remaining active. Water losses can occur from sweating, vomiting, diarrhoea, and fluid deprivation (Karpinski & Rosenbloom, 2017). Furthermore, maintaining proper hydration by drinking while exercising has the greatest impact on performance of any single nutritional intervention. Moderate to vigorous physical activity lasting more than an hour may necessitate carbohydrate or electrolyte supplementation drinks as an adequate source of hydration. Therefore, in order to maximise sport performance and reduce injury risk, every athlete's hydration goal should be to match their rate of losses, specifically fluid and electrolytes (Zoorob et al., 2013).

Resuming typical hydration measures after exercise might help to restore fluids and electrolytes. Moreover, when euhydration is required within 24 hours or significant body weight loss, a more planned approach to restore fluids and electrolytes may be recommended (Shirreffs & Sawka, 2011). The more sweat lost, the more fluid and electrolytes are needed to achieve euhydration. Fluids boost blood volume and assist in circulation of water and other nutrients required to swiftly decrease the body's core temperature and restore equilibrium (Zoorob et al., 2013). In view of this, athletes need adequate hydration during exercise so as to mitigate the effects of dehydration on blood volume, cardiac output, muscle blood flow, skin blood flow, core temperature rise, and impairment in exercise performance (Murray, 2007).

Athletes sweat 6-10% of their body weight as a result of strenuous physical activities, which can lead to dehydration (Popkin et al., 2010). As athletes lose fluid during exercise, electrolytes are additionally utilised and flushed from the body. Due to the disparities in variation in fluid loss among athletes, there is no set standard and fluid replenishment can reach upwards of 10 liters (Karpinski & Rosenbloom, 2017).

Athletes should consume 7 to 10 ounces of water 10 to 20 minutes before and during exercise and/or match their fluid loss and lose less than 2% of their body weight. Therefore, they are advised to drink at least 16 ounces of fluid for every pound lost during exercise (Fink & Mikesky, 2017).

As individuals sweat at different rates, there is no generic prescription for fluid consumption during physical exercise. And for athletes to stay hydrated, they must constantly change their fluid consumption habits to match the amount of perspiration loss during exertion and therefore avoid dehydration (Murray, 2007). It has been shown that endurance athletes should replace sweat loss via fluid intake containing about 4% to 8% of carbohydrate solution and electrolytes during training or competition. It is recommended that athletes drink about 500 ml of fluid solution 1 to 2 hours before an event and continue to consume cool or cold drinks in regular intervals to replace fluid loss due to sweat (von Duvillard et al., 2004).

Dehydration, in addition to increasing the risk of heat illness, can easily lead to decreased performance in the form of increased fatigue and decreased perceived exertion during exercise (Smith et al., 2015; Petrie et al., 2004). Sodium-containing sports drinks should be consumed during prolonged exercise, especially in hot weather. In addition to replacing the sodium lost through sweat, consuming sodium increases the desire to drink, which may lead to improved hydration status. For the same reason, flavouring fluids are recommended, as athletes tend to consume more of them during sports than non-flavouring fluids (Smith et al., 2015).

When sweat loss is excessive, incorporating electrolytes in fluids taken stimulates more fluid intake, assists in plasma volume maintenance, and lowers urine output. Consuming enough fluid during physical exercise to avoid dehydration is likely the easiest and most effective way to maintain physiological function and improve physical performance (Murray, 2007). Dehydration inhibits both physical and mental function, therefore fluid replacement measures are required when excessive sweating occurs. Moreso, athletes are recommended to begin activity properly hydrated and to drink fluid throughout exercise whenever possible to prevent water and salt deficits (Shirreffs & Sawka, 2011).

Fluids consumed during exercise may contain other ingredients such as carbohydrate, electrolytes, or caffeine that can improve palatability, voluntary consumption, thermoregulation, or performance, which may dictate a desirable volume and pattern of intake independent of thirst (Garth & Burke, 2013). On the other hand, water drinking is the only way to avoid dehydration and will be necessary before, during, and after exercise. However, a big majority of athletes generally begin the activity dehydrated of which especially, football players may suffer from chronic dehydration if fluid and salt levels are not sufficiently replenished between practice sessions (Godek et al., 2005).

Along with water losses, electrolytes, particularly sodium, are lost where it has been observed that well-trained athletes sweat more but sweat better, meaning that they sweat more water but lose fewer electrolytes (Maughan et al., 2004). However, in the case of long endurance events, the risk of overdrinking should always be considered. As hyponatremia has even resulted in death in long endurance events in hot environments, such as ultramarathons (Heikkilä, 2020). Hence, it is recommended that athletes' body weight be measured before and after exercise to ensure fluid balance is maintained (Potgieter, 2013).

2.7 Factors that Influence Dietary Practices of Athletes in Colleges of Education

Dietary practice is a difficult process since it is impacted by numerous internal and external influences, and has many diverse meanings. At the same time, people's eating choices have health and other effects. Food choices in adolescence and more especially athletes are significant since they impact overall health, performance and recovery (Contento et al., 2006). Athletes' dietary practices are impacted by factors such as time, attitudes, sociodemographic traits, behaviour, and body composition/physical appearance (Lošić & Čačić Kenjerić, 2015). A lack of time and food expense, as well as hedonic hunger, taste preferences, and decreased motivation to eat healthily during the off-season, have been identified as impediments to healthy eating for sportsmen (Birkenhead & Slater, 2015; Heaney et al., 2008).

Many socioeconomic, cultural, and physiological aspects can all have an impact on an athlete's dietary consumption (Sobal & Bisogni, 2009). Accordingly, the primary hurdles limiting athletes from consuming optimum nutritional intakes include a lack of time, food accessibility, poor culinary abilities, expenses, taste, and time spent in off-season (Sharples et al., 2021). Further, athletes lack the knowledge to make better food choices and are swayed by trainers, family, and peers, or they eat whatever is given to them (Davar, 2012).

College athletes are a unique population for which nutrition and dietary intake play a pivotal role in growth, recovery, and performance. They are burdened with training, coursework, and scheduled game days which contributed to a disordered dietary regimen coupled with financial constraints and learning difficulties to cope with early adulthood add pressure to an already competitive life (Quatromoni, 2008). As a result, athletes must follow a sound nutritional plan in order to achieve and maintain peak athletic performance. This can be accomplished by working with a sport nutritionist who oversees daily meal planning prior to, during, and after training sessions and competitions (Spriet, 2019).

A narrative review of food choice in athletes identified that food selection in athletes may be influenced by additional factors specific to their sport, such as performance expectations, concerns about body composition, and stage of training, as well as general population factors such as taste, convenience, culture or religious beliefs, peer influences, marketing, health, and cost (Birkenhead & Slater, 2015). In a qualitative exploratory study on food choice decisions of collegiate division I athletes shown that characteristics such as cost, preference, and nutrition awareness influences food choice decisions of athletes (Eck & Byrd-Bredbenner, 2021). Also, it has been shown that alternative factors which includes the individual, social, physical, and macro environment levels have important influences on athletes dietary choices in school (Devine et al., 2023).

Parents are accountable not just for their own dietary choices, but also for their children's food choices. Parents, as the major food provider, they determine what to buy, prepare, and serve to their children. They serve as essential role models for youths, influencing their dietary preferences, attitudes, and behaviours (Roos et al., 2012). Parental purchase and preparation habits are important variables affecting children's food choices. Although, children have some power over their food choices by identifying which meals they enjoy, but parental regulations, family tastes, and a variety of other variables influence the ultimate food ingested (Holsten et al., 2012).

Parents' presence in the house, time constraints and activity prioritisation, inclusion of family members' preferences, food preparation effort and abilities, and financial and health considerations all influenced children's eating patterns (Holsten et al., 2012). As a result, adolescent carry these family feedings when they enter college which impact their dietary practices as an athlete (Holsten bet al., 2012). A study confirmed that it is prudent to include family in any nutritional education since childhood nutritional intakes has shown that parents and family members influence healthy eating (Emmett & Jones, 2015; Birch et al., 2007). Also, a nutrition and culture in professional football study discovered that eating habits are primarily influenced by the players' upbringing (Ono et al., 2012).

Since most college athletes are in their adolescence transitioning to adulthood, they face new challenges in which their food consumptions are influenced by peers, new environments and social pressures. College athletes may be living away from home for the first time and may need to navigate a new environment, including access to food and cooking facilities. They may also be exposed to new social situations where food and drink are often part of the social scene, and may feel pressure to conform to certain eating habits or dietary restrictions. Therefore, they have been frequently reported by eating unhealthy foods, which can be affected by price, convenience, and peer pressure (Fitzgerald et al., 2010). Consequently, college athletes are influenced socially by making dietary decisions depending on what their teammates are consuming, regardless of their own personal needs or tastes. This can be due to the desire to fit in with the team culture, pressure to perform at a high level, or a lack of knowledge about nutrition and dietary needs (Contento et al., 2006).

It is evident that the importance of the peer environment in body image and eating disorders by predicting a girl's use of extreme weight loss behaviours and dieting based on the extreme weight loss behaviours and dieting scores of her friends

(Hutchinson & Rapee, 2007). Close friends' diet attempts have a significant influence on their colleagues' weight and, consequently, their eating patterns and diets (Whatley, 2021). A study revealed that some athletes reported that they used advice from other athletes to inform their own dietary practices but this information should be treated with caution (Bourke et al., 2019). In contrast, peers were mentioned as enablers of healthy eating when they were supportive and ate healthy, such as by bringing healthy options to school and telling participants not to choose unhealthy foods (Stokes et al., 2018).

Many young college students have just left homes where food is frequently provided and readily available. With the extra responsibilities of curricular and extracurricular activities compelled many to rely on store bought, and prepared foods (Boek et al., 2012). Most athletes have been found to be responsible for acquiring, cooking, and regulating their nutritional choices due to having a busy training and competition schedule (Long et al., 2011). It was demonstrated in a study among football players that time was the most important factor in their food selection process. The study concluded that time was a multidimensional effect that reflected not just the time of day but also a spendable commodity comparable to financial resources (Long et al., 2011). Additionally, it appears that time restrictions are a major concern in meal selection, and that athletes make frequent intentional selections based on considerations of convenience (Pollard et al., 2002).

A needs assessment survey to identify nutrition knowledge deficits in graduating Division I collegiate athletes for subsequent development of a pre-graduation nutrition education curriculum discovered that time constraints contributed to many athletes not to have the time to shop for and prepare meals that satisfy their energy demands, and hence may rely on convenience foods to meet these needs (Benavides, 2022). A study which focused on nutritional habits and knowledge in the division I collegiate football players demonstrated that due to demanding academic and practice schedules, time might be exceedingly restricted for a student-athlete. The study further discovered that more than 70% of the athletes polled consume fast food at least three times each week for reason of convenience. However, these quick and simple meals are frequently higher in calories and more processed, resulting in inferior nutritional sources (Hale, 2013).

College athletes have very high nutritional demands in addition to working through all of this and managing their busy schedule (Benavides, 2022). Athletes' eating choices might also be influenced by their rigorous schedules in which practice and lessons may influence when and how frequently one is able to eat (Hinton et al., 2004). It was confirmed in a study that hectic schedules compelled athletes to generally adopt rigid routines in order to fulfil their sports goals, and they frequently rely on familiar meals, especially before competition (Robins & Hetherington, 2005).

College athletes face a variety of barriers to healthy eating, including insufficient financial resources to purchase healthy foods, limited meal planning and preparation skills, and travel schedules that necessitate eating out (Davar, 2012). College athletes live on a tight budget, so they make the greatest use of institutional and personal funds to strike a balance between energy expenditure and energy intake. The complexity of handling this endeavour is exacerbated by the fact that athletes may not be achieving their nutritional demands only through foods offered by their institutions (Benavides, 2022). A study revealed that elite athletes on a tight budget indicated that financial restrictions make it difficult to make smart meal choices (Heaney et al., 2008).

Cultural differences or diversities also play significant role in athletes' dietary practices. Athletes within cultures differ in the emphasis they place on eating traditional foods based on other considerations. For instance, those who value health or weight control, may avoid some ethnic foods because they are heavier in fat and calories (Pieniak et al., 2009). It might be argued that cultures and traditional practices serve as the underpinnings for all food related decisions. Some of the most significant differences in food choice are related to cultural and traditional limitations, which provide us with values and attitudes about certain foods and eating patterns. For many people, these serve as the framework within which an individual's dietary preferences might develop. Certain religious organisations adhere to rigorous diets that, while not required by the faith, are seen to be healthy (Pollard et al., 2002).

In sports cultures with strong traditions and beliefs, dietary choices may be influenced by a lack of awareness of the importance of nutrition. This adds to the cultural barriers that hinder players from consuming the ideal diet tailored to their sport (Ono et al., 2012). In fact, ingrained traditions have the power to supersede health and fitness guidelines in favour of performance, as demonstrated by the popularity of weight sports like horse racing and wrestling (Pettersson et al., 2012; Dolan et al., 2011). As in the case of Muslims athletes, making dietary considerations based on religious beliefs is of utmost importance as they fast during Ramadan from sunrise to sunset, which means they do not eat or drink anything during daylight hours (Burke & King, 2012). However, some athletes, family traditions and ethnic background have little importance on food choice (Long et al., 2011).

There is the need to place a greater emphasis on the effect of culture due to the increased worldwide involvement of athletes from all over the world (Birkenhead &

Slater, 2015). It is evident that there are unique influences on food choice by athletes particularly in a competition environment, and this is influenced by their cultural background and sport specific requirements. These influencing factors include nutrient composition of the food, stage of competition time of day and familiarity of the food (Pelly et al., 2018). In addition, sociocultural and socioeconomic issues can have a direct impact on an athlete's capacity to select healthy eating patterns. Athletes from poorer socioeconomic backgrounds may have grown up consuming a very different diet than athletes from the upper middle class. These dietary habits are subsequently passed on to the player when he/she transitions from his/her family to the position of collegiate student athlete (Hinton et al., 2004).

Social media, such as blogs, social network sites and media sharing sites are rapidly becoming a quick and easy avenue for consumers to access well-presented nutrition information. Not only can registered practitioners post nutrition information, so can any other user, regardless of their background or expertise. The vast quantity of nutrition information available on social media make it difficult for the public including athletes to ascertain whether information is reliable and as such, users are potentially being exposed to misleading and harmful advice (Helm & Jones, 2016; Carrotte et al., 2015). Social media platforms are designed to be highly engaging and addictive of which it is commonly understood that it influences people's behaviour and mindsets. The fast expansion of digital media has created new chances for athletes of all ages to be connected and socially active, and college athletes especially, they have always been immersed in a digital media environment. They utilise social media to express themselves and their thoughts, as well as to develop social interactions (Kim et al., 2016).

The general populace as well as athletes are bombarded with messages about food and nutrition, many of which are inconsistent. Diet and food information is available through a range of various sources including the media; thus, television, radio, magazines, and newspapers (Pollard et al., 2002). Food marketing and labelling, as well as media and advertising, can all have an impact on food selection. College athletes frequently have specific nutritional needs to support their training and performance, and food companies target this group with advertising and marketing campaigns promoting products that claim to meet those needs by presenting certain foods as healthy or "good for you" without providing a complete picture of their nutritional value (Cohen & Babey, 2012; Pollard et al., 2002).

In a study on social media posts' influence on college athletes' protein knowledge, the findings revealed that there was no significant difference in participants' protein knowledge after being exposed to protein-related Instagram postings (Love, 2020). Another study on the effects of food advertising and cognitive load on food choices, it was suggested that food marketing may have disparate effects across populations, influencing eating behaviours disproportionately in some of the most vulnerable subgroups and potentially contributing to disparities in diet and related health outcomes (Zimmerman & Shimoga, 2014).

Diet and exercise are two lifestyle choices that can influence appetite and energy intake, thereby affecting energy balance. Exercise may have a different effect on appetite and energy intake in athletes or trained individuals than in sedentary individuals. These people regularly engage in high-intensity exercise and have normal body size and composition in which their diets may alter appetite and energy intake (Howe et al., 2014). Appetite and food intake are regulated at the physiological level by the neuroendocrine system, of which appetite-regulating gut hormones play a role as episodic mediators of hunger and satiety (Murphy & Bloom, 2006). A variety of hormonal and neural signals, including feedback from diet and exercise changes, influence appetite and energy intake regulation (Howe et al., 2014).

Understanding the relationship between exercise and appetite is important for both athletes looking to improve their performance and those looking to maintain a healthy body weight. A variety of hormones are involved in appetite regulation, including episodic hormones, which are responsive to feeding episodes, and tonic hormones, which are important regulators of long term energy storage. Among the episodic appetite-regulating hormones, ghrelin is notable for its role in stimulating appetite and energy intake (Stensel, 2011). Such hormonal changes occur concomitantly with a decrease in appetite during exercise and have been postulated as a potential mechanism underlying exercise-induced appetite suppression (Broom et al., 2009).

Athletes may eat despite a loss of appetite (Robins & Hetherington, 2005) of which their appetites may be increased by exercise, and this may be a greater motivator to eat among this population (Long et al., 2011). However, the effect of exercise on appetite suppression varies depending on gender and environmental factors (Aeberli et al., 2013; Hagobian et al., 2009) and research suggests that exercise in colder temperatures may stimulate appetite due to increased energy intakes (White et al., 2005). Since, athletes train and compete in a variety of environments, and a better understanding of this area could help the nutritionist cater and plan meals for athletes attending training camps in a variety of conditions (Birkenhead & Slater, 2015).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methods that were employed to collect and analyse data on nutrition knowledge and dietary practices among athletes in Colleges of Education in the Volta Region of Ghana. A quantitative research approach was adopted for the study. To achieve the purpose of the study, the researcher gathered data from participants and the results were calculated to establish whether there were differences in dietary practices with respect to gender among athletes in Colleges of Education. This chapter includes the research design, population, sample and sampling technique, instrumentation, data collection procedures, and data analysis.

3.1 Research Design

The study adopted a cross-sectional survey design. The cross-sectional survey design produces a good number of responses from numerous people at a time, provides a meaningful picture of events and seeks to explain people's perception and behaviour basis of information obtained at a time (Ogah, 2013). This design helps the researcher to achieve the purpose of the study as well as the drawing of meaningful conclusions from the study by obtaining varying views from the participants.

3.2 Population

McMillan and Schumacher (2010) defined population as a group of elements or cases, whether individuals, objects, or events, that conform to specific criteria and to which we intend to generalise the results of a study. The study population consisted of all athletes in the five Colleges of Education in the Volta Region of Ghana that participated in at least one sporting activities in the 2022 games at Dambai College of

Education. Out of the five Colleges of Education, four are mixed and one is single sex. The four mixed Colleges are Akatsi College of Education, Amedzope College of Education, Peki College of Education, and St. Francis College of Education while the single sex is St. Theresa's College of Education comprising of all female students. The total population composed of the following;

CoE	**No. of male athletes**	**No. of female athletes**	**Total**
Akatsi CoE	41	27	68
Amedzope CoE	43	25	68
Peki CoE	46	25	71
St. Francis CoE	45	28	73
St. Theresa's CoE	-	50	50
Total	**175**	**155**	**330**

This information was obtained from the various Physical Education tutors. Athletes in Colleges of Education were used for the study because they were better placed to provide accurate information about the problem which was investigated.

3.3 Sample and Sampling Technique

A sample of 330 was selected for the study using a census technique. A census was conducted in this study to ensure that comprehensive data was collected to be able to make a gneralising conclusion on the issue of study regarding the population (Ogah, 2013). Again, the census helps to eliminate sampling error and provide data on all the individuals in the population (Singh & Masuku, 2014).

3.4 Instrumentation

The researcher conducted the study using a questionnaire. A questionnaire is a very powerful tool for eliciting information due to the relative ease in responding to them. Furthermore, it is most appropriate when dealing with a data to be collected from a large sample (Ogah, 2013). An adapted questionnaire from Trakmank et al. (2017) with a reliability coefficient of 0.88 was used to collect data on nutrition knowledge. Question 1.2 sub-question 2 from section 1 (weight management), question 2.3 from section 2 (macronutrients), sub-question 4 from section 3 (micronutrients), questions 4.1, 4.8 and 4.10 from section 4 (sports nutrition) were adapted whereas dietary practices and factors that influences dietary practices were self-constructed by the researcher.

The questionnaire was divided into four sections and made up of 30 items. Section A sought data on the demographic information of participants such as gender, age range, educational level, type of sport, weight, height, nutrition education, and nutrition information. Section B contained ten (10) close-ended test items on nutrition knowledge with the intent to elicit information the knowledge level of each participant about nutrition. It was measured using a five-point Likert scale; Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD). Section C contained ten (10) close-ended test items on dietary practices including frequency of food intake from every section of the food pyramid, snacks, fast food, vitamin and mineral supplements, breakfast, beverages intake and meal skipping. It was measured using a four-point Likert scale; Always (A), Often (O), Sometimes (S), and Never (N). Section D contained ten (10) close-ended test items on challenges of dietary practices with the intent of finding out challenges faced by participants in dietary practices including lack of knowledge, cost, time constraints, cultural background, lack of appetite, peer influence, family feeding, long periods of cooking, social media influence and sickness. It was measured using a five-point Likert scale; Strongly Agree (SA), Agree (A), Undecided (U), Disagree (A), and Strongly Disagree (SD).

3.4.1 Validity

The validity of the instrument in this study was tested through the face and content validity procedures. Zohrabi (2013) indicated that the quality of research instruments is very critical because the conclusions researchers draw are based on the information they obtain using these instruments therefore, it is imperative that the data and the instruments be validated. The instrument was validated by the supervisor to ascertain if the test items were appropriate for the participants. Additionally, face and content validity were established by giving the prepared instrument to experts and colleagues in the Department of Health, Physical Education, Recreation, and Sports, University of Education, Winneba to read through and shape the questionnaire. Their comments and suggestions were incorporated in the corrections which were adjudged suitable to be used for the study.

3.4.2 Reliability

Reliability is an estimate of the degree to which a scale measures a construct consistently when it is used under the same condition with the same or different subjects. It describes the extent to which a measuring technique consistently provides the same results if the measurement is repeated (Suresh et al., 2011). The reliability of the instrument was determined by using the test-retest method. A sample of the instrument (questionnaire) was pilot-tested on a similar group of thirteen (13) participants at Ada Colleges of Education in the Greater Accra region of Ghana in order to sharpen and fine-tune it by correcting possible weaknesses, inadequacies and ambiguities that could characterise the items. The Cronbach's Alpha reliability coefficient was used to determine the internal consistency of the instrument. The alpha value of 0.73 was obtained and considered good since Taber (2018) illustrated that an alpha value of 0.70 is a sufficient measure of reliability or internal consistency of an instrument.

3.5 Ethical Considerations

Participants were adequately informed about the objectives of the study and were required to sign an informed consent to participate in the study. Participants were given the freedom to withdraw from the study at any stage if they were not comfortable. They were assured of confidentiality, anonymity, and privacy. Also, they were assured that the data collected would be stored and protected in a secure manner to prevent unauthorised access.

3.6 Data Collection Procedures

The researcher took an introductory letter from the Head of the Department of Health, Physical Education, Recreation and Sports of the University of Education, Winneba to introduce himself and sought permission from the head of the selected institutions, who subsequently informed the tutors, especially those in the P.E department about the study in order to solicit their cooperation and assistance. The researcher collected the data both face-to-face and online (Google form). The researcher explained the nature, purpose, and procedure of the study and scheduled meetings were communicated to the participants' days ahead of time. The participants were assured that the data collected would be used purposely for research. The researcher on the scheduled date, administered the questionnaires for which participants responded within 15-20 minutes. The completed questionnaires were retrieved on the same day, placed in an envelope, and sealed. The online was also adapted due to the track system of the Colleges of Education where most of the participants were home. The researcher sought the consent of the participants through the PE tutors where a write-up together with the researcher's picture explaining the purpose of the study and what is expected of them was placed on their Whatsapp platform. The questionnaire was converted into a Google form and the link was sent to the participants individually by the researcher. The researcher had to remind participants occasionally through messages and calls to respond to the survey in order to increase the response rate. This was repeated to achieve a sufficient response rate. In some cases, the researcher had to buy data for some of the participants before they were convinced to respond to it. The researcher carried out these activities within nine weeks. A total of 330 participants were recruited for the study of which 277 participants responded to the questionnaire representing an 84% response rate. Nevertheless, this response rate was considered appropriate for the study based on the suggestion of Richardson (2005) that a response rate of 60% or more is adequate.

3.7 Data Analysis

The data gathered were statistically analysed using frequencies and percentages as well as independent samples t-tests using Statistical Package for Social Sciences (SPSS) software version 25.0. Research question one which sought to assess nutrition knowledge among athletes in Colleges of Education was analysed using frequency and percentages. The data was transformed and computed by summing up the responses to the 10 statements into a single variable nutrition knowledge scores, which was then recoded into levels of nutrition knowledge as low and high. Thus, scores below or equal to 25.0 indicated as low knowledge and scores above or equal to 26.0 indicated high knowledge. Research question two which sought to assess dietary practices among athletes in Colleges of Education was analysed using frequency and percentages of the responses to the 10 statements. Research question three which aimed to identify the factors that influence dietary practices of athletes in Colleges of Education was analysed using frequency and percentages of the responses to the 10 statements. The scale was collapsed into a dichotomous scale of agree and disagree by transforming and recoding. Thus, strongly agree and agree indicated agree while undecided, strongly disagree and disagree indicated disagree. Research hypothesis which is there will be no significant difference in dietary practices among male and female athletes in Colleges of Education was tested using an independent samples t-test. Independent samples t-test was appropriate as Pallant (2010) stipulated that independent samples t-test is used to determine the mean values or scores of two different groups of participants. The level of significance was set at .05 to test the acceptability of the stated hypothesis.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

This chapter presents the results and discussions based on the data gathered. In analysing the data to answer the three research questions and one hypothesis, frequencies and their corresponding percentages, and independent samples t-test were conducted. The demographic information of participants was also presented before the results regarding the research questions. The presentation is divided into three sections. The first section presents the demographic information of the participants while the second section focuses on the results for the research questions and hypothesis. The final section focuses on the discussions of the results.

4.1 Results

Section 1: Demographic Information of Participants

This section presents results of the demographic characteristics of the sample used for the study.

Table 1: Gender of Participants

Gender	**Frequency**	**Percentage (%)**
Male	155	56.0
Female	122	44.0
Total	**277**	**100.0**

Source*: Field Survey (2023)*

Table 1 shows the gender of the participants used in the study. A total of 277 participants took part in this study and out of this, 155 (56.0%) were males and 122 (44.0%) were females. The result in the Table shows that males dominate the females' student-athletes population in the Colleges of Education used in the study.

Table 2: Age of Participants

Age Range	**Frequency**	**Percentage (%)**
15-20	2	0.7
21-25	195	70.4
26-30	70	25.3
Above 30	10	3.6
Total	**277**	**100.0**

Source*: Field Survey (2023)*

Table 2 shows the age of the participants used in the study. The participants were asked to indicate their age range, and out of the 277 participants, 195 (70.4%) were aged 21-25 years, 70 (25.3%) were aged 26-30 years, 10 (3.6%) were above 30 years, and 2 (0.7%) were aged 15-20. The results from the table 2 imply that most of the participants were aged 21-25 years while the least number of participants were aged 15-20 years.

Table 3: Level of Participants

Level	**Frequency**	**Percentage (%)**
200	111	40.1
300	94	33.9
400	72	26.0
Total	**277**	**100.0**

Source*: Field Survey (2023)*

Table 3 shows the level of participants. The majority of the participants 111 (40.1%) were in level 200, followed by 72 (33.9%) who were in level 300, and 94 (26.0%) were in level 400 respectively.

Table 4: Type of Sport(s) Played by Gender

Sport Played	**Male**		**Female**		**Total**	
	n	**(%)**	**n**	**(%)**	**n**	**(%)**
Soccer	93	76.2	29	23.8	**122**	**44.0**
Volleyball	23	48.9	24	51.1	**47**	**17.0**
Handball	12	44.4	15	55.6	**27**	**9.7**
Basketball	4	33.3	8	66.7	**12**	**4.3**
Netball	0	0	15	100	**15**	**5.4**
Table Tennis	3	60.0	2	40.0	**5**	**1.8**
Cross country	2	100	0	0	**2**	**.7**
Track and Field	18	38.3	29	61.7	**47**	**17.0**

Source*: Field Survey (2023)*

Table 4 shows the type of sport played by participants. Of the 277 participants, a total of 122 (44.0%) played soccer of which 93 (76.2%) were males and 29 (23.8%) were females. 47 (17.0%) of the participants played volleyball where 23 (48.9%) were males and 24 (51.1%) were females. 27 (9.7%) of the participants played handball out of which 12 (44.4%) were males while 15 (55.6%) were females. 12 (4.3%) of the participants played basketball where 4 (33.3%) were males and 8 (66.7%) were females. 15 (5.4%) of the participants played netball of which all were females (100%). 5 (1.8%) of the participants played table tennis where 3 (60.0%) were males and 4 (40.0%) were females. Only 2 (.7%) of the participants were involved in cross country of which all were males (100%). With regards to track and field, a total of 47(17.0%) of the participants were involved where 18 (38.3%) were males while 29 (61.7%) were females. It is evident from the Table that soccer was the most played sport among the participants with cross country as the least.

Table 5: Weight and Height of Participants

	Mean	**Std. Deviation**
Weight (kg)	63.53	12.92
Height (m)	2.80	1.73

Source*: Field Survey (2023)*

Table 5 shows the weight and height of participants. It was revealed that participants had an average weight of 63.53 (*SD* = 12.92) and height of 2.80 (SD = 1.73)

Table 6: Previous Nutrition Education

Previous Nutrition Educ.	**Frequency**	**Percentage (%)**
Yes	187	67.5
No	90	32.5
Total	**277**	**100.0**

Source*: Field Survey (2023)*

Table 6 shows the results of previous nutrition education of the participants. It was revealed that majority of the participants 187 (67.5%) had previous nutrition education while 90 (32.5%) of the participants did not have any previous nutrition education.

Table 7: Where Do Athletes Receive Nutrition Information?

Source of Nutrition Info.	Frequency	Percentage (%)
Coach	68	24.5
Magazine	22	7.9
Television	68	24.5
Athletic Trainer	16	5.8
Nutritionist	40	14.4
Parents	40	14.4
Peers	23	8.3
Total	**277**	**100.0**

***Source**: Field Survey (2023)*

Table 7 shows where participants received their nutritional information. Participants 68 (24.5%) turned to both a coach and television for nutrition information, 40 (14.4%) participants had it from both a nutritionist and parents for nutrition information, 23 (8.3%) participants depended on peers for nutrition information, 22 (7.9%) participants resorted to magazine for nutrition information, and 16 (5.8%) participants relied on athletic trainer for nutrition information. The result implies that participants mostly received their nutrition information from both a coach and a television, and an athletic trainer was the least consulted by the participants for nutrition information.

Section 2: Analysis of the Research Questions

Research Question 1: What is the Nutrition Knowledge of Athletes in Colleges of Education?

Research question one which sought to assess nutrition knowledge among athletes in Colleges of Education was analysed using frequency and percentages. Responses to all the 10 statements were summed up as nutrition knowledge scores which was subsequently recoded into nutrition knowledge levels as low and high. Therefore, scores below or equal to 25.0 indicated as low knowledge and scores above or equal to 26.0 indicated as high knowledge.

Table 8: Nutrition Knowledge among Athletes in Colleges of Education

Nutrition Knowledge	Frequency	Percentage (%)
Low	0	0.0
High	277	100.0
Total	**277**	**100.0**

Source: *Field Survey (2023)*

Table 8 shows the nutrition knowledge among athletes in Colleges of Education. All the participants 277 representing 100% had high levels nutrition knowledge whiles none of the participants 0 representing 0.0% had low levels nutrition knowledge.

Research Question 2: What are the Dietary Practices of Athletes in Colleges of Education?

Research question two which sought to assess dietary practices among athletes in Colleges of Education was analysed using frequency and percentages of the responses to the 10 statements.

Table 9: Dietary Practices among Athletes in Colleges of Education

Statement	**Always n (%)**	**Often n (%)**	**Sometimes n (%)**	**Never n (%)**
How often do you eat breakfast in the morning?	126 (45.5%)	64 (23.1%)	84 (30.3%)	3 (1.1%)
How often do you skip at least one meal per day?	27 (9.7%)	73 (26.4%)	165 (59.6%)	12 (4.3%)
How often do you take vitamin supplements?	27 (9.7%)	57 (20.6%)	154 (55.6%)	39 (14.1%)
How often do you take mineral supplements?	46 (16.6%)	49 (17.7%)	129 (46.6%)	53 (19.1%)
How often do you drink water during training and after training/competition?	164 (59.2%)	69 (24.9%)	40 (14.4%)	4 (1.4%)
How often do you drink carbonated beverages?	32 (11.6%)	69 (24.9%)	152 (54.9%)	24 (8.7%)
How often do you consume an adequate diet daily?	54 (19.5%)	87 (31.4%)	125 (45.1%)	11 (4.0)
How often do you eat fruits such as apples, bananas, or oranges?	56 (20.2%)	78 (28.2%)	139 (50.2%)	4 (1.4%)
How often do you eat fast food?	37 (13.4%)	64 (23.1%)	154 (55.6%)	22 (7.9%)
How often do you seek out nutrition information?	38 (13.7%)	49 (27.7%)	144 (52.0%)	46 (16.6%)

Source: *Field Survey (2023)*

Table 9 shows the dietary practices among athletes in Colleges of Education. Regarding consumption of breakfast, majority of the participants 126 (45.5%) indicated that they always eat breakfast and 64 (23.1%) often do so. A significant portion of the participants 84 (30.3%) sometimes eat breakfast while only 3 (1.1%) never do. 27 (9.7%) of the participants reported skipping at least one meal per day.

Another 73 (26.4%) often skipped at least one meal per day; whereas majority 165 (59.6%) sometimes do; and 12 (4.3%) never do.

When participants were asked about vitamin supplement intake, 27 (9.7%) reported always taking them; 57 (20.6%) often take them; majority 154 (55.6%) sometimes take them; and 39 (14.1%) never take them. For mineral supplement, 46 (16.6%) of the participants indicated always taking them; 49 (17.7%) often take them; majority 129 (46.6%) sometimes take them; and 53 (19.1%) never take them. Majority 164 (59.2%) of the participants always drink water during and after training training/competition while a significant portion 69 (24.9%) often do. Also, 40 (14.4%) of the participants sometimes drink water during and after training training/competition but only 4 (1.4) never do.

Regarding the consumption of carbonated beverages, 32 (11.6%) of the participants reported always drinking them; 69 (24.9%) often drink them, majority 152 (54.9%) sometimes drink them; and 24 (8.7%) never drink them. A daily adequate diet was always consumed by 54 (19.5%) of the participants; 87 (31.4%) often do; majority 125 (45.1%) do so sometimes, and 11 (4.0%) never do. Fruit consumption such as apples, bananas, and orange was always reported as being consumed by 56 (20.2%) of the participants; often by 78 (28.2%), sometimes by majority 139 (50.2%); and never by only 4 (1.4%). Fast food consumption was always reported by 37 (13.4%) of the participants; often by 64 (23.1%); sometimes by majority 154 (55.6%); and never by 22 (7.9%). Finally, in terms of seeking nutrition information, 38 (13.7%) of the participants always do; 49 (17.7%) often do; majority of 144 (52.0%) sometimes do; and 46 (16.6%) never do.

Research Question 3: What are the Factors that Influenced the Dietary Practices of Athletes in Colleges of Education?

Research question three which aimed to identify the factors that influence dietary practices of athletes in Colleges of Education was analysed using frequency and percentages of the responses to the 10 statements. The 5-point Likert scale was collapsed into a dichotomous scale of agree and disagree. Thus, strongly agree and agree indicated agree while undecided, strongly disagree and disagree indicated disagree.

Table 10: Factors that Influence Dietary Practices of Athletes in Colleges of Education

Statement	**Agree n (%)**	**Disagree n (%)**
I am unable to follow the recommended diet due to a lack of knowledge about sport nutrition.	179 (64.6)	98 (35.4)
I am unable to afford the cost of recommended diet.	213 (76.9)	64 (23.1)
I am unable to follow the recommended diet due to time constraints.	147 (53.1)	130 (46.9)
I am unable to follow the recommended diet due to my cultural background.	103 (37.2)	174 (62.8)
I am unable to follow the recommended diet due to lack of appetite.	104 (37.5)	173 (62.5)
I am unable to follow the recommended diet due to peer influence.	85 (30.7)	192 (69.3)
I am unable to follow the recommended diet due to family feeding.	149 (53.8)	128 (46.2)
I am unable to follow the recommended diet due to long periods of cooking.	107 (38.6)	170 (61.4)
I am unable to follow the recommended diet due to social media influence.	86 (31.0)	191 (69.0)
I am unable to follow the recommended diet due to sickness.	96 (34.7)	181 (65.3)

Source: *Field Survey (2023)*

Table 10 shows the factors that influence dietary practices of athletes in Colleges of Education. Majority of the participants 179 (64.6%) agreed that they were unable to follow the recommended diet due to a lack of knowledge about sport nutrition while 98 (35.4%) disagreed. On whether participants were unable to afford the cost of recommended diet, majority of the participants 213 (76.9%) agreed and 64 (23.1%) disagreed. Again, majority of the participants 147 (53.1%) agreed that they were unable to follow the recommended diet due to time constraints. However, majority of the participants 174 (62.8%) disagreed that they were unable to follow the recommended diet due to their cultural background while 103 (37.2%) agreed. Also, majority of the participants173 (62.5%) disagreed that they were unable to follow the recommended diet due to lack of appetite whereas 104 (37.5%) agreed. Again, majority of the participants 192 (69.3%) disagreed that they were unable to follow the recommended diet due to peer influence and 85 (30.7%) agreed.

Majority of the participants 149 (53.8%) agreed that they were unable to follow the recommended diet due to family feeding but 128 (46.2%) disagreed. Majority of the participants 170 (61.4%) disagreed that they were unable to follow the recommended diet due to long periods of cooking and 107 (38.6%) agreed. Majority of the participants 191 (69.0%) disagreed that they were unable to follow the recommended diet due to social media influence while 86 (31.0%) agreed. Majority of the participants 181 (65.3%) disagreed that they were unable to follow the recommended diet due to sickness while 96 (34.7%) agreed.

Research Hypothesis

The research hypothesis which is there will be no significant difference in dietary practices among male and female athletes in Colleges of Education was tested using an independent sample t-test. The results obtained are summarised and presented below.

Table 11: Difference in Dietary Practices among Male and Female Athletes

Gender	N	Mean	SD	t	df	p
				-.919	275	.359
Male	155	25.77	3.93			
Female	122	26.22	4.26			

* *Significant, p > .05*; ***Source:*** *Field Survey (2023)*

Table 11 shows an independent samples t-test conducted to compare the gender of the participants to their dietary practices. There was no statistically significant difference t (275) = -.919, p = .359 between the gender of the participants and their dietary practices. Therefore, the null hypothesis failed to be rejected. The result showed that there was no statistically significant difference in the scores of males (M = 25.77, SD = 3.93) and females (M = 26.22, SD = 4.26) regarding their dietary practices.

4.2 Discussions

Research question one sought to ascertain nutrition knowledge among athletes in Colleges of Education. The results revealed that participants had high level of nutrition knowledge. This is in line with the study of Kathure et al. (2022) who assess the nutrition knowledge and sources of nutrition knowledge among middle and long-distance elite athletes in North Rift Kenya, that majority of the athletes had adequate knowledge on nutrition, and there should be continuous nutrition education and counselling sessions on the importance of correct nutrition information among athletes. A study by Folasire et al. (2015) amongst Nigerian undergraduate athletes at the University of Ibadan also indicated that more than half of the athletes 64 (58.2%) had good nutrition knowledge scores. Furthermore, Elliott's (2021) study on the assessment of the nutrition knowledge of male and female GAA players also revealed an average nutrition knowledge among players. Again, in a comparable result, Sedek and Yih (2014) indicated that majority of respondents had a good level of nutrition knowledge.

On the contrary, the current findings of this study, disagreed with Weeden et al. (2014) study which focused on differences in collegiate athlete nutrition knowledge as determined by athlete characteristics and found that college athletes have low levels of nutrition knowledge. They expressed concerns surrounding what and how to eat healthy, and that completion of a collegiate level nutrition course may benefit collegiate athletes and provide them with the information to make better nutrition choices. In another study by Torres-McGhee et al. (2012) on sports nutrition knowledge among collegiate athletes, coaches, athletic trainers, and strength and conditioning specialists, it was found that 91% of athletes surveyed had inadequate sports nutrition knowledge. The authors concluded that although, athletes are using more reliable resources for nutrition information, yet their nutrition knowledge is still lacking. Again, Janiczak et al. (2022) study on systematic review update of athletes' nutrition knowledge and association with dietary intake revealed that athletes frequently failed to follow nutritional guidelines and have poor general and sports nutrition knowledge. This suggests that many athletes are not familiar with both general and sport-specific dietary recommendations because they do not possess the minimal nutrition knowledge necessary to pass a nutrition knowledge test.

Research question two aimed at assessing dietary practices among athletes in Colleges of Education. The results indicated that majority of the participants always eat breakfast. This conformed to the finding of Montecalbo and Cardenas (2015) on nutritional knowledge and dietary habits of Philippine collegiate athletes, that majority of the respondents reported to have eaten their breakfast 5-7 days/week. They concluded that eating breakfast is the most important meal of the day, which serves as fuel and source of nutrient and energy needed for the athletes' body to perform a high-quality workout/training. Likewise, the study of Ahmadi et al. (2022) to investigate the sports nutritional knowledge, attitude, and practice of adolescent athletes in Tehran, Iran demonstrated that 131 out of 174 participants had breakfast every day which is a promising statistic since breakfast is an important meal and helps improve athletic performance and overall health. However, the study of Klein et al. (2021) revealed that less than half of the athletes reported eating breakfast every day.

The current findings revealed that majority of the participants consistently take water during training and after training/competition. This is in line with the study of Klein et al. (2021), which sought to assess sport nutrition knowledge, dietary practices, and sources of nutrition information in NCAA division III collegiate athletes and found that vast majority of athletes reported drinking water during workouts/practices. They opined that athletes who engage in vigorous activity for longer than 60 minutes may need additional nutrients, such as carbohydrate and electrolytes, to counter high sweat rates, promote performance, and delay fatigue. Also, it was confirmed in study of Walsh et al. (2011) on the body composition, nutritional knowledge, attitudes, behaviors, and future education needs of senior schoolboy rugby players in Ireland that, nearly all participants followed recommendations to ingest fluids during exercise. Moreover, Kalpakçıoğlu (2008) illustrated that water is the most necessary nutrient for the body and it must be kept available at all times during the practice and competition.

The result also indicated that majority of the participants sometimes take of fruits. This finding is discouraging since it does not promote good eating habits, despite the fact that it was suggested that five or more servings of fruits and vegetables per day to provide nutrients and fiber for athletes. This finding differs from earlier studies. The study of Jusoh et al. (2021) on association between nutrition knowledge and nutrition practice among Malaysian adolescent handball athletes showed that majority of the participants reported eating enough fruits. Likewise, Eck and Byrd-Bredbenner (2021) study which aimed to identify food choice decisions of collegiate division I athletes found that athletes commonly consumed fruits and vegetables. Further, Heydenreich's (2014) study revealed that more than two third of the participants had a daily intake of at least two servings of fruits. In addition, the result from Alaunyte et al. (2015) study revealed that significantly higher percentage of rugby players in the good nutritional knowledge group reported consuming fruit and vegetables.

Research question three aimed at identifying factors that influence dietary practices among athletes in Colleges of Education. The result indicated that majority of the participants were unable to afford cost of recommended diet. This is consistent with Heaney et al. (2011) study that cost of healthy food is well-recognised among elite athletes which interfere with making food choices that support a healthy diet. Likewise, Long et al. (2011) study emphasised that food cost has been reported as influencing dietary intakes in male collegiate football players. Furthermore, Heaney et al. (2008) found that athletes on a tight budget indicated that financial restrictions make it difficult to make smart meal choices. They professed that governmentsupported study or sports scholarship allowances may not be sufficient to fund a nutritious diet and financial management skills are typically not widely featured in athlete education programmes, but may be beneficial in assisting athletes use funds wisely in selecting and consuming a healthy diet within a tight budget. Moreover, Cluskey and Grobe (2009) study posited that the transition to college can pose significant challenges to healthy eating where some students especially athletes express concern about the cost of healthy food coupled with the responsibilities of purchasing and preparing their own meals as well as managing new eating schedules. Also, Rao et al. (2013) study noted that a healthier dietary intake would be more expensive by roughly $1.50 per day. They concluded that the relatively higher cost of healthy foods may be an impediment to eating better among the general populace particularly those disadvantaged of which athletes are no exception.

The current study revealed that majority of the participants were unable to follow the recommended diet due to time constraints. This finding is in support of Sceery's (2017) study which focuses on nutritional impact on performance in student-athletes and found that time is considered a major challenge for athletes. The author further pointed out that schedule of any college student is challenging to manage classes, activities, social aspects, volunteering or work. Hence, balancing a full practice and game schedule on top of those daily undertakings can add immense stress and the necessity for careful navigation of time management. Besides, the study of Parks et al. (2018) identified that even though collegiate athletes face numerous nutrition challenges, lack of time was the primary barrier to eating for performance. Additionally, Gomez et al. (2018) study discovered that time management remains a major hurdle in the student-athletes’ preparation of which continued training load increase over the past few years keep adding extra pressure on the student athletes.

Moreover, majority of the participants in the current study disagreed that they were unable to follow the recommended diet due to peer influence. This was evident in the study of Stokes et al. (2018) which aimed to explore the perceptions and determinants of eating for health and performance in high-level male adolescent rugby union players where 55% participants identified peers as enablers to healthy eating when they were supportive and ate healthy. Thus, by bringing healthy options to school and telling participants not to choose unhealthy foods. Nevertheless, some studies are not in line with this finding. Whatley (2021) study found that female undergraduate students seem to be the most susceptible to be influenced by their friends' dieting behaviours possibly due to their significant time spent in college and development of a more consistent peer/friend group. Additionally, Bourke et al. (2019) study found that some athletes reported using advice from other athletes to inform their own dietary practice. They concluded that information obtained from colleague athletes should be treated with caution. Again, Contento et al. (2006) study discovered that most of the participants acknowledged that they were influenced by their peers in making certain food decisions.

Furthermore, the current study shown that majority of the participants demonstrated that they were unable to follow the recommended diet due to family feeding. The finding is consistent with the work of Sharples et al. (2021) on barriers, atitudes, and influences towards dietary intake amongst elite rugby union players. The study revealed that childhood upbringing was raised by the participants as a barrier to both body composition and healthy eating habits in which those participants who grew up in families greater than five thought they did not eat well growing up. Also, Ono et al. (2012) study revealed that eating habits are primary related to players' upbringing amongst athletes. This study demonstrated that taste in food is constructed in childhood based on the food experience of one's parents, because parents and children share the same food culture and environment, and it usually continues into adulthood.

Also, the current study found that majority of the participants disagreed that they were unable to follow the recommended diet due to social media. This is in support of Love's (2020) study to investigate how social media, specifically Instagram, can be used to educate Division I collegiate athletes about protein and to determine their prior protein knowledge of which majority of the athletes reported finding the Instagram posts helpful and felt they retained the information that was provided. This indicates that using social media may be beneficial for sports nutritionists and dietitians to educate their athletes. Likewise, Bourke et al. (2019) study revealed that athletes commonly used social media for practical nutrition purposes, including recipes and information about restaurants. However, the study of Stokes et al. (2018) departs from this finding indicating that social media influences dietary intakes more amongst developmental rugby players than super rugby players and therefore educating players early about interpreting such information is recommended. Similarly, the results from Carrote et al. (2015) study shown that consuming health and fitness-related social media content is common whereby participants reported liking or following at least one of the included health and fitness-related social media content types on Facebook, Instagram, or Twitter. In addition, Zimmerman and Shimoga (2014) in their study affirmed that food marketing may have disparate effects across populations, influencing eating behaviours disproportionately in some of the most vulnerable subgroups and potentially contributing to disparities in diet and related health outcomes.

The research hypothesis sought to ascertain whether there is a significant difference in dietary practices among male and female athletes in Colleges of Education. The result revealed that there was no significant difference in the dietary practices of participants. The finding aligns with the study of Montecalbo and Cardenas (2015) to examined the relationship between nutritional knowledge and dietary habits of selected college athletes in the Philippines revealed no differences in the dietary habits scores of both male and female athletes. The authors concluded that though there exist some differences in the dietary habits of athletes, however, the mean median dietary scores of both male and female athletes were the same. In another study by Fisher (2013) on understanding nutrition knowledge and behaviours of collegiate athletes which showed that there was no significant difference between male and female athletes with respect to nutrition behaviour. Thus, gender does not appear to influence differences in nutrition behavior. A similar result by Jusoh et al. (2021) on association between nutrition knowledge and nutrition practice among Malaysian adolescent handball athletes revealed that both male and female adolescent handball athletes had moderate level of nutrition practice which was not significantly different between groups. They concluded that although athletes had moderate nutrition knowledge, it only contributed slightly to their dietary habits.

Conversely, the result departs from the findings of previous studies. This was evident in the study of Webber et al. (2015) study which demonstrated gender differences among athletes, as females had significantly greater Healthy Eating Index scores than males. Moreover, Ali et al. (2015) study confirmed that male athletes were classified to have fair dietary habits whereas the female athletes had poor dietary habits. Again, Paugh's (2005) which sought to examine dietary habits and nutritional knowledge of college athletes found that female collegiate athletes had better dietary habits than their male counterparts.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

In this chapter, a summary of the findings of the study is presented, conclusions drawn, and recommendations made are all presented under this section. The study assessed nutrition knowledge and dietary practices among athletes in Colleges of Education in the Volta Region of Ghana. The hypothesis was tested to find out if there was difference in dietary practices with respect to gender among athletes. The survey was conducted in the Volta Region of Ghana.

5.1 Summary of Findings

The following are the summary of the findings of the study;

1. Participants had high level of nutrition knowledge.
2. Participants consistently consumed breakfast and water but occasionally consumed fruits.
3. Cost, time, and family feeding were factors that influences dietary practices of participants.
4. There was no significant difference in the dietary practices among male and female participants.

5.2 Conclusions

The following conclusions were drawn based on the findings of the study;

1. Participants had high level of nutrition knowledge.
2. Additionally, participants consistently eat breakfast, take water during training and after training/competition, and occasionally take fruits.
3. Furthermore, cost, time, and family feeding were factors that influences dietary practices among participants.
4. Also, there was no statistically significant difference in the dietary practices among male and female participants.

5.3 Recommendations

Based on the findings and conclusions of the study, the following recommendations were made;

1. Management in Colleges of Education should provide special meal plans for athletes since they are unique population.
2. Management in Colleges of Education in collaboration with the physical education department, should provide a counselling unit to educate athletes on healthy dietary practices which would go a long to improve athletic performance and overall health.
3. Management in Colleges of Education should put in measures to help athletes manage cost and time constraints that influences their dietary practices.
4. Coaches should educate and assist athletes by emphasizing time management, meal planning, and balancing family feeding with their dietary needs.
5. Athletes in Colleges of Education should maintain healthy dietary practices, particularly consuming fruits regularly.

5.4 Suggestion for Further Studies

The study aimed at assessing nutrition knowledge and dietary practices among male and female athletes in Colleges of Education. Based on the research findings and conclusions drawn, it is suggested that future research should look into differences in nutrition knowledge among male and female athletes in Colleges of Education. Additionally, an in-depth research should be done to examine the impact of nutrition knowledge and dietary practices among male and female athletes in Colleges of Education.

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APPENDICES

APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

QUESTIONNAIRE FOR STUDENTS

Dear Participant,

I am a postgraduate student of the Department of Health, Physical Education, Recreation and Sports (HPERS) at the University of Education, Winneba. I am conducting this survey as part of my thesis on the topic “Nutrition Knowledge and Dietary Practices among Athletes in Colleges of Education in the Volta Region of Ghana.” It is in partial fulfilment of the requirements for the award of Master of Philosophy in Physical Education and Sports Studies.

You are kindly requested to read through the items and respond to them as appropriately as possible. Your responses will be treated as confidential and will solely be used for academic purposes. Your participation in this study is voluntary and you are free to opt out at any point during the study should you find it necessary.

If you consent to voluntarily participate in this study, please sign and write the date in the space provided.

Signature……………………. Date…………………………….

SECTION A: Demographic Information

Instruction: You are kindly requested to tick (√) or provide the correct information in the space that best describes your view about each item.

1. Gender:

   Male ☐

   Female ☐

2. Age:

   15 – 20 ☐

   21 – 25 ☐

   26 – 30 ☐

   Above 30 years ☐

3. Level:

   100 ☐

   200 ☐

   300 ☐

   400 ☐

4. Type of sport played: ……………………………………………

5. Weight: ……………………………………………...

6. Height: ………………………………………………

7. Have you had any nutrition education?

Yes ☐

No ☐

8. Where do you usually get your nutrition information?

Coach ☐

Magazine ☐

Television ☐

Athletic Trainer ☐

Nutritionist ☐

Parents ☐

Peers ☐

SECTION B: NUTRITION KNOWLEDGE

Instruction: Please read and respond to the following statements by ticking **(√)** in the appropriate column indicating the degree to which you agree or disagree with each statement using the following scale:

Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD).

S/N	What is the Nutrition Knowledge of Athletes in Colleges of Education?	SA	A	U	D	SD
1	Skipping breakfast can negatively affect athletic performance.					
2	Carbohydrates are easier to digest than fats or proteins.					
3	Eating more protein is the most important dietary practice to gain more muscle					
4	Iron is needed to turn food into usable energy.					
5	Athletes should drink water to keep plasma blood volume stable.					
6	A low-intensity exercise/physical activity mostly uses fat as a fuel.					
7	A cup of boiled rice contains enough carbohydrates for recovery from about 1 hour of high-intensity aerobic exercise.					
8	The pre-event meal should be eaten 3 - 4 hours prior to the competition.					
9	During a competition, athletes should eat foods that are high in fluids and carbohydrates.					
10	After a competition, athletes should eat foods that are high in carbohydrates and proteins.					

SCETION C: DIETARY PRACTICES

Instruction: Please read and respond to the following statements by ticking **(√)** in the appropriate column indicating the degree to which you agree or disagree with each statement using the following scale:

Always (A), Often (O), Sometimes (S) and Never (N).

S/N	**What are the Dietary Practices of Athletes in Colleges of Education?**	**A**	**O**	**S**	**N**
1	How often do you eat breakfast in the morning?				
2	How often do you skip at least one meal per day?				
3	How often do you take vitamin supplements?				
4	How often do you take mineral supplements?				
5	How often do you drink water during training and after training/competition?				
6	How often do you drink carbonated beverages?				
7	How often do you consume an adequate diet daily?				
8	How often do you eat fruits such as apples, bananas, or oranges?				
9	How often do you eat fast food?				
10	How often do you seek out nutrition information?				

SECTION D: FACTORS THAT INFLUENCE DIETARY PRACTICES

Instruction: Please read and respond to the following statements by ticking **(√)** in the appropriate column indicating the degree to which you agree or disagree with each statement using the following scale:

Strongly Agree (SA), Agree (A), Undecided (N), Disagree (D), and Strongly Disagree (SD).

S/N	**What are the Factors that Influence Dietary Practices of Athletes in Colleges of Education?**	**SA**	**A**	**U**	**D**	**SD**
1	I am unable to follow the recommended diet due to a lack of knowledge about sport nutrition.					
2	I am unable to afford the cost of recommended diet.					
3	I am unable to follow the recommended diet due to time constraints.					
4	I am unable to follow the recommended diet due to my cultural background.					
5	I am unable to follow the recommended diet due to lack of appetite.					
6	I am unable to follow the recommended diet due to peer influence.					
7	I am unable to follow the recommended diet due to family feeding.					
8	I am unable to follow the recommended diet due to long periods of cooking.					
9	I am unable to follow the recommended diet due to social media influence.					
10	I am unable to follow the recommended diet due to sickness.					

APPENDIX B

INTRODUCTORY LETTER

UNIVERSITY OF EDUCATION, WINNEBA
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Our ref: FSE/ DHPERS /I.3/VOL.2.32 ***Date:*** 15th May, 2023

TO WHOM IT MAY CONCERN

Dear Sir/ Madam,

LETTER OF INTRODUCTION

We humbly write to introduce to you **Mr. Emmanuel Kodzo Manche,** a student from the above-named Department pursuing an M.Phil. in Health, Physical Education, Recreation, and Sports (HPERS) at the University of Education, Winneba with index number **220025719.**

He is doing his research work on the topic "Nutrition Knowledge and Dietary Practices Among Male and Female Athletics in Colleges of Education in The Volta Region of Ghana"

This introductory letter is for you to grant him the necessary assistance to collect data to help him complete his academic work.

Thank you.

Yours faithfully,

Dr. Munkaila Seibu
Ag. Head of Department