IMPACT OF NUTRITION ON MUSCLE RECOVERY AND PERFORMANCE IN UNIVERSITY OF BENIN ATHLETES

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF HUMAN KINETICS AND SPORTS SCIENCE, FACULTY OF EDUCATION, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FUFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE B.Sc(Ed) DEGREE IN HUMAN KINETICS.

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CERTIFICATION

We the undersigned certify that this research project was carried out by **Chideha Victoria OGORDI** with matriculation number **EDU1904472** in the department of Human Kinetics and Sports Science, Faculty of Education, University of Benin, Benin City.

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DEDICATION

This project is dedicated to God Almighty, my backbone and strength, my ever present help and my inspiration from the start to the finish of this project.

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ABSTRACT

This study investigated the Impact of Nutrition on Muscle Recovery and Performance of University of Benin Athletes.

The study adopted the descriptive research design. The population of the study consists of 12o students athletes of the University of Benin. A survey was conducted among 36 participants, 9 football athletes, 6 basketball athletes, 6 volleyball athletes, 3 handball athletes, 6 athletics athletes, 3 swimming athletes and 3 hockey athletes. The sampling technique applied was the fish bowl method of the simple random sampling. The participants filled a self-structured questionnaire which was validated by experts in the department of Human Kinetics and Sports Science, and was the research instrument administered by the researcher. The data was analyzed using the using frequency percentage and the mean and standard deviation.

The study was able to find out the Impact of Nutrition on muscle recovery in athletes, how nutritional status impact performance in various sports, the differences in the nutritional needs of male and female athletes.

The study also found out that personalized nutrition plans enhance performance and improve injury and that hydration influences performance of athletes during training activities and competition.

The study recommended therefore that athletes should pay attention to their nutritional needs to know what works best for them, athletes should incorporate meals such as sport snacks during trainings and competition to help in better performance and quick muscle recovery, athletes should be educated on what type of meals to take before, during and after training activities for quick muscle recovery and during competitions, water, energy drinks, sport water should be readily available for athletes during competition to keep them hydrated at all times during the period of the competition to reduce fatigue and enhance performance.

CHAPTER ONE

INTRODUCTION

Background of study

The rate at which food is needed to enhance body metabolism, improve performance, help in the recovery of muscle injuries and healthy living cannot be over emphasized, as the human body needs food (healthy/balanced diet) to survive. Nutrition has gone a long way in the improvement of athletes performance and muscle recovery as different dieticians have come up with different food nutrients and combinations of food nutrients for not just the improvement of athletes performance but also in the recovery of muscle. It is important that athletes know the nutrients that is best for them especially during rehabilitation (injury recovery) as these nutrients work hand in hand with the treatment being administered. Knowing the right nutrients to take, when to take it and how to take it improves the performance of an athlete. Nutrition when combined with other areas of athletic development, such as training can greatly improve an athlete's performance. An active lifestyle and exercise routine, along with eating well is two best way to stay healthy. Eating good diet can help provide energy needed to finish a race or enjoy a sport or activity. An athlete is more likely to be tired and perform poorly during sports when he does not take enough calories, carbohydrate, protein, fluids, iron, vitamins and other minerals.

The fact that constant training helps in the improvement of the performance of an athlete and also helps during injury and muscle recovery is not enough as nutrition work hand in hand with training and fitness. The scenario of a patient who was diagnosed of diabetes and was prescribed some drugs by the doctor to be taken, the patient takes the drugs religiously according to the prescription and still takes those sugary food that increases the sugar level instead of a proper diet for diabetic patients will definitely come back to see the doctor before the next appointment

because the increase in sugar level, may lead to crisis with the patient rushed back to the hospital. This scenario can be likened to an athlete who constantly trains and practices but dosen't take proper diet/nutrient, the athlete will lack in some areas of performance as those nutrients are not there to support the training, thereby enhancing performance. Most athlete take in more of carbohydrate food and pay less attention to other classes of food (minerals, protein, vitamins, iron etc) because of the general fact that carbohydrates are energy giving foods. Thus, they tend to take in more of carbohydrates to gain energy and take little of other classes of food. Proper nutrition is key to good health, without nutritious food, physical fitness cannot be achieved. Food is the fuel of our body. Food with nutritional content boosts our stamina and helps us exercise better. It is scientifically proven that nutrition can help enhance health, athletic performance, fitness and recovery.

The American Dietetics Association of Canada and the American college of Sports Medicine are in position that physical activity, athletic performance and recovery from exercise are enhanced by optimal nutrition. These organizations recommend appropriate selection of food and fluids, timing of intake and supplements choices for optimal health and exercise performance. Food is not the only thing that serves as nutrient to aid athletes performance but also several drinks have been introduced into the market to aid athletes performance and recovery after an activity, these drinks include; energy drinks, sports water, organic drinks. It has been estimated that while 5% of water loss in body weight will reduce performance by over 30%, a 7% loss will cause chronic imbalance and a 10% loss will be life threatening (Asker & Gleeson, 2010; Grandjean, 2004). This shows how important water is to the body. Hydration has a way of improving and decreasing the performance of an athlete. There is a general belief that too much intake of water reduces the rate at which an athlete performs during an activity, it makes the athlete slow and

perform poorly during an activity and also competitions so athlete take very little or no water before and during an activity. Annie Thorisdottir, had to withdraw from the 2015 Crossfit Games after suffering from heat injury which partially resulted from dehydration (Mazziotta, 2015). The mass fainting that occurred in a Bharathidasan University hall in Indian was accrued to exhaustion due to dehydration (Nadu, 2016). This shows how important hydration is to the performance of an athlete during competition. Poor hydration leads to poor performance of an athlete and good hydration leads to optimal performance of an athlete. The general belief that enough water intake during an activity is as a result of the poor knowledge athletes and even coaches have about nutrition. Most young athletes especially those at the grassroots level have little knowledge on nutrition let alone have a nutritional plan they follow to enhance performance. Nutrition is key to optimal performance as it can improve or reduce the performance of an athlete.

Success in sports is influenced by a variety of factors, and nutrition is one of them. The diet that an athlete needs depends on a number of factors, such as the sport, the athlete's objectives, the surroundings, and pragmatic considerations. The significance of personalized nutrition counseling, encompassing daily dietary guidance and targeted counseling prior to, during, and following training and/or competition, is becoming more widely acknowledged. Athletes employ various dietary tactics to enhance performance, with optimizing glycogen reserves being a crucial approach for numerous athletes. Consuming carbohydrates while exercising keeps blood sugar levels high, avoids hypoglycemia, and benefits the central nervous system. Although it's unclear if this improves performance, recent research has focused on training athletes with low carbohydrate availability to enhance metabolic adaptations. The advantages of consuming protein throughout the day after working out are now widely acknowledged. When exercising, athletes should try to stay as hydrated as possible and limit fluid loss to no more than 2% of body

weight. Whereas training has the greatest potential to increase performance, it has been estimated that consumption of a carbohydrate–electrolyte drink or relatively low doses of caffeine may improve a 40 km cycling time trial performance by 32–42 and 55–84 seconds, respectively (Jeukendrup & Martin, 2001). Recent studies have found that a planned scientific nutritional strategy (consisting of fluid, carbohydrate, sodium, and caffeine) compared with a self-chosen nutritional strategy helped nonelite runners complete a marathon run faster and trained cyclists complete a time trial faster. Information on nutrition for athletes is not always readily available. Individuals like coaches are more likely to provide generalized nutritional information of lower quality to younger or recreational athletes. It is more likely for elite athletes to have access to professional advice on sports nutrition from qualified individuals (Zinn et al, 2006). Different nations have put in place a variety of sports science and medical support systems to help elite athletes, and a crucial part of these services is nutrition. Some nations, like Australia, have integrated nutrition programs into sports organizations; other nations, like the United States of America, have national Olympic Committees that provide support for nutrition initiatives. Nevertheless, not all elite athletes have access to sports nutrition programs. This could be because of the sport's financial limitations, geographical problems, or a lack of recognition of the value of a sports Nutrition service.

Statement of problem

Many athletes today give more importance and more all personal time to physical training and fitness while paying less attention to diet. What, when and how an athlete consumes a meal or diet has a great impact on the athlete performance, muscle recovery and improvement. There is no doubt that physical fitness and activities enhance the performance of an athlete but also the nutrients being taken in is as important as those training. Many athlete do not receive sound

nutritional practices to optimize sport performances, this can be due to poor nutrition knowledge, poor practical skills in choosing or preparing meals and reduced access to food due to a busy lifestyle and frequent travel. The role of Nutrition has not been efficiently played out in sports in the University of Benin, this is because they do not know the impact of nutrition in sports. The aim of this study is to explore the important role nutrition play among athletes in the University of Benin and also, the impact of nutrition on the recovery of muscle and enhancement of performance and its practices. It is on this note that the researcher examines the impact of Nutrition on muscle recovery and performance of University of Benin athletes.

Research questions

The following research questions were raised to guide the study

1. What is the impact of Nutrition on muscle recovery of athletes in the University of Benin?
2. How does nutritional status impact athletic performance in various sports?
3. Can personalized nutrition plans designed for an individual athlete enhance performance and improve muscle recovery?
4. Are there differences in the nutritional needs of male and female athletes In the University of Benin?
5. What is the impact of timing and composition of pre-training and post-training meals muscle recovery in athletes in the University of Benin?
6. How does hydration (use of sports water, energy drinks) influence performance of athlete during training activities and also competition?

Purpose of the study

The purpose of this study is to explore the impact of nutrition on the performance of athletes and how it also yields rapid muscle recovery during and after training in athletes of university of

Benin. This study will analyze how nutrition is as important as training and fitness activities for the improvement of muscle recovery and performance of University of Benin athletes, provide a more comprehensive understanding of the benefits of nutrition, timing (when, what and how) of the intake of nutrients, and recommend effective ways of using various nutrients for athletes in the University of Benin. The objective of this study includes;

- The overview the impact of nutrition on muscle recovery in athlete
- To explore nutritional plans for the enhancement of performance and muscle recovery in individual athlete.
- To review the impact of nutritional status on athlete's performance in different sports.
- To outline the differences in male and female athletes nutritional needs.
- To compare timing of pre and post-training meals on muscle recovery in athletes.
- To explore ways in which hydration (use of energy drinks) can affect performance during trainings and competition.

Significance of the study

The study is important as it will aid athletes in improving nutritional goals, thereby improving performance. It will help athletes know the proper diet to be taken before training and also after training. It also helps athlete know which nutrient works best for them in various areas of sports.

This study is also significant to coaches to know what to recommend for athlete for muscle recovery. It is also useful for coaches to design training programs due to the nutritional program or intake of an individual athlete. This study broadens the knowledge of athletes on the understanding of the benefits of nutrition in the improvement of performance. It also brings about a balanced and healthy life of an athlete as nutrition work hand in hand with physical

activities and training. It is also significant not just to athletes but to the general individual on the understanding of the benefits of nutrition in our everyday life for a healthy living.

Scope and Delimitation of the study

This study examines the impact of nutrition on muscle recovery and performance in University of Benin athletes. This study is delimited to athletes in the University of Benin, Benin City, Edo state.

Definition of terms

Nutrition: The complex process by which organisms obtain and utilize essential nutrients from food to sustain life and promote health.

Nutrient: A substance obtained from food and used in the body to promote growth, maintenance and repair of body tissues or simply as a substance that provides nourishment.

Diet: This is a program or plan consisting of a special or limited selection of food and drink designed to promote health for a gain and loss of weight.

Athlete: An individual who engages in sports or other physical activities, often professionally, to compete and demonstrate physical prowess.

Training: The acquisition of knowledge, skill and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies.

Physical Activities: A voluntary bodily movement produced by skeletal muscles that require energy expenditure. It encompasses all activities, at any intensity, performed during any time of the day or night.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter attempts to present reviews of existing relevant literature on the impact of nutrition on muscle recovery and performance of an athlete. It was discussed under the following sub headings.

- Conceptual framework
- Sports nutrition- Definition
- Impact of nutrition on muscle recovery of athletes
- Nutritional plan for individual athletes
- Nutritional status on athletic performance
- Differences in the nutritional needs of male and female athlete
- Impact of timing on pre-training and post-training meals for muscle recovery in athletes
- Benefits of hydration (use of sports water, energy drinks) on the performance of an athlete before, during and after training activities and competition
- Summary of review of related literature

Conceptual framework

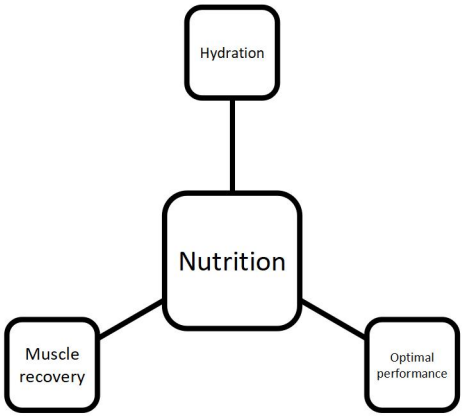

Figure 1.1: Conceptual Model of the Study

The concept of the study is based on the model above, the model shows hydration in relation to nutrition, nutrition being the key to the muscle recovery and optimal performance of an athlete. It shows that not only nutrition aids optimal performance of an athlete but also nutrition. It also shows the relationship between hydration and nutrition and how they work hand in hand to achieve the same purpose "muscle recovery and optimal performance of an athlete". This model shows two goals which are muscle recovery and optimal performance of an athlete and also how nutrition play a major role in achieving these goals. The concept of this study is to show that not

only physical activities and fitness enhances the performances of an athlete but how coupled with nutrition and hydration yields optimal performance and also aids in muscle recovery of athletes.

Sports Nutrition

There are two key words in 'Sports Nutrition' which are 'Sports and 'Nutrition'. Before the definition of sports nutrition the meaning of Sports and Nutrition needs to be looked at.

What is Sports?

Sports is any form of competitive physical activity through which casual or organized participation aims to use, improve, and maintain the physical ability of an individual and also serve as a source of enjoyment to the participants and in some cases spectators. Sports is an athletic activity requiring skill or physical prowess and often competitive in nature with rules and regulations guiding it. Sports is followed by set of rules guiding it, it is competitive and also physically exhausting in nature.

What is Nutrition?

The word Nutrition comes from a Latin word "Nutire" meaning "to nourish". Nutrition is the process by which living organisms obtain and utilize the nutrients necessary for growth, maintenance and overall wellbeing. It involves intake of food, digestion, absorption of nutrients, and subsequent utilization by the body for various physiological functions. Nutrition is the sum total of process by which living things receive and utilize the necessary materials for survival, growth and maintenance of worn out tissues (Edris, 2004). Nutrition is the study of nutrients in food, how the body uses them, and the relationship between diet, health, and disease. Nutrients provide nourishment. Proteins, carbohydrates, fat, vitamins, minerals, fiber, and water are all

nutrients. If people do not have the right balance of nutrients in diet, risk of developing certain health conditions increases.

What is Sports Nutrition?

Sports Nutrition is a specialization within the field of nutrition that partners closely with the study of the human body and exercise science (Indoria et al, 2016). Sports nutrition is the study and application of how to use nutrition to support all the areas of athletic performance. It includes providing education on the proper foods, nutrients, hydration protocols and supplements to help succeed in sports. Sports nutrition is the study and implementation of a diet/plan that is designed to increase athletic performance (Emily, 2022). An important factor that distinguishes sports nutrition from general nutrition is that athlete may need different amounts of nutrients than non-athletes. Sports nutrition is the application of nutrition principles for the purpose of improving training, recovery and performance.

Nutrition in athletes is as important as fitness training programs as nutrition makes training easier and more efficient to carry out. Elite athletes have nutritional plans they follow, most grassroot and amateur athletes do not take nutrition as important as physical training. Numerous dietary approaches to improving sports performance are supported by evidence. Combining multiple strategies together will probably be more beneficial than using just one of them alone. Optimizing intakes of macronutrients, micronutrients, and fluids as well as timing and composition throughout the day are among the dietary strategies to improve performance. Individualized or personalized dietary advice is becoming more and more important, as evidenced by the fact that different dietary strategies should be followed depending on the sport, personal objectives, and practical considerations (such as food preferences) of each athlete.

“Athlete” includes individuals competing in a range of sport types, such as strength and power (eg, weight-lifting), team (eg, football), and endurance (eg, marathon running). The use of dietary supplements can enhance performance, provided these are used appropriately. This manuscript provides an overview of dietary strategies used by athletes, the efficacy of these strategies, availability of nutrition information to athletes, and risks associated with dietary supplement intake. The study and application of diet and nutrition in relation to enhancing an individual's athletic performance is known as sports nutrition. A significant component of many sports training regimens is nutrition, which is especially prevalent in endurance sports like swimming, cycling, running, and bodybuilding as well as strength sports like bodybuilding and weightlifting. Studies on sports nutrition concentrate on the kinds and amounts of food and liquids consumed by athletes. It also addresses the ingestion of organic materials like proteins, fats, and carbohydrates as well as nutrients like vitamins, minerals, and supplements.

Impact of Nutrition on muscle recovery of athletes

Strategies for fatigue recovery must target the primary causes of exhaustion in both the general population and athletes. Every physical exercise causes the body's metabolic rate to rise and its systems to operate more efficiently. Numerous studies have shown the value and efficacy of proteins, amino acids, immediate principles, and metabolic regulators (vitamins and minerals) in relation to muscle repair. The muscles experience weakness and exhaustion after a brief period of vigorous exertion. Both during particularly intensive activity sessions and in the case of subjects who do not exercise consistently, the process is aggravated. Muscle injury in these specific situations could take days to heal. For both the general public and athletes in particular, carrying out a healing process through nutritional intervention can be crucial. Athletes who recover more quickly and effectively will be able to exercise harder and adapt better to training,

which is why getting enough nourishment is crucial. Several facets have been covered in this special issue on "Muscle recovery and nutrition" in accordance with the goals established. A systematic evaluation conducted by Drobnic et al (2022) examined the potential impact of Coenzyme Q10 supplementation on athletes' recuperation. The utilization of Coenzyme Q10 appears to provide a decent profile in the regulation of an oxidative pattern with a certain anti-inflammatory activity at the cellular level in response to exercise, according to the manuscript's conclusion. Therefore, rather than being an ergogenic substance in and of itself, it might be viewed as a protecting and recuperative substance. In a 12-week observational research, Drobnic et al (2022) examined the impact of krill oil on plasma choline and HS-Omega-3 index levels on exercise performance and recovery. The recovery of HS-Omega-3 index levels, post-exercise plasma choline recovery, and free radical scavenging following high-power physical training were the main research topics. The authors noted that there was no discernible improvement in athlete performance from the combination administration of n-3 PUFAs, choline, and astaxanthin in the form of krill oil. But according to the authors, optimizing the HS-Omega-3 index prior to training and oxidative stress and choline levels following training could be crucial for maximizing athlete recovery and performance.

Paratthakonkun et al (2021) presented a study about the effects of crocodile blood (CB) supplementation on the inflammatory, biochemical and functional performance responses to muscle-damaging exercise and to evaluate the short-term safety of CB in healthy males. The Thailand food and drug administration (FDA) has approved that crocodile blood (CB) products shall not exceed the maximum allowance level of 1 g per day as a dietary supplementation for human consumption. The authors have concluded that an 18-day supplementation of 1 g day^{-1} of CB helps to maintain peak muscle force or DOMS compared to a placebo after eccentric exercise.

In addition, biochemical analysis provided evidence that 1 g day^{-1} of CB supplementation should be safe for human consumption.

The effects of combining whey protein and casein in an 80:20 ratio (also referred to as "whey protein: casein" or "casein:whey protein") were examined in a different study in order to determine the proportions of fast-absorbing and slow-absorbing proteins in human breast milk (HBM), which is the gold standard for protein quality and nutrient contents (Liao et al, 2017). These effects may alter the concentrations of branched-chain amino acids in plasma, alter the bioavailability of these amino acids during peak period of permanence in the blood circulation, alter the final metabolites of protein metabolism, and result in delayed onset muscle soreness (DOMS) following a single fasting or resistance exercise session. The authors came to the conclusion that, although there were no beneficial effects seen in the protein metabolism markers, the amino acid kinetics showed that whey protein (WP) appeared to be the most efficient supplement to raise the leucine concentration in plasma. WP and casein (CAS) did not differ in association with the amino acid peak period of permanence from WP alone, but WP did reduce muscle soreness when compared to CAS and placebo.
Along with other amino acids, glutamine promotes anabolism in muscles, which increases protein synthesis. Supplementing with glutamine may help reduce the inflammatory response following eccentric exercise, according to (Street et al, 2011). Supplementing with glutamine has been shown to lessen muscle soreness, indicating a possible correlation with less muscle damage (Legault et al, 2015).

Mieszkowski et al (2021).studied the anti-inflammatory effects of vitamin D during exercise training. Previously, Choi et al (2013) communicated that inflammation induced by high-intensity exercise is significantly reduced upon vitamin D supplementation in an animal model.

The authors studied a group of 35 semi-professional ultramarathon runners (males) that participated in the Lower Silesian Mountain Runs Festival 2018 Ultra Marathon Race. In the study, Mieszkowski et al. showed that the administration of a single high dose of vitamin D significantly blunts the rise of proinflammatory cytokine levels after an ultramarathon, even though serum levels of 25(OH)D are significantly elevated after the run. These observations imply that the ultramarathon-induced increase in 25(OH)D levels is not sufficiently high so as to reduce inflammation. Hence, improving the vitamin D status before an endurance competition might be a good alternative to the use of anti-inflammatory drugs that are so often relied on in sports. In a meta-analysis about the effects of Vitamin D in post-exercise muscle recovery, it has been observed that although vitamin D seems to be effective against the muscular inflammatory process, the role in post-exercise recovery by modulating the release of muscle biomarkers remains to be demonstrated. It suggest that following investigations include cytokine determinations, and the use of a longer administration time or higher doses of supplementation would be variables to take into account. From a practical point of view, vitamin D supplementation serves to normalize and optimize its own blood levels. However, additional studies with comparable protocols are necessary to reach more solid evidences regarding post-exercise muscle recovery.

As it has been communicated by several authors, athletes have a high risk of vitamin D deficiency. Despite the evident benefit of vitamin D in muscle function, particularly in recovery from inflammation caused by exercise, there are still few experimental studies that demonstrate an improvement in performance after vitamin D supplementation. The musculoskeletal benefits occur when deficient or insufficient circulating levels of vitamin D (20–30 ng/mL) are corrected by providing supplements. However, no improvements in muscle function and performance are

observed when subjects with already normal circulating levels of vitamin D (50 ng/mL) are supplemented. However, there is still controversy regarding the optimal levels for supplementation. Daily vitamin D requirements have been estimated between 3000 and 5000 IU (75–125 g/day) to meet essential needs for all tissues and cells in the body (Ogan et al, 2013). However, the intakes recommended by experts might not only cover daily metabolic requirements but might also favour the storage of vitamin D and increase its availability.A supplementation with vitamin D requires, first, monitoring the long-term circulating levels of vitamin D. In addition, the daily doses recommended by the European Endocrine Society maintained in the long term could mimic the effects reached by a megadose supplementation in the short term (Holick et al, 2011).

Nutritional plan for individual athlete

What an athlete eats yields energy to practice and participate in competition, but the nutrients in food also help recover from training, repair and build muscles. A well-balanced athlete diet should include a variety of nutrient-dense foods that supply the body with the energy and nutrition it requires. Here are some key components of a good athlete meal plan:

Carbohydrate:

Carbohydrates are an athlete's primary energy source and should account for the majority of calorie intake. Choose complex carbs like whole grains, fruits, vegetables, and legumes, which provide long-term energy and are high in fiber, vitamins, and minerals. It is advised that athletes get 45-65% of daily calorie intake from carbs.

Protein:

Protein is essential for muscle building and repair, and it should make up a considerable component of an athlete diet. High-quality protein sources include lean meats, poultry, fish, eggs, dairy, and plant-based proteins such as beans, nuts, and tofu. The American College of Sports Medicine suggests that athletes ingest between 1.2 and 1.7 grams of protein per kilogram of the body weight daily.

Fats:

Fats provide essential energy and are required for the absorption of certain vitamins and minerals. Choose healthy fats like nuts, seeds, avocados, and olive oil, and limit consumption of bad fats like trans fats and saturated fats. Athletes should get 20-35% of daily calories from fats.

Hydration:

Proper hydration is essential for athletes because it regulates body temperature, transports nutrients, and eliminates toxins. Aim for at least eight 8-ounce glasses of water each day, and up fluid intake when training or competing in hot or humid weather. The American College of Sports Medicine suggests that athletes consume 17-20 ounces of liquids two hours before exercise and 7-10 ounces every 10-20 minutes throughout exercise.

Studies have shown that a diet that includes a variety of nutrient-dense foods such as complex carbohydrates, high-quality protein sources, healthy fats, and an abundance of fruits and vegetables can meet the energy needs of Olympic athletes (Luhovyy et al., 2007). Additionally, Olympic athletes must also be mindful of hydration levels and aim to consume adequate amounts of water to maintain optimal hydration (Shirreffs et al., 1996).

For athletes who participate in weight-dependent sports, paying close attention to body composition is crucial. These athletes may need to modify diets to ensure a healthy weight is reached (Burke et al., 2011). Within an hour of completing a workout or competition, consume a balanced meal or snack. This is the window in which the body is most receptive to replenishing glycogen stores and repairing muscle tissue (Ivy et al., 2002). Consume a balanced meal or snack every 3-4 hours throughout the day to maintain consistent energy levels and support muscle growth and repair (Luhovyy et al., 2007). Before training or competition, have a small, high-carbohydrate snack to top off glycogen stores and provide energy (Burke et al., 2011). After training or competition, have a small, high-carbohydrate snack to replenish glycogen stores and support muscle recovery (Ivy et al., 2002).

Athletes' nutritional needs vary according to the demands of their sport. Although the fundamental concepts of a healthy athlete diet remain constant (i.e., providing the body with enough energy and critical nutrients), athletes' diets might vary depending on their sport.

Consider the examples below:

- Endurance athletes, such as runners or cyclists, may require a greater carbohydrate intake to power the long-term training and competition. They should also be aware of hydration levels.
- Strength Sports: Weightlifters and bodybuilders may have increased protein needs to facilitate muscle growth and repair. Maintaining adequate caloric intake to support muscle growth and energy levels is also crucial.

- Power Sports: Football and basketball players may require higher energy and carbohydrate levels to power intense movements and training. Additionally, athlete should prioritize protein intake for muscle repair and recovery.
- Weight-Dependent Sports: In weight-dependent sports such as wrestling and boxing, athletes need to be cautious about weight and body composition. Athlete may have to adjust caloric intake and macronutrient ratios to achieve a healthy weight.

It's important to note that these are general guidelines, and each athlete's specific demands will vary depending on factors such as training and competition schedule, intensity level, and personal goals. It is always suggested that an athlete see a sports nutritionist or other certified specialist to create a food plan that is tailored to the athlete's unique needs.

There are many popular athlete meal plans and strategies that have been supported by professional athletes.

- The Zone Diet: Developed by Dr. Barry Sears, the Zone Diet emphasizes a balance of macronutrients (carbohydrates, proteins, and fats) in each meal. It is a high-protein, low-carbohydrate diet that aims to regulate blood sugar levels, which could promote weight loss and enhance athletic performance. Basketball player LeBron James and tennis player Serena Williams are among the athletes who endorse the Zone Diet.

- The Paleo Diet: Also known as the "caveman diet," the Paleo Diet encourages consuming whole, unprocessed foods like meats, vegetables, fruits, and nuts, while avoiding grains, legumes, dairy, and processed foods. Football player Arian Foster and mixed martial artist Georges St-Pierre are among the athletes who follow the Paleo Diet.

- The Vegan Diet: A plant-based diet excluding all animal products, the Vegan Diet is high in carbohydrates and fiber and low in saturated fat and cholesterol. Football player Tom Brady and ultra-marathon runner Scott Jurek attribute their athletic performance to the Vegan Diet.
- The Mediterranean Diet: Inspired by the traditional diets of people from Mediterranean countries, the Mediterranean Diet comprises of whole grains, fruits, vegetables, nuts, and healthy fats (e.g., olive oil) and includes moderate amounts of fish, poultry, and dairy. Basketball player Kobe Bryant and tennis player Novak Djokovic are among the athletes who follow the Mediterranean Diet.

It's important to note that while these diet plans and strategies may have been endorsed by professional athletes, it may not be suitable for everyone and it's always a good idea to consult with a healthcare professional before making any major changes to diet.

Nutritional status on athletic performance

Eating a healthy diet is thought to be one of the main pillars of community health because it meets both physical and mental needs and improves overall wellbeing. Regretfully, poor dietary habits and a lack of knowledge about nutrition have become important contributors to malnutrition, nutritional deficiencies, and a host of non-communicable diseases. In particular, professional athletes heavily depend on optimal nutrition to support the demanding training schedules, maximize performance, and facilitate quicker recovery. However, athletes may not be able to realize full potential and perform at the best if they do not understand the fundamentals of proper nutrition. Several studies have shown that particular age and gender groups exhibit insufficient knowledge about various aspects of nutrition, leading to suboptimal dietary

behaviors (Nassanga et el, 2018). Furthermore, the level of education has been recognized as a significant determinant of improved nutritional status, with nutrition education positively correlating with better dietary choices. Nutrition education has proven to be an effective means of preventing malnutrition and promoting better food resource utilization. It is critical to comprehend how diet affects athletic performance because it directly affects how much energy is produced in response to the demands, duration, and intensity of exercise. Poor food decisions put athletes at risk of lowering potential for performance. On the other hand, it has been demonstrated that implementing a healthy diet and nutrition interventions improves sports performance.

Athletes' overall performance, fitness level, and overall health are greatly influenced by diet in professional sports, where there is little room for error. Athletes can perform at best, heal from injuries more quickly, and realize full potential when they eat healthily. Regrettably, a lot of athletes just like the general public may eat enough calories but not enough vitamins and minerals, which can result in subpar performance. Energy expenditure and nutrient utilization are elevated in athletes due to increased physical activity demands (Westerterp, 2013). To fuel training sessions and support the body's physiological functions, like muscle growth and repair, athletes need to consume more energy. Furthermore, certain nutrients such as protein, carbs, fats, vitamins, and minerals are essential for improving athletic performance, maximizing recovery, and preserving general health (Thomas et al, 2016). In order to guarantee that they fulfill the demands of sport while preserving health, it is crucial to comprehend the specific nutritional requirements. The interaction of dietary practices, attitudes, and nutritional knowledge affects an athlete's performance and well-being directly. Athletes can make educated dietary decisions and guarantee they get the energy and nutrients they need by having proper nutritional knowledge. A

positive outlook on nutrition encourages athletes to regularly establish and uphold a healthy diet. However, unhealthy eating habits brought on by ignorance or misconceptions can result in nutrient shortages, weakened immune systems, exhaustion, and decrease athletic performance.

Sports nutrition strategies that enhance mental and physical performance and promote good health are recommended for athletes of all skill levels, but especially for elite athletes (Maughan & Shirreffs, 2011). Achieving optimal body mass (BM) and composition, eating a well-chosen diet with enough energy to meet the macronutrient and micronutrient requirements of training and competition, and implementing particular nutritional strategies before, during, and after training to optimize performance are some of these strategies (Maughan & Shirreffs, 2011; Thomas et al., 2016). Choosing foods high in nutrients can also lower the chance of nutrient deficiencies, which can harm the health and performance, especially when there is restriction of energy intake to lose weight or reduce body mass. Sports dietitians can help athletes with specific energy, nutrient, and fluid requirements as well as with strategies related to particular sport, but they are also frequently asked for advice on supplementation. However, unless dietary changes are not feasible, the use of dietary supplements should not be used as a temporary fix for bad eating habits and a deficient diet (Maughan & Shirreffs, 2011). Instead, the advantages of evidence-based supplement use whether for enhancing performance, delaying fat physial appearance, or enhancing health are supported by a thoughtfully selected diet. It is improbable that an athlete with low iron status or one who does not synchronize protein consumption with training will fully benefit from supplements designed to enhance endurance or stimulate muscle growth, respectively.

A nutrition assessment is the first step in advising athletes on dietary strategies or supplement use. Nutrition assessment is the “systematic method for obtaining, verifying and interpreting data

needed to identify nutrition-related problems, causes and significance" (Academy of Nutrition and Dietetics, 2015). A complete assessment should ideally include dietary evaluation, anthropometry and body composition analysis, biochemical testing, nutrition-focused clinical examination, and patient history (Academy of Nutrition and Dietetics, 2015; Driskell & Wolinsky, 2010). Nutrition assessments in relation to the use of dietary supplements in the context of sports should guarantee that the athlete: (a) is following a carefully selected sports nutrition plan that provides enough energy, macronutrients, and micronutrients; (b) is not at risk for health problems, such as interactions with prescription or over-the-counter medications; and (c) would benefit from dietary supplements and is aware of the proper supplementation protocol (Deal & VanReken, 2017). Failing to do so could result in excessive vitamin and mineral intakes, food-drug interactions, and a compromise to the effectiveness of the supplementation protocol.

Dietary Assessments

Dietary assessments are frequently used to assess an athlete's food intake, either over a given time period or in a typical day. Quantification of total energy, intake of macronutrients or micronutrients, and/or estimation of diet quality (e.g., appropriate intake of specific foods, timing of intake around training/competition) are some examples of the possible outcomes. Dietary assessment techniques are typically categorized as prospective (measuring future intake) or retrospective (recalling what was consumed). Dietary recalls (usually the 24-hour recall), food frequency questionnaires (FFQ), and diet histories are examples of retrospective methods. Prospective methods include both direct observation (e.g., at a training table) and food records.

According to Burke (2015), the 24-hour recall is the least popular assessment technique in sports nutrition; however, it can be helpful in assessing when to eat or take supplements in relation to

exercise, gastrointestinal distress, or food allergies. When evaluating the status of nutrients with few rich dietary sources, like antioxidants (Braakhuis et al., 2011), vitamin D (Halliday et al., 2011), calcium, and iodine, FFQs are especially useful. However, some important information is removed by the FFQ methodology, such as the order in which foods and beverages are consumed and the combinations of foods and beverages that are consumed at the same meal or snack (Burke, 2015).

Retrospective Methods

According to Burke (2015), the 24-hour recall is the least popular assessment technique in sports nutrition; however, it can be helpful in assessing when to eat or take supplements in relation to exercise, gastrointestinal distress, or food allergies. When evaluating the status of nutrients with few rich dietary sources, like antioxidants (Braakhuis et al., 2011), vitamin D (Halliday et al., 2011), calcium, and iodine, FFQs are especially useful. However, some important information is removed by the FFQ methodology, such as the order in which foods and beverages are consumed and the combinations of foods and beverages that are consumed at the same meal or snack (Burke, 2015). Although the diet history is one of the preferred methods for obtaining estimates of usual nutrient intake, the information/data collected is not easily quantifiable and may be more appropriate for qualitative assessment (Thompson & Subar, 2008). Though all three recall methodologies are challenged by the athlete's ability to accurately describe typical portion sizes of foods/beverages consumed, tools such as food models, pictures of food, geometric shapes, and standard household measures and/or dishes can assist the athlete to better describe quantities consumed (Burke, 2015).

Prospective Methods

Though it seems simple in theory, keeping track of meals is a labor-intensive task that demands discipline, literacy, and compliance from the athlete. Methodological concerns such as the number of days of recording and whether food portions are estimated or weighed have an unknown impact on the validity and reliability of data. The likelihood of recording fatigue (i.e., the athlete grows weary of the task and becomes either less compliant or changes intake to simplify the process) increases with the number of days, although the probability of obtaining a "true" picture of usual intake is likely to increase (Trabulsi & Schoeller, 2001). Most people are unaware that the number of recording days required to accurately reflect an individual's mean intake of energy and different nutrients is highly variable and frequently longer than the 3-day to 14-day records that are typically kept. This is because daily variability in food intake occurs.

An athlete who engages in continuous physical exercise finds it difficult to balance energy expenditure, food intake, and the extra demands of intense physical activity. Therefore, since nutrition has an impact on an athlete's health, body composition, and recuperation, a precise evaluation of nutritional status is necessary to maximize performance. It is necessary to take into account particular factors such as the sport, playing position or specialization, category, training and competition calendar, and goals that are different from those of the general public. The nutritional status, lipid profile, liver or kidney function, whether the diet is excessively high in proteins or fats, potential nutritional deficiencies, and whether supplements are necessary can all be inferred from a biochemical assessment. Sport kinanthropometry has significant utility in that it allows for the measurement of skinfolds, height, length, diameter, perimeter, and body mass. Information is processed using various equations to determine somatotype, body composition, and the proportions of various body parts. The athlete's energy requirements must be understood in order to provide appropriate nutritional counseling. There are tables with the theoretically

established energy requirements of various sports in case objective measurement is not possible. To determine how diet, health, and athlete performance are related, dietary assessments should include data on food consumption and nutrient intake. enables the measurement of skinfolds, height, length, diameter, perimeter, and body mass, which makes it extremely useful. To calculate somatotype, body composition, and the relative proportions of different body parts, information is processed through a variety of equations. It is necessary to comprehend the energy needs of the athlete in order to offer suitable nutritional guidance. In the event that objective measurement is not feasible, tables containing the theoretically established energy requirements of different sports are available. Dietary assessments should incorporate information on food consumption and nutrient intake in order to ascertain the relationship between diet, health, and athlete performance.

Differences in the nutritional needs of male and female athletes

In endurance sports, understanding and accommodating the differences between male and female athletes is essential to success and longevity. Specialized Bicycles' Erin Sprague, the Women's Product Manager, encapsulates the significance of recognizing the distinctions between men and women. A woman wouldn't consider going into a department store and purchasing clothing in the men's section. When it is contrasted with what male and female athletes require, the same conclusions apply. The same rules apply to clothing, nutrition, and determining the physiological distinctions between men and women. There isn't a "one size fits all" category for us. Ultimately, Wonder Woman possesses her magic lasso, just as Superman has his cape. When called upon, they both have incredible gifts and an attractive physique. Unique abilities and strengths make a difference. It's during those magical puberty years that male and female differences really start to show. Our bodies are essentially the same up until that point, with some women progressing

even more quickly than men. However, men's higher testosterone levels following puberty cause them to naturally have larger muscle mass (larger muscle fibers) and a lower body fat percentage. Additionally, men's VO2 max is higher genetically. An investigation by the University of New South Wales ties the hormone estrogen to the storage of fat during pregnancy. Women typically have between 6 and 11 percent more body fat than men do. According to studies, estrogen causes women to burn less fat after meals, which increases the amount of fat that is stored throughout the body. The review indicates that the most likely explanation is to prepare women for parenthood. The range of acceptable body fat percentages for each gender illustrates this. For example, a woman's extremely low body fat percentage of 17% would translate to a male equivalent of roughly 9% It hardly seems equitable. As a result, even women who are active require fewer calories overall, and depending on our unique health, the type of calories we consume may vary in some situations.

The male and female anatomy clearly differs, but physiologies are largely the same. However, methods of nutrient metabolism differ. Men tend to carry less fat overall, with the majority of it being stored in the adipose tissue of the abdomen. Androgen receptors in muscle indirectly mediate the effects on adipose tissue. Women, on the other hand, carry more total body fat in the hip region's subcutaneous layer. Women metabolize glucose through the regulation of enzyme expression, both directly and indirectly (Lizcano et al, 2014). As it turns out, men’s and women’s bodies respond differently to exercise and nutrition and thus have different fueling needs.

Physiological sex difference

Comprehending the physiological distinctions between men and women can aid in optimizing dietary approaches selected to support specific objectives, such as increasing exercise efficiency,

acquiring lean body mass, or decreasing body weight. Substance utilization, thermoregulation, fatigability, soreness and recovery, and body composition are among the important areas where sex differs. Males and females exhibit similar substrate metabolism prior to puberty. As adults, estrogen plays a significant regulatory role in fat metabolism. Women normally experience regular menstrual cycles, predictable fluctuations in ovarian hormones, and are deemed eumenorrheic until they begin the menopause transition (average age of onset is 51 years), provided they consume an adequate amount of calories after completing the transition through puberty. There are two primary phases to a regular menstrual cycle, which lasts an average of 28 days (varying from 21 to 45 days) and is represented by the follicular and luteal phases. Menstruation begins at approximately 14 days into the follicular phase, during which time progesterone, luteinizing hormone (LH), FSH, and estrogen, specifically 17β-oestradiol (estradiol), reach lowest baseline levels. The mid-follicular phase of the menstrual cycle starts around day 4-5, during which time estrogen and FSH levels rise in preparation for ovulation. Day 11–13 marks the end of the follicular phase, during which time estrogen rises and then falls and LH spikes, causing ovulation. After ovulation, the body enters the luteal phase, which lasts for 14 days. During this time, progesterone and estrogen levels peak around day 20–24 (mid-luteal phase), preparing the body for pregnancy, while LH and FSH decline and return to baseline levels. In the event that pregnancy is not achieved, hormone levels return to normal and cause menstruation, which marks the start of a fresh menstrual cycle.

Women who exercise and compete in all phases of cycles should take into account the effects of the menstrual cycle on metabolism and performance, as they may be able to tailor nutritional strategies accordingly. Given the overwhelming body of evidence indicating estrogen is a master regulator of bioenergetics and body composition, fluctuations in estradiol during the menstrual

cycle may have significant effects on nutrition and exercise capacity. Women have higher resting energy expenditure (REE) during the luteal phase of the menstrual cycle, when ovarian hormones peak, and they also exhibit heightened fat oxidation, as indicated by decreased respiratory exchange ratio (RER) and 2.5–11.5% higher REE. But regular exercise training may also control substrate utilization and enhance men's fat oxidation efficiency. While studies using indirect calorimetry have shown a significant increase in fat oxidation in women at rest, protein catabolism cannot be measured using this methodology. Studies have discovered that protein oxidation is higher at rest in women during the luteal phase by monitoring circulating amino acids in the blood and urine. When considered collectively, these results suggest that the luteal phase is associated with increased metabolism of fat and protein, higher caloric expenditure, and potentially increased appetite.

The menstrual cycle is divided into the following stages; The follicular phase, which lasts from the first day of a woman's menstrual period until ovulation and lasts an average of 16 days, the ovulatory phase, which lasts only 24 hours, and the luteal phase, which lasts from ovulation until menstruation and lasts 12 to 14 days, are the three phases of the menstrual cycle. Hormone levels determine how these phases vary. Recommendations and Nutritional Considerations for Female Athletes: Health and Performance, a review article published in 2021, discusses the anabolic effects of estrogen, including increased bone mineral density and muscle strength. In a typical menstrual cycle, peak estrogen levels are reached between days 12 and 14. Women who exercise more than 1.5 hours a day should concentrate on eating a high-protein diet, aiming for at least 1.6 grams of protein per kilogram of body weight per day, during the follicular phase, when estrogen is rising. Omega Zumpano, an exercise physiologist and menstrual cycle educator, added that, "women may feel better, be better able as progesterone increases, such as in the early luteal

phase, it has a subduing effect on the brain and body," Zumpano says. "In contrast to the high to tolerate higher intensity and aerobic exercises, and exhibit greater strength and power outcomes when estrogen is high." As progesterone increases, estrogen will start to decline leading into the first half of the luteal phase, and energy levels may start to wane as well. "strength and power training from the follicular phase, this is a great time to do longer duration, low-intensity training." In order to explain the increased rates of protein catabolism during this period, there may also be a greater need for protein. However, trying to optimize nutrient composition based on menstrual cycle phase is pointless if women aren't getting enough energy from diet. Because estrogen has a protein-sparing effect, we know that during exercise, women have higher rates of fat oxidation and lower rates of carbohydrate and protein metabolism compared to men. In order to play sports at the best and prevent the symptoms of relative energy deficiency, it is critical that women eat enough. For best health and performance, female athletes should aim for roughly 45 calories per kg of fat-free body mass (i.e., body mass after fat is subtracted).

Energy Requirement

Boys and girls have comparable minimal nutritional and energy needs (caloric needs) prior to puberty. Adolescents' energy needs vary more depending on age, activity level, growth rate, and physical maturity stage. These suggested energy allowances are the bare minimum required to support healthy bodily functions and growth. Increased calorie intake is required for growth spurts and to restore energy used during physical activity. For instance, a 60 kg boy playing ice hockey for 60 minutes would burn an average of 936 calories, while a 30 kg girl playing soccer would burn an average of 270 calories (Windsor, 2004).

Recommended energy requirements, Kcal/day

Age, years	Male	Female
4–6	1800	1800
7–10	2000	2000
11–14	2500	2200
15–18	3000	2200

Male Nutritional Requirement

Because of larger bodies and greater muscle mass, men typically require more calories and protein than women. Men's higher muscle mass necessitates higher protein intake for muscle growth and repair. Protein is necessary for the maintenance and growth of muscle tissue, so athletes must eat enough of it to support training and recuperation. Men may require higher levels of specific micronutrients in addition to protein in order to support the production of testosterone and healthy muscle mass. Because zinc is needed for the synthesis of testosterone, low zinc levels may result in lower testosterone levels. Another mineral necessary for the proper operation of muscles and the synthesis of testosterone is magnesium. Men should make sure they are getting enough of these micronutrients from food, and if needed, they should think about taking supplements.

Female Nutritional Requirement

Women's menstrual cycles and increased risk of osteoporosis mean that they have higher requirements for certain micronutrients, like calcium and iron. Women who have heavy menstrual bleeding may be at risk for iron deficiency anemia, as iron is required for the production of red blood cells. Osteoporosis, a disorder marked by weak and brittle bones, is more

common in women. Calcium is necessary for healthy bones. To meet energy demands while exercising, women might also require a higher intake of carbohydrates. Athletes must consume enough carbohydrates to support training and performance because they are the body's preferred fuel source. Because hormone levels fluctuate during different stages of the menstrual cycle, women who are menstruating may require more carbohydrates during those times.

Strategies for Meeting Gender-Specific Micronutrient Needs in Sports Nutrition

By eating a balanced diet that consists of a range of nutrient-dense foods, athletes can satisfy gender-specific nutritional needs. The vitamins and minerals that athletes require to support performance and recuperation can be obtained through a diet high in fruits, vegetables, whole grains, lean meats, and healthy fats. To make sure they are getting all the nutrients they need, athletes should try to eat a range of foods from various food groups. Athletes may find it helpful to take supplements or create a customized nutrition plan with a sports dietitian in addition to eating a balanced diet. If athletes have specific dietary restrictions, supplements can be a convenient way to make sure they are meeting nutrient needs. . It is crucial to remember that supplements should be taken in addition to a balanced diet, not in place of a healthy diet. Athletes can create a nutrition plan that is customized to goals and preferences by working with a sports dietitian to understand the unique nutrient needs. An athlete's current diet can be evaluated by a sports dietitian, who can also spot any nutrient deficiencies and offer advice on how to meet individual nutrient needs. In order to assist athletes in making knowledgeable dietary decisions, they can also offer information and assistance.

Impact of timing on pre-training and post-training meals for muscle recovery in athletes

Over the last nine years, numerous research streams have investigated issues directly linked to when nutrients should be consumed, which has helped to clarify information regarding evidence-based dietary recommendations. In order to positively influence the adaptive response to acute and chronic exercise, nutrient timing entails the deliberate consumption of all forms of nutrients at different times throughout the day (i.e., muscle strength and power, body composition, substrate utilization, and physical performance, etc). From a historical standpoint, the idea of nutrient timing was first developed in the 1970s and 80s with the first research analyzing how higher carbohydrate feedings affected both exercise performance and glycogen status. One of the first studies to show that the timing of carbohydrates can affect the rates of glycogen resynthesize following exercise was Ivy and colleagues. The effects of protein and amino acids, both with and without carbohydrates, as a nutrient timing strategy have been studied in an increasing amount of research over the last few years, although strategies involving carbohydrates were the first to be investigated. It's critical to comprehend energy systems, exercise physiology, and macronutrient metabolism in order to apply nutrient timing effectively. Science demands to know what happens to proteins, fats, and carbohydrates during rest, exercise, and recuperation. Although 24-hour recommendations for nutrient timing have been developed, the main focus is still on specific windows before, during, and after training because many athletes participate in multiple training sessions and competitions each day and often have limited windows of opportunity for feedings. Although there is research on fat manipulation, specific timing strategies have not yet demonstrated consistent and measurable benefits in terms of improving performance or recovery.

The main focus of pre-workout windows is on three time points: 4-6 hours before exercise, 30-60 minutes before exercise, and/or 15 minutes before injury. These windows mostly concentrate on the muscles' availability of glycogen or degree of carbohydrate saturation. It also takes into account how quickly certain nutrients are absorbed and digested, as well as how the substrate is used during exercise.

Post-workout feedings at specific times are intended to support muscle recovery by enhancing the recovery process. Depending on the sport they play, an athlete's muscle recovery objectives may include developing stronger muscles or preventing sore muscles.

Feedings are mostly concentrated on carbohydrates and proteins because muscles store carbohydrates and amino acids form the structure of skeletal tissues. Research comparing the effects of protein or carbohydrate feedings on muscle protein synthesis discovered that combined effects have the biggest effect on boosting muscle protein synthesis.

In the field of sports nutrition, it's well-established that training objectives are influenced by the foods and times the food is eaten. A healthy diet can:

- Boost output
- Reduce the number of injuries
- Amplify muscle power
- Accelerate response time boost power and stamina
- Boost healing

Everybody is different when it comes to the precise ratio of protein, carbs, and fat in meals. Body type (ectomorph, endomorph, mesomorph), exercise type (aerobic vs. strength), exercise

intensity, length of time spent exercising, and intervals between exercises needs to be considered. With so many variables to take into account, there isn't a universal solution.

Understanding Muscle Recovery

Restoring the body's homeostasis after exercise is a crucial function of muscle recovery. A living organism in a state of balance known as homeostasis is one in which all of its bodily systems are operating as they should in order for the organism to survive. When the body is in a state of homeostasis, it is always responding to changes both inside and outside the body. Increasing one's physical capacity and athletic performance is just as important as restoring homeostasis to the muscles after exercise. Exercise causes the body to lose fluids and fuels, alters the heart rate and temperature, and destroys skeletal muscle tissue (a process called catabolism). Initiating muscle building through protein anabolism, repairing tissue damage, and restoring bodily functions all depend on recovery from exercise. After exercise, nutrition is critical to the vital processes of repair and restoration.

The process of muscle regeneration, in which muscle cells multiply and divide and the myofibers enlarge, comes after muscle degeneration. Following differentiation, the myogenic cells combine with already-damaged muscle cells to facilitate repair, as well as with one another to generate new muscle fibers. The size of the newly formed myofibers increases after the myogenic cells fuse. Hypertrophy is the term used to describe this rise in muscle tissue volume brought on by cell enlargement. Since proteins make up the majority of the components of muscle fibers, protein catabolism causes muscle degradation while protein anabolism causes muscle regeneration. For this reason, protein is the first macronutrient that springs to mind when thinking about the building, repairing, and recuperation of muscles after exercise. The primary

substances that an organism requires for energy and structural maintenance are called macronutrients. Water, lipids (fats), carbohydrates, and protein are the four types of macronutrients. All macronutrients are necessary for post-workout nutrition because they aid in muscle recovery.

Amino acids are the building blocks of proteins. There are eleven non-essential amino acids that the body produces on its own and nine essential amino acids that are produced by the body and must be obtained through diet. The body uses protein for a variety of vital processes, such as energy production, cellular signaling, tissue formation, cell function, immune system and endocrine system functions, fluid and pH balance, and transport. Muscle tissue cannot be strengthened or maintained without protein. Because they are easily broken down and used by the body, carbohydrates are perhaps the most significant source of energy. Carbohydrates are necessary for intense exercise because they are the only macronutrient that can provide enough energy for anaerobic activities like sprinting. After a workout, consuming adequate carbohydrates helps stop protein catabolism, which is the breakdown of muscle tissue for energy. The main energy source for the nervous system is carbohydrates, which is important for exercise because poor nerve cell function will impair the effectiveness of workouts. Muscle cells primarily utilize fats as a rich source of energy. During periods of rest and low- to moderate-intensity exercise, the body uses fats as fuel. Fatty acid levels in the blood rise during muscle recovery as a way to prevent glucose from being used as fuel from carbohydrates and instead direct it toward the reconstruction of the muscle's glycogen stores. According to certain research, fat especially omega-3 fatty acids helps muscles heal by reducing inflammation and slowing down the onset of soreness.

Role of Protein in Muscle Recovery

For a variety of reasons, protein is a necessary nutrient for muscle repair. The building blocks of muscles, ligaments, tendons, and bones are proteins, to mention a few. These structures cannot be trained to maintain and strengthen if there is insufficient protein. Protein is essential for muscle recovery after exercise because it is actively synthesized by the body when it is in an anabolic state. This anabolic state is primarily influenced by the blood's amino acid composition, the timing of protein intake, and the amino acid composition of the food consumed. Eating proteins containing essential amino acids, as opposed to non-essential ones, has a more favorable impact on hyperaminoacidemia and, consequently, the synthesis of muscle protein. Whey and casein are high-quality proteins that provide essential amino acids and Branch Chain Amino Acids (BCAAs) if an individual can tolerate them. Whole foods and other essential nutrients for muscle synthesis and recovery are the best sources of protein, even though it's crucial to consume essential amino acids in any form after a workout.

The best protein sources to consume after a workout are those that supply at least 10 grams of essential amino acids. Eating 25 grams of high-quality protein, like 6 ounces of meat, usually provides this amount. Since this can vary depending on a person's body weight, the general recommendation is 0.30 grams of protein per kilogram of body weight. Tofu, eggs, meat, and milk products are excellent sources of protein that contain all of the essential amino acids. For those who are physically active, the recommended daily intake of protein is 1.3–2.0 grams per kilogram of body weight. According to recent studies, including carbohydrates and protein in a post-workout meal enhances the synthesis of glycogen, triggers the release of hormones required for muscle growth, and promotes protein synthesis.

Carbohydrate and Muscle Recovery

Even moderate-intensity exercise can partially or totally deplete the muscle and liver's glycogen stores, so replenishing them is crucial. If not enough carbohydrates are consumed after working out, performance in subsequent workouts will be negatively impacted. Any post-workout recovery plan must include a strategy for determining the optimal timing, kind, and amount of carbohydrates for each individual. Even moderate-intensity exercise can partially or totally deplete the muscle and liver's glycogen stores, so replenishing them is crucial. If not enough carbohydrates are consumed after working out, performance in subsequent workouts will be negatively impacted. Any post-workout recovery plan must include a strategy for determining the optimal timing, kind, and amount of carbohydrates for each individual.

Timing of Carbohydrate Intake

When carbohydrates are consumed within two hours of a workout, muscles have a better chance of restoring glycogen. The rate of glycogen synthesis can be halved even after a 4-hour delay. Generally speaking, it's best to consume carbohydrates as soon as possible after a workout.

Types of Carbohydrate used

Glycogen replenishment and recovery are best accomplished by consuming carbohydrate-rich foods that can be digested and absorbed easily and readily, whether in liquid or solid form. Some studies suggest that high glycemic index foods are better able to restore glycogen stores and at a faster rate than low glycemic index foods. Examples of carbohydrate-rich foods include fruits, vegetables, grains, beans, and liquid sports drinks.

Quantity of Carbohydrate

The amount of carbohydrates consumed is primarily determined by the duration, body weight, and intensity of the exercise. Walking, tai chi, and yoga are examples of low-intensity exercises that require a normal daily dietary intake of 3-5 grams of carbohydrates per kilogram of body weight. Moderate intensity requires 5-7 g/kg/BW/d. Examples of moderate intensity exercises include jogging, swimming, and cycling for an hour at a moderate effort level while maintaining conversational ability. 6–12 g/kg/BW/d are needed for high and very high intensity exercise, such as an hour or more of interval training, cycling, running, basketball, soccer, and so forth.

Pre-training meals for Muscle Recovery

Possibly the most crucial component of a fitness lifestyle is nutrition. For the body to perform at its peak, the proper ratios of vitamins, minerals, macronutrients, calories, and meal timing are required. A well-balanced diet powers the body to function at its best. Whether or not the body will have the energy to work out to the fullest extent each session depends on what an athlete eat before. It can have a significant impact on ability add weight or complete a few more repetitions during lifts.

Exercise nutrition is vastly underestimated. Many lifters recognize the value of eating a post-workout meal to get in the quickly digesting protein and carbohydrates, but the pre-workout meal is actually just as important or, for many athletes, nonexistent. The body is better fueled for optimal performance when meal is being taken before training. There is risk of losing out on a great chance to maintain the body in an anabolic (muscle-building) state if meal is not taken before working out. An athlete can optimize the amount of food that is used to gain lean mass and reduce the amount that is converted to body fat by paying close attention to diet before working out.

Eating the appropriate foods makes a big impact before working out. Giving the body what it needs to function at peak intensity and priming muscles for growth is the idea behind pre-workout nutrition. The body should have more glycogen and be able to fend off catabolism after a pre-workout meal. Amino acids individually make up protein. These serve as the foundation of muscle, inhibit catabolism, and ward off hunger pangs. Blood-sugar levels are impacted by the calories from carbohydrates, which can provide sustained energy if they are more complex or provide a rapid energy boost if they are simple and quickly digested. Fats offer slow-burning energy for extended workouts and assist in preserving ideal hormone levels (Wang & Hu, 2017). Slower-digesting carbohydrates and medium-to fast-digesting proteins make up pre-workout fuel. Some pre-training meals for muscle build up includes;

- Egg Whites and Whole Grain Bread: Whole grain bread is a convenient and fast-digesting carbohydrate, while egg whites digest more slowly.
- Low-fat milk with oatmeal: When protein is added to oatmeal, it makes a great pre-workout meal. Whey, a protein found in milk, is a great pre-workout supplement. Slow-digesting oats also help to feel full and focused during work out!
- Yams and chicken: Chicken and yams are a classic bodybuilder combination that make the ideal pre-workout meal. An athlete can reduce meal prep by eating them after workout.
- Brown rice and tuna: Any low-fat, light fish will work, but tuna is the most convenient option, and the brown rice gives flavor and energy for workouts.
- Ground Turkey and Black Beans: A little seasoning added to some ground turkey and a couple of corn tortillas makes this a high-energy, low-fat, on-the-go pre-workout snack.

Fat should be avoided before and after exercise because it slows down the body's absorption of nutrients because it causes a delay in "gastric emptying," the process by which food leaves the stomach. The only exception would be an athlete intended to work out for more than ninety minutes at a high intensity, in which case the body might use those extra calories as fuel.

Meal timing prior to exercise is a crucial component. The ideal window of time for most people to eat or snack before working out is one to two hours prior to training. This is dependent upon the metabolic rate, the size of the meal, and possibly the kind of exercise being performed. An athlete should not wait more than four to five hours before working out, as this will cause loss to the nutrients received prior to the workout. The fuel consume before training will only be available in the bloodstream for a few hours. But also, don't want to eat a large, mostly vegetable-packed meal just before a Tabata cycle sprint. Eating one or two hours prior to working out offers the ideal chance to strategically fuel the muscles during workout. The muscles will "pump up" or fill with blood during resistance training, making them highly sensitive to the nutrients being eaten. This explains the significance of pre-workout nutrition. What is being eaten can directly affect the training areas.

What Meals can an Athlete take during Training?

Not only is it inconvenient to eat in the middle of a workout, but it also wastes energy on the body as it should be using that energy to digest food. That being said, intense training does burn fuel. The body uses up a lot of carbohydrates during a vigorous training session, which are converted into glycogen. The muscles require that fuel to perform during exercise, and without it, performance declines. When an athlete lift weights, the body breaks down any

available protein because amino acids is needed. Increasing stores while exercising reduces catabolism by giving the body a consistent supply of amino acids and helps preserve glycogen. All of this can be handled with an appropriate pre-workout nutrition plan. On entering the gym, the bloodstream should already be filled with these vital macronutrients for growth, ready to fuel the muscles. This can be achieved by timing the pre-workout meal properly. If so, water will be the only requirement for the session.

It could make sense to have a drink during workout while anticipating spending more than an hour and a half training in order to sustain stable blood-sugar levels and boost energy. Long-term exercise can cause the body to go into a catabolic state, which will cause the muscle tissue being built to break down. Because protein shakes give the body exactly what it needs, they help prevent this breakdown of protein while work out. Drinking a shake during an extended training session can have anti-catabolic effects. During exercise, blood rushes into the muscles and they become more receptive to nutrients.

Post-Training Meals for Muscle recovery

One of the most crucial aspects of recuperating and gaining muscle is replenishing body's fuel after exercise. Performance the following time will suffer, gains won't be as strong, andrisk in losing muscle mass if the correct meal is not taken after training or not eaten at the right time. Also more pain is being invited, which is not enjoyable. To trigger an insulin response, eating something after working out is crucial. Since insulin is a highly anabolic hormone, increasing it helps promote protein synthesis and prevents protein breakdown. An athlete will lose out on these anabolic effects if meal are skipped. It will only promote additional protein degradation, which eventually results in mass loss. In other words, eating

after a workout promotes muscle growth and slows down protein breakdown for improved recovery. Glycogen stores are used up after a rigorous workout. Protein synthesis rises and protein breakdown is stopped when they are replenished. The goal here is to trigger an insulin response that will help build muscle, prevent soreness, and recover faster if complex carbohydrates prior to a workout are to be consumed. High-glycemic, moderate-to-high-digestibility carbohydrates and fast-digesting proteins are the best options for right after the gym. As with the pre-workout meal, fats should be mostly avoided here. This is the one instance where an athlete don't want to slow down the intake of nutrients into the body because they slow down the digestive process.

post-workout meal is to be eaten no later than one or two hours following workout. If a shake is taken during workout, wait 30 to 45 minutes after final sip of the intra-workout shake before having another one. Rather than just another protein shake, post-workout meal should consist of vegetables and other whole foods. Real foods are the body's source of vitamins and fiber. Once more, keep in mind that the amount of protein, fat, and carbohydrates in a diet will impact how quickly and efficiently the body repairs and regenerates tissue. A small amount of fat can be incorporated in this meal because the shake has already given the body the nutrients it needs to function quickly.

Some post-meals to help athlete in Muscle Recovery includes;

- Baked red potatoes and pork loin: "The other white meat" provides the body with a burst of protein, while the starchy potatoes provides a quick-digesting carbohydrates.

- Chicken Breast and Pasta: To enhance the taste of this straightforward dish, toss the chicken breast with pasta and add some tomato sauce or herbs. Adding a small amount of olive oil is also a good idea.
- Carrots, green beans, and salmon: Salmon is a natural source of heart-healthy omega-3 fatty acids, which help prevent soreness after exercise. For the best results, choose low-calorie, high-vitamin vegetables like carrots and green beans.
- Smoothie with Greek Yogurt and Fruit: If work out is done early in the morning, this is a great breakfast option. The yogurt's whey and casein combination supports protein synthesis, while the fruit's sugar raises insulin levels.
- Lean Beef Patty, Whole-Wheat Bun, and Sliced Avocado: The avocado's natural healthy fats add delicious flavor, while the whole-wheat bun provides a nutritious source of carbohydrates. Lean beef is an iron-rich protein source.

It's also important to give the body time to rest and recover. Make sure to get plenty of sleep and take time to rest between workouts. Additionally, adding foam rolling and stretching into routine can help to reduce muscle soreness and improve recovery time.

Benefits of hydration (sport water, energy drink) on the performance of an athlete before, during and after training activities and competitions

Water is an essential constituent of the human body, making up approximately 60% of its whole composition. The deficiency of water in the body is called dehydration. Dehydration will result in a dip in physical and mental performance for any athlete. Because of this, hydration effects on sports performance isn’t to be overlooked. All cells, organs, and tissues are primarily comprised of water, making it vital to correctly function all physiological processes in the body. Water

transports nutrients and oxygen into cells and regulates body temperature (thermoregulation), acts as a lubricant and shock absorber to protect joints, the brain, and fetus during pregnancy, support digestion & removal of waste products, and is also required to break down food so it can be used as energy. Water should be prioritized at all times during the day. Athletes who train for more than an hour a day and during the summer months when it is hot should consider including electrolytes in drinks to replace sodium and other vital minerals lost in sweat to maintain hydration. During long training sessions and competitions, athletes may also need to factor in carbohydrate demands to maintain sustained energy levels throughout, which can be done by consuming a carbohydrate-electrolyte drink. Hydration for athletes is essential to maintain normal blood circulation because this aids the delivery of nutrients and oxygen to every working muscle in the body. To stay hydrated, it is good to practice carrying a bottle of water around, especially during training.

The hydration plays an important role in performance, injury prevention, and recovery for athletes engaged in competitive sports. Therefore, it is important that strength and conditioning coaches understand an athlete's hydration needs to prevent illness and enhance performance. Collegiate athletes in the United States of America generally recognize the importance of proper hydration during physical activity (Nichols et al., 2005; Volpe et al., 2009). However, some individuals lack the knowledge and resources needed to adequately rehydrate and refuel during physical activity, which could then lead to detriments in performance. In fact, 66% of National Collegiate Athletic Association (NCAA). Track and field athletes may have particular risks associated with dehydration and possible negative effects on performance due to the highly variable nature of fluid needs resulting from a variety of event types, training regimens, and individual athlete differences (Casa et al., 2019). Due to variations in variables like body size,

exercise intensity, duration, environment, and clothing selection, sweat rates among track and field athletes can range from 0.5 to 3.0 L/hr (Baker et al., 2016). While the effects of dehydration on endurance exercise performance have been thoroughly investigated, less research has been done on how dehydration affects athletes who must repeatedly engage in short-duration, high-intensity workouts (Maughan and Shirreffs, 2010). Dehydration may affect muscle strength and power, according to a review of the effects on these parameters as well as high-intensity anaerobic capacity. According to Cheuvront and Kenefick (2014), body water volume loss mediated by dehydration decreased endurance exercise performance by ≥ 2%. Judelson et al. (2007) report that hypohydration consistently reduces strength (by about 2%), power (by about 3%), and high-intensity endurance (by about 10%). According to a meta-analysis by Savoie et al. (2015), hypohydration caused muscle strength to fall by 5.5 ± 1.0% ($p < 0.05$) and anaerobic power fell (-5.8 ± 2.3%). This suggests alterations in total body water can affect some aspects of force generation. According to research examining differences between euhydrated and dehydrated conditions, there is a direct connection between body water deficits (2.9% of body mass) and an athlete's ability to generate upper and lower body anaerobic power (Jones et al., 2008). Therefore, it is important for track and field athletes competing in events such as jumping, throwing, sprints, and multi-events to begin training and competition in a state of optimal hydration and consume sufficient fluid during exercise to optimize performance and health (Casa et al., 2019).

Despite awareness of the status of dehydration and the negative effect it may have on performance, athletes often fail to practice appropriate hydration strategies. For example, previous research has shown that athletes generally lack knowledge of the appropriate markers for self-regulating adequate hydration levels (O'Neal et al., 2011; Yeargin et al., 2010). This may

include a lack of clarity about appropriate targets for fluid intake, beverage types, and important information to monitor. Athletes are often unaware of the best methodologies for determining hydration status such as urine specific gravity, urine color, changes in body mass, plasma osmolality and bioimpedance. The National Athletic Trainers' Association (NATA) recommends the following practices regarding fluid replacement for athletic participation: athletes should begin a training session well hydrated by drinking approximately 500 to 600 ml of water or sports drink 2 to 3 hours before exercise and additional 200 to 300 ml of water or a sports drink 10 to 20 min before exercise. During the training session fluid replacement should approximate sweat and urine losses and maintain hydration at a level that keeps body weight loss to 2%. This can generally be achieved by the consumption of 200 to 300 ml of fluid every 10 to 20 min. Post-activity hydration should aim to correct any fluid loss accumulated during the practice or competition. Water quality and alkalinity are also factors to consider for fluid replacement as alkaline mineral water has been shown to potentially offer advantages in hydration post-exercise (Chycki et al., 2017). Additionally, research has shown that mineral content for tap and bottled water varies by region (Azoulay et al., 2001), therefore it may be important for coaches and athletes to be aware of the quality and composition of locally available water sources.

How to hydrate

Fortunately, there are methods for making sure an individual is properly hydrated before, during, and after activity. Each of the three times is equally significant. Water needed by the body can be quickly determined each day by converting half of the body weight in pounds to ounces. For instance, one would require 80 ounces of water if the individual weighed 160 pounds. Since a typical bottle of water holds about 16 ounces, an individual would require at least 5 bottles each

day to stay properly hydrated. To stay ahead of competition, customize hydration strategy according to the unique needs by using these tips.

Before Activity

It's almost as crucial to be properly hydrated before practice or competition as it is to stay that way while exercising. Athletes who properly hydrate prior to practice or competition will require less hydration during an event than those who are dehydrated. The physiological processes of a hypohydrated (under-hydrated) athlete are weakened when they start to exercise. The athlete's level of thermal stress is correlated with the extent of dysfunction. The athlete should drink 500–600 mL of water or sports drink approximately two to three hours prior to exercise in order to ensure adequate pre-exercise hydration (Casa et al., 2000). Hydrating several hours before exercise allows enough time for pee to be produced.

Being properly hydrated is the aim, even before any physical activity starts. Rehydrate as soon as the body indicates its thirsty. To stay ahead of the game, anticipate thirst and sip some water. Sip ahead of time and make sure to get enough water the night before to maximize chances of success.

During Activity

Since every person is different, there are no set guidelines for how much water is appropriate to drink while exercising. Rather, take into account the rate of perspiration, the temperature, humidity, duration, and level of activity. The following guidelines for consuming water before and during exercise have been provided by the American Council on Exercise:

- Water (17–20 ounces) should be consumed two to three hours before exercising.

- Drink seven to ten ounces of water every ten to twenty minutes while working out.

Athletes may want to monitor fluid intake while exercising in order to determine how much water they require. For each pound lost through perspiration while exercising, athlete should consume 16–24 ounces of fluids. A useful method for achieving this is to weigh both prior to and following an exercise routine. Make sure to drinking enough water to counteract the water lost through perspiration during the activity to stay hydrated, but also avoid dehydrating too much or consuming too much fluid. During an activity, young athletes should consume 1 to 1.5 liters (34 to 50 ounces) of water every hour, according to the American Academy of Pediatrics. A little over three single-use water bottles make up 50 ounces of water. Electrolyte replenishment is necessary for activities that last longer than ninety minutes. It is beneficial to have a sports drink in addition to water as it will help athletes stay hydrated.

Post Activity

While staying hydrated prior to, during, and after exercise is crucial for optimal sports performance, staying hydrated post-exercise is just as crucial. It is well known that consuming a lot of fluids in the first two hours of rehydrating after exercise greatly increases plasma volume and produces a lot of urine (Kovacs et al., 2002). For every kilogram of body weight lost, an individual should consume 1.5L of fluid in order to recover from dehydration quickly and completely (Sawka & Burke, 2007). Hydration after exercise should be done with the intention of making up for any fluid lost during the workout or competition. Electrolytes to expedite rehydration, carbohydrates to replenish glycogen stores, and water to restore hydration status should all be included in rehydration. The immediate restoration of physiological function is the main objective, particularly if an exercise session is planned afterwards. Water may not be the

ideal fluid to drink after exercise to replenish fluids lost through perspiration, depending on volume and osmolarity. Incorporating carbohydrates into the rehydration solution has the potential to enhance intestinal sodium and water absorption while also supporting the restoration of glycogen stores. Restoring glycogen stores has been shown to improve performance in later workouts (Casa et al., 2000).

Regaining any fluid lost during activity is the aim of post-activity hydration. After workout or game, replacing these fluids will help to recover more quickly, minimize the symptoms of hypohydration, and feel less exhausted afterward. An athlete can track how much sweat lost by keeping a close eye on the body weight when determining how much water should be drunk after an activity. An athlete is well hydrated and ready to go if the weight loss was 1.5% or less. There is risk for dehydration if the number is higher than 1.5%, so hydrating should start right away.

Towards the end of an extended athletic event, fatigue may arise from both fuel substrate depletion and dehydration. Even a 2% body weight dehydration can affect an individual's ability to perform during physical activity. Increases in body weight beyond 5% can result in a roughly 30% reduction in work capacity (Armstrong et al. 1985; Craig and Cummings 1966; Maughan 1991; Sawka and Pandolf 1990). Compared to endurance athletes, sprinters are typically less concerned about the consequences of dehydration. However, prior dehydration, equivalent to a loss of only 2.5% of body weight, reduces the ability to perform high-intensity exercise which causes exhaustion in a matter of minutes by as much as 45% (Sawka, Young, Cadarette, et al. 1985). While there is little chance of sweat loss during sprint events, athletes traveling to hot climates are likely to suffer from acute dehydration, which can last for several days and be severe enough to negatively impact performance.

Eight subjects were examined in a study to determine the ability to walk on a treadmill (at 25% VO2max with a target time of 140 minutes) in extremely hot and dry conditions (49° C [120° F], 20% relative humidity) both when they were euhydrated and when they were dehydrated by 3%, 5%, or 7% loss of body mass (Sawka, Young, Francescone, et al. 1985). When hydrated, all eight subjects could walk for 140 minutes; when dehydrated, they could only walk for 3 minutes. When dehydrated by 5%, seven subjects finished the walk; however, when dehydrated by 7%, six subjects gave up walking after an average of just 64 minutes. Therefore, it is evident that dehydration raises the risk of heat-related fatigue even during relatively low-intensity exercise. Sawka and associates (1992) used the identical environmental conditions as earlier study, having participants walk until exhaustion at 47% VO2max. The subjects experienced a loss of 8% of total body water due to euthanasia and dehydration. Exercise endurance time was shortened from 121 minutes to 55 minutes by dehydration. The core temperature at exhaustion was approximately 0.4° C (0.7° F) lower in the dehydrated state, suggesting that dehydration also decreased a person's ability to tolerate a certain core temperature.

Here is a summary of the primary causes of dehydration's detrimental effects on exercise performance:

• A decrease in blood volume

• Reduced blood flow to the skin

• A reduction in sweating rate

• A reduction in heat dissipation

• A rise in the core temperature

• A higher rate of muscle glycogen consumption.

Dehydration lowers a person's VO2max and impairs work capacity in incrementally taxing exercise, most likely due to a reduced maximal cardiac output (i.e., the highest pumping capacity of the heart that can be achieved during exercise). Both at rest and during exercise, dehydration causes a fall in plasma volume; this decrease in blood volume increases blood viscosity, lowers central venous pressure, and decreases the amount of blood that returns to the heart from the veins. These modifications can lower the heart's filling during diastole, the part of the cardiac cycle when the heart is relaxed and filling with blood prior to the next contraction, which lowers the cardiac output and stroke volume during maximal exercise. Additionally, when exercising in the heat, the percentage of the cardiac output that is available to the working muscles is decreased when the skin's blood vessels open up.

Climate heat stress alone reduces, even in people who are normally hydrated (euhydrated).VO2max by roughly 7%. Therefore, during high-intensity exercise, environmental heat stress and dehydration can both act independently to reduce cardiac output and blood flow to the working muscles. Additionally, dehydration hinders the body's capacity to expel heat. When comparing the dehydrated state to the euhydrated state, both sweat rate and skin blood flow are reduced at the same core temperature (Sawka and Wenger 1988; Nadel et al. 1979, 1980). When the body is dehydrated during exercise, the body temperature rises more quickly. The effects of elevated plasma osmolarity, or the concentration of dissolved salt, on hypothalamic neurons as well as a drop in blood volume (hypovolemia) are likely what cause the reduced sweating response in the dehydrated state. As previously mentioned, fatigue sets in when the core temperature approaches 39.5° C (103° F). In the dehydrated state, this critical temperature is reached more quickly. Dehydration appears to impair a person's capacity to

withstand heat strain, so when dehydrated by more than roughly 5% of body mass, the critical temperature for experiencing central fatigue is likely to be closer to 39.0° C (102.2° F) (Sawka et al. 1992). Exercise in a dehydrated state causes a greater rise in core temperature, which is linked to a greater catecholamine response. These effects may cause the exercising muscle to break down glycogen at a faster rate, which could cause fatigue to set in earlier during prolonged exercise.

Symptoms of Dehydration

The following are examples of dehydration symptoms, which can range from mild to severe:

- Feeling thirsty
- mouth dryness
- Weary
- dark urination
- Headache
- Reduced ability to perform athletically
- Cramping in the muscles

A dehydration may be indicated if any of these symptoms are seen. These symptoms could, however, have other causes. Drinking water or an electrolyte-rich beverage, like sports drinks, is the best way to accomplish this. Consuming foods high in water content, like fruits and vegetables, is also recommended. Vegetables and fruits high in water content include celery, spinach, watermelons, tomatoes, strawberries, and kiwis. By being aware of the warning signs and symptoms of dehydration and taking appropriate action early on, athletes can prevent further illness or injury. In addition to encouraging hydration prior to exercise, certified athletic trainers

must be aware of the warning signs and symptoms of dehydration in case it happens. Sports drinks can be added before, during, and after exercise in order to maintain fluid balance, even though water is the best way to rehydrate. It is well known that staying properly hydrated during exercise has advantages for improving sports performance. Overall, staying hydrated is advantageous for physiological processes as well as physical activity and athletic performance.

Summary of review of related literature

The view of related literature showed that the essence of nutrition is broad and predominant in the sport life and activities of athletes, it gives an edge over others in the sports world if properly applied. Basically, the fundamental knowledge of nutrition in sports is important, this suggest that the role of nutrition is positive in the life and performance of athletes. Nutrition plays a crucial role in athletic performance, athletes and coaches need to realize that making wise food choices can increase the chances of optimal athletic performance. It is easy for athletes to fall victim to nutrition misinformation and wrong diet plan in the search for a quick fix to improve performance. It is imperative that athlete stay current on accurate nutrition issues as they are ever changing. By making informed choices, athletes will have an advantage over those who choose to ignore the role that food plays in human performance.

Sports nutrition has become interestingly appealing, with this increase in interest, athletes and also coaches are seeking more information. However, studies indicate that they are still lacking fundamental knowledge. They also have attitudes and behaviours that may affect nutrient level, poor dietary intake can affect both the health and performance. University athletes are of particular concern because they are at a critical growth and development stage in life. Nutrition can provide athletes with the nutrients to aid muscle recovery and improve performance. There is

great need for more nutrition education for university coaches. An increase in the understanding of nutrition will lead to impact on the athlete health and performance.

Finally, the understanding of sports Nutrition pave way for Nutritional knowledge and practicing of nutritional knowledge pave way for optimal performance. Nutrition encourages hydration and hydration boosts performance and also aid in muscle recovery after an activity or training. Therefore, nutrition is as important as fitness training as both work hand in hand to achieve the desired goal of the athlete.

CHAPTER THREE

METHODOLOGY

This chapter describes the method and procedure that was used by the researcher in carrying out the study. It was organized under the following subheading

- ✓ Research design
- ✓ Population of the study
- ✓ Sample and sampling technique
- ✓ Research instrument
- ✓ Validity of the instrument
- ✓ Reliability of the instrument
- ✓ Method of data collection
- ✓ Method of Data Analysis

Research Design

The research design used for the study was descriptive survey research design. According to Ali (1996), it is preferable to use descriptive survey research design when the subject of the investigation centers on the individual's opinions, attitude, and perception. It involves the study of a group of people, event or items by collecting or analyzing data only from a few people first assessing the characteristics of the whole population through the study of a sample which is considered to be representative of the entire population. This research involves gathering opinion and information from athletes in the University of Benin.

Population of the study

The population of the study consists of 120 student athlete from the University of Benin sport complex.

Sample and sampling Techniques

The technique that was used is the fish bowl method of the simple random sampling and 30% of the study population of the athletes will be picked. Total sampling size was equal 36.

Table 1: Showing the population of the respondents

Participants	Overall population	Percentage% (30%) for athletes
Football athletes	30	9
Basketball athletes	20	6
Volleyball athletes	20	6
Handball athletes	10	3
Athletics athletes	20	6
Swimming athletes	10	3
Hockey athletes	10	3
Total	120	36

Research Instrument

The instrument used in this research study was the self-structured questionnaire. The questionnaire was constructed based on the variable stated in the research questions. The questionnaire was designed in such a way that the respondent will tick (✓) in the column of the

preferred choice. The instrument titled “Impact of Nutrition on muscle recovery and performance of athletes in the University of Benin questionnaire”. The questionnaire consisted of 2 sections; section A and B, section A addressed the demographic data of the respondent, while section B comprised of items generated from the research questions to which the respondents provided answers. The responses (alternatives) will include ‘strongly agreed’, ‘agreed’, ‘disagree’, ‘strongly disagree’ options which were used to elicit response from the respondents.

Validity of the Instrument

The research instrument was validated by the researcher’s supervisor and two other lecturers in the department of Human Kinetics and Sports Science. The corrections, criticism, recommendations, suggestions and modifications were taken into consideration before the final draft was printed and administered. These processes are expected to ensure both content and construct validity.

Reliability of the Instrument

The reliability of the instrument was determined by administering the questionnaire (test instrument) to which they obliged responding to. The data was analyzed using Chronbach Alpha statistics. Chronbach Alpha is a statistical tool used to measure the reliability of a test instrument for internal consistency.

Method of Data Collection

The questionnaire was administered to the respondents for data collection. The respondents were guided on how to answer the questionnaire and after answering, the questionnaires were collected immediately so as to avoid loss or mix up of the questionnaires.

Method of Data Analysis

Data collected was analyzed using frequency count and simple percentages in order to facilitate the interpretation of the data that was collected and used for demographic information of the athletes. Mean and standard deviation was used to analyze the response of the respondents to the research questions raised.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

This chapter deals with the presentation of results and interpretation of findings collected during the study. It is in line with the research questions stated in chapter one.

Demographic Data:

Table 2: showing the percentage distribution of respondent by gender

Gender	Frequency	Percentage
Male	23	63.89
Female	13	36.11
Total	**36**	**100**

The data in table 2 shows that 23(63.89%) of the respondent are males while 13(36.11%) are females. Hence majority of the respondents were males.

Table 3: showing the percentage distribution of respondent by age

Age	Frequency	Percentage
17-20	4	11.11
21-24	21	58.33
25-28	9	25
Above 29 years	2	5.56
Total	**36**	**100**

table 3 above, shows that 4(11.11%) of the respondent are of the age range 17-20years, 21(58.33%)of the respondent are of the age range 21-24years, 9(25%) of the respondent are of the age range of 25-28years and 2(5.56%) respondent are above 29years. Majority of the respondents are between 21-24years of age.

Table 4: showing the percentage distribution of respondent by experience

Student years of Experience	Frequency	Percentage
1-3 years	15	41.67
4-6 years	18	50
Above 7 years	3	8.33
Total	**36**	**100**

Table 4 above, shows that 15(41.67%) of the respondents have 1-3years of experience, 18(50%) of the respondent have 4-6years of experience and 3(8.33%) of the respondent have above 7years of experience. Majority of the respondents have 4-6years of experience.

Table 5: Showing the percentage distribution of respondent by sport

Sport	Frequency	Percentage
Athletics	6	16.67
Football	9	25
Volleyball	6	16.67
Basketball	6	16.67
Handball	3	8.33
Swimming	3	8.33
Hockey	3	8.33
Total	**36**	**100**

Table 5, shows that 6(16.67%) of the respondent are Athletics athletes, 9(25%) of the respondents are Football athletes, 6(16.67%) of the respondents are Volleyball athletes, 6(16.67%) of the respondents are Basketball athletes, 3(8.33%) of the respondents are Handball athletes, 3(8.33%) of respondents are Swimming athletes and 3(8.33%) respondents are Hockey athletes. This shows that majority of the respondents are Football athletes.

RESEARCH QUESTIONS

Research question 1: what is the impact of Nutrition on Muscle Recovery of Athletes in the University of Benin?

Table 6: Showing the responses of the Respondents to research question one.

S/N	Items	Mean	Standard Deviation	Decision/ remark
1.	Without proper nutrition continuous training helps in quick muscle recovery	2.08	0.77	Disagree
2.	Nutritional meals such as protein and carbs aid in quick muscle recovery	3.36	0.49	Agree
3.	Use of nutritional supplements (omega-3, vitamin D) helps in recovery of muscles	3.44	0.53	Agree
4.	Nutrition has a great impact on the performance of an athlete	3.44	0.53	Agree

Criterion Mean:2.50

From the data in table six, the mean values are 2.80, 3.36, 3.44 and 3.44 while the standard deviation values are 0.77, 0.49, 0.53 and 0.53. the mean value showed that the respondent agreed

to items two, three and four as the values are greater than the criterion value of 2.50 which means the respondent agreed on the impact of nutrition on muscle recovery of athletes in the university of Benin. They disagreed that without nutrition continuous training help in quick muscle recovery.

Research Question 2: How does Nutritional Status Impact Athletic Performance in various Sports?

Table 7: Showing the Responses of the Respondents to research question two.

S/N	Items	Mean	Standard Deviation	Decision/ remark
5.	Nutritional intake differ between athletes based on the nature of the sport they play	3.25	0.43	Agree
6.	Endurance sport such as football, athletics require higher nutritional intake than aerobic sports such as swimming, table tennis	3.25	0.55	Agree
7.	Endurance sports burn more energy and calories faster than aerobic sports	3.31	0.54	Agree
8.	All sports do not consume the same amount of	3.36	0.49	Agree

energy during training and competition

Criterion Mean: 2.50

From the data in table seven, the mean values are 3.25, 3.25, 3.31 and 3.36 while the standard deviation values are 0.43, 0.55, 0.54 and 0.49. the mean value shows that the respondent agreed to all items; five, six seven and eight as they are greater than the criterion mean of 2.50. this means that the respondent agreed that nutritional status impact athletic performance in various sports.

Research Question 3: Can Personalized Nutritional Plans Designed for Individual Athletes Enhance Performance and Improve Muscle Recovery?

Table 8: Showing the Responses of the Respondents to research question three.

S/N	items	Mean	Standard Deviation	Decision/ remark
9.	Individual athletes differ from each other physiologically	3.47	0.52	Agree
10.	The nutritional intake of athletes differ from one another due to the different health status and total wellbeing	3.44	0.53	Agree
11.	Personalized nutritional plan for athletes enhance performance	3.25	0.68	Agree
12.	Individual nutritional plan aids quick muscle recovery during and after training as the plan covers the lacking nutritional needs of the athlete	3.22	0.55	Agree

Criterion Mean: 2.50

The data in table eight, shows the mean values are 3.47, 3.44, 3.25 and 3.22 while the standard deviation values are 0.52, 0.53, 0.68 and 0.55. the mean values which are above the criterion mean of 2.50show that the respondent agreed to all the four items as regards the personalized nutritional plan designed for individual athletes enhance performance and improve muscle recovery. The low values of standard deviation shows that the responses do not deviate from one another.

Research Question 4: Are there Differences in the Nutritional Needs of Male and Female Athletes?

Table 9: Showing the Responses of Respondents to research question four.

S/N	Items	Mean	Standard Deviation	Decision/ remark
13.	Male and female athletes have different physiological characteristics hence the nutritional intake differ	3.06	0.83	Agree
14.	Female athletes perform the same way as male athletes during competition hence need the same nutrition	2.11	0.78	Disagree
15.	Male and female athletes require the same nutritional intake	2.03	0.75	Disagree
16.	Due to the masculinity and strong nature of males, they may require larger portions of nutritional meals than female athletes	3.06	0.73	Agree

Criterion Mean: 2.50

From the data in table nine, the mean values are 3.06. 2.11, 2.03 and 3.06 while the standard deviation values are 0.83, 0.78. 0.75 and 0.73. the mean values showed that the respondents disagreed to item fourteen and fifteen as the values are lower than the criterion mean of 2.50 while item thirteen and sixteen was agreed to as the value was greater than the criterion mean. This means that the respondents agreed that male and female athletes have different physiological characteristics and that due to the masculinity of male, male athletes require larger portions of nutritional meals than female athletes.

Research Question 5: What is the Impact of Timing and Composition of Pre-Training Meals and Post-Training Meals on Muscle Recovery in Athletes?

Table 10: Showing Responses of Respondents to research question five.

S/N	Items	Mean	Standard Deviation	Decision/ remark
17.	Pre-training meals enhance the performance of athlete during training	3.06	0.50	Agree
18.	Post-training meals helps in the quick recovery of muscles	3.28	0.49	Agree
19.	Per-training meals reduces fatigue during training	3.06	0.68	Agree
20.	Meals such as sports snacks (protein bars, nut butters) taken during training or competition helps in better performance and quick muscle recovery	3.17	0.48	Agree

Criterion Mean: 2.50

From the data in table ten, the mean values are 3.06, 3.28, 3.06 and 3.17 while the standard deviation values are 0.50, 0.49, 0.68 and 0.48. the mean values show that the respondents agreed to all the items: seventeen, eighteen nineteen and twenty as they are greater than the criterion mean of 2.50. this means that the respondent agreed that the impact of timing and composition of pre-training and post-training meals enhance muscle recovery in athletes.

Research Question 6: How does Hydration (use of sport water, energy drinks) Influence Performance of Athletes during Training Activities and also Competition?

Table 11: Showing the Responses of Respondents to research question six.

S/N	Items	Mean	Standard Deviation	Decision/ remark
21.	The best form of hydration during competition is water	2.14	1.60	Disagree
22.	Intake of energy drinks increases the energy level of an athlete during competition	3.11	0.52	Agree
23.	Intake of water during competition reduces performance of an athlete during competition	2.25	0.98	Disagree
24.	Too much intake of water during competition slows down an athlete during performance	2.31	1.10	Disagree
25.	Little or no hydration during competition increases fatigue which may lead to poor performance of an athlete	3.36	0.54	Agree

Criterion Mean: 2.50

From the data in table eleven, the mean values are 2.14, 3.11, 2.25, 2.31 and 3.36 while the standard values are 1.60, 0.52, 0.98, 1.10 and 0.54. The mean showed that the respondents disagreed to item twenty one, twenty-three and twenty-four as the values are lower than the criterion mean while item twenty-two and twenty-five was agreed to as the value was greater than the criterion mean. This means that the respondent agreed that intake of energy drinks increases the performance of an athlete during competition and that little or no hydration during competition increases fatigue which may lead to poor performance of an athlete.

Discussion of findings

The study analyzed the impact of nutrition on muscle recovery and performance of athletes in the University of Benin. The findings from table five, containing the analysis of research question one revealed the impact of nutrition on muscle recovery of athletes in the University of Benin. The respondents did not agree to the statement in item one that without proper nutrition continuous training helps in quick muscle recovery, therefore the respondents agreed to item two that nutritional meals such as protein and carbs aid in quick muscle recovery. The respondent also agreed to item three that the use of nutritional supplements (omega-3, vitamin D) helps in the recovery of muscle. For item four, the respondents also agreed that nutrition has a great impact on the performance of an athlete. This is in accordance with Manore and Thompson (2000) stating that; Today there is no doubt that nutrition plays a vital role in exercise performance and training. Failing to meet overall nutritional needs or to provide nutritionaal support to a session of exercise is likely to affect acute performance and decrease effectiveness of training and recovery (Shirver et al, 2013).

Proceeding to the findings from research question two, the analysis showed that all four items in research question two indicates how nutritional status impact athletic performance in various sports. Respondents agreed to item five, six, seven and eight that nutritional intake differ between athletes based on the nature of their sports, endurance sports such as football, athletics require higher nutritional intake than aerobic sports such as swimming, table tennis, also that endurance sport burns more energy and calories faster than aerobic sports and finally all sport do not consume the same amount of energy during training and competition. Westerterp (2013) stated that energy expenditure and nutrient utilization are elevated in athletes due to increased physical activity demands. To fuel training sessions and support the body's physiological functions like muscle growth and repair, athletes need to consume more energy. Athletes in various sports consume different amount of nutritional intake based on the nature of their sport. This justifies that nutritional status impact athlete performance in various sports.

Result obtained from research question three, which showed how personalized nutritional plan designed for individual athletes enhance performance and improve muscle recovery. respondents agreed to all items in research question three that individual athlete differ from one another physiologically, the nutritional intake of athletes differ from one another due to different health status and total wellbeing, that personalized nutritional plan for athletes enhance performance and that individual nutritional plan aid quick muscle recovery during and after training as the plan covers the lacking nutritional needs of the athlete. According to the English Institute of sport (2021) the performance wheel describes eating a varied diet which helps to ensure consumption of the daily amount of macronutrients (carbohydrate, protein and fat) an micronutrient (vitamins and minerals) needed to achieve healthy bodily functions. Due to the difference in the physiological characteristics, body composition and nature of sport of athletes,

personalized nutritional plan is key in the nutritional journey of an athlete to achieve maximum performance and quick muscle recovery.

The findings from table nine, in research question four which showed the differences in the nutritional needs of male and female athletes revealed the respondents did not agree to the statement in item fourteen and fifteen that female athletes perform the same way as male athletes during competition hence need the same nutrition and that male and female athletes require the same nutritional intake for performance, which shows that male and female athletes differ from each other as they don't perform the same way hence their nutritional intake differ. Therefore the respondent agreed to item thirteen and sixteen that male and female athlete have different physiological characteristics hence their nutritional intake differ and that due to the masculinity and strong nature of males, they may require larger portions of nutritional meals than female athletes. Men and women bodies respond differently to exercise and nutrition and thus have different fueling needs. This is in accordance to Julie Mancuso which stated that physiologically, women bodies tend to have more fat than men, this can result to different energy needs. During submaximal exercises of the same intensity, adult women generally metabolize more fat compared to men which is indicates by RER (Blaak, 2001). All of these justifies that there are differences in the nutritional needs of male and female athletes.

The result obtained from research question five reveals the impact of timing composition of pre-training and post-training meals on muscle recovery in athletes. Respondents agreed to item seventeen, eighteen, nineteen an twenty that pre-training meals enhance performance of athlete during training, post-training meals help in the quick recovery of muscles, that pre-training meals reduces fatigue during training and finally that meals such as sport snacks (protein bars, nut butters) taken during training or competition helps in better performance and quick muscle

recovery. This is in accordance with Contunga et al (2005); argued that the timing of food intake based on training and competition schedule is crucial. The ability to perform and recover from exercise can be positively or negatively affected by dietary intake before, during, and after the event.

Lastly the analysis from research question six, indicates how hydration use of sport water, energy drinks influence performance of athlete during training activities and also competition. Respondents did not agree to item twenty one, twenty three and twenty four statements that the best form of hydration is water, intake of water during competition reduces performance of athletes during competition and that too much intake of water slows down an athlete during performance. Therefore, they agreed to item twenty two and twenty five statement that intake of energy drinks increases the energy level of an athlete during competition and that little or no hydration during competition increases fatigue which may lead to poor performance of an athlete. As opined by Seebohar (2011) fluid balance is especially important for athlete because it can affect performance and without proper fluid balance, electrolyte within the body are affected and can cause Hyponatremia. This can lead to poor performance of athletes during competition. Therefore, fluid needs are crucial and essential to performance and recovery of athlete due to the loss through perspiration. This justifies the importance of hydration on the performance of an athlete during training activities and competition.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study was carried out to investigate the impact of Nutrition on the muscle recovery and performance of athletes in the University of Benin. Six researched questions were raised to guide the study.

A total of 120 respondents consisting of 30 football athletes, 20 basketball athletes, 20 athletics athletes, 10 handball athletes, 20 volleyball athletes, 10 swimming athletes and 10 hockey athletes from the University of Benin, Edo state was selected using simple random sampling technique. A self-constructed questionnaire was used to obtain information from the respondents. The four-point Likert scale of Strongly Agree, Agree, Disagree and Strongly Disagree was adopted as options to items.

The self-developed questionnaire was submitted to the project supervisor and two other experts in the Department of Human Kinetics and Sports Science for vetting, correction and approval to ensure its validity before administering it to the respondents. In analyzing the data, descriptive statistics of frequency counts and percentages was used to analyze the demographic data, while mean and standard deviation was used in analyzing research questions.

Findings

Based on the results and decisions of the study; the following main findings were made:

It was discovered that nutrition has a great impact on muscle recovery and also the performance of an athlete, they include use of nutritional supplements, nutritional meals such as protein and carbs to aid I quick muscle recovery.

Nutritional intake differ between athletes based on the nature of their various sports endurance sport require higher nutritional intake than aerobics sports as endurance sports burns more energy and calories faster than aerobic sports.

Also, individuals differ from each other physiologically and health wise hence their nutritional intake differ. Therefore, the nutritional plan of athletes should be individualized to enhance performance and aid quick recovery. It was also found out that male and female athletes differ from each other as their physiological characteristics differ and that male tend to have less fat than female which result in different energy needs, making them not to require the same nutritional intake for performance.

Nutritional knowledge in timing also gives adequate information on competition meals before, during and after competition to keep the athlete nutritionally informed and promote optimal performance in sport. Also, it was found out that little or no hydration during competition increases fatigue which may lead to poor performance of an athlete which shows that hydration during competition, use of sport water, energy drinks, increases energy level of an athlete and reduces fatigue during competition to maintain optmal performance.

Conclusion

Based on the findings of the study the following conclusions were made: this study has been able to highlight the impact of nutrition on muscle recovery and performance of athletes. The findings have also established that sport nutrition is key for not just the optimal performance of an athlete but also the aiding of quick muscle recovery.

Nutrition is considered paramount. It is a gateway to the best performance of any athlete. Like Ellie Krieger said: a balanced life is like a three legged stool, each leg – nutrition, fitness and wellness is necessary and supports the other. Nutrition and fitness work hand in hand as one is incomplete without the other to achieve optimal health. As athletes train and exercise the body, it is paramount that nutrition is duely added as the output of the athlete is not only considered but also the input. What an athlete consumes has a great impact on the performance of that athlete. This study established that among the athletes of the University of Benin, nutrition is a tool that if properly utilized can have a great improvement in the sport performance of the athlete.

Recommendation

The following recommendations were made based on the findings and conclusion of the study:

1. Athletes should have good knowledge of nutrition and its benefits to performance and recovery. This can be achieved by organizing seminers on the importance of nutrition. Also, coaches should encourage the use of nutrition for athletes especially at grassroot level.

2. Coaches should recommend personalized nutritional plan for athletes and also refer them to professionals where necessary.

3. Athletes should pay attention to their nutritional needs to know what works best for them.

4. Athletes should incorporate meals such as sport snacks during trainings and competition to help I better performance and quick muscle recovery.

5. Athletes should be educated on what type of meals to take before, during and after training activities for quick muscle recovery.

6. During competitions, water, energy drinks, sport water should be readily available for athletes during competition to keep them hydrated at all times during the period of the competition to reduce fatigue and enhance performance.

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APPENDICES

APPENDIX A: QUESTIONNAIRE

DEPARTMENT OF HUMAN KINETICS AND SPORTS SCIENCE
FACULTY OF EDUCATION
UNIVERSITY OF BENIN, BENIN CITY, EDO STATE.

QUESTIONNAIRE ON THE IMPACT OF NUTRITION ON MUSCLE RECOVERY AND PERFORMANCE IN UNIVERSITY OF BENIN ATHLETES

Dear Respondent,

This questionnaire is designed for Academic purpose, it is aimed at gathering information on **Impact of Nutrition on Muscle Recovery and Performance in University of Benin Athletes.** You are kindly requested to tick (✓) the response where best expresses your opinion. Your response will be treated with utmost confidentiality and will be used only for the purpose of this study. Thanks for your anticipated cooperation.

SECTION A: DEDMOGRAPHIC DATA

Gender: male ( ) female ( )

Age (years): 17-20years ( ) 21-24years ( ) 25-28years ( ) 29years and above ( )

Athlete ( )

What sports do you play? _____

How long have you been an athlete? 1-3years ( ) 4-6years ( ) above 7years ( )

SECTION B: QUESTIONNAIRE ITEMS.

INSTRUICTION:

This section contains statements on different sections. You are required to tick (✓) against any column that best represents your opinion.

Key: SA- Strongly Agree, A-Agree, D-Disagree, SD-Strongly Disagree.

S\N	ITEMS	SA	A	D	SD
	WHAT IS THE IMPACT OF NUTRITION ON MUSCLE RECOVERY OF ATHLETE IN THE UNIVERSITY OF BENIN				
1.	Without proper nutrition continuous training helps in quick muscle recovery				
2.	Nutritional meals such as protein and carbs aid in quick muscle recovery				
3.	Use of nutritional supplements (omega-3, vitamin D) helps in the recovery of muscle				
4.	Nutrition has a great impact on the performance of an athlete				
	HOW DOES NUTRITIONAL STATUS IMPACT ATHLETIC PERFORMANCE IN VARIOUS SPORTS				
5.	Nutritional intake differ between athletes based on the nature of their sports				
6.	Endurance sports such as football, athletics				

	require higher nutritional intake than aerobic sports such as swimming, table tennis				
7.	Endurance sports burns more energy and calories faster than aerobic sports				
8.	All sports do not consume the same amount of energy during training				
	CAN PERSONALIZED NUTRITIONAL PLANS DESIGNED FOR INDIVIDUAL ATHLETES ENHANCE PERFORMANCE AND IMPROVE MUSCLE RECOVERY				
9.	Individual athletes differ from each other physiologically				
10.	The nutritional intake of athletes differ from one another due to different health status and total wellbeing				
11.	Personalized nutritional plan for athletes enhance performance				
12.	Individual nutritional plan aids quick muscle recovery during and after training as the plan covers the lacking nutritional needs of the athlete				
	ARE THERE DIFFERENCES IN THE NUTRITIONAL NEEDS OF MALE AND FEMALE ATHLETES				
13.	Male and female athlete have different physiological characteristics hence the nutritional intake differ				
14.	Female athletes perform the same way as male athlete during competition hence need the same nutrition				

15.	Male and female athlete require the same nutritional intake for performance				
16.	Due to the masculinity and strong nature of male, male athletes require larger portions of nutritional meals than female athletes				
	WHAT IS THE IMPACT OF TIMING AND COMPOSITION OF PRE-TRAINING AND POST-TRAINING MEALS ON MUSCLE RECOVERY IN ATHLETES				
17.	Pre-training meals enhance the performance of athlete				
18.	Post-training meals helps in the quick recovery of muscles				
19.	Pre-training meals reduces fatigue during training				
20.	Meals such as sports snacks (protein bars, nut butters) taken during training or competition helps in better performance and quick muscle recovery				
	HOW DOES HYDRATION (USE OF SPORTS WATER, ENERGY DRINKS) AFFECT PERFORMANCE OF ATHLETE DURING TRAINING ACTIVITIES AND ALSO COMPETITION				
21.	The best form of hydration during competition is water				
22.	Intake of energy drinks increases the energy level of an athlete during competition				
23.	Intake of water during competition reduces performance of the athlete during competition				
24.	Too much intake of water during competition slows down an athlete during performance				

25.	Little or no hydration during competition increases fatigue which may lead to poor performance of an athlete				

APPENDIX B: FREQUENCY AND DESCRIPTIVE STATISTICS

Frequencies

Statistics

		Gender	Age	Sports	Years of Experience
N	Valid	36	36	36	36
	Missing	0	0	0	0

Frequency Table

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	23	63.9	63.9	63.9
	Female	13	36.1	36.1	100.0
	Total	36	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	17 – 20years	4	11.1	11.1	11.1
	21 – 24years	21	58.3	58.3	69.4
	25 – 28years	9	25.0	25.0	94.4
	Above 29years	2	5.6	5.6	100.0
	Total	36	100.0	100.0	

Years of Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 – 3years	15	41.7	41.7	41.7
	4 – 6years	18	50.0	50.0	91.7
	Above 7years	3	8.3	8.3	100.0
	Total	36	100.0	100.0	

Sport

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Athletics	6	16.7	16.7	16.7
	Football	9	25.0	25.0	41.7
	Volleyball	6	16.7	16.7	58.4
	Basketball	6	16.7	16.7	75.1
	Handball	3	8.3	8.3	83.4
	Swimming	3	8.3	8.3	91.7
	Hockey	3	8.3	8.3	100.0
	Total	36	100.0	100.0	

Descriptive

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Item1	36	1.00	3.00	2.08	.77
Item2	36	3.00	4.00	3.36	.47
Item3	36	2.00	4.00	3.44	.53
Item4	36	3.00	4.00	3.44	.53
Item5	36	3.00	4.00	3.25	.43
Item6	36	3.00	4.00	3.25	.55
Item7	36	2.00	4.00	3.31	.54
Item8	36	2,00	4.00	3.36	.49
Item9	36	3.00	4.00	3.37	.52
Item10	36	3.00	4.00	3.44	.53
Item11	36	3.00	4.00	3.25	.68
Item12	36	3.00	4.00	3.22	.55
Item13	36	2.00	4.00	3.06	.83
Item14	36	1.00	3.00	2.11	.78
Item15	36	1.00	2.00	2.03	.75
Item16	36	2.00	4.00	3.06	.73
Item17	36	3.00	4.00	3.06	.50
Item18	36	3.00	4.00	3.28	.49
Item19	36	3.00	4.00	3.06	.68
Item20	36	3.00	4.00	3.17	.48
Item21	36	1.00	2.00	2.14	1.60
Item22	36	2.00	4.00	3.11	.52
Item23	36	1.00	2.00	2.25	.98
Item24	36	1.00	2.00	2.31	1.10
Item25	36	3.00	4.00	3.36	.54
Valid N (list wise)	36				