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# OVERVIEW OF SPORTS NUTRITION KNOWLEDGE FOR ADOLESCENT ATHLETES

Samantha L. Schneider 3183296

*Southern Illinois University Carbondale, slschneider92@siu.edu*

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# OVERVIEW OF SPORTS NUTRITION KNOWLEDGE FOR ADOLESCENT ATHLETES

by

Samantha Leigh Schneider

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A Research Paper

Submitted in Partial Fulfillment of the Requirements for  
the Master of Science

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Approved by:

William Banz, Chair

Jullie Partridge

Graduate School

Southern Illinois University Carbondale

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## **CHAPTER 1**

### **INTRODUCTION**

The consumption of healthy foods is important for adolescents of any age but crucial for those individuals who are involved in athletics. Adolescents involved sports have an increased need for nutrient demands but many of them do not meet the adequate requirements their growing bodies need. This can be due to lack of or inadequate knowledge over nutrition and the importance of it in their lives. Furthermore, media, economic, culture and financial can play a critical role on a child and their family in their daily dietary choices. This is why the education of nutrition is crucial but especially for those involved in sports and to help educate them on the proper nutrient needs for performance before, during and after practice and competition. However, despite the importance of sports nutrition education there is currently a lack of research in this area, particularly for adolescents.

When athletes enter the stages of adolescents, which is between the age of 10 to 19 years old, energy demands increase and can vary based on gender, age, height and weight, genetics, activity level and the sport they are participating in (Sack, 2003). Which is why it is very important that adolescents receive the proper education to perform at their best, but also aid in proper growth and development and prevent deficiencies, malnutrition or over nutrition which can lead to underweight and overweight adolescents. Environmental factors can also affect adolescents and their energy needs, along with time, travel and body image. Many adolescents have busy schedules due to academics and extracurricular activities, along with their family members' consuming schedules which leads to many dinners being consumed out of the house or on the run and those have a tendency to lack wholesome nutrients. Body image plays a big factor in many adolescents, especially females and the desire to be a certain weight or leanness. The

type of sport a child participates in can also significantly impact body image such as wrestling, swimming, figure skating, dance, cheerleading, diving, gymnastics and sports with uniforms that are form fitted and tight. The purpose of this paper is to show and review the educational need for adolescent athletes about the importance of adequate nutrition and cover macro and micronutrient energy requirements, nutrient timing, overcoming obstacles and meal and snack planning for the athlete and the family.

Research Question:

What are the specific dietary needs for adolescent athletes?



## CHAPTER 2

### SPORTS NUTRITION FOR YOUNG ATHLETES

Purcell (2013) discussed the important of nutrition as a part of sports performance for young athletes, along with facilitating their growth and development. The article also discussed the macronutrients, micronutrients and fluid and how adequate amounts are essential to provide proper energy for optimal growth and development. Discusses its importance for young adolescent athletes to be educated in, how and what to eat and drink before and after activity. The article focused on seven topic areas, aimed towards adolescence and the parents: energy requirements, macronutrients, micronutrients, fluids, recovery foods, meal planning and reaching the finish line. The energy requirements section discussed how the nutrient requirements for adolescents are more variable or minimal, depending on age, activity level, growth rate and stage of physical maturity and how extra calories are needed during growth spurts to replenish energy (Purcell, 2013).

Table 1: Approximate Caloric Requirements for Adolescents Based on General Range

<b>Age</b>	<b>Sedentary</b>	<b>Moderately Active</b>	<b>Active</b>
<b>Early Adolescence</b> <b>(Ages 12-13)</b>	1600 calorie/day	2000 calorie/day	2200 calorie/day
<b>Middle Adolescence</b> <b>Ages (14-18)</b>	1600-2000 calorie/day	2000-2200 calories/day	2200-2400 calories/day
<b>Late Adolescence</b> <b>Age (19-24)</b>	2000 calories/day	2200 calorie/day	2400 calorie/day

*Adapted from Emergence Health Network Child Development and Parenting: Teenage Caloric Requirements at [emergencehealthnetwork.org](http://emergencehealthnetwork.org) by Angela Morelli.*

Purcell (2013) also discusses the macro and micronutrient energy requirements needed to properly fuel these energy needs such as carbohydrates (CHO) which are a crucial energy source for athletes because they provide the glucose used for energy. Glucose is stored as glycogen in the muscles and liver of the body (Clark, 1990). Every 1 gram of CHO contains 4kcal of energy and should account for approximately 45-65% of total daily caloric intake. Protein is crucial for building and repairing muscle, hair, and skin, should account for 10-30% of total daily caloric intake and for every 1 gram of protein provides 4 kcal of energy. Fat is necessary to absorb fat-soluble vitamins such as A, D, E, K to provide essential fatty acids, protect vital organs and provide insulation. It accounts for 25-35% of total daily intake and for every 1 gram of fat is 9kcal of energy. There's a difference in the types of fats one can consume such as saturated which should be consumed in moderation because it could be harmful to one's healthy and then unsaturated such as monosaturated and polysaturated. The micronutrients it discusses included calcium which is important for bone health, normal enzyme activity and muscle contraction and the daily intake being 1000mg/dL for 4-8y/o and 1300mg/dL for 9-18y/o. Vitamin D is necessary for bone health and is involved in the absorption and regulation of calcium. The current recommendation are 600IU/dL for 4-18y/o but can vary depending on geographical location and race. Lastly, iron, which is important for oxygen delivery to body tissues and during adolescents is crucial to aid it proper growth and help increase blood volume and lean mass. The recommended daily intake include 8mg/dL for 9-13y/o and 11mg/dL for 14-18y/o to avoid deficiencies which is common in athletes because many of times they aren't getting enough calories in for all their calories out (Purcell, 2013).

Proper hydration is also important of adolescent athletes because they are needed to help regulate body temperature and replace sweat losses during exercise to avoid dehydration which could lead to health complications or decreased performance. This article again discusses the requirements for fluid intake which can vary on factors such as age and body size. Before activity its suggested athletes consume 400L to 600mL of water every 2-3 hours, during an activity they should consume 150mL to 300mL of fluid for every 15-20 minutes and after activity can vary depending on the time of energy expenditure and is crucial to replenish macronutrient requirements to insure proper recovery and consume roughly 1.5mL of fluid/kg of body weight (Clark, 1990) (Purcell, 2013). The article discusses how to achieve proper meal planning success by choosing foods that will provide sufficient energy in foods with adequate CHO, PRO, and fat, while being aware to keep them simple to take on the go and not cause GI distress (Purcell, 2013). In summary the article covers many basics of achieving a well balance diet for adolescent athletes to achieve proper growth and maximize their performance. It covers the basics of macro and micronutrients, fluid requirements and easy meal planning guidance to help adolescents choose foods they like to consume but also healthy options.

### **Nutrient Requirements for Proper Growth and Development**

The body is a complex machine that people continuously continue to study and research new information every day. One thing is certain though, the body relies on vitamins, minerals, carbohydrates, protein, and fat for many functions, including growth and development. While healthy eating habits are extremely important for people of all ages, it's especially important for children whose bodies are continually growing and developing in order to create a healthy adult. In today's world nutrition is a subject that many people disregard and good nutrition is harder to come by due to personal taste, food allergies, education or financial status. In addition, nutrition

is termed as the process by which the human body takes in and utilizes food, there's an abundance of different nutrients that are crucial for good health such as carbohydrates, fat, protein which are categorized as macronutrients and then micronutrients which are the vitamins, minerals and water. Although foods contain more than one nutrient, not all foods are created equal and contain more than others. That is why when consuming foods throughout the day to choose from a variety of different foods to avoid any deficiencies and nutritional gaps because one food cannot contain all of the essential nutrients our bodies need to function (Clark, 1990) (Nisevich, 2008).

### **Nutritional Requirements of the Child and Teenage Athlete**

Both boys and girls general follow specific patterns of growth through stages of infancy all the way to adulthood. Through infancy to adolescents there is much growth and development taking place all the way to adult hood which is when generally growth spurts or changes come to a halt. These changes happen throughout life but a lot of physical changes happen between the ages of 10-19 (or in my opinion 13-19) for both females and male (Sack, 2003). This phase is referred to many as puberty and females generally reach puberty a lot sooner than males and effects their nutritional depends. In addition, the school aged periods (5-18yrs) can be the most important for when and how much children development physically, mentally and emotional. It becomes a critical time because nutritional deficiencies could have a significant effect not only on growth and development but also on athletic and academic performance (Hoch & Goosen, 2008). In the study of nutritional requirements of the child and teenage athlete the illustration declares that there is not a significant amount of changes in the biomechanics, body composition, or nutritional requirements which can make it difficult to give "general" recommendations for nutritional needs of adolescents because not only age but stage of their physical maturity and

level of physical activity must also be taken into consideration (Hoch & Goosen, 2008). The recommended dietary allowances (RDA), dietary references intakes (DRI), adequate intakes (AI) and tolerable upper intake level that have been provided by the Academy of Dietetics and many other organizations created these guidelines and dietary references that are available for people to use. Although they are general guidelines and not individuals they provide both the macronutrient and micronutrient needs for an individual but it doesn't factor in an activity level. This is important because for adolescents, especially adolescent athletes or very active kids their caloric needs will be different and continually change as they age and develop. Their caloric demands can change or vary depending on age, growth rate, and demands of their sport and physical maturity.

## **The Role of Micro and Macronutrient Requirements in the Body**

### **Protein Requirements**

The primary role of protein is that it helps build and repair muscle tissue, hormone production, red blood cell replacement, boosting the immune system and aids in the growth of hair and fingernails (Clark, 1990). Protein does not store as energy (unlike carbohydrates and fat), unless in extreme situations such as starvation. Protein is generally a misguided subject in terms that many people believe that if they eat excess protein then it's going to build them extra muscle, extra quickly. So people will consume larger portions of meat or have 6 eggs for breakfast, especially young kids such as boys in their adolescents trying to gain weight and build muscle. The excess protein they consume can't even be stored as energy, instead is rid-of through a process called deamination which is the removal of an amine group from a molecule (amino acids are building blocks of protein) or if in certain situations can be burned as energy. The truth though is that building muscle or gaining weight involves numerous factors, not just

consuming large amounts of protein. These factors include consuming adequate calories and participating in a strength and condition program regiment regularly (Clark, 1990). To reap the best benefits it's important to consume protein throughout the day, at each meal and snack to make sure we are reaping the benefits of it and avoiding deficiencies. The requirements for protein can vary for each individual but are generally higher for people with certain conditions, athletes and young adolescents. Athletes generally require higher amounts because they are burning off more energy than someone who is sedentary. Also, depending on the sport they're in can make their requirements different. For example an endurance athlete such as a swimmer, dieters consuming too few calories such as a body builder, growing adolescents, and untrained individuals starting a new sport or exercise program who are continuously damaging and repairing muscle tissue. The general requirements for protein intake are listed below in chart but for someone needed specific guidelines should contact a dietitian. Located below is a chart from Nancy Clarks Sports Nutrition Guide book 5<sup>th</sup> edition table 7.1, which covers adult protein requirements also but in this article only the younger athletes general requirements will be listed.

Table 2: Protein Requirements for Adolescent Athletes Based on General Range (page: 139)

Type of Individual	Grams of protein per lb. body weight	Grams of protein per kg body weight
Growing teenage athlete	0.7-0.9g	1.6-2.0g
Average Protein intake of a male endurance athlete	0.5-0.9g	1.1-2.0g
Average protein intake of a female endurance athlete	0.5-0.8g	1.1-1.8g

*Adapted from Nancy Clark's Sports Nutrition Guide book fifth edition table 7.1 on page 139. 2007, "Protein: Building and Repairing Muscles".*

## **Carbohydrate Requirements**

Food containing carbohydrates (CHO) containing foods comprise long complex chains or sugars that are linked together. Carbohydrates are considered the primary source of energy and they provide the substrate called glucose which is needed to replace glycogen levels after exercise and help maintain blood glucose and prevent premature fatigue during exercise. Carbohydrates can be categorized in a variety of ways including type of carbohydrate, the level of commercial processing the food has undergone, or the blood glucose or glycemic response the body has on the carbohydrate. Carbohydrates can be termed complex carbohydrates or simple carbohydrates. Complex was thought to have these long chains of sugar digested at a slower rate than simple carbohydrates and since then that has found that to be inaccurate. In addition, complex has earned the term from its chemical structure of the carbohydrates not due to its digestibility. Complex carbohydrates have a more complex chemical structure, are less processed, and contain more nutrients such as vitamins and minerals. Commonly they are foods such as fruits, vegetables, legumes (e.g., lentils and beans), and whole grains (e.g., pasta, breads, cereals). The most dominant digestible CHO is starch but these foods offer a wide variety of vitamins and minerals such as fiber. Simple carbohydrates are commonly from processed foods that are packaged or fast foods and also foods that are high in sugar such as cakes, cookies and candies. Simple carbs commonly only contain glucose, fructose, sucrose and high-fructose corn syrup that are primarily energy dense without offering much nutritional value unless fortified into the product artificially. Overall, the big chemical difference between simple and complex is complex CHO is complex carbs have a more complex chemical structure, are less processed, and

contain more vitamin and minerals than compared to simple carbs. These classifications of carbohydrates have helped to distinguish the body's glycemic response to these carbohydrates such as low glycemic and high glycemic which can be extremely important for those who suffer from diabetes. Although, research has proven that foods both in complex or simple can be high or low glycemic and not all complex carbs are considered low glycemic options (Manore, Meyer, & Thompson, 2009). Foods that produce that produce a high glycemic response results in a quick rise in blood glucose and insulin and increases muscle glycogen more than foods that produce a low glycemic response (Manore, Meyer, & Thompson, 2009). It's important to research and educate oneself on high and low glycemic carbs if suffering from a disorder such as diabetes. Diabetes can results in the bodies resistance or insufficient ability to utilize glucose which comes from carbohydrates.

For an athlete, getting enough carbohydrates is beneficial to have enough energy and maintain and replace blood glucose level or also known as glycogen. Athletes in moderate training are encourage to eat 5 to 7 grams of CHO per pound of body weight during periods of training. Although the amount of carbohydrate that is needed can depend on the frequency, intensity, duration, and type of the exercise and the environmental conditions in which the individual is performing in (Manore, Meyer & Thompson, 2009). Also the type of carbohydrate can be crucial because healthy carbs would include such foods as breads, pastas, rice, fruit, and vegetables, dairy, beans and legumes. Although many people and especially adolescents today are consuming on a daily bases carbohydrate foods such as pizza, sodas, sweets and processed fast foods products, which is where carbohydrates have gotten a bad reputation and why many believe they are linked to obesity (Clark, 1990). The truth is carbs are a friendly fuel and the enemy and link between obesity is excess calories and living a sedentary life. Although for an



athlete, especially a developing adolescent athlete, obesity is generally not an issue but as they get older it can effect a healthy development and performance when a poor diet is present. Below is the general recommended daily allowance of carbohydrate requirements, pulled from Nancy Clark Sports Nutrition Guidebook 5<sup>th</sup> edition from table 6.4 (Clark, 1990) (Manore, Meyer & Thompson, 2009).

Table 3: Carbohydrate Requirement Intake for Adolescent Athletes Based on Exercise Intensity

(page: 123)

Amount of exercise	Grams of carbs per lb. of body weight	Grams of carbs per kg of body weight
Moderate Exercise (1 hour/dL)	2.5-3.0g	5-7g
Endurance Exercise (1-3 hours/dL)	2.5-4.5g	6-10g
Extreme Exercise (>4-5 hours/dL)	3.5-5.5g	8-12g

*Adapted from Nancy Clark's sports nutrition guidebook fifth edition from table 6.4 located on page 123, 1990 "Carbohydrate: Simplifying a Complex Topic".*

## **Fat Requirements**

Generally fat also has a bad reputation in the popular press that you'll find in such reading materials like "People or Health magazine" and people believe it is something to be avoided, but fat is important for athletic performance and overall good health. As stated above carbohydrates is the primary fuel source for the body and the human body can store and use them for later use. Fat is also a fuel source and can be used by the body during exercise. Both dietary

fats and carbohydrates are oxidized simultaneously, with the proportion of energy coming from each substrate dependent on the meal prior to exercise, energy consumed during exercise, duration, intensity, fitness level, and type of exercise being performed. For example, fat primarily becomes a fuel source when endurance performance is taking place. The body's supply of carbohydrate in the form of glycogen and blood glucose is limited and is why carbs and fat should both be included in the diet (Clark, 1990). In addition, research has helped determine that the best mix of a wholesome dietary intake should include fat, protein and carbohydrates especially for a growing and developing adolescent athlete. This mixture may change depending on an individual's personal food preferences, allergies, fitness and activity level and overall general health status (Manore et al., 2009).

Dietary fats play a crucial role in an individual's diet and is a primary energy source of fuel when a body is at rest and during exercise. Fat is highly energy dense compared to protein and carbs, providing 9 kcal/gram (protein and carbs 4 kcal/gram) and accounts for roughly 20-30% of ones dietary consumptions. Fat also provides essential fatty acids (linoleic and  $\alpha$ -linolenic acid) and fat-soluble vitamins (Vitamins A, D, E and K) which ours bodies need (Manore et al., 2009). The essential fatty acids' major role is being the precursors for many regulatory compounds within the body, while fat-soluble vitamins are required for many essential metabolic process. Fats help with the growth and development of cell membranes, hormones, parts of the brain and spinal cord tissues and fat also aids in a person's physical appearance such as soft healthy skin (Manore et al., 2009). In addition, numerous chemical compounds are found in food and within the human body that are classified as fats and also known as lipids and, apart from water fat, can be the most abundant substance in the body.

There are numerous types of fats and the body can make its own fats when an individual consumes excess calories. Also, fats can be classified in many different ways but the easiest way to classify them is between harmful dietary fat and healthy fats (Good vs. Bad). Within the category of harmful fats, there are two main types such as saturated fat and Trans fat. Saturated is a fat that comes mainly from animal source of food such as red meat, poultry and full-fat dairy products. Saturated fat can be good, when not over consumed can raise total blood cholesterol levels and LDL cholesterol levels (Low-density lipoprotein) which is linked to chronic disease such as cardiovascular diseases and diabetes.

Trans fat is a dietary fat should be avoided, although sometimes it can occur naturally in some foods in small amounts. The most abundant form of Trans fat are made from oils through a processing method called partial hydrogenation. These partially hydrogenated Trans fats can increase unhealthy LDL cholesterol and lower healthy HDL cholesterol levels (High-density lipoprotein) which is also linked to chronic disease. Foods such as beef fat, pork fat, butter, shortening and stick margarine contain either saturated fat or Trans fat and have a higher percentage of fat than any others. Trans fats become solid at room temperature and because of this they can be referred to as solid fats. In addition, a healthier form of fat includes an unsaturated form such as monounsaturated fatty acids, polyunsaturated fatty acids and omega-3 fatty acids.

Monounsaturated is a type of fat commonly found in foods and oils such as coconut oil. Eating foods rich in monounsaturated fatty acids has been linked to improving blood cholesterol levels, which can lower risk of heart disease. Also, monounsaturated fats has the benefit to controlling insulin levels and blood sugar which can be crucial for an individual suffering from diabetes. Polyunsaturated fatty acids is a fat commonly found in plant-based foods and oils.

Eating foods which contain polyunsaturated fats can help improve blood cholesterol levels and lower risk of developing heart diseases.

Omega-3 fatty acids are a type of polyunsaturated fat that is made up of mainly omega-3 fatty acids, and may be especially beneficial for a healthy heart and preventing coronary artery disease (Webb, 2012). This type of fatty acid can be found in some types of fish such as salmon, plant sources such as leafy greens and flax seeds and in supplemental form such as fish or krill oil which offer equal benefits as fish itself. Foods that are commonly made up of monounsaturated and polyunsaturated fats are liquid at room temperature such as oils. A mixture of all of these in the dietary for individuals and especially for growing and developing adolescents. Fats should account for 25-30% of total calories and the recommended amount can vary in each individual but fat is crucial in the diet for healthy growing young adolescents and any individual. Keep in mind high-fat foods may cause discomfort if eaten in too much excess or close to the start of any type of physical activity. For a growing young athlete/individual find ways to incorporate health fats such as nuts, seeds, avocado, soy, oils and dairy products (Webb, 2012).

## **Hydration Requirements**

Water acts as a lubricant that bathes every joint, muscle, tissue and cell in the human body. Its primary function is to transport compounds such as nutrients, drugs, hormones, and peptides throughout the body, so it can be said that hydration plays a big role (Clark, 1990). Moreover, since the body is primarily made up of water, staying hydrated is crucial for an individual especially an active and developing individual. For a young athlete its important to drink plenty of fluids to prevent dehydration which can drain energy, performance, coordination and lead to heat-related illness. Even a mild state of dehydration can lead to an athlete feeling off

their game, having a slight headache or decreasing their performance. It is important to hydrate with water ad lib throughout the day because thirst is not a reliable sign of hydration status and commonly thirst is a sign that the body is already dehydrated, which is why experts claim adolescents should consume water before and after 15 to 20 minutes during physical activity and after to replace any possibly fluid lost through sweat lost. Although there are the famous sports drinks such as Gatorade, Propel and PowerAde, consuming plain water is the best at keeping an adolescent hydrated. Mainly because sport drinks are designed to provide energy (glucose) and replace electrolytes such as sodium, magnesium, potassium and phosphorus that through vigorous exercise can decrease through the loss of sweat. In addition, although sports drinks aren't meant to hydrate they can be a great source of liquid energy and good choice for kids who participate in strenuous physical activity for over an hour (60-90 minutes is generally the time period when the body has used up its readily available source of energy). Milk, sport drinks and 100% fruit juices are a source of hydration and do in fact provide important nutrients the body can utilize such as calcium, vitamin C, which are great source to consume in the diet, can lead to an over access of calories and also drinks such as soft drinks which do have a source of water but lack any to no to any nutritional value (American College of Sports Medicine., 2008). Water is always the best source at achieving hydration and getting the right amount.

The recommended fluid requirements can vary in gender, age, physical stature and activity level. The chart below shows approximately how much water kids of different ages and genders need daily for proper hydration. Water can also come from beverages such as drinking water, milk, juice, and from foods. Physically active kids need more water, especially in higher temperatures.

Table 4: Hydration Requirements for Adolescent Athletes Sourced from Water, Water from Beverages and Water from Foods consumed in Cups

<b>Age</b>	<b>Total Water (approx.. in cups)</b>	<b>Water from Beverages (approx.. in cups)</b>	<b>Water from foods (Approx. in cups)</b>
<b>Children 1-3 years</b>	5.5	4	1.5
<b>Children 4-8 years</b>	7	5	2
<b>Girls 9-13 years</b>	9	7	2
<b>Boys 9-13 years</b>	10	8	2
<b>Girls 14-18 years</b>	10	8	2
<b>Boys 14-18 years</b>	14	11	3

*Adapted and Based on Total Water Adequate Intake, as set by the Institute of Medicine. "Dietary Reference Intakes for Water, Potassium, Sodium, Chloride and Sulfate", Washington, DC. The National Academics Press, 2005.*

### **Importance of Vitamin and Minerals**

Although micronutrients don't cross many peoples mind unless they are sick and are seeking vitamin C, have low bone density and need more vitamin D and calcium or are an anemic female athlete in need of more iron in their diet to name a few. They do not get as much advertising compared to carbohydrates, fat and protein. In addition, micronutrients play a crucial role in metabolism and in the maintenance of tissue function. Consuming an adequate intake is necessary although and over consumption for certain individuals can be harmful (Shenkin, 2006). Current research has found trends in today's society that point to micronutrient deficiencies such as in calcium, iron, folate, vitamin B6, and zinc commonly found in young

athletes and inadequate can be linked poor performances (Nisevich, 2008). For example, calcium is needed to aid and support bone growth, increased bone mass and aid in nerve impulses and muscle contraction. Inadequate calcium levels can lead to a decrease in bone density that can increase risk for stress fractures and other orthopedic injuries, primarily because young athlete's bones are still growing and developing and can't handle the amount of stress as an adult. To ensure proper bone health it is important to have a healthy intake of calcium of 1300 milligrams per day for children aged 9 to 18 years.

Another important micronutrient includes iron, which is known for its oxygen-carrying capacity and also plays a role in energy metabolism of carbohydrates, protein and fats. When a young athlete is inadequate in iron levels, he or she may experience performance inhibition ranging from a decrease in performance, extreme fatigue, impaired immune function, and impaired cognitive reasoning. Iron can be found in supplement form and also in red meat, enriched cereals and grains, coupled fruits and vegetables that contain high amounts of vitamin C, which is linked to better iron absorption. Too much iron can also be bad and lead to iron toxicity so it is important to be aware from what source the iron is coming (Nisevich, 2008).

B vitamins such as both vitamin B6 (pyridoxine) and folate are members of part of the B-complex of vitamins and are critical components of a healthy metabolism and blood regulation and health. Vitamin B6 and folate are crucial for amino acids (i.e., the building blocks of protein) and metabolism and can be found in enriched grain products and assorted animal products. A deficiency in these can lead to fatigue, increased muscle soreness, apathy, and loss of cognitive function. It's important to incorporate these micronutrients into the diet through whole food sources or through supplements form to avoid deficiencies.

Lastly, zinc is another crucial micronutrient and while an extreme zinc deficiency is very uncommon in the United States, young athletes can be commonly at risk due to poor consumption of foods that have an abundance in this mineral. For example, zinc can come from food sources such as red meat, seafood and fortified cereals which many adolescents don't like to consume or financially can't afford to consume. In addition, zinc plays a major role in over 300 enzymatic reactions in the body and is critical for wound healing, tissue growth and maintenance, and immune functions. A deficiency in zinc is directly related to basal metabolic rate, thyroid hormone levels, and proper protein utilization which is important for being an efficient athlete. Dietary protein helps with the absorption of zinc, which is a common problem for vegan and vegetarian athletes or those who primarily consume a grain based diet. (Nisevich, 2008).

Overall, micronutrients are crucial for many functions of the human body and living a healthy and abundant life. Micronutrients play a crucial part in both energy metabolism and in the maintenance of tissue function. An adequate intake therefore is necessary but provision of excess supplements to people who do not need them could possibly be harmful (Shenkin, 2006). For growing and developing young athletes, it is important to make sure they get their micronutrients through dietary foods or last case senior a supplement to avoid deficiencies and decrease in performance. Consuming whole foods or foods fortified in micro and even macronutrients are important and vital for an athlete to perform their best.

### **Proper Nutrient Timing, Refueling and Recovery**

Many people do not see the link between pre- and post-exercise nutrition and performance; however, what you eat before and after an exercise bout greatly affects performance and energy levels (Clark, 1990). In particular, if an athlete falls into the category of



performing over 60 minutes a day, taking care of dietary needs is vital for proper refueling and recovery processes. Children especially with their high metabolisms and never-stop-moving lifestyles it is easy for them to forget to consume a wholesome meal or snack and to disregard consumption of fluids, which are bad habits to fall into and the importance of teaching adolescents, especially athletic adolescents, nutrition education and performance can depend on how they are fueling before and after training can affect them.

When an adolescent is partaking in exercise that is over 60 minutes it is important to balance any sweat lost and energy output with enough fluids such as water and macronutrients such as carbohydrates. Doing this will keep energy levels high and blood sugar (glucose levels) within normal levels to replenish oneself and maintain stamina. Sports drinks such as Gatorade and PowerAde are popular choices for restoring carbohydrates and recovering after a workout but they can also work as energy before exercise to help maintain endurance and fight off fatigue. Although sport drinks do not provide hydration unless you water them down they can be extremely beneficial for pre and/or post exercise intake, especially for a picky athlete or child who finds it hard to consume food prior due to nerves. For example, a young athlete who doesn't like to consume solid foods a few hours before a competition or practice can opt for a sports drink to provide them energy due to the many sugars and carbohydrates contained in the beverage. The reasoning for this is because the human body is able to start to digest and utilize carbohydrates as soon as they enter the mouth, so just consuming a bit before a race or exercise can be beneficial to energy levels. In addition, the best plan though is to mix up foods and fluids to ensure the child gets a variety of macronutrients such as carbohydrates from commercial and natural foods instead of just sport drinks and other sport products. The benefits of mixing is

because different dietary sugars use different transporters and the body can absorb more sources of carbohydrates and have more fuel to support the human body for endurance exercises

### **Overcoming Obstacles**

Although many athletes, especially adolescents rely on attaining adequate nutrition for their parents/guardians. Adolescents in today's society are extremely influenced to peer and media influence and what's the latest trend. Which, with the plethora of misinformation and misleading claims that exist in the world of sports nutrition it is extremely hard to overcome and improve obstacles and nutritional status of young impressionable children. As stated in *Sports Nutrition for Young Athletes: Vital to Victory* it notes that adolescent athletes often struggle with obtaining adequate nutrition education, lack of healthy food options, and making the "right" food choices (Nisevich, 2008). It's important to take a short period of time to plan ahead and pack lunches and energy fueling snacks to fight off fatigue and decrease in performance. Although kids can sometimes be picky it is important to try new things and choose healthy energy dense foods such as oats, whole wheat products, whole granola bars, nuts, sandwiches, fresh fruit and vegetables, peanut butter, 100% fruit juices, water, and Gatorade. In addition, consulting a professional such as a Registered Dietitian for some helpful Intel would be extremely educational for a parent and young athlete and could help decrease some of the stress in planning (Nisevich, 2008).

### **Meal and Snack Planning**

Meal planning can sometimes be difficult for an adolescent and parents whose schedules are already hectic, and worry about food at home can only make it more stressful. That is why many kids and parents find it easier to stop through a drive-thru or hit up the concession stand at the meet, which most of the time one can find something healthy if motivated to eat it, although

most the time that isn't the case. Also, in the end individuals end up spending more money than they would if they would have done some meal/snack planning for a practice, competition, etc. Most athletes and parents are familiar with the general meal plan of consuming 3-5 times per day: getting enough fruits, vegetables, carbs, protein, healthy fats and paying attention to caloric intake. When meal/snack planning it's important to consider both pre-workout/competition and post-workout/competition. Pre-workout consumption should be carbohydrate-based with added protein but low in calories to avoid over consumption that can cause bloating, gas and GI discomfort. An example of a pre meal could include cereal, pasta, sandwich, fresh fruit, nuts, granola bars or veggies. Post-workout consumption can be considered the most important because without proper intake the body will not reap the benefits from the workout. The combination of exercise plus a post-workout meal is that the food allows the body to help repair and rebuild itself and store glycogen levels. This all allows the human body to remain active longer without wearing out or feeding off its energy stores. A proper post-work/competition meal consist of carbohydrates, proteins and fats and a good example of this would include chocolate milk, Greek yogurt with almonds, or banana with peanut butter. Taking time to stock up on these at home or packing in a cooler for on-the-go away competitions can be extremely beneficial to an athlete's performance and help shape a better knowledge of what the body needs to perform better. Below is a simple visual example I made of how to meal plan for an athlete and generally what foods to choose titled as "Eating to Perform". This example uses the 5-6 small meals a day rule because generally adolescent have higher metabolic rates.

Table 5: Eating to Perform an Example Daily Dietary Choices Guide

<p><u>Breakfast</u></p> <p>Protein + Veggies + Healthy Fats</p>
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<p><u>Lunch</u></p> <p>Protein + Veggies + Healthy Fats</p>
<p><u>Pre-workout</u></p> <p>Protein + Low Glycemic Carbs</p>
<p><u>Post-workout</u></p> <p>Protein + High Glycemic Carbs</p>
<p><u>Dinner</u></p> <p>Protein + High Glycemic Carbs</p>
<p><u>Post Dinner</u></p> <p>Missing Macronutrients</p>
<p><b>Examples</b></p> <p><u>Healthy Fats:</u> Olive &amp; coconut oil, avocados, salmon, nuts</p> <p><u>Saturated Fats (Fats to be limited):</u> Fried foods, sweets, fatty cuts of meat, butter</p> <p><u>Protein:</u> Protein Powders, lean boneless chicken, eggs, 95% or less lean red meat, dairy products, nuts, fish (consume a minimum of 25grams of protein each meal (Ex: 1 egg= 6 grams, 1 6oz boneless chicken= 28grams)).</p> <p><u>High Glycemic Carbs:</u> Potatoes, white bread, rice, raisins, beets, banana, oatmeal, pasta, corn flakes</p> <p><u>Low Glycemic Carbs:</u> strawberries, apples, oranges, beans, lentils, nuts, raw vegetables, all-bran cereal, whole-wheat products (bread, pasta, wraps), grapes</p>

*Example guide of dietary choices for athletes as use of a visual aid.*

## CHAPTER 3

### CONCLUSION

In summary the way children and adolescents eat and the foods they choose is not only important for healthy growth and development over their lifetime but can play a crucial role in the performance for an active athlete. Although this information usually isn't prevalent for them due to their lack of understanding, education and what the hot new thing on the television is, it's important for parents to choose the right foods for their kids and be role models themselves. Taking a few moments to teach a child, especially an active child about nutrition education can be highly beneficial in avoiding any inadequate energy intakes, malnutrition and consumption of foods pre- and post-workout if involved in sports. The purpose of this paper is to show and review the education for adolescent athletes about the importance of adequate nutrition through macro and micronutrient energy requirements, nutrient timing, overcoming obstacles and meal and snack planning for young athletes and the family. This review is consistent with Purcell's (2013) overview which illustrates energy needs, consumption, meal planning and hydration. In addition, the body can be a very complex machine and people continue to study and explore, especially with children. Which is extremely limited but with worldwide obesity increasing over the years is cause for a need to research and educate. Currently the recommended daily allowances can differ in everyone and especially for a child as they grow and develop can be extremely crucial to make sure they are getting adequate amounts. Such as it's important to have a healthy mixture of micronutrients which come from vitamins and minerals and highly important macronutrients. Protein a macronutrient that is crucial for proper growth and development can range in amounts (grams) for children, female and male from 0.7 to 1.8g/per/dL. Carbohydrates, the primary energy source for the body can be different for every

individual due to gender, genetics and physical goals. Although the general requirements based on activity level and grams of carbs per pound of body weight can range from moderate exercise (1hr/dL) at 2.5-3.0g, endurance exercise (1-3 hours/dL) at 2.5-4.5g and extreme exercise (>4-5hr/dL) at 3.5-5.5g. Lastly, fat can sometimes be seen as bad food choice but it is important to know the difference between bad and good fats and fat should make up 25-30% of a well balance diet. Along with proper hydration of primarily water can make up the components of an overall healthy dietary consumption for a child and lead into proper growth and development. Although finding the time to educate and get the kids interested in proper nutrition can be difficult it's important for a guardian to be mindful of the adolescent's consumption. To help be a role model for them and supply them with a few options of variety so they are getting adequate nutrition, especially if the adolescent is involved in athletics or has an active lifestyle. Although many don't acknowledge the link between nutrition and performance the consumption of a healthy diet can not only effective an adolescent's athletic performance but their physical change and avoiding issues in the future such as obesity and chronic diseases. More importantly making wiser choices can help everyone and leave a tremendous imprint on a child who is beginning to make their own chooses. In summary it is important, and always will be important to pay attention to what foods are being consumed and when, in order to live a healthy life where the body functions properly.

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VITA

Graduate School  
Southern Illinois University

Samantha Leigh Schneider

slschneider92@gmail.com

Southern Illinois University Carbondale  
Bachelor of Science, Human Nutrition & Dietetics, May 2014

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