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Preparing for the Game, Eating for Life: A Review of the Female Athlete Triad and Nutrition Deficiencies Amongst High Level Athletes

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Preparing for the Game, Eating for Life

A Review of the Female Athlete Triad and
Nutrition Deficiencies Amongst High Level
Athletes

By

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Abstract

In recent years, nutrition has become a topic of extensive discussion. There are books, blogs, television segments and more; the list goes on and on. Each individual has an opinion, perspective, diet, or goal. We all need to eat to fuel our bodies for everyday activities. This is an important concept for everyone to understand, but essential for athletes. To meet the high physical demands, athletes must feed themselves in a way that best fuels their bodies to perform. As a volleyball athlete, I have experienced firsthand the difficulty of developing sustainable eating habits. Female athletes are not only trying to perform athletically, but many also deal with social pressures and body image. In my own experience as a player and coach, volleyball-specific nutrition information is not easily accessible to anyone, especially young players. Without correct information, girls are more likely to develop unhealthy habits. To better understand the proper eating habits necessary for female athletes, we must investigate the barriers and consequences of inadequate nutrition. Resources must become available for athletes and coaches, to promote and develop eating behaviors that are sustainable, which will result in higher performance and better overall health. By examining proper volleyball nutrition and various barriers to implementation, this paper contributes to the larger discussion of health and sports nutrition.

Personal Interest

[What? I have an eating disorder?]

It never crossed my mind that I had an eating disorder. I ate 3 meals a day, had a few snacks, and thought I was in the clear. The Female Athlete Triad was not something I had ever heard of, and it was certainly never discussed during team meetings. Considered a “metabolic injury,” the triad consists of low energy availability, menstrual dysfunction, and low bone mineral density. Extreme dieting was okay in my mind, until I lost over a half inch in height and stopped menstruation for over 3 years.

I have been a female athlete my entire life. Starting at a young age, I played a variety of sports, but eventually settled on volleyball. I trained, competed, and pushed myself to be the best I could be: a college athlete. I spent countless hours in practice, learning the skills necessary to become a high-level volleyball player, while simultaneously struggling with the societal pressures of becoming a woman. It felt as though I was always being told what to do, in one way or another. From peers saying, *don't eat this and don't wear that*, to coaches yelling *hit that ball, run faster, do better*. I have known a variety of pressures, from athletic expectations to societal demands, I experienced it all.

My coaches trained me in the physical skills for success on the court but never addressed the skill of feeding my body to meet the physical demands. I was left to form my own eating plans and make my own judgements on nutrition. I was a health-conscious teenage girl, surrounded by friends and teammates who ate junk, while others hardly ate at all. Looking back, I wish I could tell myself to focus on creating the healthy habits that I knew were ultimately better for me, not succumb to ideals of being thin. I *knew* that my physically demanding practices and tournaments required fuel, but I let the peer and societal pressures win. I let outside factors influence my decisions.

In hindsight, I realize the torture I put my body through. The consequences of my unhealthy choices had long term effects. I want to believe if someone had reached me at the right time, with the right nutrition information, it would have made a difference - but in all honesty, I'm not sure it would have mattered. Once I began my spiral of extreme dieting, I only continued on this detrimental path. I experienced just about every form of disordered eating, from calorie tracking and fasting to binge eating and purging. I have gone from one extreme to the other, been on a healthy path only to relapse. This is not an issue that is easily overcome. Unfortunately, I still struggle with the choices I make in the kitchen. Once these behaviors begin, it is a constant battle to choose the correct path.

My personal experience is not an isolated incident, and many female athletes face similar struggles. Many athletes I know admit to their struggles with food yet still have no guidance for the appropriate amount to consume. As an athlete, you often discount the number of calories you expend because practice, competition, and weight training are a part of your everyday life. Athletes spend countless hours with their team and through discussion with teammates, occasionally, we find a common ground about our struggles. It was easy to pick up on the tendencies of other teammates, and their own unhealthy relationships with food. I'll admit some of my closest friends on each team resulted from a similar obsession with restrictive diet and over-exercise. We bonded over shared experience and unfortunately, further encouraged unhealthy behaviors. We all shared a drive to perform athletically, with a negative relationship with food and detrimental lack of sports nutrition knowledge.

Personal and societal pressures are not the only factor in determining the nutrition decisions of athletes, we must consider the role of coaches and trainers. In my own experience, I have been praised for unhealthy behaviors. During my college athletic career, I was praised by my coaches for "being healthy" and "dedicated to nutrition." On many occasions, I would skip pre- and post-game team meals, opting for a granola bar, and fly under the radar

for skipping meals. This was far from healthy or dedicated; this was obsessive and dangerous. I received praise, while many others received criticism.

Countless times, discussions with former teammates have led to the topic of specific nutritional pressures placed on them by coaching staff. Both on an individual and team level, coaches have made statements regarding weight and performance, without providing proper nutrition resources. Comments like “verticals are down, and weights are up, you need to do better,” stating, “that donut is going to look good on your hips and really help your college recruitment opportunities,” and advising that “there is no reason you shouldn’t be going out for runs after practice;” keeping in mind this is after two-hour practices and one-hour of weightlifting and conditioning. Players strive to please their coaches, as to maintain their play time, and position on the team. I happily ran miles after practice to burn calories and received praise for my commitment, drive, and leadership. I was burning over three thousand calories a day, while consuming far less than one thousand.

As a young athlete, I wanted to ignore the facts of my nutrition deficiency, but I couldn't deny the physical symptoms of inadequate eating. It wasn't until a few years into my collegiate athletic career that I was forced to recognize the conflicting goals within my diet choices and make changes. The physical demands ramped up and I understood that I was not feeding myself to athletically perform. I wish I could pinpoint one specific reason I decided to

change my behaviors, but mentally, I'd just had enough. I was exhausted from the mental and physical battle, and had spent too long denying the truth that food was not the enemy. Today, I believe nutritional training is just as important as the training on the court. If such emphasis had been made when I was younger, I can only imagine the difference it would have made in my athletic performance and overall health both physically and mentally.

Coaches are in the position of authority and have the power to alter the mindset of young players regarding their eating habits, positive or negative. If coaches do not approach the topic with sensitivity and knowledge, they can permanently alter a player's nutrition behavior, without forethought as to the long-term consequences. Coaches need education so they can act as a motivating factor for players to attain adequate nutrition. In this place of authority, coaches should learn warning signs of disordered eating, understand the barriers to proper nutrition, and view female athletes holistically as women.

Although I cannot change the nutrition choices I made as a young adult, by sharing my story, I hope to open a conversation that will aid young athletes to prevent metabolic injuries. As a former assistant coach for a group of teenage volleyball players, a passion for public health, and an athlete myself, I see a huge opportunity to create a platform through which I can aid young women in the development of correct nutrition habits. I hope this

paper will underscore the importance of nutritional information as a part of club volleyball training, partnering with club directors and coaches. I honestly believe that if I had been given nutritional information or had an easily accessible resource when I was younger, it would have lessened the consequences of my poor nutrition choices. Further, if information had been provided to me as a collegiate athlete, there might have been proactive steps taken to prevent my nutrition from getting so off track. Education is essential in the prevention of conditions like the female athlete triad.

Limitations of Study

COVID-19 has impacted our world in unexpected and long-lasting ways. Prior to the pandemic, the purpose of this project was to work alongside a group of young players, to understand their nutrition habits and aid them in developing behaviors that would best prepare them for the game and sustain a healthy lifestyle. The plan was to contact club directors to promote nutritional knowledge throughout the organization, to prevent long-lasting consequences of inadequate nutrition amongst high-level volleyball players. Through analyzing data on successful intervention and preventative methods, I hoped to educate players, coaches, and parents. In addition to working with club players and directors, I hoped to discuss nutrition amongst my own college team. Unfortunately, due to COVID-19, the 2020-2021 collegiate and club seasons were cancelled and/or cut short. The original intent of the study was no longer feasible and the focus shifted. Without the opportunity to work with young volleyball players, the project changed to an analysis of the larger issues amongst female athletes. My work is now a collective summary of nutrition, barriers, and interventions, that I hope will serve as a resource to those hoping to compete as high-level volleyball athletes.

Literature Review / Larger Context

Everyone eats. Whether for taste, energy, or social reasons, we all must consume food. We learn and develop the knowledge to fuel our bodies as we age and eventually develop habits - good and bad. We are influenced by a variety of factors including peers, parents, and society, the same is true for athletes. However, as an athlete, food consumption is essential to performance and long-term health. Developing habits to properly fuel your body is imperative. The digested food goes directly to the creation of energy necessary for practices, games, and performance (Holway & Spriet, 2011). Young players face the same challenges as everyone else but have greater consequences for improper nutrition.

Outside pressures and standards often influence the eating decisions of young athletes, specifically teenage girls. Many teenage girls face societal pressures to be thin or “in shape,” and as an athlete, these pressures are intensified. Athletes may intentionally or unintentionally consume inadequate calories. Many are not educated in the realm of nutrition and underestimate their nutritional needs. However, a more common behavior among female athletes is intentional disordered eating. These behaviors include, “anorexia nervosa [AN], bulimia nervosa [BN], binge-eating disorder, and feeding and eating conditions” (Coelho et al., 2014). Behaviors leading to

these disorders include “starvation, fasting, frequently skipping meals, overeating, and binge-eating followed by purging, as well as the use of diet pills, laxatives, diuretics, and even excessive exercise” (Coelho et al., 2014). The term, anorexia athletica, has been coined to describe sports anorexia but is also known as hypergymnasia. This specific eating disorder is characterized by excessive and compulsive exercise. Athletes with this specific disorder may exercise multiple times a day, without consuming nearly enough calories to properly function, and further perform in their sporting event.

Many female sports place importance on leanness or specific stature, including figure skating, gymnastics, swimming, and volleyball. Often, uniforms are form-fitting and provide minimal coverage. Participation in these, “aesthetic” sports is considered a risk factor for eating disorders, body image issues, and inadequate calorie consumption. The prevalence of eating disorders among female athletes is significant, ranging from 0%-27%, with many cases undiagnosed or unreported (Coelho et al., 2014). The estimate of all eating disorders among female athletes reaches up to 62% (Coelho et al., 2014). A study conducted in Norway found that of 970 female participants, 522 athletes and 448 nonathletic controls, 18% of the athletes studied had clinically diagnosed eating disorders, compared to the 5% of controls (Coelho et al., 2014). This is a significant difference, demonstrating the elevated risks that female athletes face. Female athletes often fly under the radar in regard

to disordered eating because of their physique (Coelho et al., 2014). Many athletes are already lean and muscular, but health professionals and coaches must question how they maintain such body type and the extremes to which these individuals are willing to go to maintain; or even further “slim down.”

Although female athletes are an at risk population, this does not discredit the risks of eating disorders that non-athletes face. A study conducted by Mark Reinking and Laura Alexander at a large Midwestern University, found that non-athlete college students displayed higher rates of body dissatisfaction compared to collegiate athletes. Of the 146 undergraduate students studied, 84 athletes and 62 nonathletes, only 7.1% of the athletes compared to 12.9% of the nonathletes were identified as a female at risk of disordered eating (Reinking & Alexander, 2005). However, of the athletes at risk, 25% of them were found to be “lean-sport athletes” (Reinking & Alexander, 2005). This data is an important contribution to the discussion but must be considered with the limitations in mind. The researchers mentioned that all participants were volunteers, recruited by a convenience sample. Additionally, the information was self-reported, leading to potential reporter bias. This study is not conducted to derive any concerns related to the totality of disordered eating among females, but simply to study the direct relationship between sports and body image issues.

Looking directly into the nutritional needs of volleyball players, we must consider the specific pressures they face. Volleyball is a demanding sport, both physically and mentally. As an anaerobic sport, “volleyball student-athletes maintain a high muscle mass-to-fat ratio and work hard to achieve a balance between strength, speed, endurance and skill” (North Collegiate Athletic Association, 2014). Coaches, parents, and teammates, all impose various demands on these young players. In fact, coaches were found to be the “the most influential individuals in motivating athletes for dieting behaviors” (Patel et al., 2003). Intense pressure is placed on young women to maintain a certain body image of thinness. In a study of 23 elite adolescent volleyball athletes, 52% considered themselves overweight and desired to lose from 10-20 pounds, regardless of meeting a healthy standard of Body Mass Index (BMI). Of these players, 40% reported high body dissatisfaction scores, 15% reported use of diet pills, 26% reported fasting, and 10% reported vomiting, all for weight control (Beals, 2002). Jesse Steinfeldt of Indiana University found that volleyball uniforms directly affect the body image of female collegiate volleyball players. The tight, revealing jerseys intensify body issues and distract players, impacting their overall court performance (Steinfeldt et al., 2012). This research exemplifies the risks that young volleyball players have to developing eating and body image issues.

Volleyball nutrition is an under-researched field. Although much of the nutrition information for young athletes can be generalized, there is minimal study on volleyball specifically. As a high intensity sport, there are certain speed requirements and demands on large muscle groups. Volleyball athletes competing at high levels have caloric expenditures ranging from 2509-4072 (Valliant et al., 2012). With such high energy expenditures, players must intake energy equal to or greater than that expended, in order to maintain an energy balance. When energy consumption is not in balance with energy expenditures, players may experience fatigue, poor performance, and other long-term consequences - such as the female athlete triad. Additionally, players must consume adequate macronutrients to “sufficiently replenish glycogen stores” (Valliant et al., 2012). This means volleyball players must eat a calorie dense diet, balanced in carbohydrates, proteins, and fats.

In light of these societal pressures and energy inefficiencies, we must question how young athletes learn to fuel themselves. There are various resources available, yet studies show that volleyball players are not accessing the information. The University of Mississippi studied 11 NCAA Division 1 volleyball players. Even at this elite level, the girls studied consumed only *half* of the calories needed to meet their energy requirements (Valliant et al., 2012). Their diets lacked a balance of all macronutrients, especially carbohydrates, which are essential for muscle glycogen storage. As a result,

the players studied were at a high risk of energy deficiency consequences. The researchers imposed an intervention, educating players on proper nutrition and periodically checked their progress. The players who retained and implemented the nutrition knowledge, made significant improvements in energy consumption. Although they did not completely meet the nutritional recommendations, they were significantly closer than those that did not receive the intervention (Valliant et al., 2012). Valliant and her team demonstrated that interventions regarding nutrition information have an influence on the eating behaviors of elite female volleyball athletes.

The predisposition of nutritional deficiencies among female athletes has been examined by many scholars. Information about proper nutrition is often not provided in an adequate timeline. In most cases athletes have established eating behaviors without any form of nutrition education. Beginning at the initiation of athletic training, nutrition should be integrated into the coaching and training of any sport. Many young athletes are left to receive information from their parents or seek it out themselves. If parents are not properly informed, young players will not have the opportunity to develop proper nutrition behaviors.

Without adequate nutrition, young women are at risk for serious health consequences, ranging from poor performance, to the extreme case of the female athlete triad. The triad is a condition that occurs when individuals

consistently expend more energy than they consume. Conditions of the female athlete triad include low energy, menstrual dysfunction, and low bone mineral density. This condition is considered a metabolic injury that can occur “with or without disordered eating” (Powell, 2011). The triad is not a simple diagnosis as many females see symptoms on a spectrum (Daily, 2018). Although the triad typically affects highly competitive athletes, it can also impact athletes at all experience levels. The most common symptom of the female athlete triad is low energy availability, and the most extreme is the long-term effect on bone density, which occurs in 10-20% of female athletes (Powell, 2011). A study conducted by Jenna Gibbs at Pennsylvania State University, examined the prevalence of the triad among different types of female athletes. The study found “the prevalence of all 3 components, [low energy, menstrual dysfunction, and low bone mineral density], as well as each individual component was higher in lean sport athletes compared with non-lean sport athletes” (Daily, 2018). Gibbs and her colleagues also found additional risk factors of the triad were “vegetarians, and those who limit the types of food they consume” (Daily, 2018).

To diagnose the triad, a screening process has been developed for pre-participation and annual health exams. One example of a screening exam is the “Triad Consensus Panel Screening Questionnaire, published in British Journal of Sports Medicine and Current Sports Medicine Report in 2014”

(Daily, 2018). To be proactive in diagnosis, physicians, coaches, and athletic trainers should be aware of the physical indicators of the triad, including “fatigue, declining performance, recurrent injury, or illnesses” (Daily, 2018). Extreme cases may show signs of lanugo, hair loss, dry skin, brittle hair and nails, callus or abrasion on back of hand (from induced vomiting), bradycardia, and swollen parotid glands (Daily, 2018). Post diagnosis, the athlete will need to undergo “laboratory testing, cardiac work-up, and imaging,” to determine the true extent of the damage and initiate plans of treatment (Daily, 2018).

Treating the female athlete triad is a delicate balance. Depending on the root and extent of the issue, connected to intentional or unintentional nutritional deficiencies, each athlete will need to receive a different care plan. First and foremost, “natural menstruation needs to be restored,” if the athlete has lost such due to the triad (Powell, 2011). This is achieved primarily through an increase in caloric intake and a reduction of physical activity. For athletes, sitting out of their sport can be a motivator for change on its own. If the athlete is intentionally reducing calories to lose weight, a deeper issue may need to be resolved. Eating disorders often need specific treatment, including therapy. One recommendation by the American Physical Therapy Association is a replacement of cardiovascular training for strength training.

Strength training “results in skeletal adaptations due to new loading patterns that ultimately are beneficial for bone strength” (Daily, 2018).

The key preventative measure of the triad is increased awareness. All individuals, from “health care team, athletic administrators, coaches, and parents, as well as athletes should have education regarding identification of risk factors for the triad as well as the 3 components of the triad” (Daily, 2018). Awareness of symptoms and risk factors is essential to prevent further metabolic injury to athletes. Young players often do not have the knowledge or experience to self-identify as at risk. Those overseeing athletes should seek to be a resource or advisor to help players navigate the difficult process of developing nutrition habits.

Volleyball Specific Nutrition

There are many different aspects of sports nutrition, and each athlete has different caloric and nutrient needs. High intensity, lean, and endurance sports all have a different balance of energy requirements, and each participating athlete needs a nutrition plan that matches their energy expenditure (Holway & Spriet, 2011). Analyzing the energy expenditure of high-level volleyball athletes can be difficult because endurance, leanness, and quick movement are all important for peak performance. Volleyball is “a high intensity game requiring speed and large muscle groups for actions such as jumping, spiking, blocking, and retrieving the ball” (Valiant, et al., 2012). A lean structure and “high level of muscle mass,” is considered the desired body composition for these athletes (North Collegiate Athletic Association, 2014). In order to achieve such body composition and optimal performance, specific nutritional standards must be met.

There is a large difference between high-level and recreational volleyball competition. A high-level, or high-performance athlete, is defined as “one who participates in an organized team or individual sport that requires regular competition against others as a central component, places a high premium on excellence and achievement, and requires some form of systematic (and usually intense) training” (Araujo, 2016). There are many

different factors that must be considered when defining the appropriate nutrition for these athletes, including number of practices and competition per week, timeline of the competition season (pre, post, or during competition), and player position. In addition to activity rate, the basal metabolic rate, thermic effect of food, and thermic effect of activity will further determine an individual athlete's energy requirements (Sjoberg, 2015). The Food and Drug Administration (FDA) recommends that active females, ages 14-30, need to consume approximately 2,400 calories per day (Food and Drug Administration, 2020). The FDA defines active as reaching a level of "physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living" (Food and Drug Administration, 2020). Athletes far exceed this level of activity and Nanna Meyer, an Olympic athlete sports dietitian, recommends that individuals participating in team sports need to consume between 3,000 to 4,500 calories per day (Schuna, 2018). Caloric intake is often spoken of in a general range, as there are many variables that come into play when determining energy needs. If we analyze a typical volleyball practice, we can build our understanding of the average caloric output of a player on a daily basis, to further expand our understanding of competition and off-season training.

A typical volleyball practice averages from 60 to 240 minutes, 5-6 days per week (Mielgo-Ayuso et al., 2015). These practices include a variety of activities including jumping, diving, swinging, and sprinting. One study, conducted by Christine Sjoberg at the University of Nebraska Omaha, focused on analyzing the bioenergetic components of 12 players of the University's volleyball team. In the 3-week study, players wore a "portable metabolic measurement device for approximately 45 min during their regularly scheduled team practice sessions" to examine the average output of energy. The metabolic measurement devices "measure[d] the VO₂ and analyze[d] the expired air during training" which allowed for estimation of kilocalorie (kcal) expenditure (Sjoberg, 2015). The term kcal, or a kilocalorie, refers to the "the amount of heat required to raise the temperature of 1 kilogram of water one degree Celsius," but "one kilocalorie is the same as one calorie" (United States Department of Agriculture 2018). The study found that "the mean energy cost during on-court data collection was 419 ± 85 kcal" (Sjoberg, 2015). When applied to a 2-hour practice session, Sjoberg stated that the average energy expenditure amongst all players was 1070 kcal. Further analysis "revealed a mean daily energy cost of 3630 ± 442 kcal" (Sjoberg, 2015). The study was conducted during off-season training and included an analysis of each players height, weight, and body fat percentage, while also considering the dietary intake of each player. In light of the high energy expenditures realized in the

study, Sjoberg found that the players were consistently at “48.7% negative energy balance” (Sjoberg, 2015). Study of diet logs showed an average energy intake of 1861 ± 516 kcal. Self-reporting bias may have played a role in skewing the results of the energy imbalance, but it is safe to assume there is a significant discrepancy between energy expenditure and energy intake (Sjoberg, 2015). A continuous negative balance in energy intake can lead to poor athletic performance and unforeseen health consequences. The energy output demonstrated in this study of offseason training, is only increased in the competition season.

There is a significant difference between a college competition season and a youth club competition season. Collegiate volleyball typically begins in August and extends through the beginning of December (NCSA). There are approximately 30 games in the regular season, with championships occurring at the end of December. Each game is best 3 of 5 sets, to 25 points, and the winning team must win by at least two points. If the game is pushed to 5 sets, the final set is to 15 points, with the same win by two requirements. A set typically lasts between 20 and 25 minutes, with an entire volleyball match averaging from 60 to 90 minutes (NCSA). Most often, collegiate teams play just one game a day, unless the competition is a structured tournament. Alternatively, the club volleyball season has a much different structure. Most players compete in their high school program, which has a similar set up to

collegiate volleyball. Club season, however, begins with tryouts in November and competition season begins in January. Competition for club volleyball players is in the form of tournaments, which can be all day, or even multi-day events. Teams may play between 4 and 7 games per tournament day. Each match is best 2 out of 3, with each set to 25, except for the third which is limited to 15 points, with the same win by two rules. Club games last between 45 and 60 minutes (NCSA). The differences between collegiate and club volleyball competition are important to consider when determining proper nutrition for each of these groups. Collegiate volleyball is more intense for a shorter period of time, but high-level club tournaments require energy for a longer amount of time. These factors influence meal timing, habit formation, and competition preparation.

Considering the demonstrated caloric output of a volleyball athlete, we must now determine how to calculate the proper amount of consumption for these high-level athletes. To achieve optimal athletic performance and physical well-being, energy balance is critical. Energy balance “occurs when energy intake equals energy expended” (Valliant et al., 2012). Based on the University of Nebraska Omaha study, we can predict an average energy expenditure of 1070 kcal for a two-hour session of high-level volleyball play. This is in addition to normal daily activities, which bring the daily energy output between 3188-4072 kcal (Sjoberg, 2015). However, not every

individual necessarily uses this amount of energy. The energy recommendations for high level volleyball athletes, during competition season, can be estimated with the figures of 50-80 kcal per 1 kilogram of body weight (Mielgo-Ayuso et al., 2015), in order to “support high levels of fat free mass and thus to maintain body weight” (Valliant et al., 2012). For example, a female volleyball player who weighs 150 pounds or 68.04 kilograms, should consume between 3402-5443 kcal to maintain weight and create an energy balance. Off season training requires less intense energy requirements, with an estimation of 39-44 kcal per 1 kilogram of body weight (Valliant et al., 2012). The same 150 pound female would then only need to consume between 2654-2994 kcal for energy balance. Preseason training, in preparation for the competition season, has demonstrated that athletes “may burn near double the amount of calories as they do during regular competition as a result of two and three a day training sessions” (Holway & Spriet, 2011).

Proper energy intake is important, but the quality of food and balance of nutrients is also crucial to athletic performance. Food can be broken down into three categories: carbohydrates, proteins, and fats. A female volleyball player's diet should generally consist of 45-65% carbohydrates, 10-30% proteins, and 25-35% fats (Holway & Spriet, 2011). More specifically, volleyball athletes are recommended to consume 1.6-1.8 grams of protein per

kilogram of body weight, 5-8 grams of carbohydrates per kilogram of body weight, and 20%–35% of total kilocalories should come from fat, in order “to appropriately meet the demands of performance.” (Mielgo-Ayuso et al., 2015). Our 150 pound female example, would then need to consume 109-123 grams of protein per day, 340-544 grams of carbohydrates, and 680-1905 kcal of fats. Carbohydrate intake is essential because glycogen stores are the primary source of energy and after expenditure must be recovered.

In light of the macronutrient parameters, micronutrients are also of importance. Specific minerals and vitamins do not provide the body with energy but are “essential nutrient[s] to maintain the body's normal life activities” (Yan, 2015). Minerals needed include calcium, phosphorus, iron, magnesium, potassium, and sodium, while vitamins include Vitamin A, Vitamin B1, Vitamin B2, Vitamin C, Vitamin D, Vitamin PP, and Vitamin E (Yan, 2015). Each of these vitamins and minerals need to be maintained to ensure optimal health. With such high energy expenditures, these micronutrients “need to be constantly replenished from the diet in order to maintain a balance” (Yan, 2015). A well-rounded diet will provide adequate consumption of these nutrients, but awareness should be present to avoid deficiencies.

Fluids are another essential portion of proper nutrition. Players should be consistently drinking water, not just during competition or training (Holway & Spriet, 2011). Proper hydration is essential to athletic

performance because “fluids help to regulate body temperature and replace sweat losses during exercise” (Purcell, 2013). Inadequate fluid intake can lead to poor performance, heat exhaustion, and even heat stroke (Purcell, 2013). Specific fluid intake is correlated to age and body size, but 2-3 hours prior to activity, athletes should consume 400-600 mL of water and during activity 150-300 mL every 15-20 minutes. Post activity “athletes should drink enough fluid to replace sweat losses,” which is approximately 1.5 L per kg of weight lost (Purcell, 2013) and “sports drinks containing 6% carbohydrates and 20 mEq/L to 30 mEq/L of sodium chloride are recommended to replace energy stores and fluid/electrolyte losses” (Purcell, 2013). It is important to consume appropriate amounts of fluids but not to over consume because this may prevent consuming adequate calories and nutrients” (NCAA, 2014). On average, athletes should aim to consume half of their body weight in ounces of water per day (Team USA, 2018). For example, a 150 pound athlete should aim to consume 75 ounces of water per day.

To compete at peak performance, the timing of meals plays a crucial role. Considering that food provides energy, athletes must consume their meals at an appropriate time to allow the body enough time for digestion and conversion to energy. Days before competition, a volleyball player should focus on consuming a high carbohydrate diet to ensure glycogen stores (Valliant et al., 2012). The day of a competition, a pregame meal containing

low fat and fiber, a moderate amount of high-quality protein, whole-grain starchy carbohydrates, and adequate fluids, should be consumed 3-4 hours before competition (NCAA, 2014). Pre-game meals should be considerate of potential gastrointestinal consequences, including nausea, stomach cramping, gas production, sluggishness, and slow digestibility. Each athlete will digest ingredients differently and should choose a pregame meal that will best fuel their body. An example of an appropriate and balanced pregame meal is “3-6 oz Chicken breast, rice or pasta, cooked or raw vegetables, 1% Milk, and fresh fruit” (NCAA, 2014). Morning competition should be treated in the same regard for digestion timing. A breakfast of “oatmeal with nuts and fresh fruit, with a serving of yogurt and glass of milk or juice,” will provide energy, without impeding performance (NCAA, 2014). An hour before competition, a snack between 100-200 kcal may be consumed (NCAA, 2014). This is not necessary but is a personal preference that provides a quick supply of energy prior to competition by increasing glycogen stores in the liver (Gamage & Silva, 2014). During competition, food and hydration remains important, “in order to maintain muscle glycogen stores and uninterrupted fuel supply” (Gamage & Silva, 2014). Volleyball’s anaerobic nature of explosive movements requires a lot of stamina, which makes during game snacks beneficial to athletes. Small bench snacks, like fruit, sports drinks, gels, and/or bars, are a perfect way to supply energy, without causing digestion

problems. Players should take advantage of the time they have off the court to fuel their bodies with food and liquid. During game snacks should be small and “very low in fat, fiber and protein” (NCAA, 2014). Post-game meals are very important to replenish energy lost in competition. Travel, media interactions, team debriefings, or personal physical therapies, “should not delay initiating recovery nutrition strategies” (NCAA, 2014). Those that had playing time more than 60 minutes should consume food as soon as possible after competition, ideally within 30 minutes. Immediately after competition, players should consume foods that are high in carbohydrates to initiate the recovery process (NCAA, 2014). This can include snacks like pretzels, granola bars, smoothies, or any other high carbohydrate food. A meal should be consumed within two hours after a competition, along with adequate hydration recovery. Carbohydrates and proteins are the most important elements of post-game nutrition because they replenish diminished glycogen stores and repair muscle tissue (Gamage & Silva, 2014). It is recommended that post-game, players consume “1.5 grams of carbohydrate per kilogram of body weight” to recover glycogen stores (NCAA, 2014) and between 15-25 grams of protein (Gamage & Silva, 2014). Timing of competition can play a role in the meal that is consumed, whether it be lunch, dinner, or an additional meal, but the highlighted nutrient elements should be attained to ensure recovery.

Barriers to Proper Nutrition

In light of the consequences outlined for improper nutrition, it is important to identify the key barriers that prevent female athletes from attaining sufficient nutrition. Although these individuals are competitive athletes, they are still women. The societal pressures women face to attain a slender body and achieve certain physical ideals, is historically prevalent. A drive for thinness has impacted generations of women. Body image is defined as “perceptions and attitudes about one’s body, particularly physical appearance, and has been described as a complex social construct shaped by context and gender socialization experiences” (Gamage & Silva, 2014). The media plays a significant role in “over-exposing people to thinness ideals” and turned “this ideal into a new reference standard” (Jiotsa et al., 2021). These publicized ideals do not alone result in poor body image but raise issues when individuals internalize standards of thinness and begin to evaluate themselves based on these standards. “Body dissatisfaction is characterized by an inconsistency between one’s real body and the idealized body,” and can play a large role in one’s body image (Jiotsa et al., 2021). Television, magazines, newspapers, and other forms of traditional media have propagated these ideals, and currently, social media is a major driver in publicizing these standards.

Social media “refers to every website and online mobile app with user-generated content” (Jiotsa et al., 2021). User generated content can vary in form, through various avenues, which include Facebook, Instagram, Snapchat, Twitter, and TikTok. Each individual on these platforms has the freedom to post pictures or updates, follow their friends, and build a social network. However, with these freedoms, comes exposure to thinness ideals and a culture of comparison. For example, a young girl may create an Instagram page and follow only lean, tall, swimsuit models. The content that she is ingesting, creates the viewpoint that this is the way a woman should look. The photos she sees may be heavily photoshopped and airbrushed, but to her, this is real, and this is what a woman should look like. Consequently, there will be an internalized standard of thinness and the young girl may begin to compare herself against this standard. This is not to say that individuals should be limited in their personal posting freedoms, but simply point out that body dissatisfaction and drive for thinness increases, when social comparison is present. Through the expansion of social media in recent years, social comparison and promotion of thin ideals is more present than before. There is constant access to images of an ideal physique, which can disrupt an individual’s perception of their own body and health.

An article, published in the *International Journal of Environmental Research and Public Health*, studied the relationship between social media

use and body image disorders, in relation to social comparison and eating disorder behaviors (Jiotsa et al., 2021). The results of the study demonstrated that “using platforms such as Facebook and Instagram has been particularly associated with a higher body dissatisfaction and the appearance of ED symptoms” (Jiotsa et al., 2021). Subjects of the study were observed to “yearn for a thinner body ideal than the general population, thus creating a substantial inconsistency between what they think they look like and what they yearn to look like” (Jiotsa et al., 2021). The study also commented that as body dissatisfaction and social comparison increased, individuals experienced more thoughts centered on diet and physical activity. Western culture has been found to combine the concept of femininity with “images of thin bodies and subsequent pressure to conform to appearance-related norms have been found to affect body satisfaction and weight control behaviors” (Jiotsa et al., 2021). Those that were more active on social media, had an “authentic concern for one’s physical appearance, which will be observed and judged by others” (Jiotsa et al., 2021). The authors concluded that “widespread use of social media in teenagers and young adults could increase body dissatisfaction as well as their drive for thinness, therefore rendering them more vulnerable to eating disorders” (Jiotsa, et al., 2021). Investigation of diet in this study showed that individuals began “ingesting smaller portions, eating healthier food, [and had] major food restrictions and

complete removal of some types of food,” all of which is behavior found in eating disorders (Jiotsa et al., 2021). This study was conducted on a population of 1331 people and did not specify athletic status. However, the conclusions are widely applicable to the population of young individuals as a whole. Young athletes also face the social pressures of thinness and body comparison and may even have further struggles with body image than non-athletes as a result of “the socially desirable body type and the athletic body type often conflict[ing]” (Steinfeldt et al., 2012).

In addition to social comparison to individual social media accounts, there is also a large portion of fitness social media platforms that promote behaviors in the name of well-being and weight loss which lack credibility. Anyone can create content about nutrition substantiation or base knowledge. *Drink this special juice to lose the weight, complete this 10-minute workout every day for abs*, and many more, all encourage a diet culture of weight loss and thin ideals.

The culturally accepted physique of a woman does not align with the muscular demands of being a high-level athlete. Jesse A. Steinfeldt of Indiana University found a large discrepancy “between female athletes’ beliefs about their athletic body and the societally desired female body type,” which resulted in negative body attitudes and concerns (Steinfeldt et al., 2012). Many female athletes recognize that in order to succeed at their sport, they

need to be strong, powerful, and muscular, but this does not diminish the larger social comparison to non-athletes and those that match the socially constructed physical ideals. Steinfeldt further found that when standing among fellow athletes, female athletes reported a positive body image, yet, in a social environment, “reported negative body image and maladaptive behaviors” (Steinfeldt et al., 2012). There was a fear of looking masculine, as a result of muscle and athletic physique. Such beliefs and societal pressures may act as a barrier to proper nutrition, for both athletes and non-athletes, who strive to meet the unrealistic standards of thinness. With the goal of a slender body in mind, female athletes may sacrifice their overall nutrition in order to achieve the body they desire; one that has been promoted through the media.

Another area that creates a barrier for female athletes, especially volleyball, is sports uniforms. The short spandex shorts and form fitting jerseys have been found to further promote body dissatisfaction (Steinfeldt et al., 2012). Other aesthetic sports, like figure skating, gymnastics, and swimming, must also combat physical pressure placed on athletes by exposure through uniform. Jesse Steinfeldt and her colleagues published an article titled “The Role of Uniforms in the Body Image of Female College Volleyball Players,” which analyzes specific body image issues related to volleyball specific uniforms. The researchers interviewed a group of Division I

volleyball players from a large Midwestern University (Steinfeldt et al., 2012). The key themes the players relayed in connection to their uniform and body image were “expectations of volleyball body/uniform, uniform distraction/affirmation, perceptions of others’ comments, and social comparison” (Steinfeldt et al., 2012). The researchers found that players perceived specific expectations of their bodies and how it *should* look in their uniforms. Specific expectations were categorized into four key areas of a “purposeful body, athletic, fit, and self- assured, desire to be comfortable, and transition to spandex” (Steinfeldt et al., 2012). Players stated that having a muscular and athletic physique made them feel confident on the court, but they also described the expectation that their body would be fit and slim. Players in the study “discussed the difficulties they faced in worrying about how they look in their spandex uniform, especially when this focus takes attention away from their on-court performance” (Steinfeldt et al., 2012). For many, the uniform was too tight, for no justifiable reason. One athlete stated, “not all girls have like the right body for it, or they feel so self- conscious about it. And I feel like, why do you have to feel like that? You shouldn’t have to worry about how you look in the uniform. You should only have to worry about how you are going to play, and like, focus on the game” (Steinfeldt et al., 2012). The discomfort of the uniform can impede athletic performance, or even further, drive a need for thinness.

Transitioning to spandex can be a memorable experience, in fact, each athlete was able to comment on the moment they began wearing spandex. Commentary on the topic aligned with a general discomfort of the revealing athletic clothing. Girls transitioned from basketball or running shorts to short, tight, volleyball shorts. One player recounted thinking, “should I even go out in public in this?” (Steinfeldt et al., 2012). Players mentioned that in their uniform, they felt like “everything is hanging out” and it “shows all imperfections” (Steinfeldt et al., 2012). Body image was highly connected to the statements players made in interviews. One player said, “there is no room to hide anything. If you have one imperfection, everybody is going to see it, so you’d have to be really okay with yourself to not have to worry about that” (Steinfeldt et al., 2012). The players shared a hyper-awareness of their bodies during games and warmups, feeling that the small and tight jersey’s brought attention to their insecurities. The revealing nature of the jerseys promotes a desire for a specific body image, with one player stating, “I would be worried, pulling my spandex down so I wasn’t falling out of them or pulling my jersey down so people wouldn’t see my stomach or my hips,” and another mentioning, “I have to be skinny, and I have to be toned for these uniforms to look right” (Steinfeldt et al., 2012).

Players also shared the pressure to fit the body type that was expressed by coaches. Coaches have one of the most influential roles in

shaping a player's body image and nutrition habits. Through Steinfeldt's study, players shared conversations with coaches that influenced their body image and drive for thinness. One player stated that her coach told the team they "had smaller uniforms so that everyone would want to lose weight or look better" (Steinfeldt et al., 2012). She went further to say that her coach wanted the team to "be aware of [their] bodies and want to look a certain way" (Steinfeldt et al., 2012). These messages from their coach "affected players' perceptions of both their appearance and their performance" (Steinfeldt et al., 2012). Coaches walk a fine line when communicating weight related messages to players. Expressing concern for performance in relation to weight, is a challenging subject. Another study, titled Eating Disorders in Adolescent Athletes, found that a "teacher or coach was the most influential individual in motivating the athletes for dieting behaviors" (Patel et al., 2003). This study analyzed young athletes, both male and female, across all sports, and found that players collectively felt the most pressure from coaches in relation to their weight. The study directly connected the pressure of coaches to increased behaviors of "weight-control practices and eating disorders" (Patel et al., 2003). The important factor is emphasizing coaches learn how to communicate concern, without triggering unhealthy behavior.

The perceptions of the players' bodies in Steinfeldt's study were realistic for the most part, in that they were aware they needed more muscle

to athletically perform, but this did not prevent a longing for the socially accepted female physique. Muscle and strength were described by players as more masculine, which led to personal insecurity. Players shared that they compared themselves to non-athletes and felt “a little more on the manly side,” because they were not petite (Steinfeldt et al., 2012). Participants also recounted comparing themselves to other players, both their competition and teammates. Physical comparisons were made, based on how others looked in spandex jerseys and “participants reported how spandex uniforms made them particularly aware of weight and of certain body parts” (Steinfeldt et al., 2012).

All of these factors contribute as a barrier to proper nutrition. Athletes may choose to go on a diet, skip meals, or over-exercise to “look good” in their uniform. Volleyball uniforms promote a specific body image that many girls do not naturally have. Steinfeldt concluded her study by mentioning that each of the participants were in the “normal weight” range of BMI and compared to U.S. National averages, the players interviewed “were six inches taller but weighed 4 pounds less than” the average woman (Steinfeldt et al., 2012). In light of this, the players collectively “reported feeling concerned with how their bodies looked, particularly in revealing sports uniforms” and “within social contexts outside of sport” (Steinfeldt et al., 2012). Volleyball

uniforms and athlete body image stand as large risk factors for inadequate nutrition and disordered eating behaviors.

Although some volleyball players cultivate unhealthy diets in pursuit of a specific body image, others unknowingly harm their body. Nutrition is a topic that is often left out of discussion amongst athletes. Several studies investigated the nutritional knowledge of high-level volleyball players and collectively found that athletes lack appropriate knowledge for fueling their bodies. Melinda Valliant and several colleagues at the University of Mississippi, studied 11 NCAA Division I female volleyball players to evaluate “dietary intake, nutrition knowledge, and [decide] whether education improves dietary intake of collegiate female volleyball players” (Valliant et al., 2012). Two off seasons were studied, with the first documenting players nutrition habits and the second imposing intervention. Through this, researchers were able to determine the nutritional knowledge of players. Prior to a nutritional intervention, “54.5% of participants described their eating habits as fair with nearly 50% reporting a diet based on a wide variety of different foods” (Valliant et al., 2012). However, upon observation, the researchers found that none of the players were in an energy balance and “the average percent of energy intake for the team at the beginning of the season was 56% of estimated needs” (Valliant et al., 2012). A sports nutrition knowledge survey was given as a pre-test before the study, and players

scored an average of 24.7 (± 5.9) out of a possible 55 points (Valliant et al., 2012). Valliant was able to demonstrate that the participants did not have the proper knowledge for sports specific nutrition and were underestimating their nutritional needs. Further, more than 50% of participants reported wanting to lose weight, and the same amount reported not knowing the “appropriate number of calories to restrict for weight loss” (Valliant et al., 2012). Each of the participants were unaware they were in an energy deficit, so further attempts to lose weight only further harmed the athlete. Another study, published in the Journal of the International Society of Sports Nutrition, conducted a similar sports nutritional knowledge survey amongst another group of 12 Division I female volleyball players, which yielded comparable results (Cortez et al., 2011). The participants of this study “scored 38% \pm 12% of the answers correct on a nutrition questionnaire while ranking water (hydration), protein and then carbohydrate in order of importance to maximizing sport performance” (Cortez et al., 2011). Of the players studied, 75% demonstrated concerns for weight gain and “either agreed or strongly agreed that they would like to change the way their body looks” (Cortez et al., 2011). Both of these studies demonstrate a lack of sports centered nutritional knowledge, while also showing the desire of players to lose weight. The lack of knowledge surrounding healthy weight loss behaviors, speaks further to the nutritional deficiencies amongst high level female volleyball athletes.

Outlined are just a few of the barriers that influence a volleyball athlete's relationship with food and nutrition. It is not as simple as telling an athlete to eat more or stop comparing herself to others, because the barriers are complex and impact each individual differently. Coaches play one of the biggest roles and can be a positive influence for overall health, or a detriment to body image and nutrition. It is difficult to counteract the pressures that all girls, including athletes, face, in light of social media and a popularized drive for thinness. Education programs have shown to be the most effective form of intervention. Athletes need to learn the importance of proper nutrition, while recognizing the flaws of their current behaviors.

Successful Interventions

The consequences of inadequate nutrition are extensive and can be dangerous. To counter the barriers to proper nutrition - which include societal pressure, uniforms, coaches, and lack of knowledge - several interventions have had success. As mentioned above, Melinda Valliant and her colleagues implemented an intervention amongst 11 Division I female volleyball players. The methods of intervention were designed to give each player nutritional information, specific to themselves, based on the Nutrition Data Systems for Research, which is a computerized nutrient analysis program. Each player tracked their food 3 days a week, one weekend and two weekdays, to monitor nutritional intake based on provided recommendations (Valliant et al., 2012). In addition to the personalized nutrition plan, each player also met with a registered dietitian four times during the intervention process to check each athlete's progress. Prior to intervention, the participants consumed an average of 56% of required energy, with a range of 25% to 88% (Valliant et al., 2012). Post intervention, average energy consumption increased by 14%, to an average of 70% of recommended consumption (Valliant et al., 2012). The range of consumption was "44% to 95%, representing a significant improvement" (Valliant et al., 2012). Overall, post intervention, the team's nutritional knowledge and behaviors changed in

a beneficial way. Macro and micronutrients were consumed on a more accurate level to meet energy requirements. A post-intervention survey on sports nutrition knowledge was completed by each participant, in which the average score was 31.5 (± 6.1) (Valliant et al., 2012). 18% of participants were able to completely meet their energy requirements, while the other 82% demonstrated improvement (Valliant et al., 2012). In comparison to the pre-intervention survey, the results demonstrated a “statistically significant improvement” (Valliant et al., 2012). The study recognized the dangers of continuous energy imbalance, because “an athlete cannot sustain optimal athletic performance with a low energy intake” (Valliant et al., 2012). Participants had an overall positive reaction to the intervention, with 72.7% expressing “the importance of good nutrition and sports performance” (Valliant et al., 2012). Prior to intervention, players reported receiving most of their nutrition information from the media, internet, or coach/trainer, but after intervention began using a sports dietitian/nutritionist as their primary source of nutrition guidance (Valliant et al., 2012). A post study check-in showed that “the changes in dietary intake were maintained by 66% of participants” (Valliant et al., 2012). Although the intervention was not perfect, players showed much improvement. This study demonstrates that informational intervention is a potential solution to combat the lack of nutritional knowledge amongst volleyball athletes, yet demonstrates a

potential solution. An informational intervention, that works with individuals on a personal level to develop correct sports nutrition behaviors, is an optimal solution to prevent further nutrition deficiencies.

While Valliant and her team were able to reach a group of high-level volleyball players who lacked the proper education on sports nutrition, it's critical to understand why this group of elite college athletes had not prior received or implemented this information. Education regarding proper nutrition should be implemented throughout their life, but female athletes in particular, should be reached at a young age, prior to becoming high-level athletes, to make sure there is an understanding of the energy required to compete at a high level. A proactive approach will ensure that young players will have a level of understanding about their energy requirements that will serve as a baseline for further education. One study in Brazil, worked with a group of adolescent volleyball players to improve their knowledge and teach them sustainable habits. With parental consent, Natália Daniel and Luana Jürgensen worked with 10 adolescent female volleyball players, ages 16 to 18, who had been classified as high-level because they played for the “best teams of São Paulo state” (Daniel et al., 2016). The researchers established the Food, Nutrition and Health Education program (FNHE), to analyze “nutritional issues of athletes in the city of Santos/Brazil, which identified inappropriate food intake, nutrition knowledge gaps, food beliefs, and body dissatisfaction”

(Daniel et al., 2016). The program had 6 key steps, including “education profile assessment; goal setting; selection of programmatic content; development of materials; logistical design; program evaluation process” (Daniel et al., 2016). The researchers used a variety of surveys, assessments, discussion groups, evaluation systems, and models to gather information on the players, to identify body image and nutritional issues. Prior to intervention the mean nutritional knowledge, based on a sports nutrition knowledge questionnaire, was 57.0 (\pm 9.9) (Daniel et al., 2016). Post intervention the mean score improved 6 points, with an average score of 63 (\pm 11.8) (Daniel et al., 2016). The standard deviation rose, indicating that some players understood the content better than others, but the overall average was higher than in initial testing. The researchers took steps to help implement the nutritional knowledge into the lives of the participants. Through each informational session, there would be discussion amongst players about issues and intention to implement new practices into their lives as athletes. Interventions have been found to have the most success when implemented from a team approach (Anderson, 2010). Players that have the opportunity to discuss and work through nutritional information together, have the most success in creating long term change. On the fourth meeting day, coaches “reported having observed positive changes regarding the food brought to competitions, saying that habitual commercially-prepared snacks

were replaced by homemade sandwiches and fruits” (Daniel et al., 2016). At the end of the intervention “positive eating behavior changes were identified” and there was a “higher intake of fruits, lower intake of ‘junk foods’, daily intake of breakfast, and awareness of the quantity consumed” (Daniel et al., 2016). The education sessions also worked to improve body satisfaction among the players, however, these results were inconclusive. Some players improved their body image, while others increased dissatisfaction. The authors used this area to conclude that “the lack of results on body image issues shows that there are still challenges to be overcome” (Daniel et al., 2016).

Each of these interventions used a personalized approach to educate players and motivate behavior change. Approaching players in small groups, the researchers were able to have individualized discussions, which aided understanding and development of proper nutrition implementation. Both interventions proved successful in increasing sport nutrition knowledge amongst female volleyball players. Reaching players at a younger age with information is a proactive approach to preventing deficiencies. Currently, there is not a broad recognition of the issues related to inadequate nutrition amongst female athletes. Consequently, coaches, parents, club directors, and public health officials lack the urgency and awareness to create teaching

programs that ensure players have the knowledge necessary to protect and feed their bodies.

Conclusion

I've been there for the on the court victories and team celebrations, while simultaneously obsessing about my physical appearance, pulling my spandex down, and calculating how many calories I had left for the day. I write this thesis from a place of experience; I write this for what I wish I would have known; and I write this for the girl that is struggling to acknowledge her disordered eating. Even at my worst, I truly believed the female athlete triad was a joke, I didn't have a real eating disorder, and I still believed I needed to lose weight. These were the lies I was constantly telling myself. As a high performing athlete, it's hard to understand the pain you're putting your body through because you think you're invincible. "*One more lap won't hurt, I'm not that tired, I don't need to eat.*" But it will hurt, you are tired, and yes - you really need to eat. For some, it's an element of control, for others it's unawareness. As athletes we dedicate our time to practices, weightlifting, team meetings, traveling, and all other activities for the sport we love, yet we needlessly sacrifice our nutrition.

The purpose of this paper is to contribute to the larger discussion on nutrition and deficiencies amongst female athletes. I focus on volleyball because this was my personal experience but much of the generalized barriers and intervention strategies can be applied across all sports. Young

girls are at stake of falling into nutrition deficiencies and eating disorders, based on media and social exposure alone. Add in a sport that prioritizes leanness, coaching pressure, and physical comparison, and the risk of inadequate nutrition rises exponentially. A drive for thinness has been present in our society and we cannot deny the pressure placed on women. In combination with athletics, the pressure can become dangerous to overall health and well-being.

There is a stigma that individuals with eating disorders look or act a certain way, but the disorders present differently for each individual. It is not always an extreme condition in which these women are depriving their bodies. It can be small, but ever so significant. Who knows the level I could have reached, had I been providing myself with the proper fuel. Without education, female athletes are jeopardizing their overall health and their ultimate potential as an athlete. Sports nutrition education is just as important as the training on the court. We need to acknowledge the larger issue at hand and take charge of protecting female athletes and preventing metabolic injuries.

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