Nutritional Needs for Competitive Swimmers

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Introduction – What is Swimming? :

Swimming has become a much more world renowned sport throughout the years. Sometimes it doesn't get put in the category of an actual sport because it is not played in a gym, in an arena, or on a field; but in fact it is one of the toughest sports to train for and to compete in. When looking at the stats from other physical activities, for a normal two hour practice of moderately fast exercise one can burn up to 1600 calories during swimming (usually fast and continuous), whereas walking one could burn up to about 300 calories, biking one could burn between 700-900 calories, and running one could burn about 1200 calories. (*Swimming Crunch Calculator*). This shows just how much of a great workout swimming really is when one is training for it as a competitive sport. Swimming burns so many calories because it is a mixture of aerobic and anaerobic exercise depending on the type of event someone is swimming. The three different types of events for a competitive swimmer are sprints, middle distance or long distance. When swimming in a pool the water offers a greater amount of resistance against all of the muscles not just a specific area at one time. Each muscle group works to move the body through the water simultaneously. This is why it is so demanding on the body and requires proper nutrition. As a person is

going through a strenuous workout in the pool one usually doesn't realize that they are sweating because they don't feel it, but the water one is swimming in becomes warm to them.

The actual sport of swimming and swimming for fun are very different. Competitive swimming involves swimming laps down and back across the pool (known as laps) mixing up strokes and building up both endurance from distance sets and lactic acid build up from sprinting sets. Competitive swimming is an endurance sport involving the competition against other swimmers of all different levels using the four main strokes. These four strokes include freestyle, backstroke, breaststroke, and butterfly. A typical elite competitive swimmer usually has a specific stoke focus or two that they spend most of their time working on and that is what they usually swim when they are competing, but there are swimmers that swim all of the stokes at one time and that event is known as the individual medley (or IM). Also, different competitive swimmers have different distance focuses as well such as long distance which can include events such as the mile, 1000 yard freestyle, and

500 yard freestyle; middle distance which can include anything in the 200 yard range, or a sprint which is swimming any stroke for 100 yards or less. Most competitive swimmers swim all year round and dedicate their lives to this sport and the extensive training that comes with it. The reason swimmers swim all year round is because the maintenance and improvement in training is so important to not lose what one has worked so hard to reach. It is said that most swimmers can reach the elite level after 8 to 10 years of all year round competitive swimming and as soon as the training stimulus is discontinued, detraining of athletes occurs in just a few short weeks. (*Sokolovas, G., 2003*). Although it is important to keep it up it is important for an athlete not to push themselves over their limit because that can cause a spiraling down effect in their performance. A completive swimmer's body goes through many muscle changes and breakdowns every day and requires much to be put back into it for it to stay healthy and up to par with the work it is putting itself through. A major way to maintain a healthy body is to provide it with the proper nutrition it needs to succeed as an athlete. A video from USA swimming today talks about how practice is so important for a swimmer and just gives a brief look at the training that is involved for a competitive swimmer to succeed at their maximum potential. Lots of people don't understand the extensive training that goes on for a competitive swimmer to swim only two to four events at an actual meet but cover thousands of yards during practice, but it's important to build that mental and physical toughness for a swimmer to be able to be comfortable with feeling uncomfortable.

Video explaining the training of a swimmer:

Sierra Nevada LSC: PRACTICE; (have to scroll down to get to the video). http://www.usaswimming.org/DesktopDefault.aspx?TabId=1891&Alias=Rainbow&Lang=en

(Figure 1: Showing how swimming can begin at a very young age)

Activities	Estimate of calories burned in one hour
Swimming slow	450
Swimming fast	550
Backstroke	450
Breaststroke	360
Freestyle	550
Butterfly	800

(*Figure 2: Pointing out how many calories one can burn by swimming different strokes.)*

Literature Review:

Supplementations- Importance of Vitamins and Minerals:

Most of the articles and case studies that were looked at focused on the use of supplementation and its benefits for competitive swimmers. Since highly trained athletes have to have high training loads in their diets they are more likely to get their recommended nutritional needs from carbohydrates and proteins as well as their vitamins without having to add any extra supplements, or so one would think because of how much they are eating; but sometimes that is not the case. A very prevalent vitamin deficiency in athletes is zinc (Zn).

(*Figure 3: Zinc is one of the most prevalent vitamins that swimmers bodies are deficient in.*)

There are many possible causes of zinc deficiency in athletes, especially in swimmers. These include inadequate intakes of zinc itself (which come from numerous food sources), excessive losses by sweat and urine, and the redistribution of plasma zinc to specific tissues to counteract the oxidative stress, and the maintenance of the immune response. A major study evaluating zinc status in athletes presented data on zinc response after certain exercises and investigated swimming athletes as being one of the most prone athletes to this deficiency (*Giolo De Carvalho, 2012*). Getting that proper diet for training is very important for a swimmer. An athlete should be considering a diet that is high in carbs, is nutrient dense, and is also fairly accessible and easy to digest. The major source of zinc according to the study done in Burbank California of the *Evidence of Zinc Deficiencies in Competitive Swimmers'*, to replenish it back into the body an athlete would need to consume moderate amounts of red meat and poultry, along with eating sources such as beans, nuts, and certain types of seafood. During this study they took eight male athletes ranging from the ages of 18 to 25 years old that had been training in competitive swimming at the national level for at least five years and tested their zinc intakes. Results concluded that only one of the athletes showed zinc intake values to be between the estimated average requirements and the recommended dietary allowances, and the rest of the subjects fell either too high or too low on the scale (*Giolo De Carvalho, 2012*). This puts into prospective how when one is an athlete they can put less focus on nutrition because they justify what they are eating by how much they are working out, but nutrition goes hand in hand with training because without the proper food intake athletes would not be able to perform as well as they do.

An athlete's body is wired differently; they are wired in a way that their nutritional needs are that much more important to make sure that they are putting back into their bodies what they are taking from them. There are many articles linking to the benefits or discrepancies of the additions of supplementation in a competitive swimmers diet. One thing a lot of the athletes had in common was that one of the main reasons for low levels of vitamins such as vitamin D or zinc was because of inadequate amounts of them were incorporated into the athletes diet. From another study performed specifically looking at the correlation between Vitamin D concentrations and physical performance, it was found that swimmers also show a low amount of vitamin D in their systems then they should. There is a growing concern regarding the health consequences of highly-prevalent low vitamin D concentrations in athletes, including harmful effects on physical activity. Vitamin D deficiencies in athletes can also often be closely related and are more likely to have an iron deficiency accompanied with it as well. Although many athletes have shown to have a vitamin D deficiency, the research study proposed that it can be hard to directly relate that back to one's physical fitness (*Dubnov-Raz, 2014*). Regardless of physical activity, one who is highly active and is doing so outside can have elevated vitamin D levels because of their exposure to the sun as well as what their diet consists of. All of these factors can make a difference as well. The conclusion here from this study is that vitamin D deficiencies are not more prevalent in athletes it is just one of the more common vitamin deficiencies around in general (*Dubnov-Raz, 2014*).

Electrolyte and fluid Imbalances

Something very specific to competitive and elite swimmer athletes that are struggled with widely among them because of the location of the sport, is electrolyte and fluid imbalances. Electrolytes in swimmers are shown to be out of balance because; for especially elite competitive swimmers; they are excreting enormous amounts of electrolytes and vitamins from sweating and not replenishing what is being lost. The success of rehydrating properly depends on how much a certain athlete drinks and on how much of this fluid is retained and re-equilibrated within one's body fluid compartments.

(*Figure 4: Replenishing the body with fluids is one of the most important aspects of recovery for a swimmer.*)

Because sweating and obligatory urine losses continue during the rehydration phase, athletes must replace more than their post-exercise fluid deficit to achieve full fluid restoration after a workout. According to a research study done on the *Nutrition for Recovery in Aquatic Sports*, usually a volume of fluid up to 125%–150% of the deficit must be consumed to compensate for the continued losses and ensure that fluid balance is achieved over the first four to six hour period of recovery. The recovery period based off of this study is one of the most important times for replenishing what was lost and broken down from a certain training session; whether that means replenishing those electrolytes that were lost, correcting the fluid imbalance, or consuming the macronutrients needed to rebuild one's muscle mass. Replenishing those key nutrients is very important for an elite completive swimmer to perform at their peak capability (*Burke, 2014*).

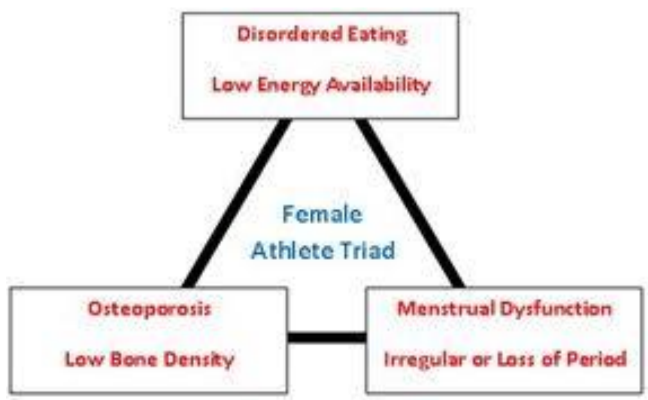
Nutritional Knowledge and Lack Thereof:

One research study that was found to be particular interesting was one that tested female collegiate swimmers on their nutritional knowledge and their daily dietary intake compared to their recommended RDA level of nutrients.

Mineral	RDA/AI		Best Sources	Functions
	Men	Women		
Calcium	1,000mg	1,000mg	Milk and milk products	Strong bones, teeth, muscle tissue regulates heart beat, muscle actio and nerve function; blood clotting
Chromium	35ug	25ug	Corn oil, clams, whole-grain cereals, brewer's yeast	Glucose metabolism (energy); increases effectiveness of insulin
Copper	900ug	900ug	Oysters, nuts, organ meats, legumes	Formation of red blood cells; bone growth and health; works with vitamin C to form elastin
Fluoride	4mg	3mg	Fluorinated water, teas, marine fish	Stimulates bone formation; inhibi or even reverses dental caries
Iodine	150ug	150ug	Seafood, iodized salt	Component of hormone thyroxine which controls metabolism
Iron	8mg	18mg	Meats, especially organ meats, legumes	Hemoglobin formation; improves blood quality; increases resistance to stress and disease
Magnesium	420mg	320mg	Nuts, green vegetables, whole grains	Acid/alkaline balance; important i metabolism of carbohydrates, minerals, and sugar (glucose)
Manganese	2.3mg	1.8mg	Nuts, whole grains, vegetables, fruits	Enzyme activation; carbohydrate and fat production; sex hormone production; skeletal development
Molybdenum	45ug	45ug	Legumes, grain products, nuts	Functions as a cofactor for a limite number of enzymes in humans
Phosphorus	700mg	700mg	Fish, meat, poultry, eggs, grains	Bone development; important in protein, fat, and carbohydrate utilization
Potassium	4700mg	4700mg	Lean meat, vegetables, fruits	Fluid balance; controls activity of heart muscle, nervous system, an kidneys
Selenium	55ug	55ug	Seafood, organ meats, lean meats, grains	Protects body tissues against oxidative damage from radiation, pollution, and normal metabolic processing
Zinc	11mg	8mg	Lean meats, liver, eggs, seafood, whole grains	Involved in digestion and metabolism; important in development of reproductive system; aids in healing

(*Figure 5: This chart lists many different minerals and the RDA recommended level of how much one should be consuming, along with their food sources and functions.)*

Female athletes in general as well as male's often have inadequate diets due to lack of nutritional knowledge and nutritional misconceptions of what is actually beneficial to them. This specific study showed the eighty-five female collegiate swimmers that were involved in the study were tested on their nutritional knowledge and scored a mean of 71%. Also, after testing their total caloric intake recommended by the RDA, less than five percent of them were getting their recommended amounts of the three main macronutrients of carbohydrates, proteins, and fats (*Hoogenboom, 2009*). This is suggesting that the athletes lack knowledge of nutrition, healthy food choices, components of a well-balanced diet, and the implications of nutrition on performance. The study performed on these female collegiate athletes was done a while back in 1996 so it can be expected that people are trying to expand their nutritional knowledge on their specific body types and nutritional needs as best they can as the information becomes more widely known and more widely thought about. Since the growing knowledge has become more popular especially for women athletes, the disorder of female athlete triad has become more dispersedly known as well.



(*Figure 6: This visual shows the three main symptoms of someone with the condition female athlete triad.*)

This disorder is mentioned in the study because it shows that it is getting more recognition for being a major concern among female athletes and is at the forefront of sports medicine but not many people actually know about it. Female athlete triad is a condition that refers to the association between energy availability, menstrual function, and bone mineral density. Researchers agree that many female athletes have inadequate diets that lead to this disease. Swimming especially, due to its emphasis on lean body weight and tightly fitting clothing while they are training, has been associated with several nutritional deficiencies which place these athletes at risk of developing components of the female athlete triad. The nutritional practices identified that female athletes struggle with the most include deficient caloric, vitamin, and/or mineral intakes. The causes of inadequate dietary intake have been identified and link back to the lack of nutritional knowledge and nutritional misconceptions (*Hoogenboom, 2009*). With an increased amount of knowledge an athlete can be more prepared on what they are doing to their bodies and how it can hurt them or how it can help them in the future. Athletes receive most of their nutritional knowledge from parents, coaches, and peers, yet many athletes' knowledge bases are lacking and incorrect. The people around us and someone's' simple curiosity can shape that athlete for the better or can bring them down a long road which might require more time for recovery. This studies main focus was to point out how little we know as a whole about proper nutrition and how even competitive athletes who need it the most take it into consideration even less. It has to start somewhere so the more an athlete wants to know the more prepared they can be.

Why is a swimmers diet so important?

Competitive swimmers can expend up to 5,000 calories during a four hour practice during training and have energy expenditures that are about 1.5-3 times higher than the active, untrained individuals. The sport of swimming has energy requirements four times greater than that of running on land.

This corresponds with competitive swimmers using up to 40% of their daily energy expenditure in just the two to four hours of intense training. If only normal eating patterns are maintained in an athletes' diet, the swimmer's nutritional intake could be severely inadequate. This shows how utterly important a competitive swimmers diet is to their health as well as it is to their performance. A study performed evaluating twenty age group swimmers was done to see what the average daily nutrient intakes were throughout a training period. Some of the results from that study concluded that many of those swimmers (guys and girls) had calcium and iron intakes below RDA values. This matches what was found in previous studies of many common vitamin deficiencies in athletes having iron being one of them. This study also went more deeply into gender differences in the dietary intake without even looking at body mass. It was shown that male swimmers had greater energy consumptions than females and by doing so were able to keep up with maintaining their energy balance. Females in this study were consuming fewer calories as well as fewer nutrients then the males and were fatiguing faster and not able to go as hard (*Hawley, 1991*). Granted this is only one study, but in any athlete no matter what sport, female athletes always have a higher percentage of those who perform less than their potential because of inadequate nutrient requirements. These females seem insensitive and are not caring as much as they should about their daily energy expenditure and also have difficulty maintaining their recommended carbohydrate and caloric balance. Even though 90% of the swimmers reported in this study were eating regular snacks between meals, only about four (20%) were taking any form of vitamin or mineral supplementation (*Hawley, 1991*). Some competitive swimmers see intense training as an excuse to eat whatever they want and usually constitute eating way to many of the wrong kind of calories. There are also swimmers that are training so hard that they don't want to over compensate what they worked very hard at doing. Both mindsets are not happy mediums and can cause detrimental effects on the athlete's body and doesn't help advance performance which is ultimately the main goal of a competitive swimmer. Although one does want to get to that place of optimal performance and energy expenditure it is different for each athlete and can be hard to figure out what that right balance might be.

What should a swimmer actually be consuming?

To stay in energy balance, it is necessary that a certain amount of calories are eaten to balance energy expenditure for that specific athlete. If this is not the case, the athlete may not experience the optimal physiological adaptations to training.

A certain study calculated the energy demands of female's swimmers during their high volume training. One key way to replenish the body after an energy demanding training circuit and to ensure one will be able to keep up and try something new and harder the next time is to consume the right amount of carbohydrates (*Trappe, 1997*). Carbohydrates yield and store lots of energy for the athlete to be able to compete at their optimal and desired level. Also the other macronutrients such as protein and fats are very important as well. An athlete like a competitive swimmer needs the carbohydrates because they should be the foundation of one's diet. Carbs provide the most energy expenditure and can be stored for a longer period of time. Some examples of good sources of carbohydrates, coming from Alison Green who is a notes dietitian on the SASO swimming, include rice, cereals, pasta, potatoes, beans, peas and lentils. According to her also, carbohydrates should make up at least half of an athlete's meal. The other half of their meal should include a balance of proteins, healthy fats and vegetables. Good protein sources include lean meats, fish, eggs and low-fat dairy. Healthy fats include olive oil, nuts, avocados, and seeds (*Samuels, M, 2013*). There are always ways to meet an athlete's calorie requirements but it's what calories your meals are consisting of that's important. Here is an example of an ideal swimmers meal schedule for just one day.

Breakfast

Whole grain wheat bread/toast

1 Bowl cereal

Baked beans

1 Cup fresh fruit

2 Eggs

1 Glass of Milk

Half a cup serving of cottage cheese

Lunch

Tuna/ turkey/ chicken sandwich

1 Large bowl of vegetable salad

Stuffed pitas

Whole grain pasta

Dinner

Grilled fish

Lean Steak

Chicken soup

Brown rice

Stir fried veggies

Snacks

Nuts and Seeds

Fresh fruit/ fruit salad

Fruit juice

Crackers

Granola bar

Low fat, dark chocolate

One point that could not be stressed enough is that every competitive swimmer is different, even though every athlete has most of the same things to worry about and keep in mind such as suggestions from this diet; no two people have identical bodies. A swimmer must adjust their own dietary plan based on their nutritional knowledge and that of their coaches and/or physicians, also on how much they are training and what their specific body needs or does not need to fulfill and replenish it fully making sure to maximize its full potential. Nutrition is so important and is the corner stone to every athlete's performance especially a swimmer's.

(*Figure 7: This is a picture of Michael Phelps who is a very well-known and prestigious Olympic competitive swimmer.*)

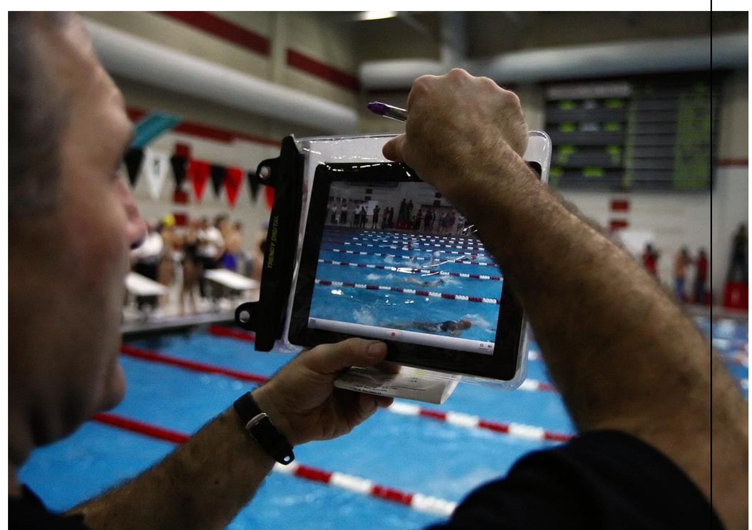
Public Icons:

A staple "icon" competitive swimmer that gets the most publicity around the world is Michael Phelps. Michael Phelps is an Olympic competitive swimmer and was one for many years and was also very successful. In his peak of training he was swimming about fifty miles per week two times every-day. He trained around five to six hours a day at six days a week. As well as being in the water, an elite athlete like Phelps must also add weight training dry land workouts to build strength in order to build up speed in the water (*Michael*

Phelps Diet, 2014). Most people are amazed to hear that anyone could possibly consume close to 12,000 calories each day, but Olympic gold medalist Michael Phelps' diet has to include lots of food to replenish what he is losing while he is training. Phelps excessive training is using up thousands of calories, so in order to match that in his diet can be mind blowing. His nutrition is so important to make sure his fuel is matching what he is burning. Health professionals, such as sports trainers, nutritionists, physicians, and others say that Phelps can probably eat whatever he wants to eat. This is because his metabolism is so fast that he burns calories much faster than the average man of his age. If anyone else tried to eat as much as him they would probably gain excessive amounts of fat just because they either are not doing the same extensive training and have a different body type (*Michael Phelps Diet, 2014*). Michael is an example of a swimmer whose diet is very important to his performance and is not compared to others.

Case Studies:

While I do have personal experience being a competitive swimmer for the majority of my life most of my knowledge about the sport and how to become a better swimmer came from my swim high school swim coach Dale Magnuson who was my coach for three years. He taught me healthy ways to treat my body whether that was with nutrition or in sleep in order to help me become a better swimmer in and out of the pool. I asked for his thoughts about nutrition for a competitive swimmer and having been a swim coach for over ten years and being a swimmer himself I find him very credible.



"*I think I have learned more about nutrition since I have gotten older and compete in triathlons. Your body is much more dependent on good nutrition as you compete at an older age. I think nutrition is just as critical at a younger age, but recovery seems to be much quicker. Because swimming uses all muscles in the body together, and the heart doesn't have to work against gravity, it is important that swimmers focus on quality nutrition. You must have enough carbohydrates to fuel the muscles as well as protein* *(muscle building), vitamins, and minerals to sustain endurance races/practices. There is a difference between sprint and endurance events - quick energy versus sustainable energy. It is also fascinating to see the usage of gels in endurance/multisport events. I think it is only a matter of time before we will see them enter into swimming and other similar sports.*"

- "Quote by Dale Magnason"

Conclusion:

Nutrition plays a huge role in a swimmer's athletic performance. Simply more knowledge about it can be that first step in the right direction; without it can be detrimental. Every competitive swimmer is different but all have the same basic needs. Consuming the right amount and right kind of calories that match what an athlete is expending is just as important as replenishing the electrolytes that were lost by drinking water or by adding a fluid replacement. A properly fueled body will result in better performance during practice and competition. Nutrition is everything.

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