Dietary Requirements For Serious Swimmers

After speaking to some of the kids I put this together because I'm not sure that all of their diets are allowing them to get the most out of their swimming and strength training. Understandably they are kids so there is going to be a certain amount of junk etc in their diets which is fine, it is more about ensuring that they have a sufficient energy intake and are getting enough protein and carbohydrates so that all of the time and effort they are putting is resulting in maximal returns. Nothing more frustrating than training 20 hours a week and not recovering properly between sessions because you glycogen stores are low, or not putting on any muscle despite doing the three strength training sessions a week because your protein intake is not adequate, or your overall energy intake is not adequate so that the protein you are getting is being used for energy instead of building muscle. So here's a bit of information for the parents and the kids to read. There's a fair bit about strength training because that is my area.

- It is well known that the strength of a muscle is generally proportional to its cross-sectional area, and it is often necessary to increase muscle bulk in order to enhance strength.
- Building muscle requires a rigorous strength-training program.
- Muscle tissue is mainly composed of proteins and water, and it is important to increase the protein content by modulating protein metabolism when increasing muscle bulk.
- In other words, muscle bulk and strength can be increased by promoting protein synthesis and inhibiting protein degradation.
- Resistance training enhances the secretion and production of growth hormone and various growth factors, and thus promotes protein synthesis and an increment of muscle mass.
- In order to maximize the effect of resistance exercise, it is important to maintain the muscular pool and blood levels of various amino acids that are substrates for the synthesis of muscle proteins. For this purpose, it is necessary to maintain a positive nitrogen balance by increasing the dietary protein intake.
- But even when dietary protein intake is adequate, if total energy intake is not high enough the protein being consumed will be used as an energy source and not as a means of increasing muscle mass.
- Therefore for athletes in sports such as swimming who are required to perform both pool and strength training sessions on a weekly basis adequate intakes of both protein and total energy are critical for the promotion of muscle mass gains.

Carbohydrates

- CHO availability to exercising muscle is critical for intense muscle contraction, as it is a more efficient fuel (produces more adenosine triphosphate per unit of oxygen) than both fat and protein.
- In combination with the fact that the total CHO stores in the body can be depleted in a single exercise bout, this makes CHO the single most important exercise fuel.

- Inadequate CHO for muscle contraction is also critical because its availability is inversely related to the rate of exercise protein catabolism.
- Dietary CHO intake is used to replenish CHO stores depleted by training/competition.
- In fact, rather than over-consuming CHO, athletes typically have great difficulty replenishing CHO stores following exercise.

CHO intake guidelines

- 5-7 g/kg/day in moderate training
- Up to 10 g/kg/day during heavy training

(The 2008 pre-Olympic Conference on Science, Education and Medicine in Sport).

e.g. 70 kg athlete requires:
350 – 490 grams CHO per day during moderate training
Up to 700 grams per day during a heavy training load

Protein

The protein requirements of athletes are influenced by the following factors:

- How intensively the athlete exercises - the greater the exertion, the higher the protein requirement.
- How long the athlete exercises during training sessions and events - long periods of training will increase protein requirement.
- The type of exercise the athlete participates in - endurance training leads to protein breakdown and increases the requirement.
- The level of training the athlete has achieved - highly trained athletes have a lower protein requirement than athletes who are starting their training. During rest periods, increased protein synthesis occurs in highly trained athletes.
- Gender - male athletes tend to burn fat preferentially and thus usually require less protein than female athletes who tend to burn more protein and CHOs - despite this physiological difference most male athletes ingest large amounts of protein. However, Female athletes - approximately 15% less protein than male athletes
- The influence of hormones - the male hormone testosterone builds muscles, and insulin also has an anabolic effect that increases muscle growth. Cortisol, one of the stress hormones, is classed as a catabolic hormone which breaks down muscle tissue and increases the protein requirement.

Several studies have shown that protein requirements of athletes performing strength training are higher than those performing only endurance exercise, and of sedentary individuals.

Protein intake guidelines

- Athletes 1.6 – 1.7 g/kg/day (American College of Sports Medicine)
- Elite male endurance athletes ≈ 1.6 g/kg/day (Burke & Deakin, 2000)
- Protein intakes ≈ 1.7 g/kg/day are sufficient *(The 2008 pre-Olympic Conference on Science, Education and Medicine in Sport)*
- Resistance training athletes during early training – 1.5 -1.7 g/kg/day (Burke & Deakin, 2000)

- Athletes 1.6 – 1.8 g/kg/day (Beyond the zone: Protein needs of active individuals. Journal of the American College of Nutrition)
- Female athletes approximately 15% less than males (Burke & Deakin, 2000)

Children and adolescents are known to have even higher needs because they are growing, although as yet guidelines detailing the exact amounts have not been published.

Note: These recommendations are only valid *as long as energy intake is adequate*!!! If not the protein will be used as an energy source and not for building muscle! In order to accomplish weight gain an extra 500 cal/day is required in excess of the energy intake needed for weight maintenance.

e.g. Requirements based on 1.5 – 1.7 g/kg/day
**Note this is not allowing for greater requirements for children/adolescents*
70 kg male = 105 – 119 g/kg/day
70 kg female 15% less = 89 – 101 g/kg/day

Timing

- Ideally CHO and protein should be consumed immediately post exercise.
- CHO intake immediately following glycogen-depleting exercise can enhance subsequent muscle glycogen resynthesis when compared to the same intake an hour or more later.
- Similarly, it is possible to stimulate muscle growth (by minimizing protein degradation and/or maximizing protein synthesis) via CHO and amino acid (protein) ingestion following a strength training session.

Protein Quality

It is well known that humans can synthesize only about 50% of the necessary amino acids that make up the proteins in our bodies. Therefore, if the remaining amino acids (called essential amino acids) are not consumed in sufficient quantities, protein production is affected adversely. The quality of protein in a food is determined by its essential amino acid content. Some foods contain all of these indispensable amino acids and in amounts sufficient to maintain protein synthesis, while others are lacking in at least one amino acid.

Complete protein foods include: Dairy products, eggs, meat and fish
Incomplete protein sources include: Grains, vegetables and fruits

Vegetarians

Although it is also possible to obtain sufficient essential amino acids from a diet that excludes complete protein foods entirely by combining grains, vegetables and fruits, this requires some knowledge of which foods to combine. As a result, vegetarians, especially those that exclude eggs and dairy products, when they adopt a physically active lifestyle constitute a group that is likely at greater risk for insufficient dietary protein intake. Moreover, it has been shown that strength training produces greater muscle mass gains with a meat-containing diet in comparison to a vegetarian diet.

Below are some examples of protein rich foods and their approximate contents.

	Protein	Fat

Meat (per 100g)		
Skinless chicken breast (grilled)	30 g	7 g
Fillet steak	30 g	9 g
Beef mince (low fat)	20 g	6 g
Roast turkey	28 g	6 g
Roast lamb	29 g	12 g
Fish (per 100g)		
Tuna (cooked)	27 g	4 g
Salmon	20 g	12 g
Tinned tuna in spring-water	26 g	1 g
Nuts (per 100g)		
Peanuts	25 g	46 g
Almonds	21 g	56 g
Cashews	20 g	50 g
Pistachio	10 g	30 g
Milk (per 100 ml)		
Whole milk	3.3 g	3.9 g
Skim milk	3.3 g	0.1 g
Yoghurt (per 150g)		
Low fat (fruit)	6 g	
Low fat (plain)	8 g	
Eggs (per egg)		
Poached or fried)	6 g	
Scrambled (2eggs + milk)	14 g	
Vegetables (per 100g)		
Others range from	0.5 – 2.5 g	
Beans	9 g	
Other (per 100g)		
Tofu	8 g	

Daily energy requirements specifically for swimmers

	Age Range (yrs)	Average Caloric Needs (In-Season)	Daily Training Duration (hrs)
Males	< 10	2,800-2,900	1
	11 - 14	3,700-4,100	2
	11 - 14	4,700-5,500	4
	15 - 18	4,800-6,000	4
	19 -22	4,990-6,100	4
	23 - 50	4,700-5,500	4
Females	< 10	2,800-2,900	1
	11 - 14	3,000-3,400	2
	11 - 14	3,800-4,600	4
	15 - 18	3,700-4,900	4
	19 - 22	3,700-4,900	4
	23 - 50	3,600-4,400	4

These needs are from a study which looked at a period of fairly heavy training so may be on the higher side, and take note that most are based on 4 hours of

swimming training a day. Actual daily requirements depend on not just the age of the individual but their build, resting metabolism, the exact nature of the training done on a daily basis (number of sessions, duration of sessions, volume and intensity of work during the session) etc but they do give you an idea.

Suggestions as to the daily make up of the caloric intake (CHO/protein/fat) specifically for athletes are varied, but the American College of Sports Medicine recommends a diet consisting of:
55 – 60% of energy from carbohydrate (CHO)
12 – 15% from protein
25 – 30% from fat

Keeping in mind that:
1 gram CHO ≈ 4 calories
1 gram protein ≈ 4 calories
1 gram fat ≈ 9 calories

So for example if you are a 14 year old male swimmer training only once in the morning (2 hours) you may need around 4000 calories in a day, which would involve:
60% CHO ≈ 2400 cal ≈ 600 g CHO
15% protein ≈ 600 cal ≈ 150 g protein
25% fat ≈ 1000 cal ≈ 111 g fat

If you were also doing weights that afternoon you will require slightly more!

These numbers may seem high but when you take into account all the snacks and drinks you have during the day it shouldn't be that hard to make sure you are getting enough fuel.

E.g. If Norma eats a 250 g steak at dinner he is getting around 75 g protein (50% of his daily requirement) and 22.5 g fat (20% of daily requirement).

Also factor in the energy found in sports drinks or soft drink that the kids often consume which are quite high in CHO.
e.g. Gatorade 600 ml provides 36 g of CHO and 150 cal (about 6% daily CHO requirement).