Nutrition: Don't Swallow the Seawater

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Some unbiased nutritional comments: I was going to say, read on for some unbiased nutritional advice, but detailed below is not advice, simply my thoughts and comments on the substances and some of the products available in this very, very complex field.

What did I do for a living? I was a nutritionist, specialising in the nutrition of farm animals and performance enhancers. I graduated in Zoology, Physiology and Biochemistry and then stayed at University to take a second degree in Physiology and Nutrition. My first job was as a Biochemist and then I moved into nutrition, nutritional research and into the field of performance enhancement where I spent a total of 35 years.

Did my knowledge help me with my swimming? Yes and No. There is so much written on human nutrition and so little understood about sports nutrition relating to long distance swimming, that this is truly an area where a little knowledge is a dangerous thing.

Ergogenic Aids. There is an ever-increasing array of sports supplements from which we can choose, all claiming to help the body improve upon what it does naturally, like running or swimming and there is no shortage of positive reports from consumers (testimonials). The products claim whatever you want, to add endurance, build strength, increase metabolism and deliver assorted other benefits, such as reducing fat. This is the first problem, knowing what we really need to support our normal life functions plus our training requirements and X for the big day. Secondly we can't even be sure when we are going to need X, it is a bit like keeping a car full of petrol, so that we are ready when we have to go!! Unfortunately, we are not inanimate objects and stress and strain affects the way our body functions.

A 1996 paper "Ergogenic Aids: Evaluating Sport Nutrition Products", published in the International Journal of Sports Nutrition, by Gall Butterfield, Ph.D., classified the benefits of these products as coming under the following four headings which should help you to appreciate the complexity of sports nutrition.

* Metabolic fuels (carbohydrate, lactate, fat);

* Cellular components that improve metabolism (creatine, carnitine, vitamins);

* Anabolic substances that enhance performance (protein, amino acids, chromium, plant sterols, herbals)

* Substances that enhance recovery (fluids, electrolytes, herbals).

This is just the tip of the iceberg . . . there are numerous strategies: carbohydrate build up, the 40:30:30 programme, high protein diets, HMB, ATP, omega fatty acids, creatine, electrolytes, hydration, rehydration, dehydration, isotonic fluids, co-enzymes, antioxidants, complex carbohydrates (known more simply as starch), B

vitamin complex, vitamin C and so on. You only have to spend 10 minutes on the Internet to realise that there are wide differences in the advice given by the leading experts and to become completely confused. In fact the more you try to understand it, the more likely you are to wonder how we ever stay alive at all.

What lessons have I learned? Common sense has been my best friend. I subscribe to the balanced diet theory with a variety of foods as the best sports nutrition. No supplement in the world can make up for poor eating. If you are really concerned about your nutrition your best strategy is to analyse what you're eating and then try to fill in the gaps according to your specific fitness goals and the target you seek to achieve. But it takes time to fill the gaps and to establish the limiting ingredients, possibly a vitamin or a mineral. Also it takes time before it starts to function to maximum effect. We also have to distinguish whether we are talking about normal, everyday nutrition, which is part of the training process, or whether we are talking about feeding and nutrition for the big day. It is really quite complicated and eating sensibly and well should be all you really need to do.

How does it apply to you? If you are determined to try and understand a little simple nutrition, here goes . . . You have to decide whether you are feeding for sprinting, long distance (2-3 hours) or very long distance (10-20 hours). Sprinters will burn 100% carbohydrate, instant sugar will be helpful. Longer events will benefit from carbohydrate and fat, carbohydrate/glycogen loading will be helpful, the body can be trained to hold a store of about 1,800-2,000 Calories. But the really long distances need a supply of fat. Every gram of fat converts to 9 calories when utilised for energy, every gram of glycogen to 4 Calories. The accepted figures to achieve adequate carbohydrate loading are for intakes of 500-550 grams of carbohydrate for three days before the big event. It is not essential or necessarily beneficial to splurge on spaghetti alone for a week.

It is my personal belief that the single main cause of Channel failures is in fact feeding and nutrition. The body works differently when it is under stress than at times when it is not.

For a channel swim, you need energy and you need fresh water, you do not need electrolytes, you are already up to your neck in them at a high concentration, not only are sodium and potassium in ample supply so is almost every other soluble mineral, even gold !

In my experience you can expect to lose about 3-4 kg in weight on a swim, mainly glycogen reserves, fat, water and a little protein. The body utilises its energy sources best when there is adequate oxygen available and very inefficiently when the muscles are full of lactate, so try and remember, it is not a race, just a personal challenge. Using protein for energy is also inefficient and possibly damaging. Therefore, you want to feel as if you are swimming downhill, rather than swimming uphill !

What works for you? I learned many years ago, that you need to discover what you like and even more important, what likes you, when selecting your choice of food for a swim and be prepared for the worst possible scenario, no food at all. Seawater and the motion of the waves can have a very unsettling effect on the digestive system,

such that you may not want to eat at all, in some cases sufficient to make you want to "die".

Some modern day swimmers stop to refuel every 20-30 minutes. I used to stop once an hour for about 30-45 seconds. I tried every combination of feeds from chicken and ham, to soups and nutrient feeds. I finally decided that the only thing I could keep down was fruit sugar dissolved in lemon and lime juice. Even then the lemon and lime gets sickly after a few hours and I then just ask for fructose and water. Whilst there is no harm in talking generalities, it is terribly important to understand that we are all different and that we all utilise our food differently. We all know people who can eat forever and never put on a gram and others who only have to look at a chocolate advert to put on a kilo.

Electrolytes. Those of us who are older and wiser also know that our metabolism changes with age. The kidneys or the liver may fail to work with 100% efficiency where type 2 diabetes is steadily progressing. These problems are not the end of the world, but they do have to be taken into consideration before starting a major endeavour such as a channel swim. Then, there are factors such as renal tolerance and renal threshold to consider. The body reacts to excess of some seemingly similar products in a completely different way. You take a really sweet drink with lots of sugar in it and within minutes you want to urinate. The sugar is absorbed into the blood stream, there is too much for the blood to absorb and the kidneys come to the rescue and chuck it out. Now, in excess this can cause problems, because you are losing valuable water - if you are in the middle of the channel, the chances are that you are also consuming excessive quantities of electrolytes (sodium in the salt water), albeit involuntarily and the body wants to get rid of them. But urine is much more dilute in electrolytes than seawater and so there is a build up of electrolytes in the body and that spells new problems. It is for this reason that I can see no justification for compounding the problem by using products supplemented with electrolytes on a channel swim. But there is an alternative to sugar, for some reason, the kidneys are much more tolerant of fruit sugars, the blood will hold much higher levels of these, you can even taste the sugar being recycled in the saliva.

Carbohydrate needs. The energy expenditure on a channel swim is likely to run at between 600-900 Calories/hour, possibly higher if the water is much below 60ºF. There are complicated formulae available that take into account speed of swimming, swimmers body weight and temperature of the water, which you can use to establish your own requirement. With 1g of pure carbohydrate capable of being metabolised to give 4 calories of energy, you can soon work out that you will require at least 150-225 g of carbohydrate/hour to maintain your glycogen level, equal to 5-8 ounces/hour, every hour. Put another way, it is equal to the bulk of 3 Mars bars. Mars bars are a good example to use, as they are 68% carbohydrate and 17% fat. The fat boosts their energy content to 290-kcalories/65g bar, 435 Calories/100 g.

So, let us say that you need 750 Calories/hour for 12 hours, total requirement is 9000 Calories. This can be met by eating 1 kg of pure fat, (1000 grams x 9 Calories), or 2.25 kg of sugar/complex carbohydrate, (2250 grams x 4 Calories) or if you are consuming a feed with 70% carbohydrate content, then 3.2 kg. I read somewhere that a slice of bread was the equivalent of 15 grams of carbohydrate, it did not say if it was thick sliced or thin sliced! It is a comforting thought that you only need 150 slices of

bread, that is 12 slices/hour and you have got a maximum of 45 seconds, preferably 30, in which to swallow them!

You need glycogen reserves. I suspect that it is probably almost impossible to consume enough food to meet the energy demands of an average channel swim. You will need to use up all your glycogen reserves and also some of your fat. You need fat and you will burn fat on a swim. I am not suggesting that too much fat is a good thing but you can still be in good shape with 14-18% body fat and it does help to insulate you from the cold as well as supplying you with valuable energy.

Remember also that it is essential that you produce enough energy to keep warm, if hypothermia sets in, you are on the slippery slope to failure. As your stroke rate slows down energy production falls and core body temperature falls with it. Extraneous muscle contractions such as shivering require more energy expenditure but do not contribute to effective power output. Performance is determined by how effectively you can sustain sufficient power output to overcome the resistance of the water and move forward. Sustainable power output depends on the rate of energy expenditure that you can sustain throughout the swim and the efficiency with which that energy can be converted into mechanical power and propulsion.

Promoted - But are they Essential? So let's take a look at some of the nutrients on offer and at some of the substances frequently referred to in the press.

* Water: Don't forget water, our body is made up mostly of water, 75%, and whilst tea, cocoa and coffee contain a lot of water, they are diuretic. That means that for every cup of coffee you drink you will probably excrete a greater quantity of water. The recommended intake of water is 1-2 litres/day. Water helps to ensure that the major organs function efficiently. The muscles store about 15% of the body water so it is not very difficult to understand that if you are dehydrated your muscles will have difficulty in performing effectively. The experts recommend that you always drink water between meals; our meals already contain substantial amounts of hidden water. The question is, what water to drink, tap, bottled, fizzy, flavoured, distilled, purified, mountain, the options are almost endless. Apparently, as many as 800 different compounds/bacteria have been identified in British water ranging from aluminium to arsenic, from fluorides to nitrates and even perchloroethylene to e-coli. So there you have it, cut out the coffee and tea, throw away the fizzy drinks loaded with carbon dioxide and sweeteners, give up the alcohol - and drink buckets of water. You may be miserable and worried but those who know about these things claim that you will feel a lot better for it! (Anna Selby - H20: Healing water for mind and body).

* Amino acids: Amino acids are the building blocks of proteins and proteins are the building blocks of the muscles. Amino acids are either essential or non-essential. Essential amino acids are the building blocks which cannot be synthesised by the body and have to be ingested. Non-Essential amino acids are the building blocks, which can be synthesised by the body from other amino acids and do not have to be ingested.

* Carbohydrates: Carbohydrates are the major source of energy. Carbohydrates are simple or complex. Simple carbohydrates are the sugars, glucose, fructose, ribose, usually 6C but sometimes 5C, easily digested and an immediate source of energy.

Complex carbohydrates are the starches and celluloses, which during digestion can be broken down into the more manageable sugars. They therefore act as a more long lasting source of energy. But not all complex carbohydrates (the celluloses in particular) are a source of energy - except if you are a cow.

* Fats/Fatty acids: Fats can be short chain triglyceride fatty acids (from 3-24C) usually liquid, or long chain (above 24C) usually solid, saturated or unsaturated. One gram of fat will give you more energy than 2 grams of carbohydrate.

* ATP, Adenosine Triphosphate: This is the chemical in the muscle cell that is broken down and in conjunction with sugars, actually produces energy. I note that vegetarians suggest that a carbohydrate intake of 65-70% ensures maximum glycogen storage and that this will give you enough fuel to last you through long hard swims and workouts. It may well help you through the workouts but it will not see you through the long hard swims. The body needs a balanced diet and the chemical interactions are many and often interdependent. Proteins and fats are equally important, they provide a source of some of the vitamins and trace elements that vegetables cannot supply. The production of energy is one of the many miracles that the body performs every second of the day. It is an extremely complex process that involves glycogen as a possible source of one of the major ingredients and a huge range of other chemicals which include ATP, calcium, magnesium, potassium, creatine, phosphates, oxygen and many enzymes. If the body is working at maximum efficiency, i.e. with adequate oxygen available, glucose is converted to pyruvic acid, but in the absence of enough oxygen, glucose is converted at greater cost to lactic acid. Whilst reaching maximum lactic acid levels may be ideal for sprinters, long distance swimmers would be well advised to breathe more often.

* Glucosamine Sulphate: 1000 mg/day Glucosamine is found naturally in the connective tissues of the joints, cartilage, tendons and ligaments where it plays an important role in maintaining mobility.

* Creatine Monohydrate: Instantly absorbed, 5 mL is claimed to delay fatigue and combat lactic acid build up, specifically formulated for endurance athletes such as swimmers. Claimed to build muscle, without adding bulk to your body and to increase long distance endurance.

* Creatine Powder: Creatine, "the safe steroid" and a legal food supplement in the UK, a naturally occurring amino acid that is normally produced by the body, so it is a non-essential amino acid. Claimed to help muscles work harder and for longer, but specifically recommended for sprinters who require short sharp bursts of energy. It is claimed to speed up the recovery of muscles and to permit more intensive training schedules. Also claimed to cause water retention, resulting in dehydration, bloating, kidney problems and muscle cramping. A British Olympic nutritionist is reported as suggesting that if you are using creatine, you should drink a lot more water, before, during and after training and competition!!! Weight gain appears to be one inevitable side effect. Muscles are 80% water and more muscles must mean more water and more weight to pull around. Does it cause kidney problems? Only in people with an underlying kidney disorder, says a University expert. How many of us are aware, whether or not, we have an underlying kidney disorder? Takes an hour or more to

digest and 80% is destroyed during the digestion process. Rapidly degrades into the waste product creatinine.

* Gatorade Energy bar: Claimed to have 47 g of carbohydrate, 250-260 kcals.

* EnduroxR4 performance drink: 1-2 scoops per 12 oz of water. 12 oz serving size supplies 53 g of carbohydrate, 1.7 g fat, 14 g of protein, and 280 kcals. 4:1 carbohydrate/protein ratio to accelerate glycogen replenishment and rebuild muscle protein. Antioxidants such as vitamins C (470 mg) and E (400 i.u.) to reduce post exercise muscle damage and decrease free radical formation, plus glutamine and electrolytes to restore muscle levels. Two scoopfuls would equal 2 ozs.

* HMB (beta-hydroxy-beta-methylbutyrate): Apparently studies have shown that HMB helps to decrease stress-induced muscle breakdown, or put more simply the normal wear and tear from training. Think of the body as a car, you drive 500 miles and without realising it you have worn away some of the tyre tread. Additionally HMB is claimed to increase muscle size and strength. Damage to muscle tissue can be measured by analysing the blood for the level of creatine phosphokinase, (CPK, an enzyme) which increases with muscle damage. Furthermore it is claimed to increase to VO2, (the rate at which the body can consume oxygen) thereby reducing blood lactate levels, thoroughly incredible stuff!! Again, the body apparently produces 0.3-1.0 gram/day but it is claimed endurance athletes would benefit from a supplement of 3 grams/day.

* Ribose: This is where nutrition starts to get a little technical. Ribose is a simple sugar with 5 carbon atoms (pentose sugars) and pentose sugars play an important role as constituents of nucleic acids and many of the co-enzymes essential in the production of energy and the part played by oxygen transported in the red blood cells. They are formed naturally by the breakdown of glucose. Ribose is a constituent of ATP, the energy source that makes the muscles work. Those who recommend ribose suggest that supplemental ribose may dramatically improve recovery time after exercise, arguing probably rightly that although ribose is formed naturally in the body from one method of the breakdown of glucose, the amount produced (possibly from 10% of the glucose) is insufficient to replace the ATP pool reduced during extensive muscle exercise. The recommended intake is 3-5 grams/day during hard training. Ribose has the advantage over nucleotides in that when taken by mouth they survive the process of digestion.

* Vitamins: The requirements for vitamins have been determined on many occasions, but most frequently under conditions of deficiency, rather than concentrating on the optimal level for a particular individual, training at a particular intensity at a specific location and generally consuming a fairly precise range of foods. To say that deciding on the correct nutrient level for each vitamin is complex is being simplistic in the extreme, as a non-physicist I am sure nuclear physics is a simpler subject.

Perhaps the best way to appreciate the importance of vitamins in the diet is to think about rickets (a deficiency of Vitamin D) and scurvy (a deficiency of Vitamin C). Vitamins are complex organic substances which cannot normally be produced by the body but which in minute quantities are essential for our healthy functioning. They play an essential role in aiding digestion, absorption, the utilisation of food for energy,

in the development of tissues needed for growth and replacement, repair and reproduction. Some also perform an antioxidant function. But if you eat a good wholesome, balanced diet, the average person is unlikely to suffer from vitamin deficiency. They are present in most natural foods along with the many other substances essential for our health and well being. But the advent of convenience foods, processed foods, canteen foods, and frozen foods, have all added to the loss of vitamin activity in our food and for the need for adequate supplementation. Again, illness, age, some genetic conditions, an unbalanced diet, a stressful life style, dieting without taking professional advice or excessive activity may mean that a person has a higher requirement than another. Also each type of food has its own level of bioavailability, it may be rich in a vitamin source, but the body may not be able either to get at it or, if it can, utilise it. For instance, leather shoes are a good source of protein, but first they are not very appetising and secondly the level of tannin also present, binds the protein to make it unavailable to the body for use. Consequently people buy beef to eat - although on a cost/kilo of protein basis shoes are probably a good buy! Again, the body is unable to store some of the vitamins, the water soluble ones are lost daily and require regular replacement. And so endurance athletes are encouraged to take sufficient levels of essential vitamins and trace elements to ensure optimal race performance and speedy recovery after training.

Many state-of-the-art dietary supplements claim to be designed to take your body beyond "normal" biochemical functioning to optimum functioning.

It is difficult if not impossible to eat consistently "three square meals a day." In addition, the quality of food in most people's diets, as already mentioned above, is declining due to modern agricultural practices and increased consumption of highly processed and refined foods.

Numerous research reports show that many supplements improve health and performance by supplying certain nutrients in amounts that are not obtainable from your diet alone. But in vitamin research, it really is easy to prove a negative and where a vitamin is in short supply the effect of its absence or shortage can be clearly demonstrated. On the other hand, once the body has an adequate supply the benefits of taking excess are less well documented.

Intense exercise creates a need for increased levels of nutrients, particularly antioxidants. The Recommended Dietary Allowances (RDA) of vitamins - which you may be acquiring through your diet – makes no allowances for the nutrient demands imposed by strenuous exercise. Furthermore, many RDA levels are based on outdated science. Some researchers believe that even sedentary individuals may be nutritionally deficient if ingesting only the RDA. But this is not surprising when you consider the methods used and needed to establish an RDA. There are so many factors that affect the result that it is a miracle that we have any figures at all. Just a few of the factors to consider include, the methods used to determine need, the bio-availability of the vitamin, the method used to evaluate the level of vitamin in the feed, interfering substances, the effect of the presence of other vitamins, sex, age, race, growing phase, pregnancy, post natal phase, bodies hormonal balance and the environment.

Multivitamin and mineral formulas offered by most companies provide a broad range of nutrients in sufficient dosages to meet the needs of athletes in training. In addition to a broad based multivitamin, they also suggest that it is also advisable to take extra doses of antioxidants to combat free radicals.

* Free radicals: The subject of "free radicals" is an area of its own, with extensive literature in the complimentary medicine and homeopathic field.

It must constantly be kept in mind that the body is the most perfect, delicately balanced piece of engineering, where everything has a part to play and everything works in association with everything else. Problems only arise when there is an imbalance.

There is apparently an excellent book by Dr. Kenneth H. Cooper, who directs the Cooper Institute for Aerobics Research in Dallas and is already the author of two best sellers, Aerobics (1968) and Controlling Cholesterol (1988). Many people credit his work, particularly Aerobics, with saving millions of lives. This book is claimed to have almost single-handedly established the importance of endurance exercise in the fight against heart disease and stroke. In the Antioxidant Revolution, Dr. Cooper recommends that we take megadoses of antioxidants (vitamins E, C and Beta carotene) to fight free radicals. Free radicals are unstable oxygen molecules produced in our bodies. Antioxidants do good by fighting inflammation, killing bacteria, and controlling certain muscles. If, however, free radicals are overproduced and not eventually inactivated, their volatile movements start doing harm by damaging cells including degradation of our DNA, fats, and proteins. They become what Dr. Cooper calls "molecular outlaws" that can cause 50 or more conditions including heart and blood vessel disease, certain cancers, cataracts, and aging.

Free radicals are toxic to your body and abundant in our environment - air pollution, processed foods, pesticides, cigarette smoke, etc. - there's no escaping them! Millions of free radicals are also created when you exercise. Superoxide free radicals, hydroperoxides and hydroxyl free radicals produced during cellular energy processes are described in the literature as acting like shrapnel, damaging every muscle cell they contact. This is one of the sources of the muscle soreness and weakness that accompany heavy training sessions. It should be remembered that over-activity might contribute to the inflammatory process.

Free radicals have multiple damaging effects. Free Radicals are molecules that are highly reactive and unstable because they contain an unpaired electron in their molecular structure. Electrons are most stable in pairs, and the free radical tries to stabilize itself by attaching to the cell membranes of the body, robbing their molecules of electrons. This attack spontaneously generates another free radical molecule, starting a chain reaction, which leads to the cell's death.

However, the damaging effects of environmental and exercise-induced free radicals may be blunted by taking a comprehensive vitamin/ antioxidant formula. The most effective vitamins with antioxidant activity are Vitamin A, beta carotene, Vitamin C and Vitamin E, and one of the most effective trace elements, working in conjunction with the above, is selenium.

* Antioxidants: Antioxidants are one of the body's major defences against free radicals. Antioxidants are the good guys to the rescue. They make up the posse assigned to round up and neutralize the molecular outlaws, the "free radicals". Unfortunately, the posse can be overwhelmed when the body, reacting to physical or psychological stress, really begins to overproduce free radicals. And getting reinforcements from our diets may not be sufficient to bolster an out-gunned posse.

Antioxidants such as vitamin C and E are electron-rich substances that donate electrons to the free radical molecules, stabilizing them before they can damage body cells and tissues.

Selenium with vitamins A, C, & E, as well as a diet that has ample fresh fruits and vegetables, provides ample anti-oxidant protection. There is an easy way to fuel the body with antioxidants to combat the free radicals. At lunch, have a salad containing chopped fresh vegetables like broccoli, carrots, purple/red onions, and green peppers, served over lettuce. By having fresh fruit for the morning and salad in the afternoon and sautéed vegetables at dinner this can be easily accomplished. Unfortunately, on a salad and fruit diet, endurance athletes will find themselves desperately short of energy.

Some experts contend, however, that Dr. Cooper is extending the facts beyond the data and possibly over-medicating. His critics admit that consuming substantial amounts of Vitamin E, vitamin C and beta carotene may help beat-off the molecular outlaws and that antioxidant supplements, in reasonable amounts, should do no harm. But they rightly point out that very careful planning is required to get enough antioxidants for this purpose from our diets. Vitamin A is definitely toxic in large doses - but if you are still looking for the richest source, you will be hard pressed to beat polar bear liver!

The practice of using excessive quantities of these substances may be dangerous. Side effects and long-term effects are not known. Always remember that it is the dose that is the poison, not the product. Salt is excellent for us in small doses - but in large doses, it is not.

A dietary balance needs to be struck. Fresh fruit and vegetables are high in vitality - and processed, pre-prepared and fast foods are low in vitality. There is a place for both vegetables and chocolate cake in the diet, but excess of either can be harmful.

Conclusions. So, can we draw any conclusions from the above and my own experiences? Don't eat too much within 6 hours of the start of the swim. Ignore all the hype, just pretend to yourself that you are about to embark on a long, hard 12-hour-plus working day. Don't swallow the seawater if you can possibly avoid it and try to enjoy the swim. I am always ravenous after a swim and yet when food is put in front of me, I never feel like eating it.