"SUPER" Carbs

A New Source of Fuel for Ultrarunners?

By Sunny Blende, MS, Sports Nutritionist

"Faster than a speeding bullet, more powerful than a locomotive, able to leap tall mountains *(or at least large roots)* in a single bound." There are some newer sports nutrition products on the market – superstarches - and okay, so they don't really claim to turn you into superman, but they do have some interesting properties that could help the ultrarunner solve some of their seemingly inevitable gastrointestinal distress issues and recovery problems. They are an unusual type of carbohydrate made from sources such as waxy corn maize, barley or potato starch and they have the distinction of being very high molecular weight, low osmolality molecules that clear the stomach quickly. *What?*

Gastric Emptying

Stomach distress can be disastrous to an ultrarunner and yet, in a longer race (100K to 100 miles and beyond), the concern is usually not "if" an athlete will get gut issues, but how long can they "postpone" getting them. And how do these problems start? From food and liquid sitting in the stomach. The most advantageous fuel for an ultrarunner is the one that empties from the stomach the fastest. Until water and nutrients actually *reach* the cells that need them for hydration and energy, they are doing the runner no good and some harm. Gastric emptying is important to let the contents, or fuel, move on down into the small intestine where they are absorbed into the blood and delivered to thirsty, hungry, depleted muscle cells.

Consequential upset with food remaining in the stomach means bloating, cramping, vomiting, less energy and other such outcomes. It also means that the runner usually has to S L O W down and let the queasiness pass – not exactly conducive to a PR or a comfortable run or race.

New Products

There have been several products containing high molecular weight carbs on the market, and even waxy maize starch sold in bulk, but most of these, in the United States anyway, have been marketed to the weight lifting, body-building industry. Europe has been researching and using superstarches a bit longer for distance athletes and now there are some newer products that promote quick gastric emptying marketed here in the US specifically for endurance athletes – namely two, **Generation UCAN** and **VitargoS2 by GENr8**. Both have a molecular weight of 500,000 to 700,000, versus maltodextrin, which has a molecular weight of 1,000 to 10,000 and sucrose with a molecular weight of 180. The *exact* weight doesn't really matter, but you can see that we are talking about a whole "new (super) carb" here! UCAN is a patent-pending heat moisture process applied to ground up corn while the current form of VitargoS2 is a patented molecular carbohydrate that has been fractionated to make it rapidly digestible and is derived from a special barley (amylopectin) starch. Neither product contains sugar or caffeine.

This is, however, where the two products similarities end. They have been designed for different purposes and both might be interesting for the ultrarunner to try in training. Are they better than our tried and true sport drinks, gels and bars? No –they are different. The carbohydrate products ultrarunners have been using for years have been getting us to the finish lines in record times. If stomach issues are not a problem for you and you have been running and racing on these products, then lucky you – they work! Will your performance be better on race day with the new products? No, not if you have not used them in training…but you may want to give these a try in preparation for your next ultra. One product helps you train your fat-burning system, thus sparing your muscle glycogen as long as possible and using a plentiful source of energy (fat) to fuel your running. Beginning to "train" this system at the start of an ultramarathon would not be any more beneficial than trying out never-worn shoes at the start. The other product particularly helps with recovery and repeat performances, such as twice a day training bouts or back-to-back long runs. Both may allow you to train more *efficiently*. Do athletes use a combination of these newer products and traditional ones? Yes, they do. On race day, filling yourself up at the Aid Stations with traditional fare will be fine. The training is over and you are racing. Your fat-burning ability and recovery training is "in the bank" so to speak.

Fat Burning

Let's talk about fat-burning first. According to Bob Seebohar, MS, RD, CSSD, CSCS, a board-certified specialist in sport dietetics (and an ultrarunner), "glycogen stores can deplete rather quickly, after about 2 to 3 hours of continuous training at moderate intensity, and carbohydrate supplementation cannot provide adequate energy for longer-distance training because of gastrointestinal distress, (therefore) it is beneficial for athletes to try to teach the body to have greater metabolic efficiency in using fats as an energy source". We can train our bodies to be more efficient at using fat – or more specifically –at using a higher percentage of fat (versus carbohydrates). This **crossover concept** states that as we increase our speed, we "crossover" from using mostly fats to using increasingly more carbohydrates for fuel. The biomechanics of fat metabolism are too slow to help meet the need for faster energy production. We can however, still learn to use more fats, or use fats longer before crossing over. There are several ways of accomplishing this and a current concept of training is running in a fasted, or glycogen-depleted state, causing your body to learn to use more fat as fuel. ***VESPA*** is a tried and true product that uses this concept. Eating a proportionately larger amount of fat in your diet also increases your usage. Remember, we are adaptable and we can learn to use *any* substrate or nutrient we have available. This fasting-while-running teaches fat burning, however some athletes may experience an earlier onset of fatigue and/or a decrease in their pace when using fat as an energy source. This might be more appropriate in your base training phase in order to build up more "fat-burning enzymes" in your mitochondria, which would allow for more fat fuel delivered every minute. The superstarch UCAN still provides plenty of carbohydrates, but with a more desirable blood glucose profile. It prevents insulin spiking while still providing a slow, sustained flow of glucose. In other words, it "drips" in carbohydrates. And as you use a higher percentage fat along with this "drip", your body composition changes.

You become leaner. According to Jeff Volek, PhD, RD, "From a functional perspective, body fat is not involved in force production and therefore deceasing body fat does not adversely affect strength or power production. In fact, a loss in body fat, and therefore body weight, improves the power to weight ratio, a very important determinant of endurance performance". Think about 2 runners climbing a hill who have the same power, but one weighs 165 lbs and the other 150 lbs. Who reaches the top first? The lighter athlete.

Recovery and Repeat Performances

Because muscle has a limited storage of glycogen, the more you have at the onset of a training session or competition, the harder and longer you can perform. For instance, incomplete recovery of muscle glycogen means you will tire sooner than you usually do in your next bout of exercise. Applied to ultrarunners that train daily (or twice daily), incomplete glycogen recovery from a previous run will hinder performance in the next. Once depleted, glycogen stores will need to be refueled in order to train or compete at your optimal level again. The problem is that it can take a full day or more to fully recover. Timing is crucial and the sooner you can begin refueling, the quicker the recovery will be and a return to a higher level of performance. Hence the *30-Minute Window* we have all heard about. But what if you could refuel at an accelerated rate, or as Anthony Almada, MSc, FISSN, of GENr8 states, "What if you could refuel at the rate of usage? Studies show that VitargoS2 can be consumed at the rate of 1000 calories per hour without gastric distress. Most sport refueling and recovery drink formulas use carbohydrates such as maltodextrin; and sugars like glucose (dextrose), fructose and sucrose. The problem with these carbohydrates is that they result in a beverage that has a high **osmolality**, which refers to how aggressively it will pull water. This sponge-like property slows the movement of those carbohydrates through the stomach, which in turn slow refueling efforts." On the other hand, superstarches that have a relatively low osmolality, speed refueling. VitargoS2, in a university study, emptied from the stomach 2.3 times faster than ordinary carbohydrates within the first 10 minutes of ingesting. Faster recovery results in better performance more quickly. How much better and how much quicker? Another study found that when individuals used Vitargo®S2 – after glycogen-depleting exercise – they were able to perform up to 23% better in a second bout of exercise after just 2 hours of recovery than when using an equal amount of maltodextrin. This accelerated recovery means your glycogen stores will be more refueled when you head out to train or compete again the next or even the same day.

Insulin Spiking

Whenever we consume a high-sugared food at rest, especially by itself, we spike our insulin levels. Insulin is secreted to help our body bring our blood sugar back down to a normal level (homeostasis) by binding with the sugar molecules and then taking them to our fat cells for storage. They need the insulin for transport because sugar molecules by themselves cannot cross the cell walls. However, when we are exercising, this response is *significantly blunted* as our body tries to send all the sugar (glucose) to the exercising muscles for immediate energy. Remember, your body running is a "fight or flight" response.

It thinks you are in trouble - it doesn't know you actually paid good money to run an ultra! However, during the time period ***before*** and ***after*** your run, it is especially important ***not*** to spike your insulin levels. Spiking before exercise would decrease your use of fat for fuel during exercise. This is why we are told not to consume sugar one hour to ten minutes just before heading out on our run. And after exercise, "Over stimulation of insulin by fast-acting carbs can have a more insidious effect of diverting glucose into fat storage, which is obviously not conducive to promoting favorable changes in body composition. Spiking insulin with fast acting carbs during recovery has also been shown to diminish the beneficial effects of exercise on insulin sensitivity and other cardio-metabolic risk markers." says Jeff Volek. In addition he adds, "The argument that high insulin is required for glycogen synthesis is not supported by recent studies. Glycogen synthesis after exercise does not require excessively high blood sugar or insulin levels to proceed at an accelerated pace. A spike followed by a subsequent fall in blood sugar is not an optimal metabolic milieu for promoting glycogen synthesis over a 24 hour period." The new superstarches have a minimal effect on insulin levels and therefore allow greater access to fat for fuel *during* exercise when consumed before running, and allow for the body to burn fat for fuel longer *after* exercise when used in recovery.

Conclusion

The sports nutrition world is constantly searching for the next new idea and breakthrough. Becoming leaner and enhancing your recovery between workouts are worthy goals, for sure. But each of you will have to decide yourself whether to try these new products and see what the results are for your particular body. They are thicker in texture than our current sports drinks and they have a "chalky" taste to them that diminishes with COLD water and really mixing well. Are there more products coming? Almost certainly. Scientific based studies are showing these concepts are improving performance for endurance athletes with less stomach distress. The current studies use small numbers of athletes and "endurance exercise" is in the realm of three plus hours. More studies are certainly needed. For an ultrarunner, it usually comes down to an experiment of one, so please plan accordingly - in training!

(Side Bar)

Generation UCAN (http://www.generationucan.com)
UCAN comes in five different flavors…Plain (without Stevia sweeteners), Lemonade, Pomegranate-Blueberry, Vanilla (with protein), and Chocolate (with protein). The first three are to be used before exercise (and during when duration of exercise is exceptionally long) and the latter two for post-exercise recovery. Serving size is 120 calories, all from carbohydrate. UCAN is gluten free and has 210-to 240 mg. sodium per serving.

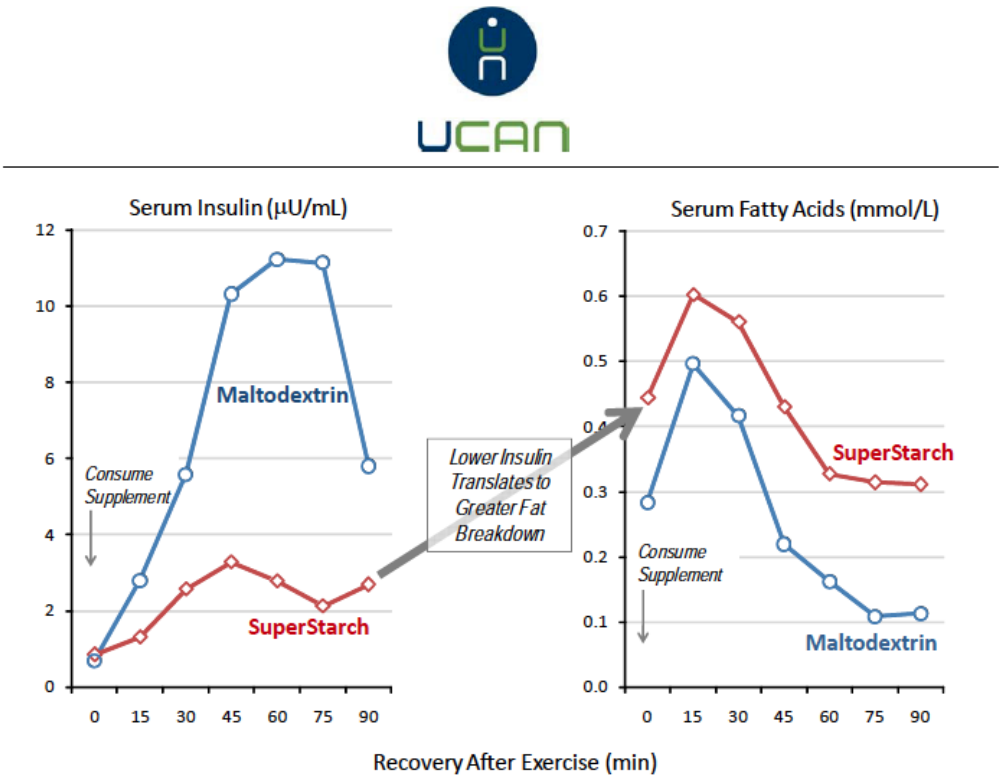

Fig 2. Serum insulin (left) and fatty acid (right) levels in high level cyclists who consumed either Maltodextrin or SuperStarch immediately after cycling for 2.5 hours. SuperStarch resulted in a significantly muted insulin response and a corresponding increase in fat breakdown and fat oxidation during recovery. Data from Roberts et al. Nutrition. 2010 Oct 13.

VitargoS2 by **GENr8 (http://www.genr8speed.com/endurance/endurance.php)**
VitargoS2 comes four flavors…Unflavored/Unsweetened (without Sucralose sweeteners), Natural Tropical Fruit Flavor, Natural Grape Flavor and Natural Juicy Orange Flavor, and is coming out with a combination carbohydrate/protein flavor soon. All are to be used before, during and (especially) post-training. Serving size is 280 calories, all from carbohydrate. VitargoS2 has gluten free options and no sodium.

References

1. Leiper, J. B., Aulin, K. P., & Soderlund, K. (2000). Improved gastric emptying rate in humans of a unique glucose polymer with gel-forming properties. Scandinavian Journal of Gastroenterology, 35, 1143 – 1149.
2. Holtz, K.A., et al., (2008). The effect of carbohydrate availability following exercise on whole-body insulin action. Applied Physiology, Nutrition, and Metabolism, 33(5): p. 946-56
3. McGlory, C., & Morton, J.P., (2010). The Effects of Postexercise Consumption of High-Molecular-Weight Versus Low-Molecular-Weight Carbohydrate Solutions on Subsequesnt High-Intensity Interval-Running Capacity. International Journal Of Sport Nutrition and Exercise Metabolism
4. Piehl Aulin, K., Soderlund, K., & Hultman, E. (2000). Muscle glycogen resynthesis rate in humans after supplementation of drinks containing carbohydrates with low and high molecular masses. European Journal of Applied Physiology, 81, 346 – 351.
5. Roberts, M.D., Lockwood, C., Dalbo, V. J., Volek, J., & Kerksick, C. M., (2011). Ingestion of a high-molecular-weight hydrothermally modified waxy maize starch alters metabolic responses to prolonged exercise in trained cyclists. Nutrition, 27, 659-665.
6. Rowlands, D. S., Wallis, G. A., Shaw, C., Jentjens, R. L., & Jeukendrup, A. E. (2005). Glucose polymer molecular weight does not affect exogenous carbohydrate oxidation. Medicine and Science in Sports and Exercise, 37, 1510 – 1516.
7. Stephens, B.R. and B. Braun, (2008). Impact of nutrient intake timing on the metabolic response to exercise. Nutrition Reviews, 66(8): p. 473-6.
8. Stephens, F.B., Roig, M., Armstrong, G., & Greenhaff, P.L. (2007). Post-exercise ingestion of a unique, high molecular weight glucose polymer solution improves performance during a subsequent bout of cycling exercise. Journal of Sports Sciences, *26,* 149–154.
9. Vist, G. E., & Maughan, R. J. (1995). The effect of osmolality and carbohydrate content on the rate of gastric emptying of liquids in man. Journal of Physiology, 486, 523 – 531.