ENDURANCE NEWS

A NEWSLETTER FOR ENDURANCE ATHLETES ISSUE #30

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CARBOHYDRATES 101 REVISITED

by Steve Born

CARBOHYDRATES DURING EXERCISE

In the article "Carbohydrates 101" (*Endurance News* #29), Dr. Bill Misner Ph.D. suggests that, while permitting for a greater allowance for the larger athlete, a maximum of 280 carbohydrate calories an hour is the most the liver can return to the energy cycle. Yes, you may be using up 400-500 calories or more an hour but your body cannot replace those in equal amounts on an hourly basis. The body can only process a given amount of calories an hour and to force additional food down, in the hopes of "topping off" or "getting ahead of" calorie needs, will usually backfire. Instead of having more calories available for fuel, they will sit in your stomach causing, at the very least, bloating, at the most, nausea and vomiting. Few things will slow you down faster or cause you to have to stop than taking in too many calories than your body can handle. Even the leanest of athletes has several thousand calories available in the form of stored fatty acids, most carrying nearly 100,000 calories of energy from their stores of fatty acids. Body fat stores are the fuels of choice, providing 60-65% of your energy needs, when exercise goes beyond two hours in length. A very important part of our performance is determined by our ability to utilize stored fatty acids as energy, which is why we can continue to exercise on so seemingly few ingested calories during exercise. One of the benefits of training is an increase in utilizing these stores more efficiently and, as mentioned, the body will rely more on these stored fatty acids to provide fuel during prolonged exercise.

As exercise duration increases, it will be necessary to add protein to the fuel mix along with your carbohydrate intake to satisfy the 5-15% of the body's energy requirements (and to help preserve lean muscle tissue). But as far as carbohydrates are concerned, take a look again at the chart Dr. Bill outlined in the Carbohydrates 101 article. This chart (which I've listed below) will give you a general idea, based on body weight, the maximal amount of carbohydrates you can consume and efficiently process on an hourly basis. To make things easy for us, he even lists the amount of servings of Hammer Gel and/or Sustained Energy you should use based on those numbers. But as a general rule of thumb during exercise, keep carbohydrate consumption at or below 280 calories (70 grams) per hour. And yes, the type of carbohydrates you use is very important.

SUGGESTED MAXIMUM CARBOHYDRATE (CHO) GRAMS PER HOUR
HG=HAMMER GEL, SE=SUSTAINED ENERGY

Weight	Max CHO g. Per Hour	k/cal	HG (servings)	SE (scoops)
110	48	192	2	2.0
121	53	212	2	2.17
132	58	232	2.3	2.38
143	62	248	2.5	2.54
154	67	268	2.75	2.75
165	72	288	3.0	3.0
176	77	308	3.0	3.16
187	82	328	3.25	3.36
198	86	344	3.50	3.53

WHY COMPLEX CARBOHYDRATES, NOT SIMPLE SUGARS AND THE TRUTH ABOUT THE GLYCEMIC INDEX

Sugar is defined as a monosaccharide or a disaccharide. The shorter the chain length a carbohydrate is, the higher it raises the solution osmolality (the solution concentration of particles carrying an electric charge) in the stomach. Simple sugar must be mixed in weak 6-8% solutions or they will sit undigested in the stomach and not pass the gastric lining, possibly creating sour stomach, cramps, or flatulence. Maltodextrin is a multiple of sugars hooked together, allowing from 18% to 24% solution immediately in transit to the liver where it is turned back to the energy cycle as muscle glycogen. As Dr. Bill mentioned, the Amylose-Amylopectin content of maltodextrin or potato starch are very similar in their chemistry to human stored glycogen. Therefore the "Gold-Standard" carbohydrate source for energy drinks, bars, or gels originates from longer-chain carbohydrates (Maltodextrins) because more caloric volume crosses gastric lining with less distress to the competing athlete. Sports drinks or gels containing simple sugars need to be extremely diluted to match body fluid osmolality. This weak of a concentration will more than likely not allow enough calories (most are up to 100 calories at a 6-8% solution) to be available to working muscles on an hourly basis.

What the above means is that complex carbohydrates are superior to simple sugars in that they allow more volume of calories to get into the bloodstream from the GI tract than anything containing simple sugars; you have more calories available for en-

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APPLE CINNAMON! THE NEW HAMMER GEL FLAVOR!!

by Brian Frank

We have had seven flavors of Hammer Gel for a couple of years now and have decided that it was time for a new one. We received a lot of feedback from you and while we tested and considered flavors like Mango and Cherry-Vanilla, the Apple Cinnamon was a landslide winner. If you close your eyes when you take a shot of the new Apple Cinnamon flavor, you will think you just took a bite of Mom's best apple pie. Of course it is made with fresh apples and real cinnamon to give you that wholesome, natural taste that is characteristic of our other fruit flavors.

I'm sure you're thinking, "is it really that good?" The answer is "yes!" You know how great all our other flavors are so you can trust us on this one as well. When you order your next supply of Hammer Gel, definitely give this new flavor a try. It's awesome! If you want to be more cautious, we will be happy to send you a sample with your next order of Hammer Gel. However, since we don't have this new flavor in pouches yet, we will have to squirt some in one of the flasks that comes with your order and send it out that way.

Here is a list of the eight flavors of Hammer Gel now available to you:

APPLE CINNAMON
BANANA
CHOCOLATE
ESPRESSO
ORANGE
RASPBERRY
VANILLA
PLAIN

If you are using any other energy gel, or drink mix for that matter, you really should give Hammer Gel a trial run. Call 1-800-336-1977 or go to hammergel.com to order our new Apple Cinnamon Hammer Gel. ■

NEW SHIPPING RATES FOR 2001

by Brian Frank

As was mentioned in the "Shipping Saga" article from EN#29, there have been a lot of changes in the landscape of shipping in the recent past. Heavy increases in fuel and now the recent increases in electricity have helped drive up the cost of shipping packages significantly in the past year. In fact, every carrier, including USPS, has raised their rates substantially. Despite all of these rate increases, my goal has always been to get your orders to you for the lowest possible shipping cost. Most importantly, I want you to know that I do not look at shipping charges as a "profit center" the way many direct mail companies do. I know that many of you would like this whole issue to go away, as would I, but the alternative would be to raise product prices, and I am not fond of doing that.

For most of the past year, I have been trying to figure out a simple, easy means of calculating shipping charges for you and for our customer service staff. To do this, we have devised the "cheapest way" shipping option. So, from now on when you place an order, unless you specifically request 3-day, 2-day or 1-day shipping, we will expedite your order using this "cheapest way" option. With this new system, you may pay as little as $3 shipping on an order, whereas our old minimum shipping charge was $5.95. Here's how it works:

CHEAPEST WAY SHIPPING RATES:

Amount	Shipping
$0 to $49	$3.00
$50 to $99	$4.00
$100 to $149	$5.00
$150 to $199	$6.00
$200 +	FREE

However, because almost all of our products that are heavy by weight are low in price and vice versa, we have had to add a small shipping surcharge to those heavy items.

To balance out this differential in weight and price, the following products have now their own shipping charge in addition to the rates above which will be added to calculate your total shipping charge:

Hammer Gel	$1.00
Hammer PRO	$1.00
Hammer PRO SOY	$1.00
8 Serving SE	$1.00
30 Serving SE	$2.50

(SE = Sustained Energy)

Time in transit for packages expedited via the "Cheapest Way" option will range from 1 to 7 business days, depending on carrier and distance in transit. If you must have your package by a certain date, call or email to determine whether "Cheapest Way" will get you your product in time or if you will need to choose a faster delivery option.

3-day, 2-day and overnight delivery is available and calculated based on package weight and zone of delivery address and will be billed at our discounted rates. Please call or email for rate quote.

All orders to Alaska, Hawaii and Puerto Rico are shipped USPS unless otherwise requested. Orders going to military addresses (AP, AE) will also be sent USPS as in the past. Priority Mail rates will be charged based on weight and zone of delivery address, with no added surcharges.

Hopefully, this new system will make everyone's life a little simpler and might even reduce the shipping cost of your future orders. I will keep you posted of any new developments or changes in the future. ■

E-CAPS/HAMMER NUTRITION ATHLETE SPOTLIGHT: INTERVIEW WITH AMANDA MCINTOSH

This is a new section of *Endurance News* which features interviews with E-CAPS/HAMMER NUTRITION athletes. This is an informal interview that we hope will give other athletes an insight into the lives of some of the athletes who are making an impact in their chosen sport. If you know of an athlete you think we'd all like to hear more about in future issues of *Endurance News*, please send me an email!

Our first interview for Endurance News is with Ultra marathon trail runner Amanda McIntosh. Amanda, 36, currently resides in San Antonio, Texas and works as a personal trainer, runner, and Mom.

Q: Can you give us a little history/resume of your races and results and how you got into this sport to begin with?

A: I began running for weight loss and fitness in 1986 while living in Denver. I moved to Dallas where a coach spotted me at a race and said I had some potential. I began training with him and six other women to run 5 and 10Ks. My first trail race was also my first marathon, the 1991 Pikes Peak Marathon. I swore I would never do another trail run, they were just too dangerous. I continued to run road races, mostly marathons, until 1995 when some friends talked me into doing a 50K trail race in Huntsville, Texas. I loved the run so the next year I did the 50-mile. In 1997 I again ran the Sunmart 50 mile. This time I did pretty well and won my age group. I decided to try a 100-miler on the same course two months later. I won the Rocky Racoon 100 and set the women's course record. I was hooked on Trail Ultras. I found a group of trail runners in San Antonio and began training and racing on the trails. 1999 was my best year. I won several local ultras at various distances, was national champ at the 50 mile distance, placed 5th at Western States, and won the Sunmart 50 mile and the Leadville 100. 2000 was also great, I was learning more about training and was using E-CAPS /HAMMER products extensively. Unfortunately, I had a medical problem which forced me to drop from Western States. I did, however, place 3rd at the 50 mile national championships, won the Lake City 50 miler, took my second consecutive victory at the Leadville 100, and placed 2nd for a Texas Team Victory at the Arkansas Traveller 100. I am looking forward to the 2001 season and hope to have my best year ever.

Q: Whoa! Sounds like your training and racing keeps you busy! Any other interests?

A: I don't have a lot of time for other interests. Work and training take a huge chunk out of my day. The rest is devoted to my children, driving to various activities, helping with homework, and reading. We also do some training together. Ryan, 11, is a hockey player so three times a week we do a land workout which includes running and calisthenics. Callie, 7, rides her bike while we run. In our spare time we like to hike, camp, play football, and occasionally watch movies. I love to read but have very little time to do that (except children's books).

Q: What E-CAPS supplements do you use? What is your normal usage/protocol with these supplements? In other words, what do you take on a daily basis and why?

A: On a daily basis I take 3 Digest Caps, 3 Tissue Rejuvenator, 1 Race Cap, 2 Enduro Caps, 6 Omegasource, and 2 Super AO. Before workouts I take 1 Race Cap and 2 Enduro Caps, Sustained Energy flavored with espresso or chocolate Hammer Gel. After workouts I take 2 Super AO, Hammer Pro with Hammer Gel, and two droppers of Liquid Xobaline.

During a race I take 1-2 servings of Hammer Gel every 45 minutes, 1 Race Cap and 2 Enduro Caps every hour, Sustained Energy as tolerated, usually 4-6 oz. every 2 hours, depending on when I see my crew.

I started using Race Day Boost in training and have tried it in a race. I plan to try it in my next race as well. Recovery is a huge issue with me. I am constantly pushing my body beyond the normal limits and use E-CAPS products (Hammer Pro, Tissue Rejuvenator, Super AO, Xobaline) to recover more quickly.

Q: Sounds like a stellar program. You briefly mentioned your fueling during races. What do you use for fuel during training? And what about racing; anything different?

A: Fueling is a major concern for me. I have some sugar metabolizing problems so Hammer Gel and Sustained Energy are my fuels of choice. In training I have to supplement with real food including trail mix (heavy on the nuts), beef jerky and turkey slices to slow down sugar absorption. During a race I rely solely on Hammer Gel between aid stations. I drink Sustained Energy or eat at the aid stations, depending on what I can tolerate. I like using espresso Hammer Gel during the night hours because of the caffeine.

Q: How many miles a week do you train? What's your training schedule during both the on and off season. Do you take time off or just keep rolling all year?

A: Usually, I adhere to a long week, short week regimen. Long weeks are approximately 70 miles, short weeks 50 or so. I usually run long on Sunday, off or deep water running (pool) Monday, track workout on Tuesdays (I do longer repeats and lots of them. Typically the speed portion is 6-10 miles). I run 1.5 to 2 hours easy on Wednesday, tempo or hills on Thursday, off or deep water on Friday, 2-3 hour run on Saturday. During heaving training times I do really long weekends. 3-4 hours Friday night, 5-6 hours on Saturday, 3-4 hours on Sunday. On my short weeks I do the same schedule but cut the miles on the weekend. This gives me more time with my kids.

There is really no off-season. For the past couple of years I have taken four weeks off in December and January. This is complete rest time. I usually really need this time to recuperate after a summer and fall filled with 100 and 50 mile races.

Q: What's the most miles/hours you've trained in a week?

A: The most miles I've logged in a week are 114. I did two-a-days for five days and no days off. I felt like a running maniac. The rest of the time I ate and slept. I don't know how some athletes do this week in and week out.

Q: What was your most memorable race and why?

A: My most memorable race has to be the 2000 Leadville 100. I woke up at 2:45 AM to have my usual pre-race peanut butter and jelly sandwich. I felt a little queasy but attributed it to nerves. I felt a good bit of pressure being the returning champ and the women's field was full of excellent runners. From the start I felt a little less than good and by 20 miles I could do little more than swallow a sunflower seed. Fortunately, Tyler Curiel ran and talked with me for a good 10 miles keeping my mind off my misery. Then I hooked up with my good friend Stephanie Ehret and another runner, Kathleen Hoffman. We ran together for about 25 miles sharing stories of training and racing. It was great to have that female companionship. At 50 miles I was at least 35 minutes off pace and feeling lousy. I picked up my pacer at 52 and headed up Hope Pass. This was definitely my low point.

I always give first time 100 milers this bit of advice, "Keep going. You will have periods of mental and physical lows but you

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QUESTION: I see it (90 minutes) everywhere. It's the threshold for lots and lots of stuff, some of the E-CAPS recommended dosages for one. And, I've regularly seen training advice (at least for running) that proclaims the importance of workouts of this duration.

Why is 90 minutes so special? Why is it, at least in the case of the E-CAPS dosage recommendations, not even sport-specific? Is 90 minutes of cycling in some way equivalent to 90 minutes of swimming or running? Is 90 minutes of easy running similar in some way to 90 minutes of hard running?

ANSWER: Excellent question! My suggested answer is one relative to your individual biochemistry, which falls within a certain time optimal range. Consider the following:

NUTRIENT PEAKING PARALLELS POSTPRANDIAL BLOOD GLUCOSE

Peaking substrate levels in the blood stream follow the rate of performance-limiting carbohydrate transit time in the digestive process, which ranges from 60-90 minutes in the majority of us. Older subjects may take 70-90 minutes while younger subjects enjoy 30-50 minutes peaking glucose levels post-ingestion. Making sure that the substrates are in blood-route beforehand is important, since the body's survival mechanism's response to internal heat produced during exercise is to divert blood flow to deliver nutrients, remove metabolic wastes, and induce evaporative cooling fluids to restrain heat excess. Nutrient transit rate is less efficient under these circumstances, suggesting a 60-90 minute preparatory ingestion of the hoped-for nutrient compounds.

In a typical **Glucose Tolerance Test** (6 hours) a fasting patient is given a 100-gram carbohydrate (glucose) drink. Upon ingestion blood levels are measured periodically showing the following typical of normal glucose response: normal values = (in milligrams per 100 ml of blood):

Sedentary Subject	
Fasting	= 80 MG
Drink 100 Grams Glucose	
30 Min	= 150 MG
60 Min	= 135 MG
2 Hours	= 100 MG
2.5 Hours	= 80 MG

CALORIC-EXPENSE COMPARISON OF RUNNING/CYCLING/SWIMMING

90 minutes running is different from both swimming and cycling in terms of how fast you spend a calorie per pound body weight:

EVENT - K/CAL SPENT - DISTANCE - PER LB BODYWEIGHT

Running = 0.653 calories/mile/lb
Cycling = 0.280 calories/mile/lb
Swimming = 2.930 calories/mile/lb

Therefore, a highly fit 70 kg athlete (154 lbs) to increase rate of c-Reactive Protein as the typical primary determinant of muscle damage seen in runners at 90 minutes or 21 kilometers, calorie expense rate for leveling the field at roughly 1300 calories from a 13-mile run expenditure. The ame athlete has to cycle 30 miles or swim 2.8 miles to exert the same expenditures calorically doing a triathalon run, or cycle, or swim. Thus, 13 miles running equals 30 miles cycling or 2.8 miles swimming. It may vary slightly with age, size, fitness level and gender.

TRAINING EFFECTS NUTRIENT EXPENSE WITH IMPLICATIONS FOR NUTRIENT TRANSIT

Training elevates glycogen stores enabling all of us to go longer, faster, and more efficiently. Carbohydrate is the performance-limiting macro-nutrient. We spend it anywhere from 10-15 calories per minute but it returns no faster for postponing fatigue than 4.0-4.2 calories per minute, suggesting we are spending energy much like the Federal Government at a rate that leads to deficit. Muscle cell damage as measured by C-reactive protein levels increases right at the 21-kilometer mark in running or roughly 13 miles via foot at a 75% VO2 Max rate or for peddling-cyclists right at 90 minutes at a 75% VO2 Max rate effort. C-Reactive protein is the marker that begins to show in the blood stream right at 90 minutes give or take 20 minutes and proportionately increases with time or mileage after that distance/time is reached. Interesting that this occurs when rate-limiting muscle glycogen stores begin to reach low-tolerated levels and fatty acids begin to be the fuel of choice. During moderately strenuous exercise of intensities that can be maintained for 90 minutes or longer (approximately 55-75% of VO2max), there is a progressive decline in the proportion of energy derived from muscle glycogen and a progressive increase in plasma fatty acid oxidation. Oxygen must be proportionate due to the fuel selection favoring aerobic metabolism; without which citric acid cycle efficiency recruiting muscle glycogen at the rate of approximately 60% to 30% fatty acids the first 60-90 minutes then the reverse of these figures, 60% fatty acids to 30% muscle glycogen thereafter. Peak rates of glucose oxidation occurs approximately 75 to 90 minutes after ingestion and are unaffected by the time of glucose ingestion during exercise.

CONCLUSION

We usually suggest trial of any nutrient supplements in training race pace trial before race day. Therefore, a resting athlete may be well advised to ingest a nutrient supplement between 60-90 minutes before exercise to insure peak availability of the substrate in terms of required transit time. Personally speaking, as an older athlete (61), I prefer to dose 90 minutes before a workout, that way I know the full dose has been "delivered" in spite of any plausible age-related digestive interference. Taken sooner or later than the recommended 60-90 minutes may not give you the expected ergogenic bang for your buck as noted in observed nutrient-transit relative to performance outcome. ■

EVEREST AND EVERYWHERE ELSE!

by Steve Born

I don't have all the details yet, (I will soon), but Greg Wilson, a good friend of mine, is planning on reaching the summit of Mt. Everest for the third time in his climbing career. Two years ago, his attempt was called off due to consistently poor weather. Sitting at Camp 3 for at least a week or two, Greg relied on the samples of Sustained Energy and Hammer Gel I gave him to keep quality calories on the plus side.

Greg's often commented that many alpinists do not fuel properly, relying on a lot of sugary products such as candy bars. Greg however is convinced, based upon his use of the products during his last attempt on Everest, and in his training for this year's attempt, that proper nutrition is crucial to success. (Where have we heard that before?) As soon I get more details on the expedition, including web site information, I'll pass it on to everyone via the Endurance Forum.

Sustained Energy and Hammer Gel are part of the biggest and most extreme athletic endeavors including Everest Expeditions, RAAM, the Badwater Ultramarathon, and many, many other ultra running, cycling, mountain biking, and adventure racing events. But we're always looking for other events to sponsor. If you know of an event that we should be sponsoring, send me an email at steve@e-caps.com. Give me all the details; event name, date of event, race director, and any other contact information and I'll get in touch with them. ■

DOES THE BODY ABSORB CYTOCHROME C?

by Steve Born

It's a question I've been asked many times since I started at E-CAPS last May. Brian has probably heard it more times than he cares to remember. Perhaps it's a question you've had on your mind. The foundation for this question comes from a 1993 book by Dr., Michael Colgan where he considers Cytochrome C supplements as being "snake oil." Now, it's 8 years later and we don't know if his opinion has changed since the early 90's, but the question still remains, can the body absorb Cytochrome C? With information and insights provided by our resident expert, Dr. Bill Misner, let's find a reasonable answer to this question.

Cytochrome C and Coenzyme Q-10 take turns within the mitochondria transferring electrons in the dynamic production of energy. Gullnick notes that even when endurance activity beyond 50% VO2 Max occurs, Cytochrome C activity may drop by as much as 50%! (European Journal Of Physiology, 1990; 415:407-413,). When Cytochrome C fails to efficiently support the energy cycle, CoQ10 comes to the rescue to regenerate ATP in working muscle mitochondria cells (Loschen, E., Febs Letters, 1974,42:68-72.). In simple terms, they help each other do a critical function in the energy making process. It has been shown that exogenously (externally) ingested fat-soluble CoQ10 goes through the same gastric chambers to replenish the substrates that contribute to increase its available presence as an electron transfer carrier. Why would we not be able to do the same with its twin electron transfer carrier, Cytochrome C? If oral supplements of CoQ10 can be absorbed by the body to provide a critical substrate in the energy making process, why shouldn't oral supplements of Cytochrome C be able to do the same?

Colgan agreed with the above research conclusions and quotes exactly the same research references in Optimum Sports Nutrition as already mentioned (page 235), then suggests Cytochrome C could not enter from exogenous donation while it's twin companion mitochondrial electron transfer carrier CoQ10 could. He turns right around and recommends exogenous supplementation of CoQ10, with no mechanical rationale to explain why Cytochrome C does not transit gastric entry. In other words, he uses the same research to recommend oral supplements of CoQ10 but then states that oral supplements of Cytochrome C, a nutrient that can be used similarly to CoQ10, cannot be absorbed and is, in essence, "snake oil."

We may never know the reasons behind his rationale but the truth is neither he nor I (Dr. Misner) knows the metabolic pathway of Cytochrome C substration-replenishment pathways. Yet it has to get there somehow! The question begs, if it is exogenously amino acid diet-dependant, how does the body recruit the substrates to make it within its survival motive? It must come from either a whole food in parts or a whole supplement in part or in whole. In other words, if the body can't make an important nutrient itself, one that is naturally occurring and essential for survival, it must have some way of obtaining it from outside sources whether they are from food or supplements. Answer: the body makes it from whole foods or supplements, in parts or from whole entities.

There are some metabolic pathways we still do not understand yet which undeniably occur. Simply because we do not understand how it is possible, does not mean that it is impossible. In these instances we rely on hypothetical stances that make theoretical sense. A number of substrates such as glutathione were previously thought unavailable through exogenous pathways have now been proven otherwise. We believe this is true with Cyctochrome C and since 1987 athletes have relied on ENDURO CAPS to provide this critical nutrient for the energy making process. ■

HAMMER GEL RETAIL NETWORK GROWS

by Brian Frank

The superior taste, performance and cost of Hammer Gel have helped to establish a toehold in the retail sector. With the addition of The Hawley Company in 2001 as our second major US distributor, we can reach just about every Independent Bike Dealer (IBD) in the country. We are also very near a distribution agreement with a major player in the Canadian market, which would facilitate retail sales north of the border.

Many customers find retail distribution of Hammer Gel to be more convenient than purchasing direct. No shipping charges and no wait 2-10 days for delivery are just two of the many reasons that athletes prefer to buy Hammer Gel from their favorite bike shop. We've been adding dealers on almost a daily basis, and there just might be one near you that you don't know about.

What? You say your favorite bike shop doesn't carry Hammer Gel yet? If you are so inclined, you can help us to attract new dealers. We can send you samples to bring into your local shop or you can give us their shop name, contact name and address and we will send them a complete dealer kit with pricing, samples and literature. So, if you'd like to see more shops stocking Hammer Gel in addition to the overpriced, litter inducing pouches from GU, Power Gel and the likes, this is your chance to help a good cause.

Call 1-800-336-1977 or email ecaps@e-caps.com with the contact information of your local bike shop or ask for a few extra sample pouches with your next order to hand out. Thank you in advance for helping to spread the good news about Hammer Gel. ■

E-CAPS/HAMMER NUTRITION SPONSORS THE 2001 RAAM

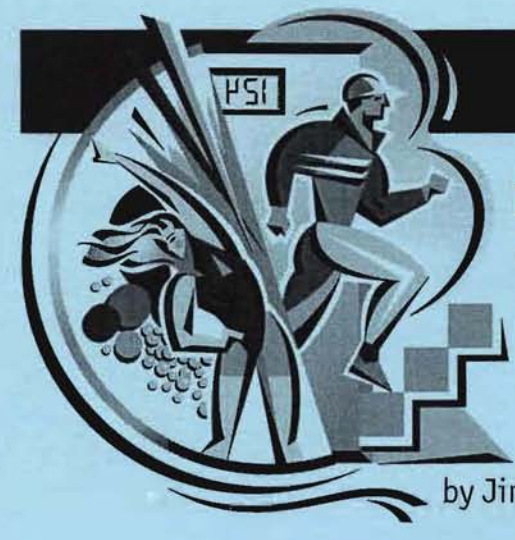
by Steve Born

The ultimate supplements and fuels for what could be the world's ultimate endurance race! E-CAPS and HAMMER NUTRITION are the official nutritional sponsors of the 2001 Race Across America (RAAM) transcontinental bicycle race. This annual race was selected by a group of experts and detailed in OUTSIDE magazine as the world's toughest endurance contest. This year's race will closely follow the route that was used last year, a nearly-3000 mile, very mountainous course from Portland, Oregon to Gulf Breeze, Florida.

Several of this year's RAAM entrants already incorporate E-CAPS supplements and HAMMER NUTRITION fuels in their training and race program, including last year's Women's Champion Cassie Lowe, previous winner Danny Chew, and veteran Terry Lansdell. Also entered is Bill Maida, a member of last year's winning Two-Person Relay Team. This year Bill will be competing with a new team member, veteran RAAM solo rider, Peter Pop, another E-CAPS/HAMMER NUTRITION athlete. Also entered is a member of last year's winning tandem team, Katie Lindquist, who will be competing in her first solo RAAM. Katie is also using E-CAPS and HAMMER NUTRITION products in her training and in RAAM.

This year's race will begin on June 17th from Portland, Oregon and travel through Idaho, Utah, Wyoming, Colorado, New Mexico, Oklahoma, Arkansas, Mississippi, Alabama, and finish in the panhandle of Florida at Gulf Breeze (just across the bay from Pensacola).

We are extremely proud to sponsor this great event. For more information on RAAM check out the official web site at www.raceacrossamerica.org. ■



PICK YOUR MOMENTS

by Jim Bruskewitz

If you haven't already started to hammer away at your training in preparation for the best year ever, you're probably at least giving it some serious thought. Those thoughts will lead you to that place in your training where you know you are getting in the kind of good hard work that will make you stronger and faster. No doubt, good hard training is part of any successful athletes training regime. The more the better...the more that is well placed and absorbed that is.

If recovery weren't an issue, you could train at the highest intensity possible each training bout and position yourself to achieve your personal best. You can't recover that fast. I want to encourage you to pick your moments when you go hard, so that you are exercising from a position of compensation, having absorbed the training stress from the collection of previous workouts. Since the racing season is still ahead, periodize your training to promote continued fitness growth throughout the season.

Too much dependence on anaerobic energy delivery at this time of year can yield some early season success, but the cumulative effect of going too hard too often can turn your continued successes into long term mediocre performances. How can so much hard work yield ordinary results?

You will notice significant anaerobic energy adaptations in 6 to 8 weeks. The rate of these gains begins to slow and level off in 12 or so weeks. Really high intensity training is very difficult to maintain for more than 16 weeks. Injuries and staleness can change your approach to training and racing at this junction in your season. Take this into account when planning your training for the upcoming season. Work backwards when planning the different phases of your training. Pick those moments when a great race will give you the most satisfaction, and precede that moment or period with the necessary intensive training and unloading (taper). Don't VO2 max train yourself to death now for a race in September. You won't be able to hold on to those gains that took so much sweat and huffing and puffing. Pick your moments.

Aerobic energy delivery is what you depend on most to train, race and recover. It is a very clean burn (products of energy delivery are CO2 and water). The rate at which energy is delivered aerobically is slow compared with anaerobic energy delivery or a lactate energy delivery (ATP/creatine phosphate). Aerobic adaptations are slower to come, but once they set in, they're robust and will pay dividends for seasons to come. Since practically all your energy is delivered aerobically, even in an all out gut-busting hour effort, gaining aerobic adaptations should occupy almost all of your training time.

Pick your moments not only when planning your upcoming training, but also while you exercise. The way you exercise influences the way that energy is delivered in your working muscles. Any accelerations/decelerations will require a faster rate of energy delivery. You'll be more lactate and anaerobic energy delivery dependent because these are the two ways of delivering energy at a fast rate.

Pick the moments when you can efficiently deliver energy by paying attention to your technique. Consider the pedal stroke while cycling. No matter how accomplished you are at spinning circles on your bike, the stroke is still a series of accelerations/decelerations with both legs. If you are maintaining a certain workload, say 325 watts while pedaling, you can deliver this wattage at various rpms. The lower the rpms you use to deliver a set wattage, the greater the magnitude of each acceleration and deceleration. The rate of energy delivery required to accomplish these accelerations/decelerations of greater magnitude is higher than if the accelerations/decelerations are smaller. Under most circumstances, you are more dependent on anaerobic energy delivery at lower rpms when delivering a set wattage. You can promote aerobic energy delivery while maintaining a set wattage by spinning efficiently and not grinding away at the gears.

Heel striking with a large vertical component while running is a way to increase the degree to which you accelerate and decelerate. Excessive head and hip movement along with dead spots in the arm stroke can increase the magnitude of accelerations/decelerations while swimming. You needn't always focus on the discomfort, an indicator of the degree to which you are dependent on anaerobic energy delivery while maintaining a particular form at a given intensity, while you train. Changing our focus/picking our moment to promote efficient technique and a higher degree of aerobic energy delivery at any intensity, will get us where we hope to go in less time. ■

(Amanda McIntosh continued from page 3)

will come out of them and feel better again." I kept playing this tape in my head, but after 60 miles I was having trouble believing I would ever come out of this. By 62 miles I was an hour behind the women's leader. My pacer got me to eat some Hammer Gel and orange slices as we came through the aid station. He kept on me forcing Hammer Gel every 25-30 minutes. Suddenly I felt great. I began picking up the pace and really having fun. At 70 miles I was 45 minutes behind the leader and feeling great. I picked up my next pacer (accomplished road runner and great friend Annamaria). When we got to the top of Sugarloaf Mountain we were treated to a shower of shooting stars. It was magical and Annamaria was so exited that it totally pumped me. We blasted down Haggerman pass and into the next aid station. I didn't even stop and my pacer had to catch me. My sister Laurie would run me in. When she caught me she told me I was only 10 minutes behind the leader. I was totally jazzed and feeling great. My sister was even worried that she wasn't going to be able to keep up with me. A mile later we passed the leader. The last 11 miles were great. Running in the darkness toward the town of Leadville with my sister was so cool. When I got to the top of the hill at 6th street I could see the finish line and the adrenaline began to flow. When I crossed the finish line I was both exhausted and ecstatic. My soul mate and training partner was there to place the medal around my neck. All of my family and friends were standing in the cold at that finish line at 2:00 in the morning! That is the most memorable moment.

Q: What advice would you give to someone just starting to do ultras?

A: Do the training, prepare for the event, then HAVE FUN! Running should be done for the pure joy of running. Ultras are a physical and mental test which many people over analyze. You do need to be prepared but it has to be fun. ■

ADVANCED CARBOHYDRATES COURSE FOR ENDURANCE SPORTS PERFORMANCE

by Dr. Bill Misner, Ph.D.

ALL YOU EVER WANTED TO KNOW AND MORE... ABOUT CARBOHYDRATES

INTRODUCTION

I wrote this to clear up the confusion from misuse of carbohydrates (CHO). Athletes eat the wrong kind of CHO too much, too soon, or too often before, during, and after events. They end up with heat stress, gastric stress, cramps, or perhaps even a DNF. When made available, a list of fluids, electrolytes, total calories, pre-event vs. post-event body weights, and preparation fitness protocols, usually resolves the problem.

McArdle WD, Katch FI, Katch VL, Exercise Physiology, Williams & Wilkins, Baltimore, Md., 4th Edition, 1996:72-77 is the major reference, supporting for each of the principle applications here suggested.

Carbohydrate fuel (CHO) is either a performance-limiting or performance-enhancing macronutrient fuel for endurance exercise. In spite of 25 previous specific explicating articles, carbohydrate misuse, overuse, under use, timing, and confusion continue to plague endurance athletes, interfering with their hoped-for maximal performance. Misinformed athletes continue to misuse simple sugars, other carbohydrates, and complex carbohydrates prior to exercise, during exercise, and after exercise. This definitive "overkill" exposition focuses on how carbohydrates make or break an endurance performance. It is hoped to clarify what is known about the whys and hows to use carbohydrates to generate efficiency for endurance during fuel expense, depletion, and then repletion. Carbohydrates used in energy drinks and gels are generally formulated from longer-chain carbohydrates (Maltodextrin) or short-chain carbohydrates (Sugars).

MALTODEXTRIN DEFINITIONS

The U.S. Food and Drug Administration has defined maltodextrins (D-glucose) as a "non-sweet nutritive saccharide polymer that consists of D-glucose units linked primarily by (alpha)-1,4 bonds and has a dextrose equivalent (DE) of less than 20. It is prepared as a white powder or concentrated solution by partial hydrolysis of corn starch or potato starch with safe and suitable acids and enzymes." (21 Code of Federal Regulations Sec. 184.1444.) The chemical structure of maltodextrins falls somewhere between the complex polysaccharide chains of starch and the simpler molecules of corn syrup solids or sugars. They do consist of a mixture of different saccharide polymers by virtue of the hydrolysis process. A starch molecule undergoes enzymatic or acid hydrolysis or a combination of the two. This cleaves the molecule into smaller, random-length chains. Maltodextrins are usually classified by Dextrose Equivalence (DE), which is a wet-chemistry method that indicates the amount of hydrolysis done on a starch molecule, indicating the degree of polymerization (DP) of the starch molecule or the number of monosaccharide units in the molecules. (DE is derived from a formula: DE = 100 ÷ DP).

The higher the DE, the higher the level of monosaccharides and short chain polymers. Glucose (dextrose) possesses a 100 DE; starch is -0-(zero). Because maltodextrins and other hydrolyzed starches consist of a mixture of polymer lengths, the DE is an average value. DE does not refer to the amount of glucose, but is refers to the glucose at the end of the molecule (A "5" DE doesn't mean 5% glucose). In a maltodextrin, it may only be one-tenth of that. This analysis is a measurement of the average reducing power compared to a dextrose standard. Maltodextrins with a low DE contain a larger amount of longer straight- and branched-chain units, which tends to exhibit characteristics more in line with those of starch, such as viscosity. As the DE increases and the level of lower molecular weight product increases, the maltodextrin tends to act more like a corn syrup solid and is sweeter tasting. This means that a number of characteristics of maltodextrins are related to the DE. Corn Syrup solids are those with a DE from 21-100. All maltodextrins formulated in E-CAPS & Hammer Nutrition products report a DE of 4-18. Because these maltodextrins fall in the lower DE range, they supply little or no sweetness. They are fairly bland, although they sometimes provide some flavor.

For sports beverages for oral rehydration and low-residue liquid fueling, maltodextrins provide complex carbohydrates and allow the formulation to equate to body fluid osmolality (280 to 300 mOsm/Kg) in 5 times the caloric content or higher solutions than simple sugars. This may eliminate gastric cramping and other undesirable side effects caused during rehydration. Even an 18 DE maltodextrin is mildly sweet, but unlike sugared sweeteners, such as fructose or sucrose, which at the same level of maltodextrins is too sweet, the osmolality would be too high to provide rate-demand absorption.

SUGAR DEFINITION

(Sugars are monosaccharides or disaccharides.) The key definition, as you know, to what is and is not "Sugar" follows: "Sugars shall be defined as the sum of all free monosaccharides and disaccharides, such as glucose, fructose, lactose, and sucrose. Sugar content shall be indented and expressed to the nearest gram, except that if a serving contains less than 1 gram, the statement -'Contains less then 1 gram'- or -'less than 1 gram'- may be used as an alternative, and if the serving contains less than 0.5 gram, the content may be expressed as zero."

BEFORE EXERCISE PRE-EVENT MEAL WARNING (TAKE NO SOONER THAN 3 HOURS BEFORE EXERCISE)

Both Maltodextrin and sugar have corresponding high glycemic indexes which will elevate blood glucose and insulin release at similar rates. The high glycemic index of sugar and maltodextrin ranges between 90-137. High glycemic carbohydrates such as maltodextrins or simple sugars taken 60 MINUTES BEFORE exercise may have the following less-than-optimal or possibly negative effects on performance:

1. Rapid rise in blood sugar raises insulin excess leading to hypoglycemia.
2. High insulin levels inhibit lipid mobilization during aerobic exercise.
3. High insulin-induced blood sugar influx into muscle cells causes a higher rate of carbohydrate metabolism, hence rapid carbohydrate fuel depletion.
4. The pre-event meal hormone insulin-induced blood sugar levels is not effected when ingested 3 hours prior. Hormonal balance is restored 3 hours following a carbohydrate pre-event meal, but is out of metabolic balance if taken within 60 minutes of the start.
5. The metabolic pathway and caloric donation generated from fructose exclude it completely from consideration as an efficient or required carbohydrate in prior to or after energy expense.

CONCLUSION

The pre-event meal should consist of 75-100 grams of carbohydrates from complex carbohydrate maltodextrins but should be taken no later than 3 hours prior to an exercise event (1). Intake of high glycemic carbohydrates between meals may be the number one cause of excessive body weight gain in the off season, which may be resolved by either lowering the serving size and frequency of high glycemic carbohydrates or choosing dietary low glycemic complex high fiber carbohydrate foods: (See Chart A at top of next page)

(continued on page 8)

(Advanced Carbohydrates continued from page 7)

CHART A
PRE-EVENT MEAL GLYCEMIC INDEX
(Pre-Exercise, In between Meals)

GI of 50-59:	Buckwheat, White Spaghetti, Sweet corn, All-Bran, Peas, Yam, Potato Chips.
GI of 40-49:	Whole meal Spaghetti, Sweet Potato, Navy Beans, Dried Peas, Oranges, Sponge Cake
GI of 30-39:	Butterbeans, Blackeye Peas, Apples, Milk, Yogurt, Tomato Soup
GI of 20-29:	Kidney Beans, Lentils, Parsnips
GI of 10-19:	Soy Beans, Peanuts

DURING EXERCISE HOW MUCH CARBOHYDRATE AND HOW OFTEN

During exercise insulin release is inhibited because sympathetic nervous system hormones are released and concurrently exercise augments muscle uptake of glucose from exogenous intake accompanied by lower insulin levels and effects. Low solution sugars (5-8%) or moderate-to-higher solutions (15%) maltodextrin (glucose polymers) postpone fatigue efficiently during exercise. The endurance fuel-of-choice is always carbohydrates. Carbohydrates generate TWICE the rate of energy as fats when converted into the energy cycle. Proteins donated to the energy cycle from lean muscle mass are limited, but constant. Most of the energy fuels required in transition from rest to aerobic energy is initially supplied by stored muscle glycogen in active muscles. During the first hour of submaximal exercise, 50-65% of energy is generated by carbohydrate-glycogen, 30-35% from stored bodyfat, 5-15% from cannibalized lean muscle mass amino acids.

However, as exercise continues in 2nd and 3rd hour, lipids from body fat stores are converted, providing 55-65% of the fuels, while glycogen stored carbs provide only 25-35%, and muscle proteins the remaining 5-15%. The rate of protein cannibalization remains fixed, meaning the differences are resolved from lipids and glycogen mobilization. Altering performance at a slower rate pace demands a larger portion from bodyfat stores, while the faster the pace increases the rate at which the carbohydrate-glycogen stores are depleted.

For maximal production of energy during athletic activities, the American Dietetic Association supports a nutritional program (2) consisting of 60-65% complex carbohydrates, 10% from protein, and less than 30% from fat. Why are carbohydrates preferred? High muscle glycogen stores support both anaerobic and aerobic activities, which delay fatigue and promote both strength and endurance. There are three types of muscle fibers are recruited during athletic performance, slow twitch (ST), fast-oxidative Glycolytic (FOG) and fast twitch (FT). Slow twitch muscle fibers are the high-repetition endurance muscle units that feed on lipid-triglyceride-fats stored within the muscle or transported through the bloodstream. If muscle stores of glycogen are depleted or low, lipid metabolism will not occur efficiently (STEVE'S NOTE: This is why it is so vital to start replenishing muscle glycogen stores immediately after exercise. Refer to the chart in my carbohydrate related article in this issue.) FOG fibers burn both lipid and muscle glycogen during their employment, while fast twitch (FT) burn only muscle glycogen or available blood serum glucose. Optimal performance of each muscle fiber type is supported by a 60-30-10 ratio of Carbohydrates-Fat-Protein ratio of macronutrients. However, the body will, in time, partially adapt to whatever nutrient composite it is given to work with for endurance demand for movement through time and space.

At 50% maximal aerobic rate or less, the body chooses body fat for energy fuel demands. Fatigue is postponed during the higher 60-80% VO2 Maximal aerobic exercise rate, if the athlete ingests a specific carbohydrate solution. These refueling benefits peak at 75% maximal aerobic capacity: (a)-Gastric emptying rate is efficient and unimpeded up to 75% VO2 Max rate, (b)-Glycogen expense is also most efficient at 75% VO2 Max rate. The human body is able to return approximately 1 gram per minute or 240-280 food calories per hour by way of the liver to refuel the working muscles (3). Carbohydrate solution strength calls for a body fluid level of "osmolality". This determines what type and what volume of carbohydrate is absorbed immediately.

CHART B

Type of Fuel	Calories Provided at 280-300 mOsm. Osmolality
Glucose	0.2 cal/ml
Fructose	0.2 cal/ml
Sucrose	0.4 cal/ml
Maltodextrin	1.0+ cal/ml

Athletes should dilute 1 ounce (28.3 grams) of medium to long-chain maltodextrins in each 5-8 liquid ounces of water, or between 15-20% in solution (fluids:fuel, 5:1 by weight). This provides a solution at body fluid osmolality of 280-300 mOsm/l. for immediate-efficient gastric emptying. Athletes using the simple sugars sucrose, fructose, or glucose are unaware that simple sugars double the solution osmolality, significantly delaying gastric absorption. When absorption of fuel is delayed due to a high osmolar sugared solutions, fluids and electrolytes must be drawn out of the body then across gastric linings for reducing the high osmolar pressures to body fluid levels for absorption. If a sugared solution is chosen, it should be no higher than 5-8%, while more calories as long-medium chained maltodextrins are readily absorbed at a higher 15-20% solution. It takes a much greater fluid volume for sugary solutions to meet endurance caloric expense. (1, 4, 5)

Osmolality solution numbers justify using maltodextrins during exercise: (see Chart B at top)

Gastric emptying rates are effected by stomach volumes ranging from 400 ml. to 800 ml. (13-26 fl.oz.). Some athletes tolerate significantly higher stomach volumes than do others. As noted here, one athlete tolerated 50% stomach volume of the other. In a 10-minute period of time, athletes were observed to empty stomach volumes at the following rates (4): (see Chart C)

CHART C

1. **Pure Water Solution 65%**
   From 400 ml., 260 ml. was emptied - From 800 ml., 520 ml. emptied
2. **Isotonic 7% Carbohydrate Solution-50%**
   From 400 ml., 200 ml. was emptied - From 800 ml., 400 ml. emptied
3. **Glucose 15% Solution-25%**
   From 400 ml., 100 ml. was emptied - From 800 ml., 200 ml. emptied
4. **Maltodextrin 18% Solution-25%**
   From 400 ml., 100 ml. was emptied - From 800 ml., 200 ml. emptied

CARBOHYDRATES (CHO) "TO-AND-FRO" GLYCOGEN EXCHANGE RATES?

Noakes (5) suggests approximately 600 ml. fluid per hour (20 Fl.Oz.) with up to 120 grams from a glucose polymer energy drink will adequately convert 50% of a complex carbohydrate drink (60 grams of the glucose polymer solution) transferred into the energy cycle of oxidized exogenous CHO (foods) processed by the liver to working muscles. There are of course different dietary interventions known and shown to dramatically affect muscle and liver glycogen (carbohydrate) stores (5): (see Chart D at top of page 12)

Short lived is the "fate" of high carbohydrate intake storage proportionate to exercise intensity and duration. However, consuming a high percentage of carbohydrate-rich foods (CHO) is a must-do for maintain a high-constant energy flow from these most efficient of the stored combustible fuels designed to fight off fatigue, feebleness, or muscle- failure. Just eating lots of carbs is not the answer, but timing, choice, and balance must be considered choices of food, liquid, and electrolytes. Hidden factors exist specific to each

(continued on page 9)

(Advanced Carbohydrates continued from page 8)

CHART D

Subjects	Type & Time Of Diet	In Muscle (g/kg)	In Liver (g/kg)
Trained	Low Carbohydrate Diet	14	30
Trained	High Carbohydrate Diet	21	70
Trained	24-Hour Fast	21	10
Trained	Glycogen Stripping (3 day low Carbohydrates during training)	7	10
Trained	3 day high Carbohydrate Loading	36	90
Trained	After 3-4 hours Intense 70-85% V02 Max Rate	4	23
Trained	24 hours post-race (high CHO)	15	90
Trained	48 hours post-race (high CHO)	27	90

athlete's calculation for how their body responds to extreme endurance equally important to training both the cardiovascular system and the muscles.

FATE OF FOOD AND FLUIDS IN TRANSIT - EIGHT HIDDEN FACTORS INHIBIT PERFORMANCE

At least 8 hidden HINDRANCES or help factors should be considered as a predicted model for completing such demanding performances:

1. Athlete's individual gastric volume tolerances-400 to 800 ml. avg. range. *(Hindered by drinking more than 900 ml./ hour may result in Dilutional Hyponatremia.)*
2. Solution Osmolality at 280-300 mOsm. *(Hindered by slow absorption of simple sugars doubling solution osmolality.)*
3. Solution Temperature at 41 degrees F. *(Hindered by a warm solution being absorbed slowly at a 39% rate compared to 100% of colder solutions.)*
4. Caloric Content Absorption Rate (Simple Sugars vs. Complex Carbohydrates) *(Hindered by lower caloric volume absorbed from Simple Sugars in comparison to larger volumes absorbed from complex carbohydrates.)*
5. Aerobic Rate of Pace from 55-75% V02 Max. *(Hindered by Speed, speed kills: the faster you go, the faster one's carbohydrate stores are depleted.)*
6. Environmental Temperature and Humidity: Slow Down in Heat! *(Hindered when body Core Temperatures exceed 103 degrees, i.e. when the outside temperatures and humidity cause core body temperatures to rise above 102, efficiency deteriorates proportionately. When core temperatures are 100-102 F., core temperature is suggested as "optimal" for the max-efficiency burning rate of muscle glycogen stores. Note: When perspiration first appears on the brow, core body temperature is 102 degrees F.)*
7. Individual Fitness and Acclimatization. *(Hindered by lack of acclimatization or fitness training effects by up to 50 percent! The same fit athlete finishing the event in 8 days would otherwise finish the event in only 12 days in an unfit-unacclimatized state. The fit, acclimatized athlete requires only 50% of the electrolyte stores of an unfit, unacclimatized athlete and has higher tissue buffering and enzymatic capacities for efficient endurance energy production.)*
8. Age, Gender, Body Mass Index. *(Hindered by genetic capacity, hormone mechanics prevalent to gender favor the most lean muscle mass to body fat ratio specimen. Age also may be a factor, favoring youth, another cause for variable responses to the rate of carbohydrate intake upon its oxidation rate in the working muscles.)*

SUGGESTED SOLUTION TO MOST INHIBITING FACTORS

Timing 240-280 calories of carbohydrates in an osmolar solution (280-303 mOsm) of 16-24 fluid ounces during a 50% V02 Max to no higher than 75% V02 maximal aerobic exercise rate per each hour during exercise is supported from the literature to postpone endurance-induced fatigue. This general principle works metabolically to maximize endurance performance in 99% of those competing in prolonged athletic events even in extreme conditions. (1, 3, 4, 5)

GLYCEMIC INDEX FOR POST-EXERCISE MUSCLE SYNTHESIS RECOVERY VS. THE PRE-EVENT MEAL

Glycemic index is typically based on the standard score of 100 from the measured blood glucose levels resulting from eating 50 grams of glucose or white bread. Athletes should eat low glycemic carbohydrates before exercise. Eating moderate-to-high glycemic carbohydrates after exercise, during the 2-hour window post-depletion enhances glycogen restoration, while carbohydrate-induced body fat gain is minimized if dose-frequency is controlled, limiting the volume of higher glycemic sugars or moderately high glycemic foods. Why? After exercise, when the hormone insulin is low and exercise-induced catecholamines are high, the glycogen-storing enzyme-activate, Glycogen Synthetase, replenishes depleted glycogen from intake of dietary moderate-to-high glycemic indexed carbohydrates. This occurs at an optimal rate of 50-75 grams carbohydrate per hour up to a maximum of 500 carbohydrate grams. After muscle glycogen stores are depleted, restoration occurs at the rate of 5-7% per hour. The initial post workout meal recommended contains 4 portions of carbohydrates to 1 part complete protein from soy, whey or egg whites. This formula is suggested to enhance both muscle synthesis substrates and glycogen stores after an intense depletion workout. A post workout repletion meal needs to be low-fat, since fat slows digestion and absorption rate significantly. The only time a large glucose rise is recommended is during the 2-hour window AFTER a workout. The largest glucose rises from food categories are from vegetables (70), followed by breakfast cereals (65), cereals and biscuits (60), fruit (50), dairy products (35), and dried legumes (31): (Chart E)

For more on food glycemic index, see Rick Mendosa's Glycemic Index List. (6)

If the endurance athletes adapt to a lower consumption and timing intake of high glycemic carbohydrate sources while raising the dietary low glycemic index foods, both glycogen stores and reduced bodyfat dead weight may result in an optimal performance. ■

CHART E

HIGH *(post-exercise)*		MODERATE *(post & 60' pre-exercise)*		LOW *(pre-exercise & in-between meals)*	
Glucose	100	Orange Juice	57	Apple	36
Baked Potato	85	White Rice	56	Pear	36
Corn Flakes	84	Popcorn	55	Skim Milk	32
Cheerios	74	Corn	55	Green Beans	30
Graham Crackers	74	Brown Rice	55	Lentils	29
Honey	73	Sweet Potato	54	Kidney Beans	27
Watermelon	72	Banana	50	Grapefruit	25
Bread/Bagel	70-72	Orange	43	Barley	25
Table Sugar	65	Apple Juice	41	Raisins	64

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ergy. The biggest problem is that once only a minimum (it doesn't take much) of the short chain sugars are present in the blood channels, a "Sugar/Insulin Spike" occurs followed by traumatic blood-sugar below-fasting depression or "Bonk". Because complex carbohydrates may enter at a relatively high 15-20% solution, the typical crashing "Bonk" is not typically as low as the simple sugar "Crash". There are several studies that show that glucose (a simple sugar) causes a greater drop in blood sugar levels (even BELOW fasting baseline levels!) than complex carbohydrates. Simply put, simple sugars are a very inefficient fuel source. Trying to use simple sugars to fuel your exercise is kind of like trying to heat your home burning newspapers in the stove. They're hot but very short-lived. If you want to keep warm you'd have to constantly add more and more newspapers to the fire...highly inefficient!

The other question people always seem to ask is in regards to the glycemic index (GI) of various carbohydrates. Prior to exercise this is critical unless the pre-workout meal is completed three hours prior to exercise, thus allowing insulin levels to return to baseline. After exercise begins glycemic index impact on insulin release is moderated DURING exercise and is inhibited because sympathetic nervous system hormones are generated in a low depleting blood sugar environment. In other words, the body has a highly effective way of regulating insulin during exercise. Processed simple sugars are usually in the 95-110 GI range, while processed complex carbohydrates are generally in the 110-130 GI-range or lower, depending on the type of maltodextrin. During exercise Glycemic Index is not a factor unless one consumes more than the liver can return to the energy cycle (again about 280 carbohydrate calories per hour maximum). I believe that everyone who concerns themselves more with the GI makeup of a carbohydrate source than the saccharide profile is making a big mistake.

CARBS FOR RECOVERY

It's important to start replenishing carbohydrates as soon as possible after exercise. This is because the enzyme that controls glycogen storage, glycogen synthase, is highly active immediately after exercise when muscle glycogen stores are low. Several studies have shown that the most important fuel, the one that will determine exercise performance, is the level of glycogen in the muscles before exercise. In simple terms, what you do in recovery today can greatly determine how you are able to perform tomorrow. Studies from the University of Texas at Austin demonstrated that glycogen synthesis was highest when subjects were given carbohydrate immediately after exercise. This suggests that glycogen synthesis from carbohydrate intake takes place most rapidly the first hour after exercise, but may occur up to 4-6 hours, less rapidly from hours 3-6 post. The best glycogen replacement form is complex carbohydrates from glucose polymers (maltodextrins). Fiber is good for colon health, but it's not the best choice for those first two hours immediately after exercise.

Some experts suggest taking 225 grams complex carbohydrates for 2-4 hours post-exercise. More than that will add to body fat stores. Other research studies suggest that about 650 total grams carbohydrate is all the carb volume the body can regenerate into muscle glycogen stores each day. The following chart shows the variations of this average figure based on body weight and length of training. This includes everything pre, during, and post workout regarding carbohydrate consumption.

Bodyweight	Hours Training		
	2	4	6
110 lbs.	300	500	700
132	400	600	800
154	500	700	900
176	600	800	1000
198	700	900	1100

So for recovery, I would suggest 75-100 grams of complex carbs in the first hour, with another 125-150 grams in the next three hours. For a daily total, to complete the "muscle glycogen resynthesis" picture, aim for what the above chart suggests. If you just want to play the averages, aim for a daily total of 650 grams.

Because insulin plays such a vital role in replenishing glycogen stores after exercise, it's important to focus on how to make it work optimally. Studies show that protein, when combined with carbohydrates, almost doubles the insulin response. This makes it seem logical to include some protein along with your complex carbohydrates. A ratio of around 4:1 is a good recommendation. This makes a scoop of HAMMER PRO along with 4 servings of HAMMER GEL in water a very simple, yet effective recovery drink. For variety, I also like to use four scoops of SUSTAINED ENERGY in water. Other times I'll use less scoops of SE and add a couple servings of HAMMER GEL (to increase the carbohydrate total) in water as a post-workout recovery drink.

Chromium also plays an important role in how well insulin works. Studies suggest that within two hours of completion of exercise if an athlete takes 200 mcg chromium polynicotinate along ample carbohydrates, they will experience a 300% increase in the rate of glycogen synthesis compared to no supplementation. Taking PIC or Chromate with your post-workout recovery drink will really boost glycogen syntheses.

What you choose to use as your fuel, how much, and when plays a crucial part in determining your performance. By following these general guidelines during training and recovery, you will go a long way towards optimizing your performance.

DURING EXERCISE:

1. No more than 280 carbohydrate calories an hour (or use chart to determin maximum allowed for your bodyweight).
2. No simple sugars! If you want to use your body fat stores as fuel more efficiently keep them out of your fuel mix and out of your body.
3. During exercise lasting longer than two hours, start providing some protein in the fuel mix to satisfy the 5-15% the body requires. I've done bike rides of five hours on just Hammer Gel without a problem, but consistent exercise over two hours requires protein to be a part of the fuel mix.

FOR RECOVERY:

1. Consume 100 grams of complex carbohydrates and 20-25 grams of protein in the first hour upon completion of exercise.
2. Don't use carbohydrates rich in fiber this first hour.
3. Take 200 mcg chromium polynicotinate. Note tha both Sustained Energy and Premium Insurance Caps have chromium as part of their makeup if you already use them as part of your post workout recovery strategy.
4. Consume another 125 grams complex carbohydrates and an additional 20-25 grams of protein within the next three hours.
5. Try to aim for 650 grams of carbohydrates total for your daily intake or follow the above chart. ■

Steve Born is a technical advisor for E-CAPS with over a decade of involvement in the health food industry. He is a three-time RAAM finisher, the 1994 Furnace Creek 508 Champion and 1999 runner-up, and is the holder of two Ultra Marathon Cycling records.

TRAINING THE VARIOUS PERFORMANCE SYSTEMS

by Nate Llerandi

Slow-twitch fibers. Fast-twitch fibers. We've all got them in our muscles, albeit in different percentages. Sprinters have a higher number of fast-twitch fibers than endurance athletes, for example. And endurance athletes have a higher number of slow-twitch fibers than their sprinting counterparts.

While an endurance athlete could sprint day after day until he/she is blue in the face, he/she would never get as fast as a sprinter (and vise versa). But this is not to say we can't train ourselves to be faster, or to go longer. We can teach our bodies to do just about anything.

The principle is a simple one: Use it or lose it. There are neuropathways that connect to the brain, and to each type of muscle fiber and energy system. It's all systemic and it's all interconnected. If you don't use a specific energy system or muscle fiber, the neuropathway leading to it grows over, similar to an unused path in the woods. When a lot of people trek along a path, it's well-beaten and easy to use; if people fail to use a path, it becomes grown over with weeds and hard to walk along. If you are an endurance athlete (as most, if not all, of us are) the best way to increase your speed for your endurance event is not necessarily to keep your HR aerobic and go longer. The best way is to utilize the fast-twitch muscle fibers and access the energy systems inherent in training at higher intensities.

Think of it as a trickle down effect. If you train aerobically - below 75% - because you think this will help you run a marathon, complete RAAM or race an Ironman faster, you're right to a limited degree. Training aerobically will help your body utilize fat for fuel and will help you get faster while racing in an aerobic state. But, at some point, your performance will plateau. This is where the trickle down effect comes in to play.

When you train at a given intensity level, you improve your performance at that level and at every level below it. So, if you train to improve your lactate threshold by training at 84-95% on your hard days, you are improving your performance at HR levels below that as well. Now, this is not to say that to make yourself the best endurance athlete you can be, you need to train anaerobically. You need to mix the right blend of anaerobic training into your aerobic training mix.

For example, when I raced as a pro triathlete, I found the biggest difference in training between Olympic distance and Ironman distance athletes was how long they each went on their long days. Both types of athletes still hit the track for running, went on the same group rides and turned beet red in the pool.

With as little as one day a week dedicated to anaerobic training, you can realize greater gains in your aerobic capacities and endurance racing. Early in the year, anaerobic training should be more unstructured, done as fartlek workouts. As winter progresses and spring approaches, you should extend the amount of time you spend in an anaerobic state. Then, as the race season approaches, anaerobic workouts should take on a more structured look. For workouts in the 75-84% range, you need to hold your HR there for an extended period of time. This is called Tempo training. Extend the amount of time you spend in this HR zone, maxing out at around 30 minutes for running and 50-60 minutes for biking. For workouts in the 84-92% range, the work/rest ratio should be about 2/1. Very little training should be done in the 90-95% range. If you venture up here, the work/rest ratio should be 1/1 or 1/2.

If your problem is the opposite - you're fast but can't sustain a steady aerobic pace for too long - then you need to decrease the amount of anaerobic training you're doing and increase the amount of aerobic training.

A good test to repeat every month or so is an aerobic time trial. For running, do a 3-mile time trial on a track or treadmill; for biking, complete a dead-flat 8-10 mile course on your CompuTrainer or pick a low-traffic loop outside. For swimming, do 5x200 with :20 rest for best average. For each test, keep your HR within 2 beats above/below 75%.

Each level of intensity is a different piece of the overall training puzzle. While the various pieces are different sizes, if one piece is missing the picture won't be complete. And your results won't be as good as they could be.

Happy Training! ■

ENDURANCE NEWS MISSION STATEMENT

The objective of Endurance News is to provide you, the serious endurance athlete, with a valuable resource that you will find to be informative, educational, thought provoking and helpful in your ongoing pursuit of optimum performance and health.

Endurance News features insightful articles on diet, nutrition, training and other topics of interest to endurance athletes - written by myself as well as professional and elite amateur athletes, and other experts in the area of nutrition and exercise. In addition, EN will include articles highlighting new and existing E-CAPS products and how to get the maximum benefits from them.

In reading this and future issues, please remember that the views expressed in this publication will always be biased in favor of a healthy diet, hard training that emphasizes quality over quantity, and prudent supplementation to improve health and performance. But above all, we at Endurance News believe there are no short cuts, and success can only come from hard work.

Brian Frank
Editor

Legal disclaimer: The contents of Endurance News are not intended to provide medical advice to individuals. For medical advice, please consult a licensed health care specialist.

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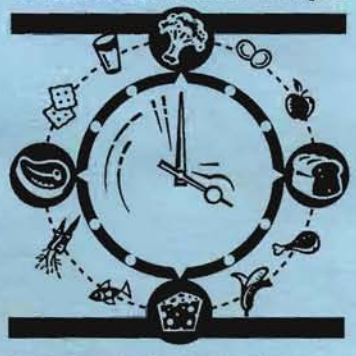
THE BACK PAGE

FROM THE DESK OF BRIAN FRANK

In the last issue of *Endurance News*, I was remarking that it was hard to believe that 2001 was already here. Today, I find myself just as surprised that April and the start of the racing season is just around the corner. The good news is that we have more human and online resources than at any time since 1987. For you, this means that we are better equipped than ever with the right products and information to help you reach your athletic goals while staying healthy and having enough energy to enjoy the rest of your life outside of training and competition.

The introduction of Appestat, our first new product for 2001 has been a big hit. I guess I wasn't the only one with a few pounds to lose after all. We blew through our first production run in less than 3 weeks, but we have a fresh load on the shelves, so if you missed out on the first go around or still have a few pounds you'd like to part company with, order now. Also, for those of you who have been using the Appestat, we'd love to hear your feedback on how it has helped you manage your appetite and weight loss.



Besides the Apple Cinnamon Hammer Gel and Appestat, we have a couple more tricks up our sleeve for 2001 and you will be among the first to know about new products and updates of existing products.

On a final note, Dan Taylor has resigned his marketing/promotion position here. We wish him the best as he moves on to pursue his goals elsewhere. ■

Tailwinds forever,
Brian Frank