EFS-PRO™ Research Packet

Rev. 1, Oct 2014

Corporate Philosophy

Our Mission

Integrate our passion for racing, knowledge of sports nutrition, integrity, and values to provide endurance athletes with the ultimate, scientifically validated, high-performance racing formulations.

Research Philosophy

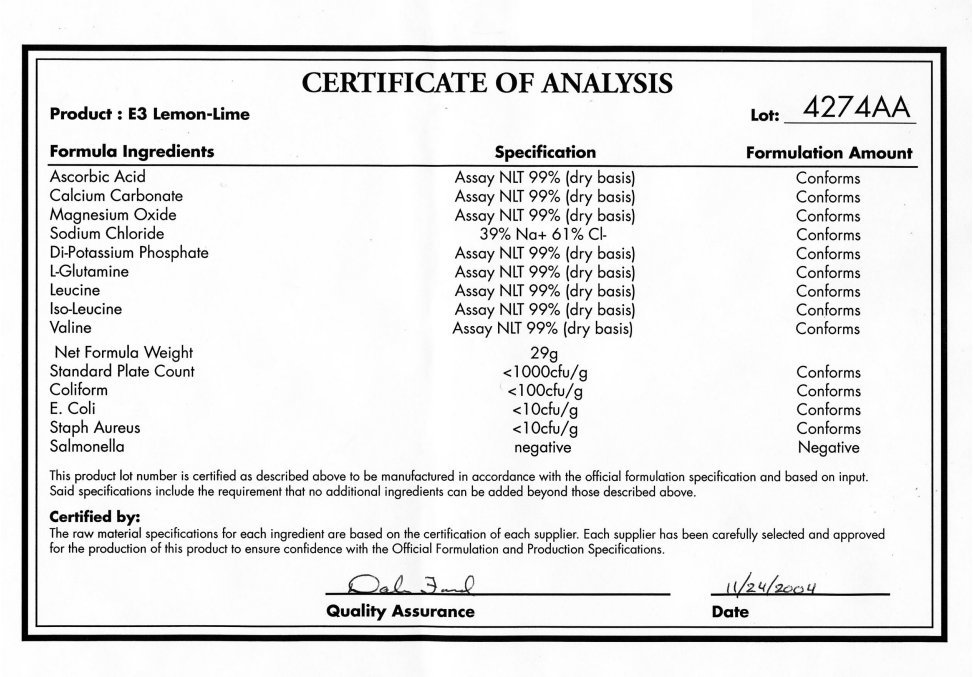
Research is the most important value at First Endurance. We are driven by a desire to ensure our products are proven to enhance endurance performance and have scientific validation. At First Endurance, we refuse to reduce costs by using "pixie dust" amounts of ingredients just to dress up the label. Our formulations utilize the same levels (sometimes more) of the active ingredients that were used in the actual human scientific research. We assure effective products by using the same ingredients used in the human clinical studies. We are meticulous about research and go out of our way to make sure we have addressed each of our stringent requirements. All products that First Endurance develops are based on human scientific research.

Commitment to Quality

First Endurance uses only the finest ingredients and follows stringent quality control. Supplements can be easily ruined. Even if you buy the right ingredients, they can degrade quickly and lose their efficacy if they aren't handled under the most stringent controls. We are determined to ensure nothing goes wrong with any step of the way. EFS is manufactured under the highest manufacturing guidelines assuring potency and strict quality control.

Certificate of Analysis

A Certificate of Analysis (C of A) is a document which states every active and inactive substance used to manufacture a product. A C of A also shows that there are no additional ingredients added to the EFS formulation.



CERTIFICATE OF ANALYSIS

Product : E3 Lemon-Lime **Lot:** 4274AA

Formula Ingredients	Specification	Formulation Amount
Ascorbic Acid	Assay NLT 99% (dry basis)	Conforms
Calcium Carbonate	Assay NLT 99% (dry basis)	Conforms
Magnesium Oxide	Assay NLT 99% (dry basis)	Conforms
Sodium Chloride	39% Na+ 61% Cl-	Conforms
Di-Potassium Phosphate	Assay NLT 99% (dry basis)	Conforms
L-Glutamine	Assay NLT 99% (dry basis)	Conforms
Leucine	Assay NLT 99% (dry basis)	Conforms
Iso-Leucine	Assay NLT 99% (dry basis)	Conforms
Valine	Assay NLT 99% (dry basis)	Conforms
Net Formula Weight	29g	
Standard Plate Count	<1000cfu/g	Conforms
Coliform	<100cfu/g	Conforms
E. Coli	<10cfu/g	Conforms
Staph Aureus	<10cfu/g	Conforms
Salmonella	negative	Negative

This product lot number is certified as described above to be manufactured in accordance with the official formulation specification and based on input. Said specifications include the requirement that no additional ingredients can be added beyond those described above.

Certified by:
The raw material specifications for each ingredient are based on the certification of each supplier. Each supplier has been carefully selected and approved for the production of this product to ensure confidence with the Official Formulation and Production Specifications.

Quality Assurance — Date: 11/24/2004

Safe and Legal

First Endurance is committed to developing the most advanced endurance supplements on the market. First Endurance has taken additional measures to assure that our products are safe and legal. First Endurance supplements are legal to use in any sporting event.

Some commonalties among these governing bodies include banned substances which fall into one or more of the following categories as listed in Section I A-E of the UCI Prohibited Classes of substance and Prohibited Methods document. A) Stimulants B) Narcotics C) Anabolic agents D) Diuretics and E) Peptide hormones, mimetics and analogues. This document goes on to list banned substances within each of these classes. Regulations also ban 'Compounds chemically or pharmacologically related to the products mentioned'.

First Endurance products contain NO ingredients which are explicitly listed under the banned substance list, and none of the ingredients are related chemically or pharmacologically. Note: USADA, WADA and UCI do not offer any certification or written confirmation.

First Endurance manufactures its formulations to the highest GMP (Good Manufacturing Practice) standards available. In addition, a proprietary manufacturing method is used for added safety and assurance.

All ingredients used in First Endurance formulations come from audited suppliers who do not carry, broker or supply any banned substances.

Part XIV Article 7 of the Anti-doping Examination Regulations contains the following warning:
riders must refrain from using any substance, foodstuff or drink of which they do not know the composition. It must be emphasized that the composition indicated on a product is not always complete. The product may contain prohibited substances not listed in the composition.

For a complete list of regulations and banned substances please use one of the following links:

UCI Banned Substance List
WADA
USADA

Typical Supplement Facts for EFS Drink

Use Directions: Take one serving every 30 minutes, during long or exhaustive exercise.
Mix two to four scoops in 12oz cold water. 1 scoop = 40 calories

Supplement Facts Serving size 3 scoops (40g): makes 12 fluid ounces	Amount Per Serving	%DV *
Calories	120	
Calories from fat	0	
Total fat	0 g	0%
Cholesterol	0 g	0%
Total Carbohydrate (long high branched amylopectin dextrin, short chain maltodextrin, dextrose, sucrose)	30 g	%
Sugars	10g	**
EFS Total Electrolyte Blend (Ca, Mg, Cl, Na, K)	1500mg	*
Calcium (as DiCalcium Malate) 100mg		10%
Magnesium (DiMagnesium Malate) 150mg		38%
Chloride (as sodium chloride) 530mg		10%
Sodium (as sodium chloride and citrate) 500mg		15%
Potassium (as di-potassium phosphate) 220mg		6%
Hydration Potentiator (Sustamine® :L-Alanyl L-Glutamine)	200mg	*
Malic Acid (from DiCalcium and DiMagnesium Malate)	700mg	*
Ultra Pure Amino Acid Blend (L-Glutamine, L-Alanyl L Glutamine, Leucine, Iso-Leucine, Valine)	2000mg	*
*Daily Value Not Established **Percent Daily Values are based on a 2,000 calorie diet.		

Ingredients: long high branched amylopectin dextrin, maltodextrin, sucrose, dextrose, Ultra Pure Amino Acid Blend (L-Glutamine, L-Alanyl L-Glutamine Leucine, Iso-Leucine, Valine), Electrolyte blend (chloride, sodium, potassium, magnesium, calcium), natural flavors, citric acid.

	Scoop	**Calories**	**Solution %**	**Osmolality**	**Total electrolytes**
Low Cal	**Two**	**80**	**6%**	**240**	**1000mg**
Optimal Osmolality	**Three**	**120**	**9%**	**290**	**1500mg**
High Cal	**Four**	**160**	**11%**	**340**	**2000mg**

About EFS-Pro

The new EFS-PRO drink mix prototype contains a special carbohydrate source that has a significantly lower osmolality than any other carbohydrate available. Because of this, absorption is improved so you can consume more calories than ever before without gastric distress. In addition, this revolutionary carbohydrate has virtually no sweetness. It's designed to taste like flavored water, eliminating the dreaded 'sugar-fatigue' commonly found with sports drinks. EFS-PRO also delivers a special blend of sodium chloride and sodium citrate that has been shown to improve mineral absorption at high doses. The blend of these two electrolytes provides the optimal sodium shuttle for racing in hot environments which also minimizes gastric distress. Plus, EFS-PRO contains the amino acid L-Alanyl L-Glutamine for enhanced nutrient and water absorption. This means that the 1,500mg of electrolytes in EFSPRO will get absorbed faster and easier than ever before. FUELING TIP: We designed this formula to be mixed at varying strengths to suit your requirements. Each scoop is 40 calories. It can be used as a hydration drink at 80 calories in 12oz of water or a high-calorie formula at 120 or 160 calories in 12 ounces of water.

Energy = Carbohydrates

Consuming carbohydrates during prolonged exercise enhances performance by supplying energy for muscles to use when glycogen stores begin to drop. EFS-PRO has been specifically formulated to deliver a blend of long branched amylopectin dextrin, complex carbohydrates, glucose (dextrose) and sucrose for energy. Clinical research shows a combination of carbohydrates is better than a single source for the absorption and utilization of blood glucose (Guezennec, C.Y, et.al.). EFS-PRO provides four different high-glycemic sources of carbohydrates for immediate energy and easy digestion during long and intense workouts. The low osmolality of the EFS-PRO energy drink provides superior fluid absorption. Clinical research shows that energy drinks mixed within 6-8% offer the optimal absorption of *both* carbohydrates and fluid for endurance racing and training (Shi, K et al.). The biochemical structure of the carbohydrate, the absorption process, the size of the food particle, the degree of processing, the contents and timing of the previous meal, and the co-ingestion of fat, fiber, or protein affect the absorption of a carbohydrate as well as its glycemic index (GI). (Guezennec, 1995).

Optimal Absorption Technology

OPTIMAL ABSORPTION TECHNOLOGY

EFS-PRO utilizes a proprietary 'Optimal Absorption Technology' to shuttle water, electrolytes and other essential nutrients through the digestive system more efficiently than ever before so you don't have to worry about all the negative symptoms of GI distress. This is of the utmost importance because when endurance athletes need the benefits of their drink mix the most (when at or above lactic threshold) is when the conditions are the worst for essential gastric emptying.

L-Alanyl L-Glutamine: EFS-PRO contains L-Alanyl L-Glutamine because it's clinically proven to significantly improve absorption of water and electrolytes in humans under exercise stress and mild dehydration and improve endurance performance. This special dipeptide amino acid is a highly-soluble, water-stable source of glutamine that has a number of unique benefits for endurance athletes. Like L-Glutamine, this dipeptide plays a role in the supply of energy, promotes protein synthesis, heals wounds, promotes a healthy intestinal tract and also stimulates immune function. The alanine component of L-Alanyl L-Glutamine helps stimulate gluconeogenesis (the generation of glucose through non-carbohydrate sources). Clinical studies on L-Alanyl L-Glutamine have shown it improves plasma glutamine by 26% over a basic L-Glutamine source. In a study done in the Journal of the International Society of Sports Nutrition, L-Alanyl L-Glutamine and water were administered to college students with induced dehydration of -2.5% while a second group used only water. The group using L-Alanyl L-Glutamine showed a dramatic improvement in their hydration status and well as their serum sodium levels. This group also improved their performance in a treadmill exercise significantly.

Hoffman JR, et al. Examination of the efficacy of acute L-Alanyl L-Glutamine ingestion during hydration stress in endurance exercise. Journal of the International Society of Sports Nutrition. 7:8, 2010

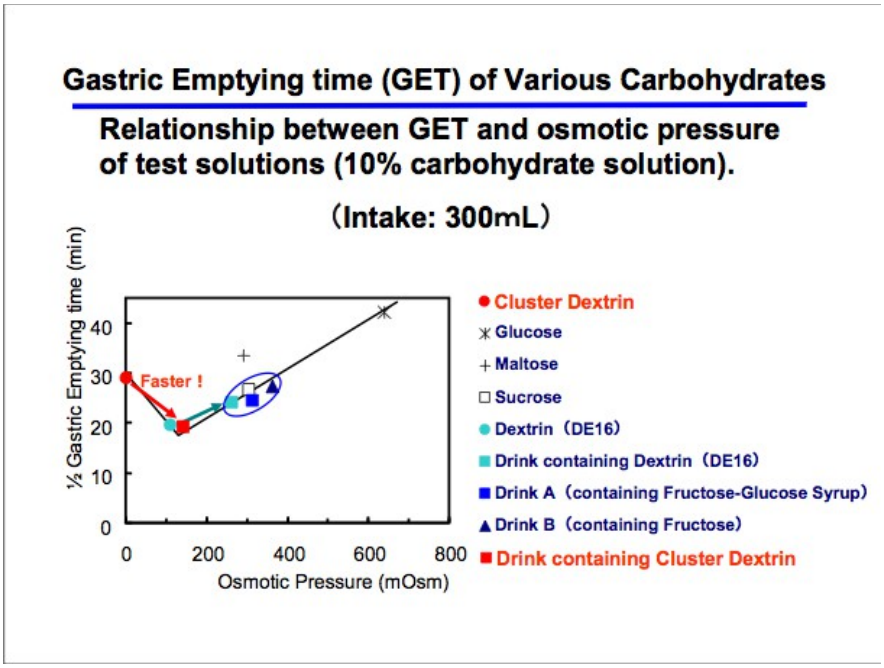
More is Not Always Better

When it comes to choosing a hydration sports drink that also provides energy, a lot of endurance athletes tend to select something that suits their taste or that provides a variety of sugars, vitamins, minerals, and other substances that usually fall into the category "the more the better". In reality, "the more" is not always "better", and even if it is in some instances, the delivery efficiency may be more important than the actual quantity. Many athletes often push the quantity of calories they want to consume not realizing that only the calories that actually get absorbed offer a benefit.

In the case of carbohydrates, different sugar sources have different bio-availability properties, different absorption efficiencies and different effects on insulin secretion rates [1]. This simply means that not all sugars are being absorbed and utilized at the same rate. For the endurance athlete this could be detrimental to optimizing training time and dialing racing performance.

It's all About Gastric Emptying

At 10% solute concentration, studies have shown that distinct sources of carbohydrates (e.g. fructose, sucrose, dextrin, etc.) have different gastric emptying times (varying from 12.1min to 39.9min) and different osmotic pressures (varying from 5mOsm to 646mOsm)[2]. Due to their diverse biochemical properties (derived source, molecular weight, osmolality, solubility), different carbohydrates affect insulin secretion and glucose levels depending on their molecular size and digestion process. Blood has an osmolality between 280mOsm to 330mOsm. Evidence shows that drinks that are isotonic or hypotonic absorb better than drinks that are hypertonic (> 330mOsm) [3].



CCD for Sports Nutrition Presentation-Glico 2012 pp18-31.

Don't Forget About Osmolality

Osmolality is a measure of total solutes (solids) in a solvent. Because osmolality takes into account molecular weight of the solids, 100g of fructose has a distinctly different osmolality than 100g of CCD. Since osmolality measures total solids in a solvent, one must also consider the concentration percentage of the drink in order to fully appreciate the biochemistry of these osmolality variances. In other words, when one consumes a gel that contains 25g of carbohydrates in a 1-2oz solution, one can expect the osmolality to be extremely high regardless of the make-up of the gel. This same 25g gel consumed with a 12oz solution would have a concentration (8%) where the osmolality would be closer to an ideal absorption level.

Table 1 Osmotic pressure and gastric emptying time (GET) of the test solutions

		Osmotic pressure (mOsm)	GET (SEM) (min)
Solution			
– *water*		2	12.8 (1.3)^{af}
– *NaCl*	0.9%	289	8.4 (0.6)^{a}
– *glucose*	5%	307	20.4 (3.0)^{be}
	10%	646	39.9 (4.7)^{c}
– *maltose*	5%	149	16.2 (1.9)^{bfh}
	10%	298	31.2 (2.8)^{d}
– *sucrose*	5%	160	14.9 (2.0)^{bfh}
	10%	313	24.4 (3.3)^{eg}
– *dextrin (DE16)*	5%	59	12.1 (1.4)^{eh}
	10%	117	17.3 (2.1)^{bfh}
– *HBCD*	5%	5	18.8 (2.0)^{ef}
	10%	9	26.7 (2.6)^{dg}
Sports drink based on			
– *10% HBCD*		150	17.0 (2.0)^{bfh}
– *10% dextrin (DE16)*		269	21.9 (2.0)^{eg}

Data represent means ± SEM for 10 subjects. Values that do not share common superscript letters are significantly different at $p < 0.05$

[2] Takii, H., et al., *Fluids containing a highly branched cyclic dextrin influence the gastric emptying rate.*

Insulin spikes can wreak havoc on the energy system because they create glucose imbalances and reduce the body's ability to utilize fat as energy if not managed properly prior to exercise [4]. Once an athlete begins exercising, insulin is blunted and the risk of a sugar high and crash is minimal [5, 6]. Apart from making sure that sugars are being absorbed fast, efficiently and with few gastrointestinal issues, endurance athletes need to be more cautious in selecting the appropriate carbohydrate at the appropriate time to maximize performance.

The Perfect Carbohydrate To Use During Exercise

EFS-PRO contains four different carbohydrate sources that work synergistically to provide optimal absorption. The main source of carbohydrates is a new branched-chain cyclic cluster dextrin (CCD) produced from waxy corn starch. Despite its high molecular weight, CCD is extremely soluble in water and very stable. CCD has been shown to have the fastest gastric emptying time (compared to glucose, dextrin, maltodextrin and other sugars), very low osmotic pressure (almost equivalent to water) and minimal insulin response [2, 7, 8]. Because of these unique properties, CCD is the perfect during-exercise carbohydrate source that minimizes the risk of gastrointestinal distress [7].

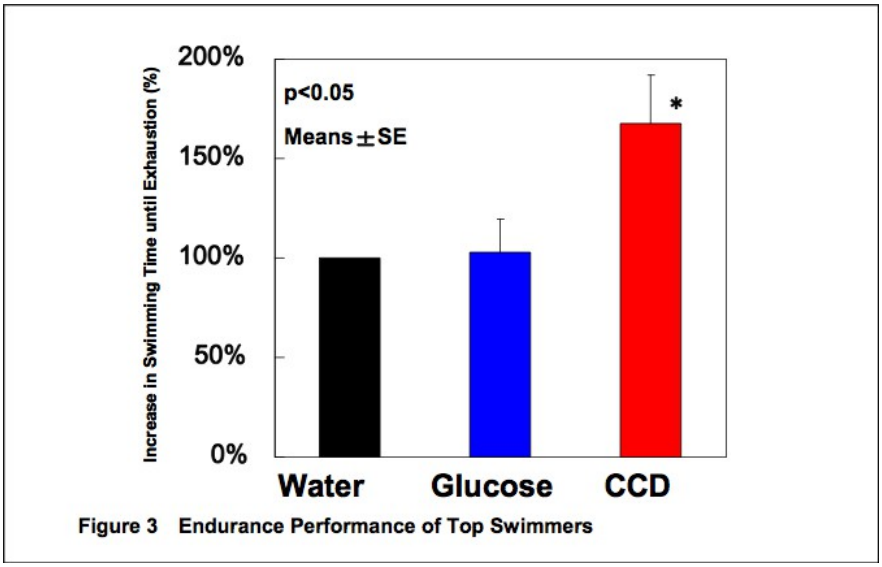


Figure 3 Endurance Performance of Top Swimmers

CCD for Sports Nutrition Presentation-Glico 2012 pp18-31.

But What if You're Consuming Bars and Gels Too?
Because EFS-PRO utilizes CCD as the primary carbohydrate source, it has the ideal 290msOm in a 120 calories/12oz solution. Because EFS-PRO is low in osmolality, it can actually reduce the risk of gastric distress when using gels, bars or other high-concentration/ high-osmolality calories.

EFS-PRO Can Be Mixed at Varying Strengths
EFS-PRO is designed to be mixed at varying strengths. Each small scoop is 40 calories. It can be used as a high-hydration formula at 80 calories in 12 ounces of water or a high calorie formula at 120 or 160 calories in 12 ounces of water. The low-insulin response and fast gastric emptying properties associated with CCD, coupled with other varied carbohydrate sources make EFS-PRO the ideal drink both prior and during exercise.

	Scoop	Calories	Solution %	Osmolality	Total electrolytes
Low Cal	**Two**	**80**	**6%**	**240**	**1000mg**
Optimal Osmolality	**Three**	**120**	**9%**	**290**	**1500mg**
High Cal	**Four**	**160**	**11%**	**340**	**2000mg**

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2. Takii, H., et al., *Fluids containing a highly branched cyclic dextrin influence the gastric emptying rate.* International Journal of Sports Medicine, 2005. **26**(4): p. 314-319.
3. Maughan, R.J. and J.B. Leiper, *Limitations to fluid replacement during exercise.* Can J Appl Physiol, 1999. **24**(2): p. 173-87.
4. Khayat, Z.A., N. Patel, and A. Klip, *Exercise- and insulin-stimulated muscle glucose transport: distinct mechanisms of regulation.* Can J Appl Physiol, 2002. **27**(2): p. 129-51.
5. DeFronzo, R.A., et al., *Synergistic interaction between exercise and insulin on peripheral glucose uptake.* J Clin Invest, 1981. **68**(6): p. 1468-74.
6. Goodyear, L.J. and B.B. Kahn, *Exercise, glucose transport, and insulin sensitivity.* Annual Review of Medicine, 1998. **49**: p. 235-261.
7. Takii, H., et al., *A sports drink based on highly branched cyclic dextrin generates few gastrointestinal disorders in untrained men during bicycle exercise.* Food Science and Technology Research, 2004. **10**(4): p. 428-431.

8. Furuyashiki, T., et al., *Effects of ingesting highly branched cyclic dextrin during endurance exercise on rating of perceived exertion and blood components associated with energy metabolism*. Biosci Biotechnol Biochem, 2014: p. 1-3.

GI during exercise

Much research has focused on carbohydrate drinks and foods during exercise to slow the depletion of the body's carbohydrate stores and thus delay the onset of fatigue. While the availability of carbohydrate for use within the cells is extremely important, much of the regulation of glucose concentration rests not solely with the type of carbohydrates ingested, but in the hormonal regulation of glucose. Among the hormones that are especially important to glucose concentrations are insulin, glucagon, epinephrine, and cortisol. Exercise-induced elevation in epinephrine depresses the release of insulin from the pancreas. Thus, concerns about carbohydrate feedings increasing insulin and depressing fatty acid availability is less likely to occur when carbohydrate is fed during exercise.

Exercise, in addition to carbohydrate type and timing of ingestion, also modulates the release of these hormones. Exercising at or above threshold can dramatically reduce your body's ability to properly digest foods (due to the pooling of blood to the exercising muscle). During these times, it is best to consume carbohydrates and foods that are easily digested, i.e., those with a high GI.

A recent research study has indicated that during a time trial effort, a carbohydrate drink mouth rinse (not consumption) actually improved performance during a 1-hour cycle TT. The study authors believe the mouth rinse with a carbohydrate drink might have provided the benefit compared to a water-only rinse (Carter, J.M., A.E. et al.).

Conversion

The ability to rapidly replenish carbohydrates after training, and the ability to consume and convert ingested carbohydrates into a usable form of carbohydrate, is important in allowing you to train and compete at your best. Ingestion of the wrong carbohydrates at the wrong time, or ingesting too little carbohydrate can impair performance both in the short term and long term. Consuming a slowly digested carbohydrate during times where the body is at or above threshold can lead to disaster. During times where you exercise or race at and above your threshold, your blood circulation is focused on the working muscles and away from the stomach. This makes digestion of foods difficult. In fact, consuming a slowly absorbed sugar during these times will slow gastric emptying (the emptying of fluids and foods from the stomach to the blood stream) and in essence block fluids from being absorbed. This can actually cause dehydration.

How do sugars differ?

Conventional wisdom says that since all carbohydrates are eventually digested and absorbed as glucose, the original food source of the sugar, whether a bean or a candy bar, matters little. Sugar is sugar and sucrose is sucrose. Not exactly!

Fructose

Fructose has a GI of 20±5 and is a simple sugar (monosaccharide) like glucose and galactose. Natural sources of fructose include honey and fruits. Fructose is 75% sweeter than glucose and is generally found in honey and fruits in addition to its many uses as a food-sweetening additive. It is absorbed more slowly into the bloodstream than straight glucose and sucrose and, therefore, has a less erratic effect on blood sugar levels (at rest). Diabetics or those that are very sensitive to changes in blood sugar find fructose to be advantageous. But, as a result of its slow absorption, beverages that contain fructose can cause gastric upset and slow gastric emptying. Research suggests that fructose is more tolerable when combined with sucrose and glucose. Avoid beverages that list "high fructose corn syrup" as primary ingredients as they will slow fluid uptake and not provide optimal sugars to support exercise energy requirements. As a pre-exercise meal, or between workouts, fructose is an excellent source of carbohydrates.

Galactose

Galactose is a simple sugar that has recently shown up in sports drinks. Lactose is the primary sugar in dairy products and is composed of one molecule of glucose and one of galactose. Because of its galactose content, it is more slowly absorbed into the bloodstream than pure glucose and is therefore more blood-sugar-friendly. The GI of galactose could not be found on any of the official GI lists*, though G-Push (a popular sports drink) does claim that galactose is absorbed quickly like glucose without a subsequent increase in insulin release. This is not confirmed with clinical studies.

Glucose

In terms of immediate use of carbohydrate within the body, glucose (a monosaccharide) with a GI of 99±3 is the most important. Glucose can be directly absorbed by the small intestine and directly transported to the cells to be metabolized. Glucose can also be stored as glycogen (chains of glucose) within muscles and the liver, and can also be converted to fats for energy storage. During exercise, consumption of glucose allows the body to maintain an adequate supply of carbohydrate for metabolism. Glucose is often called dextrose when it is added to foods. The body eventually breaks down all sugars and carbohydrates into glucose, which is the form in which sugar enters cells to be used for energy. During times of exercise at or above threshold, glucose can be easily digested.

Sucrose

With a GI of 68±5 (otherwise known as table sugar), Sucrose is composed of one molecule of glucose and one molecule of fructose. This is the white sugar that comes in many forms, such as powdered or granulated. It is usually made from refining extracts of sugar beets or sugar cane.

Maltodextrin aka Glucose polymers GI=99±3:
Lactose GI=46±2
Maltose GI=105±12
Honey GI=55±5
Gatorade® GI=78±13

Energy/Carbohydrate References

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*Glycemic Index scores: http://diabetes.about.com/library/mendosagi/ngilists.htm

Electrolytes

Electrolytes, the mineral salts that conduct the electrical energy of the body, perform a cellular balancing act by allowing nutrients into the cell, while excreting waste products. Certain elements, sodium, chloride, magnesium, calcium and potassium, play a primary role in cellular respiration – that of muscle contraction and nerve impulse transmission. It is at the cell membrane where these electrolytes conduct electrical currents similar to nerve impulses. Hydration is the medium which aids electrolyte transport and is crucial

for both the health and performance of the cell. Your hydration state is mostly dependent upon water intake or loss through sweat but is also heavily influenced by electrolyte status.

Sweat

Endurance performance is compromised greater by warmer temperatures than cooler temperatures. Here's why: to control an excessive rise in body temperature, the blood flow to the skin increases in order to dissipate heat to the environment. This shift of blood to the skin will result in a lesser proportion of blood, and hence oxygen, being delivered to the working muscle. In some individuals the circulatory adjustments may not be adequate and the body temperature will rise rapidly, leading to hyperthermia (excessive body heat). Individual sweat rates vary, but those that sweat early, heavily, and cake with salt tend to be more prone to muscle cramps during exercise (Burke, 2001). Evaporation of sweat in a hot environment can purge as much as 3 liters an hour. Alberto Salazar reportedly lost an average of 3.7 liters per hour of sweat during the hot and humid 1984 Olympic Marathon in LA (Armstrong et al. 1986). About 99% of sweat is water, with a number of major electrolytes found in varying amounts. Since sweat is derived from the extracellular fluid (fluid outside the cell) the major electrolytes found are sodium and chloride. The concentration of salt in sweat is variable, but averages about 2.6 grams per liter of sweat loss. Potassium, magnesium, calcium, iron, copper, zinc, amino acids and some of the water-soluble vitamins can also be found in sweat.

Too much water?

Hyponatremia is defined as a decrease in sodium concentration in the blood, which can have adverse effects on muscle contraction and performance. One study observed 27% of participants following a three-day cycling stage race competition were hyponatremic. Symptoms of hyponatremia include headache, nausea, muscle cramping, fatigue, and possibly death. Although there may be many causes of hyponatremia, the most common one for athletes is over-hydration. Athletes tend to super-hydrate in the days leading up to a race without an appropriate increase in electrolytes. In some cases, super-hydrating can produce hyponatremia prior to the race ever starting. However, drinking only water during a race can also causes hyponatremic conditions because the body requires electrolytes to effectively maintain hydration status. Hyponatremia, rare in events lasting less than 4 hours, has been shown in recent medical studies of slower marathon runners and ultra-distance triathletes to be at least as problematic and dangerous – if not more so – than dehydration.

Sodium and Chloride

Sodium is one of the principle positive ions in the body's fluid and is found primarily outside the cell (extracellular). Chloride, another extracellular electrolyte, is a negative ion and works closely with sodium in the regulation of body-water balance and electrical impulses across the cell membrane. Consuming adequate amounts of sodium and chloride, more commonly known as table salt, is crucial to maintaining the volume and balance of fluids outside your body's cells and in your blood. Sodium is especially important because it plays a key role in transporting nutrients into cells to be used for energy production, tissue growth, and repair. Sodium also assists in muscle contraction and nerve impulse transmissions. During exercise, your body loses fluids and sodium through sweating. This causes a decrease in your blood volume, thereby increasing sodium and chloride concentrations in the blood. The increased concentration of electrolytes in the blood through decreased blood volume is what triggers the thirst mechanism. By the time you have become thirsty your electrolytes are already out of balance, so restoration of blood volume is critical for the prevention of dehydration. While water consumption is effective in increasing your blood volume, there is a consequential dilution of sodium in your blood due to the increased blood volume and excessive sodium losses in sweat so electrolyte replenishment is critical. Drinking fluids with added electrolytes instead of just plain water is the best option, particularly when your exercise bout lasts longer than one hour and is in a hot or humid environment.

Sodium Citrate

Sodium citrate is absorbed and metabolized into sodium bicarbonate which causes an alkaline solution. This ability to reduce stomach acidity improves absorption. Sodium citrate has been shown clinically to have the best absorption rates among various sodium sources. Alkalizing agents have been shown to improve performance in high intensity exercise. Consuming Sodium citrate prior to high intensity exercise was shown to reduce blood pH and oxygen debt in healthy males exercising on a cycle ergometer.

Jain P,. et al. Effect of sodium citrate ingestion on oxygen debt & exercise endurance during supramaximal exercise. Indian J of Med Res. Jul; 118: 42-6, 2003.

Potassium

Potassium is the main electrolyte found inside the body's cells (intracellular) and stored in muscle fibers along with glycogen. It plays a key role by helping transport glucose into the muscle cell. Potassium also interacts with both sodium and chloride to control fluid and electrolyte balance and assists in the conduction of nerve impulses. When glycogen breaks down to supply energy for your workouts, muscle cells are depleted of potassium. As a result, there is a greater concentration of potassium in your blood and greater quantities are lost in the urine. Symptoms of potassium depletion include nausea, slower reflexes, irregular heartbeat, drowsiness, and muscle fatigue and weakness. Although potassium deficiencies are rare, they may occur under certain conditions -- during fasting, diarrhea and when using diuretics. Replenishing lost potassium after exercise is important, but hyperkalemia (high serum potassium levels) can cause electrical impulse disturbance, irregular heart beat, and possibly death. Individuals should never take potassium supplements in large doses without the advice of a physician.

Calcium

Calcium is an electrolyte that may be overlooked. The skeleton is the major reservoir of calcium in the human body. Besides building teeth and bones, calcium is needed by many other cells to perform different functions in the body: contraction and relaxation of muscle, nerve conduction, secretion of hormones, enzymatic reactions, and blood coagulation. Calcium plays a central role in both the synthesis and breakdown of muscle glycogen and liver glycogen. Blood calcium levels are tightly regulated by hormones at the expense of bones. Many do not realize that bones are constantly being broken down and rebuilt through the processes of resorption and formation.

The National Academy of Sciences recommends the following calcium intake levels for different age groups:
500mg for 1-3year olds
800mg for 4-8 year olds
1,300mg for those aged 9-18
1,000mg for ages 19-50 years
1,200mg for those over 50 years of age

Endurance athletes may require even greater levels. Dairy products like milk, cheese and yogurt are excellent sources of dietary calcium because they are also fortified with vitamin D which is necessary for optimal absorption of calcium into the body. Low serum levels of calcium can cause a number of problems, including muscular cramping due to an imbalance of calcium in the muscle and surrounding fluids. Muscular contraction and exercise performance in active individuals is also compromised with low serum calcium. In addition to calcium intake, athletes should be aware that weight-bearing exercise is beneficial the maintenance of a healthy skeleton. Non-weight bearing sports like bicycling and swimming have been associated with bone mass similar to or below that of normal sedentary people (Duncan, 2002; Heinonan, 1993; Warner, 2002; Taaffe, 1995 & 1999). So, remember to fit in some weight-bearing exercise and consume varied sources on calcium in your diet!

Magnesium

Magnesium is a crucial element in the body, especially during exercise. It is a cofactor in more than 300 enzymatic reactions and plays a role in cellular energy production, glycogen breakdown, and the modulation of ATP for energy. Mg also serves as a regulator of neuromuscular functions and is the second most abundant intracellular cation in the body. Currently, there are not separate recommendations for Mg levels for athletic and non-athletic populations. However, numerous studies have identified that exercise results in decreased Mg levels. Furthermore, the intensity and duration of the exercise bout are correlated with the drop in Mg levels. It has been suggested that supplementation of Mg can increase performance in endurance activities although no protocol has been established regarding amount necessary to see performance gains nor the source of Mg which is absorbed at the highest levels. This discussion will serve to review the relevant literature to shed light on these two issues.

Exercise increases both the demand of Mg as well as the secretion of Mg which leads to the noted deficit. Suppressed levels of Mg are associated with muscle weakness and neuromuscular dysfunction as well as impaired efficiency of energy metabolism. Recommendations on Mg supplementation are difficult for a number of reasons. First, Mg concentrations have been shown to increase after high-intensity short duration exercises but decrease after high intensity long duration exercise. Furthermore, many forms of Mg exist and each has different absorption rates as well as differing bioavailability.

The RDA for Mg intake is 310 to 420, but researchers overwhelmingly agree this is an insufficient amount for athletic populations. Chen and colleagues (2009) concluded that further research is needed to determine the optimal dosages of Mg supplementation in exercise performance. Currently, the performance daily intake recommendations are 400-800 mg/day. However some researchers have recommended that 5 mg/kg body weight would be a more appropriate figure (and some as much as 10 mg/kg). Others have recommend 100 mg/hour during exercise with a max of 300 mg in one exercise bout. The upper limits are between 3000 and 5000 mg/day for most individuals. It is important to note that by definition, tolerable upper limit is that amount that most people can consume without experiencing adverse effects. There will be a small percentage of the population who will consume within or under the TUI levels and experience side effects.

The most common adverse reaction to Mg supplementation is GI distress including cramping and diarrhea. GI issues as a result of mg supplementation can be related to other supplements. For example, if the athlete is taking an additional supplement with high amounts of Mg or their diet is high in Mg already, this may lead to an issue. Mg supplementation coupled with Maalox and Milanta seems to commonly be a culprit for GI issues. High amounts of Mg in the intestines lead to an increased retention of water in the stool which caused diarrhea symptoms. The main regulator of Mg absorption is the Mg in the blood vessels in the intestines. If Mg levels in the blood are elevated, absorption decreases.

The daily intake of Mg has been steadily decreasing in North America over the last 20 years. The increasing use of fertilizers and the increased consumption of processed foods have led to the decline. Furthermore, excessive fiber intake as well as high fat and protein diets hinder the absorption of dietary Mg. Numerous studies have shown that many endurance athletes fail to meet even the minimum RDA guidelines. As previously mentioned, it has been suggested that endurance athletes increase Mg above RDA levels. Symptoms of Mg deficiency include muscle weakness, fatigue, depression, muscle cramps, loss of appetite, nausea, irritability, and ECG changes.

The best sources for Mg supplements are the ones related to an amino acid which include Mg gluconate, Mg taurate, Mg malate, Mg citrate, or Mg fumarate. They have a absorption rate of 5-10 times that of Mg chloride and Mg carbonate. The organic Mg sources such as Mg Gluconate have shown higher bioavailability (Mg Gluconate = 67%) than inorganic Mg sources which hover around 50%. As the dose of Mg increases, the absorption of Mg decreases in a curvilinear fashion regardless of the source. It should also be noted that many companies selling Mg supplements often mixed them with dolomite which has been known to contain both mercury and lead. As result, Mg supplements with dolomite are not advised. In a 2002 review, Brown suggested not consuming high levels of soft drinks while taking an Mg supplement as it may hinder absorption.

In conclusion, the need for Mg supplementation, especially in athletes, is highly supported. Sources of Mg should be related to an amino acid and organic. A threshold does exist where Mg levels are no longer increasing performance and may lead to GI distress including diarrhea. The recommendations listed above are the amounts and upper limits set for endurance athletes based on the best and most current available research. Unfortunately, individual needs will differ.

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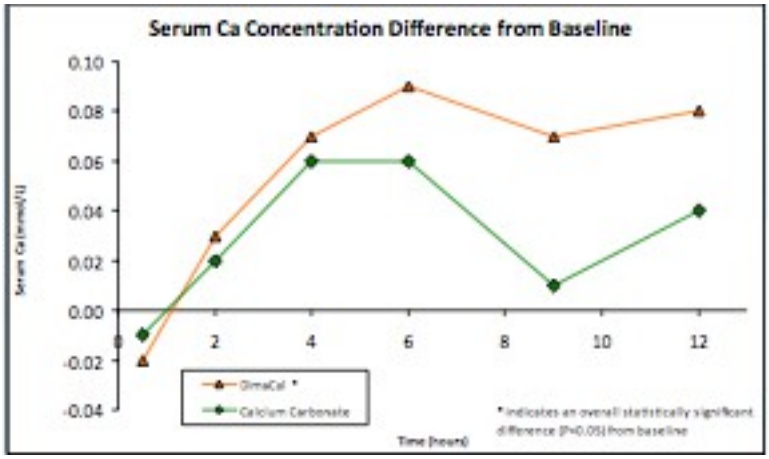
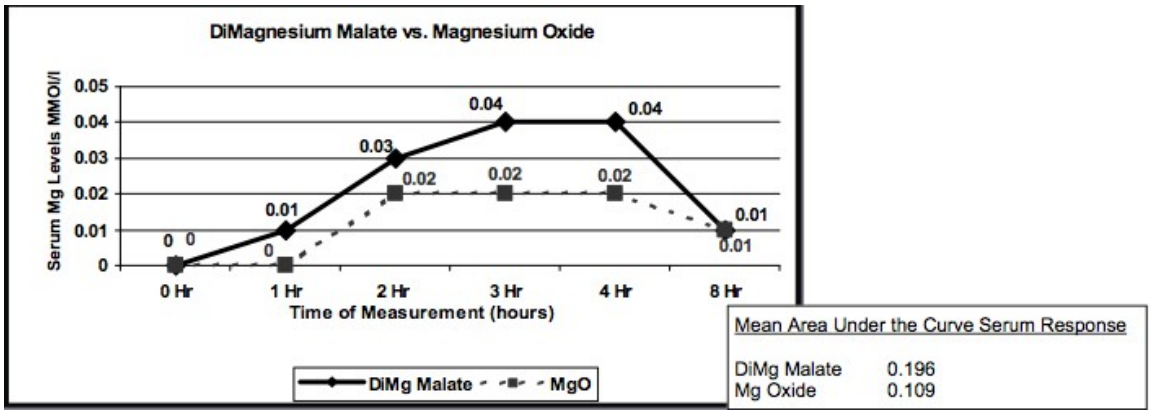
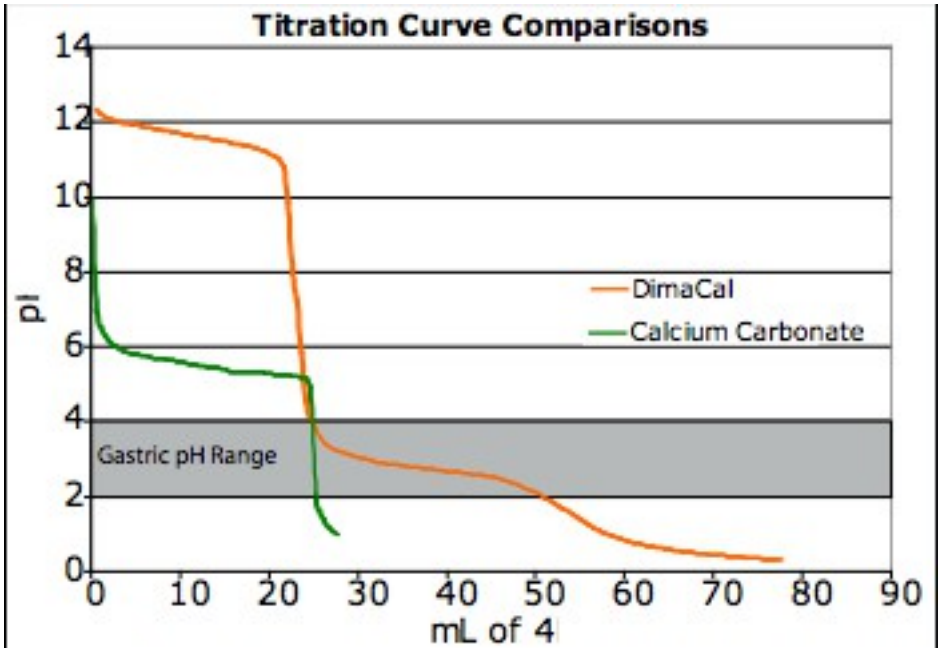
Patented sources of calcium and magnesium in EFS drink formula

The EFS drink formula uses two unique patented sources of calcium and magnesium as amino acid malates. DiCalcium malate and DiMagnesium malate have superior bioavailability over other calcium sources. DiCalcium malate in a bioavailability study proved to be absorbed significantly better and remained elevated from time 0 to 12 hours, representing a more absorbable form for a longer period. Absorption rates were between 20% and 100% higher using DiCalcium and DiMagnesium malate.





Furthermore, these superior minerals also offer a buffering of stomach acids. DiCalcium malate and DiMagnesium malate lower stomach acids significantly, helping to reduce the unwanted gastric distress that can be associated with other minerals.



Electrolyte Chart

	Extracellular (mmol/L)	Sweat (mmol/L)	Intracellular (mmol/L)
Sodium	137-144	20-80	10
Potassium	3.5-4.9	4.0-8.0	148
Calcium	4.4-5.2	3.0-4.0	0-2.0
Magnesium	1.5-2.1	1.0-4.0	30-40
Chloride	100-108	30-70	2

From Maughan and Shirreffs, 1998. Fluid and electrolyte loss and replacement in exercise. In Oxford textbook of sports medicine, 2nd Edition. Edited by Harris, Williams, Stanish, and Micheli. New York: Oxford University Press, pp. 97-113.

Fluid and electrolyte needs for endurance athletes

Endurance athletes have different fluid and electrolyte needs, particularly during longer and higher intensity training sessions and competition. The increased loss of sweat translates into an increased loss of

electrolytes, and, as previously mentioned, sodium is one of the important electrolytes that must be replaced during exercise to prevent dehydration and hyponatremia. The composition of standard sport drinks may not provide an adequate amount of electrolytes during activity lasting longer than two hours. Most standard sports drinks contain 50- 110 mg (200-460 mg/liter) of sodium per 8 oz. Because we are limited on the amount of fluid the body can absorb by the intestines, it may be important to consume a higher amount of sodium during exercise to minimize fluid loss. The body can tolerate a higher sodium intake (closer to the amount lost in sweat) and it does not appear to negatively affect carbohydrate absorption.

Comparison of the Electrolyte Content between Standard Sport Drinks and Endurance Specific Sport Drinks

Electrolyte	Sweat Loss mg/L	Standard Sport Drink mg/L	Endurance Specific Sport Drink mg/L
Sodium	900-2600	200-450	800-1110
Potassium	100-200	80-125	390-650
Magnesium	60-260	0	10-615
Chloride	900-1900	0	390-1550
Calcium	50-100	0	250-500

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Endurance: Free Form Amino Acids

Free Form Amino Acids vs Protein

New research done in 2003 and 2004 indicates that supplementing with protein during exercise improves time to exhaustion (Ivy, J.L. et al, Saunders, M.J. et al) and reduces post exercise muscle damage (Saunders 2004). In these two protein studies, the study authors were unable to explain why time to exhaustion increased. They postulated that the reason was due to a greater sparing of muscle glycogen, which would provide a greater reserve during exercise. However, the insulin responses to the carbohydrate and carbohydrate/protein supplements were not different. In addition, carbohydrate oxidation was similar in both groups, which would suggest that the utilization of muscle glycogen was also similar. Scientists are left to hypothesize that another mechanism may be involved in producing enhanced performance.

1. Central fatigue hypothesis. During exercise, branched chain amino acids (BCAAs) decrease and tryptophan, a precursor to serotonin, competes with BCAAs. Essentially, tryptophan overpowers the BCAAs and crosses the blood brain barrier rather than BCAAs. It also increases serotonin in the brain and lowers brain activity and possibly causes central body fatigue. Some studies show that the addition of BCAAs during exercise will improve endurance exercise performance while others do not and a definitive consensus has not been reached regarding this topic.

2. Maintain Krebs Cycle intermediates. This is a relatively new hypothesis in this area. The authors speculated that the addition of protein during exercise could provide precursors for the reactions required to maintain the Krebs Cycle (this is one of the metabolic cycles that is responsible for making energy to supply the muscles during exercise). As exercise duration increases, the precursors, specifically 2-oxoglutarate and oxaloacetate, for the Krebs Cycle reactions decrease to critically low levels and therefore decrease energy production. Although carbohydrate supplementation is thought to assist this process somewhat, it may not be as efficient as once thought when the proper amino acids are provided.

While the claims for improved performance can be clearly supported, it may be a misleading generalization that protein is the reason for the benefit. Protein naturally contains BCAAs and glutamine. Clinical evidence supporting the use of BCAAs and glutamine during exercise dates back to 1991. These clinical studies clearly indicate supplementing with as little as one gram of free form amino acids improved performance, reduced post-exercise muscle damage, improved muscle glycogen re-synthesis, reduced

central fatigue and improved rate of perceived exertion. These are the same claims made by the most recent protein study and clearly support a mechanism for improved performance.

Glutamine

Glutamine is the most abundant amino acid in the body, accounting for greater than 60% of the total intramuscular free amino acid pool. Virtually every cell in the body uses this non-essential amino acid. Glutamine is synthesized in both skeletal muscle and in adipose tissue in addition to the lungs, liver and brain. Because the body has the ability to produce glutamine it has long been considered a non-essential amino acid, which simply means the body has a mechanism to produce this powerful amino acid. However, there is evidence that, during times of stress, the body cannot produce enough glutamine to keep up with demand which in turn can reduce performance, immune function and mood. As a result, glutamine has recently been classified as a conditional non-essential amino acid. Glutamine offers a significant benefit to exercising individuals and those looking to increase lean muscle mass and decrease body fat. Supplemental glutamine can help promote cell volumization, the phenomenon of drawing of water *inside* muscle cells which can help increase muscle "fullness", increase protein synthesis (the making of proteins), and decrease proteolysis (the breakdown of protein).

Glutamine and overtraining

Intense physical exercise drains glutamine stores faster than the body can replenish them. When this occurs, the body breaks down muscles and becomes catabolic. Clinical evidence supports supplementation with glutamine for recovery, glycogen storage & transport, synthesis of other amino acids and to reduce the catabolic effects of overtraining. It has been proven that glutamine levels in the serum are dramatically reduced following exhaustive exercise. With reduced glutamine levels, performance and recovery are also compromised.

Conditions of severe stress such as exposure to extreme altitude, massive trauma, and burns have been shown to decrease glutamine concentrations similar to the reductions noted in endurance athletes after training and competition. Supplementation with glutamine has been shown to improve recovery rates in these patients, and has also been linked to improved gastrointestinal function. The evidence for maintenance of healthy immune function is one more great benefit to glutamine supplementation. A strict and strenuous training program, which does not allow for enough time to recover, may cause an athlete to experience overtraining syndrome (OTS). Researchers have effectively correlated OTS to amino acid imbalances. Decreased performance, decreased mood, and increased incidence of infections characterize these amino acid imbalances caused by OTS.

Significantly decreased plasma glutamine concentrations have been observed after prolonged exercise in healthy athletes as well. Athletes who exercise extensively and are suffering from OTS may become immuno-suppressed leading to infection and increased upper respiratory tract infections (URTI). Supplementing with glutamine in order to maintain normal levels of intramuscular glutamine is critical in maintaining a strong immune system AND preventing the breakdown of skeletal muscle and catabolism (the breakdown of muscle).

Supplementation vs. Foods

Most naturally occurring food proteins contain only 4 to 8% of their amino acid as glutamine. Though glutamine is available in small quantities from a variety of foods, it is easily destroyed by cooking. Raw vegetables can be a good source of glutamine though evidence suggests that dietary glutamine is not easily absorbed through the intestine. On the contrary a stable form of glutamine from dietary supplements has a better absorption rate.

Branched Chain Amino Acids (BCAAs)

Low levels of branched chain amino acids (BCAAs) may contribute to fatigue so BCAAs should be replaced within two hours or less following exercise. These include the essential amino acids leucine, isoleucine, and valine. They are very popular among athletes and there is some research validating their use. Numerous research studies have shown these three key amino acids are extremely important to consume, especially during dieting and exercising (and according to one study, BCAAs are even more important when exercising in the heat). During exercise, the body uses a mix of glucose, fats, and even

protein as a fuel source. When diet and carbohydrate intake is lower than normal, the percentage of protein the body uses for fuel (specifically Leucine, Isoleucine, and Valine) dramatically increases. The body will pull those needed amino acids from the continuously circulating pool of amino acids in the bloodstream. And if not replenished from an outside source, i.e. specific amino acid ingestion in the form of BCAAs, the body will breakdown in other areas in order to supply this pool. Studies have shown that subjects who consume an effective dose of BCAAs while endurance training have greater levels of lean muscle mass retention than control subjects who ingest a placebo (and typically *lose* muscle during the same dieting period). Additionally, BCAAs form antibodies that combat invading bacteria and viruses. The body cannot manufacture its own BCAAs, so they must be supplied through diet and supplementation. BCAAs have also been studied for their ability to improve exercise capacity in heat. In a 1998 study, subjects supplementing with BCAAs significantly improved moderate exercise performance in the heat.

BCAAs and Central Fatigue

Branched Chain Amino Acids are also associated with a syndrome termed *central fatigue*. Following exhaustive exercise, BCAAs are depleted from the working muscle and from the circulating pool of amino acids. This depleted state causes an imbalanced ratio of BCAA to tryptophan (another amino acid). When BCAAs are low, tryptophan (a precursor to serotonin, which results in lethargy) is more readily available and can cause increases in serotonin. It is this imbalance that can cause an athlete to become lethargic and almost sleepy. Supplementing with higher levels of BCAAs will help stop the tryptophan/serotonin mechanism. All whey protein supplements contain tryptophan, however only some will actually disclose an amount on the label. An effective supplement should contain at least three grams of BCAAs and minimal levels of tryptophan.

A 2006 Study conducted in Tokyo discussed the beneficial effects of a dietary amino acid supplement on muscle function, fatigue and recovery in exercising athletes. The mixture of amino acids included the branched-chain amino acids, arginine and glutamine and was studied chronically at several daily dose levels for 10, 30 and 90 days. At dose of 2.2, 4.4 and 6.6 g/day for one month showed indices of blood oxygen carrying capacity were increased and those of muscle damage were decreased at the end of the trial. The study suggests that amino acid supplementation contributed to an improvement in training efficiency through positive effects on muscle integrity and hematopoiesis.

Why EFS?

EFS drinks are fortified with 2,000 mg amino acids per serving and are now upgraded to include AjiPure amino acids, the purest, most bioavailable source of free form amino acids available. AjiPure amino acids have purity levels of 99%-100% corresponding to faster and more complete absorption. After five minutes, 100% of AjiPure amino acids were released compared to only 46% from other amino acids.

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Malic Acid

Malic acid is the only metabolite of the Krebs Cycle which falls in concentration during exhaustive physical activity. Malic acid is involved in the production of energy in the body under both aerobic and anaerobic conditions. During anaerobic conditions, malic acid has an ability to remove the accumulation of reducing equivalents. Human studies have shown that after endurance training, athletes' muscles were characterized by a 50% increase in the malate-aspartate redox shuttle enzymes. In both animals and humans, when there is an increased demand for ATP there is an additional demand and utilization of malic acid. Malic acid stimulates oxygen consumption by increasing mitochondrial uptake of other substrates. It also stimulates the removal of components that build up under hypoxic conditions and inhibit ATP production (Wu J et al 2006).

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Antioxidants

Through training as athletes, more oxidative stress is caused than in the average individual. In fact, studies have shown that endurance and strength training athletes produce more free radicals than sedentary individuals. This oxidative stress not only causes damage to cells and DNA, it may also limit aerobic capacity. Antioxidant supplementation helps maintain the integrity of cell membranes, allowing oxygen to be carried more efficiently and effectively to the working muscles. Damage to membranes may compromise the blood's oxygen carrying capacity, negatively affecting aerobic performance. Antioxidants like vitamin C also have powerful immune enhancing properties, beneficial because intense exercise may cause a suppressed immune system in athletes. For example, after an intense aerobic bout phlegm and coughing may last a few hours or a few days. Vitamin C may help combat this suppressed immune function allowing an athlete to train at a higher level day in and day out.

Because of the wide variety of reactions in which vitamin C plays a role, many structure/function claims can be made for supplements. Perhaps the most well known function of vitamin C is as one of the key nutritional antioxidants – where it protects the body from free radical damage. As a water-soluble vitamin, ascorbic acid performs its antioxidant functions within the aqueous compartments of the blood and inside cells and can help restore the antioxidant potential of vitamin E (a fat-soluble antioxidant).

Vitamin C is thought to strengthen the cell membrane, thereby preventing the viruses from entering the cell. In addition, vitamin C supports immune cell function, an effect which may help fight infections in

their early stages. The combined effects of cellular strengthening, collagen synthesis and antioxidant protection are thought to account for the multi-faceted approach by which vitamin C helps to maintain health.

A number of smaller targeted studies, however, in subjects under heavy acute physical stress, show that vitamin C decreases common cold incidence by half. In other studies, healthy subjects consuming low levels of vitamin C (below 60 mg/day), have a cold incidence that is about one-third lower following vitamin C supplementation. Vitamin C, mainly known for its antioxidant properties and ability to fight infection, may also have some anti-cortisol effects.

Antioxidant References

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EFS-PRO Q & A

Q: What is EFS-PRO?
A: EFS-PRO is a new energy drink that provides endurance athletes with the nutrients they need to fuel working muscles and increase endurance during exercise. The EFS formula utilizes the latest clinical research on endurance nutrition and input from some of the best endurance athletes in the world.

Q: What electrolyte can we find in the new EFS-Pro?
A: There is 500mg of sodium per serving in the new EFS-Pro drink (EFS has 300mg). This represents the highest sodium content in any electrolyte drink on the market. The EFS-PRO formula now offers over 1,500mg of electrolytes coming from all 5 electrolytes, per serving.

Furthermore these superior minerals also offer a buffering of stomach acids. DiCalcium and DiMagnesium malate lower stomach acids significantly helping to reduce the unwanted gastric distress that can be associated with other minerals.

Q: Are there any changes to the amino acids?
A: The amino acids in the EFS-Pro drinks are AjiPure amino acids, the purest, most- bioavailable source of free-form amino acids available. AjiPure amino acids have purity levels of 99%-100%. This results in faster and more complete absorption.

Q: What is L-Alanyl L-Glutamine?
A: The EFS-Pro is also fortified with L-Alanyl L-Glutamine which is a highly soluble water stable source of glutamine with some very unique features. This amino acid has been clinically proven to significantly improve the absorption of water and electrolytes in the intestinal tract.

Q: What is malic acid used for in the EFS-Pro drinks? Why is this important?
A: The new EFS-PRO drink contains 700mg of malic acid. Malic acid stimulates oxygen consumption by increasing mitochondrial uptake, improving mitochondrial respiration and increasing energy production. Malic acid is essential in the formation of ATP, the body's energy source. Malic acid allows the body to make ATP more efficiently, even under low oxygen, or hypoxic conditions.

During anaerobic conditions, malic acid has an ability to remove the accumulation of reducing equivalents. Human studies have shown that after endurance training, athletes' muscles were characterized by a 50% increase in the malate-aspartate redox shuttle enzymes.

Q: How is the flavor?
A: The new EFS-PRO formula went through extensive flavor testing in the most demanding races in the world. We used this extensive feedback to create a flavor profile that mimics flavored water. With practically no sweetness this formula is ideal for those long, hot workouts where sweet drinks simply do not cut it. All formula uses 100% natural flavors and contains NO color. This allows athletes to use EFS not having to worry about staining water bottles.

Q: I've heard that there are benefits to having protein during exercise. Why doesn't EFS contain protein?
A: EFS contains 2g free form amino acids per serving which is the equivalent in BCAA and glutamine profile to 9g whey protein. Protein naturally contains BCAAs and glutamine. Clinical evidence supporting the use of BCAAs and glutamine during exercise dates back to 1991. These clinical studies clearly indicate supplementing with as little as 1g free form amino acids improved performance, reduced post-exercise muscle damage, improved muscle glycogen resynthesis, reduced central fatigue and improved rate of perceived exertion. These are the same claims made by the most recent protein study and clearly support a mechanism for improved performance.

The First Endurance Research Board sides with the abundance of clinical studies supporting improved endurance performance while supplementing with amino acids during exercise. In addition to the clinical support, other factors lead to a decision to use these free form amino acids over complete proteins.

- Proteins are more difficult to digest than amino acids during exercise
- Proteins don't taste very good during exercise
- Proteins can reduce the glycemic index of a drink, further reducing its ability to be quickly absorbed
- There is considerably more evidence supporting free form amino acids than complete proteins

Q: What are the benefits of using EFS-PRO during exercise?
A: The benefits of EFS are:

- Supplying fast and sustained energy for muscles
- Improved fluid absorption
- Reduced cramping and dehydration
- Improved performance
- Easy to digest and absorb
- Improved glycogen resynthesis
- Delayed central (mental) fatigue
- Replenishment of electrolyte loss

Q: How does it taste?
A: EFS-Pro literally tastes like cucumber water.

Q: How much EFS should I use during my training and racing?
A: Clinical research shows that a 6-8% solution delivering between 45-60g carbohydrates, >1000mg amino acids, 400-600mg sodium and equivalent balance in all electrolytes should be taken every hour during exercise. EFS is designed to maximize all these levels. Athletes should consume one serving for every 30

minutes of intense exercise. Adjustments should be made based on body weight, training state, individual sweat rates and preference. Use one serving for every 30 minutes as a starting point and adjust as necessary from there.

Q: What types of athletes should be taking EFS-PRO?
A: Long and short distance athletes can use EFS-PRO effectively.
1) Athletes which experience cramping from strenuous exercise.
2) All athletes who demand rapid fluid absorption in order to stay hydrated.
3) Athletes who want all the benefits of protein without the heavy/chalky consistency of protein drinks.
Essentially any athlete exercising for one hour or more will benefit from the use of EFS in their training and racing.

Q: Should I use EFS-PRO even when it's cold, like during XC ski races?
A: Cold weather sports still put a considerable fluid and electrolyte demand on the athlete. EFS works just as well in the cold as is the heat. Through experience we have found the EFS Liquid shot to be preferred during cold weather training.

Q: Should I use EFS-PRO in short races?
A: Short races generally don't put a heavy demand on your glycogen carbohydrate stores, given that you are well nourished prior to the start of the race. During a short race athletes can be slowed significantly from cramping and electrolyte imbalance. A serving of EFS can be used 15-30 minutes prior to a short race (<1 hour) to assure adequate carbohydrates and electrolytes are available for the intense effort. Short race is defined as one lasting less than one hour.

Q: Should I use EFS-PRO in long races?
A: During long races (3+ hours) considerable stress is put on an athlete's body: 1) glycogen (energy) stores are depleted; 2) electrolytes are depleted; and 3) amino acids are depleted.

1) EFS-PRO replenishes glycogen by using a mix of high glycemic carbohydrates including both simple and complex sugars. This easy to digest mix is rapidly absorbed and delivers fast and long term energy. EFS-PRO contains a powerful absorption technology blend of cluster dextrins and L-Alanyl L-Glutamine that further drives fluid and electrolytes from the gut to the working muscles.

2) EFS-PRO provides the most potent electrolyte profile available. The combination of all five electrolytes delivers a potent 1500mg per serving, helping to prevent cramping. The 500mg sodium per serving also aids in maximum fluid absorption so you stay hydrated throughout your training and racing. Supplementing with additional salt tabs, electrolyte tabs, or salty snacks is no longer needed when using EFS-PRO.

4) 2000mg of Amino Acids offers the same BCAA and glutamine levels as 9g whey protein. These amino acids have clinically shown to improve performance, reduce post-exercise muscle damage, improve muscle glycogen resynthesis, reduce central fatigue and improve rate of perceived exertion.

Q: How many servings are in a container of EFS-PRO?
A: There are 25 servings per container of EFS.