

Maximizing Any Workout: The Science Behind the AminoFast™ Series

David M. Gundermann, M.Sc., Ph.D.

Chief Scientific Officer, Blue Star Nutraceuticals

Physical exercise is typically an arduous and painful process that, in the long run, will yield positive metabolic, aesthetic, and/or performance adaptations. There are rarely any other reasons to partake in voluntary physical exercise. However, getting the most out of any exercise typically means exercising at a relatively high capacity. It is no coincidence that exercise is difficult, fatiguing and draining of energy. Without the proper fuel in the body, the efforts of exercise may not be optimally applied to achieve the maximal adaptations. Having an optimal nutrition status during exercise that ultimately improves the workout is thus ideal to achieve the desired outcomes most effectively. Regardless if the goal is to achieve more muscle, strength, endurance from the workouts, or simply just burning away fat, the proper source of fuel will allow the muscles to perform at their very best while also minimizing the negative attributes of exhausting exercise. However, since not all workouts / exercises are the same, not everybody needs the same nutrients to maximize that workout.

The AminoFast<sup>TM</sup> series is a collection of formulas to consume while you exercise, tailored to your specific training goals. Whether you are training for endurance, strength, or fat-loss, there is an AminoFast<sup>TM</sup> for you.

### **STAMINA SERIES**

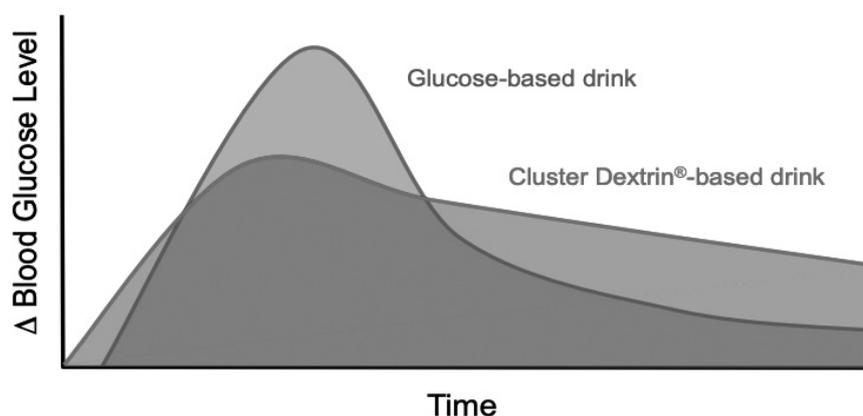
The “Stamina Series” AminoFast<sup>TM</sup> is a stimulantfree formula that includes only the highest quality nutrients exclusively designed to optimize exercise performance in a wide array of exercise types and durations. Perfect for long duration endurance activities, as well as sporting events and tournaments, the unique individual ingredients in AminoFast<sup>TM</sup> “Stamina Series” have been clinically tested to improve performance by reducing fatigue and sparing energy reserves.

The main reason anyone needs to consume an intra-workout supplement is to keep up with the energy demands of a long and grueling workout. This is especially true for endurance athletes who need a steady supply of energy throughout their training.

### **Enhancing Exercise Performance**

The fastest and most reliable sources of energy preferred by the muscles are carbohydrates. Many diets demonize the ingestion of carbohydrates due to the propensity to be stored as fat when consumed in excess. However, for any demanding form of exercise, carbohydrates are absolutely necessary to maximize performance. Multiple

studies have shown that carbohydrate ingestion prior and during exercise can improve performance, however, the delivery of carbohydrates to the muscle is the crucial step for its effectiveness. Gastrointestinal transit and absorption kinetics appear to play a major role. Complex carbohydrates are typically calorie-dense and slow absorbing whereas simple carbohydrates are fast releasing but also trigger a sharp insulin peak. The release of insulin after carbohydrate ingestion can potentially inhibit performance by acting as a carbohydrate storage agent rather than permitting carbohydrate use during exercise. The ideal ingredient would therefore operate as a fast digesting and transiting, yet prolonged releasing, carbohydrate molecule. AminoFast™ “Stamina Series” takes this conundrum into consideration with the inclusion of **Cluster Dextrin®**, a carbohydrate source that quickly transverses through the gastrointestinal tract and yet gets slowly released into the bloodstream over time. This results in both an immediate and sustained release of carbohydrates, ideal for the performance enhancement of any exercise.



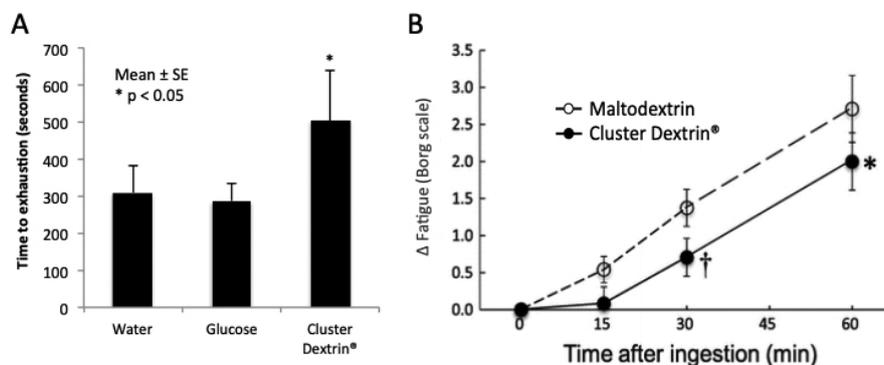
**Figure 1.** Schematic of glucose availability comparing Cluster Dextrin® vs Glucose supplementation. Cluster Dextrin is associated with both a quicker and prolonged release of glucose in the bloodstream.

Compared to other sources of carbohydrates of equal caloric value, a Cluster Dextrin® based sports drink passes through the stomach 22% faster than a maltodextrin-based drink, and 57% faster than a glucose solution. Moreover, due to the complex molecular structure, Cluster Dextrin® requires multiple enzymes to break down the different bonds for its full digestion. While Cluster Dextrin® is the fastest available source of carbohydrate, the combination with its slow release from the intestine allows for quick blood glucose availability, yet a prolonged action that does not cause any sudden rise in blood sugar nor an insulin overload. This is in contrast to simple sugars

that get immediately absorbed into the blood stream all at once. This unique combination results in immediate and sustained blood glucose availability to sustain high-intensity muscle performance (Figure 1).

To demonstrate the ability of Cluster Dextrin<sup>®</sup> to deliver bioavailable energy and enhance performance, a study was conducted in sprint swimmers who were given either Cluster Dextrin<sup>®</sup>, an equivalent amount of glucose, or water as a control prior to training. During a final bout of a sprint interval training session, swimmers swam at 90% VO<sub>2</sub> max until volitional failure. The sprint swimmers who ingested Cluster Dextrin<sup>®</sup> were able to swim 75% longer than the group who ingested a glucose solution and 63% longer than the group who only ingested water (Figure 2A).

A separate experiment was conducted in 24 experienced exercisers analyzing the rating of perceived exertion during exercise with Cluster Dextrin<sup>®</sup> compared to an equivalent amount of maltodextrin. This study concluded that even at a dose as small as 15g, Cluster Dextrin<sup>®</sup> is sufficient to significantly reduce the perception of exertion that progresses throughout a workout (Figure 2B).



**Figure 2.** Functional comparisons to Cluster Dextrin<sup>®</sup>. **A.** Increased time to exhaustion compared to water or glucose. **B.** Reduced perception of fatigue after fatiguing exercise.

Collectively, the superiority of Cluster Dextrin<sup>®</sup> over other carbohydrate varieties on the market has been observed clinically with improved gastric emptying time and extended energy release. Ultimately these features translate to a reduction in the perception of fatigue and thus increased time to exhaustion. These significant benefits make Cluster Dextrin<sup>®</sup> the ideal fuel to maximize the efforts toward a productive workout.

## **ENERGY SERIES**

If you want to train with higher intensity and a shorter duration than the average endurance athlete, you may benefit from some extra fast-acting stimulation to keep you going. AminoFast<sup>TM</sup> “Energy Series” is specifically designed for high-intensity exercise, HIIT training, hypertrophy training and strength training. Enjoy all the same benefits of “Stamina Series” AminoFast<sup>TM</sup> but with the added boost of energy coming from caffeine. The added 125 mg of caffeine coming from both caffeine anhydrous and organic green coffee bean extract is ideal to boost your central nervous system to push yourself to a higher threshold.

### **Caffeine**

Acting as a stimulant to the central nervous system, caffeine has proven effects on potentiating the mind muscle connection for enhanced muscle activation. At the level of the muscle cells, caffeine is an activator of the ryanodine receptors and consequently enhances intramuscular calcium release and increases the intensity of muscle contraction. A moderate dose of caffeine has been shown to significantly enhance strength, as well as extend the time to fatigue with high-intensity exercise. The coupling of Cluster Dextrin®, with caffeine makes AminoFast<sup>TM</sup> “Energy Series” the most elite intra-workout supplement on the market.

## **SHRED SERIES**

Exercising for performance benefits and exercising for weight loss might seem similar, but the strategies are quite opposite from each other. When trying to become more endurance, faster, stronger or more powerful, you want all the extra energy you can handle, to fuel those actions and efficiently maximize your body’s ability to push those physical limits. On the contrary, if the objective is to burn excess fat mass, you want to do the opposite; restrict fast-acting energy resources and force your body to work harder and less-efficiently to expend as many excess calories as possible. The less efficient your body works, the more energy it takes to perform a given exercise. This final series is designed to help you shed any unwanted bodyfat as you train. If your purpose to exercise is primarily to lose weight, this formula is for you. AminoFast<sup>TM</sup> “Shred Series” is a low-calorie lowcarbohydrate supplement with added ingredients specifically focused to target fat loss during exercise.

### **Taurine**

Taurine is a conditionally essential sulfur-containing amino acid that is believed to be involved in a wide range of metabolic processes. In regards to enhancing fat metabolism, research shows that as little as 1.66g of taurine can significantly and acutely increase total fat oxidation in a single 90-minute workout. This research indicates that you can expect to burn an extra 5g of fat per workout just from Taurine alone. The mechanism of action is still relatively unknown but it's believed that taurine directly enhances the activity of the enzyme cascade known as AC/cAMP. This is the same pathway also activated during exercise via with the production of catecholamine hormones. The combination of taurine with exercise is believed to augment this process. Activation of the AC/cAMP cascade, either directly by taurine or mediated via augmented catecholamines is the primary mechanism responsible for increased lipolysis and fat oxidation during moderate intensity exercise. One study showed that taurine caused a 45% increase in plasma free fatty acids after 45 minutes and at exhaustion during submaximal steady-state exercise.

### **N-Acetyl L-Carnitine**

The actual process of fat-burning is called betaoxidation, and as a consequence of exercise, it occurs in the mitochondria of the active muscles. Maximal rates of fat burning during exercise naturally occurs during moderate-intensity exercise, while increased intensity tends to decrease the rate of fat burning. One of the limiting factors of beta-oxidation during exercise is the transport of fatty acids into the mitochondria. The shuttling process requires intramuscular carnitine for this to happen. Research indicates that muscle-carnitine availability is a limiting factor to the rate of fat oxidation and that increasing the intramuscular carnitine pool can have a significant impact upon fat metabolism during higher intensity exercise. The rate of fat oxidation is thus dependent on the rate of fatty acid shuttling into the mitochondria. Supplementing with carnitine has been shown to increase fatty acid oxidation even at higher relative exercise intensities while reducing glycogen utilization. For example, in a study where participants were asked to cycle at 50% maximum intensity, carnitine supplementation was sufficient to reduce glycolytic flux by 31% compared to control. These data suggest that supplementing with carnitine can significantly impact the rate of fat-burning at a given exercise intensity.

**Kinetiq®**

In terms of fat burning, Kinetiq® is a must. Kinetiq® is a branded extract of *Citrus aurantium* that has been standardized to 25% p-synephrine. P-synephrine, is a unique fat burning compound that stimulates an increase in metabolic rate, an increase in energy expenditure, and an increase in lipolysis. Collectively this attributes to greater overall weight loss.

The effects of Kinetiq® are supported by over a dozen safety and efficacy human clinical trials, which demonstrate its ability to increase thermogenesis and promote weight loss with exercise. Kinetiq® exerts its beneficial effects through p-synephrine targeting and activating beta-adrenergic 3 ( $\beta_3$ ) receptors. These receptors are specifically responsible for breaking down fat for energy. As opposed to other betaagonists, p-synephrine exerts its effects without any further cardiovascular interference. Recent research has further demonstrated that Kinetiq® enhances sports and resistance training performance by helping to increase mean power, velocity, number of repetitions and total exercise volume.

In a recent 2018 double-blind randomized exercise trial of healthy exercise participants, ingestion of psynephrine elicited a 43% increase in the rate of fat oxidation compared to placebo during submaximal exercise. Interestingly, the absolute energy expenditure remained the same, meaning that less energy was consumed by lean muscle or glycogen stores. This evidence suggests that p-synephrine is an invaluable component for those interested in specifically in fat loss.

**COMMON TO ALL AMINOFAST™ SERIES**

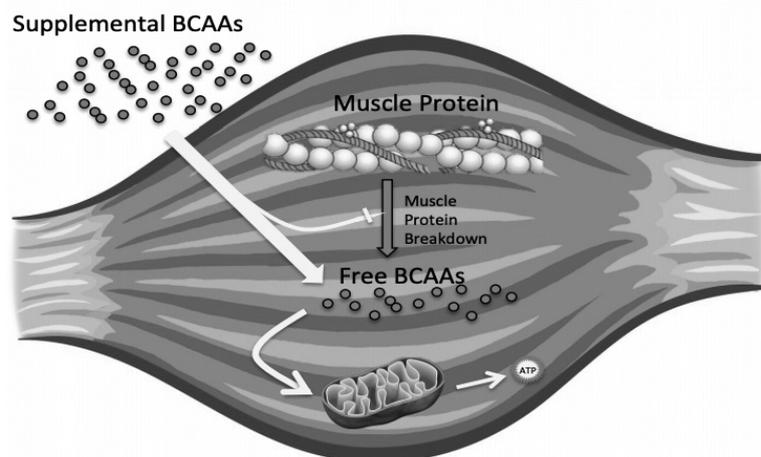
Despite the unique capabilities of each product series. There is still a lot of commonalities that all exercisers can benefit from an intra-workout supplement. Things like sparing muscle or hydration is not specific to a particular style of exercise training but rather common to all athletes. For this reason, each of the AminoFast™ Series share the same additional features.

**Muscle Sparing**

During exercise, the bulk of the energy may come from any ratio of carbohydrate and fat metabolism, dependent on many factors. However, a significant portion of the energy expenditure unavoidably comes from the oxidation of certain

amino acids. Skeletal muscle can directly oxidize the branched chain amino acids (BCAAs; leucine, isoleucine, and valine) for the production of energy. Unfortunately, muscle cells only maintain a small pool of free BCAAs for this purpose, which can be rapidly depleted during exercise. Therefore, as amino acids are being oxidized during exercise, muscle proteins are consistently being broken down to sustain the intracellular amino acid concentration. Consequently, the longer exercise lasts, the more muscle protein gets broken down which leads to muscle loss during exercise.

It's a common misconception that muscle loss is required for muscle gain. Muscle breakdown is indeed associated with muscle gain but not all breakdown is the same. Muscle growth is caused by some form of muscle stimulation and trauma to the muscle that leads to muscle breakdown and recovery. However, this is quite a different process than the muscle breakdown that occurs for the sole purpose to liberate energy for exercise. The latter is not associated with any stimulation for regrowth. Therefore, attenuating muscle loss during exercise can be an effective strategy to maintain muscle mass during endurance activities or to achieve the greatest amount of muscle growth with resistance training. Providing free form BCAAs directly to an exercising muscle enhances the pool of intracellular BCAAs and thus reduces the need to breakdown muscle protein. Human trials of ingesting BCAAs before and during exercise has been shown to effectively reduce the breakdown of muscle proteins during exercise (Figure 3).



**Figure 3.** Supplemental BCAAs reduces the necessity for muscle protein breakdown to free up free BCAA for the purpose to generate energy. Consequently, this preserves muscle mass, muscle function, accelerates recovery and reduces muscle soreness from exercise.

As an additional benefit, BCAA supplementation is associated with improved recovery post-exercise. Through a mechanism that is not fully understood, the reduction of muscle protein breakdown during exercise can permit expedited recovery afterward. For instance, recent evidence indicates that BCAA supplementation can modify the pattern of the exercise-related cell signaling that effects the immune systems response to exercise to favor enhanced muscle recovery.

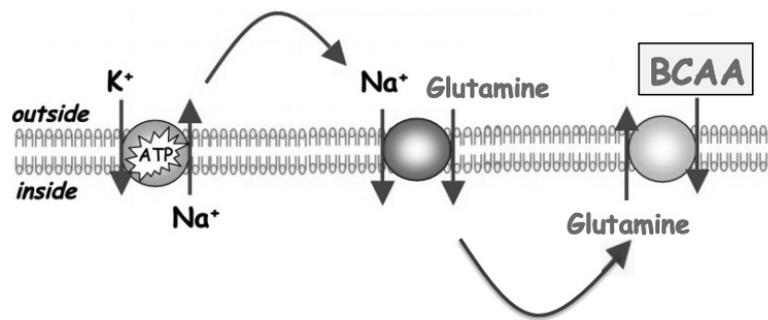
Evidence for improved muscle recovery comes from several studies observing that ingestion of 5-6g of BCAA prior to exercise reduces soreness and muscle fatigue for several days after exercise while also preserving muscle function and strength. This combination allows for optimal performance for subsequent workouts instead of becoming incapacitated with soreness.

Muscle sparing, faster rates of muscle recovery and improved muscle function are great attributes from BCAAs, but there may be a single limitation that prevents them from getting into the muscle cells in the first place.

### **Significance of Glutamine for BCAA Delivery**

BCAAs cannot simply pass through cell membranes to be delivered to muscle cells. In fact, cells containing basal levels of free amino acids are less susceptible to the uptake of supplemental amino acids. This is also exceedingly difficult without a robust insulin response from typical food ingestion.

Therefore, in order to maintain the delivery of BCAAs toward the inside of cells, muscles rely on a complex active transport system. The active transport system requires three things to function: 1) energy to power the reaction in the form of ATP, 2) the BCAAs to be transported and 3) Glutamine to facilitate the transport. Glutamine is indeed required for the transport of BCAAs into muscles and can become a limiting factor when supplementing with only BCAAs (Figure 4). Therefore, the co-ingestion of glutamine with BCAAs assists with their delivery into muscle cells. The AminoFast™ Series is thus formulated with 3 grams of free-form glutamine to ensure optimal BCAA transport.



**Figure 4.** Glutamine is required for the transport of BCAAs across a cell membrane using a tertiary active transport system. Supplemental glutamine is actively pumped into the cell through a sodium dependent transporter, powered by the Na/K pump. The enhanced intracellular glutamine concentration can then be exchanged for the import of BCAAs.

## Hydration

The final feature to the performance enhancing effects of the AminoFast<sup>TM</sup> Series is the hydration support. The inclusion of key electrolytes works to assist with fluid transport into the muscles, and increasing cell volume. Specifically, sodium, potassium and chloride, work together to assist with water balance by creating an osmolarity gradient that pulls water into the cells from the bloodstream. The flux of fluid moving into the cells triggers an increase in thirst that replenishes blood volume. Insufficient cell hydration can interfere with muscle contraction. Thus, the hydrating properties of the AminoFast<sup>TM</sup> Series allows for normal muscle contraction for the duration of the workout.

Simply drinking mass amounts of water is not always an optimal method to hydrate. Drinking plain water can dilute the existing electrolytes in the bloodstream causing a condition called hyponatremia. Therefore, supplementing with these nutrients will ensure optimal muscle functioning during the workout and prevent hyponatremia.

**Coconut Water Powder** is known for its concentrations of electrolytes, vitamins and minerals. This will enhance cell volume and hydration, stimulate thirst to keep you drinking water and also prevent cramping during exercise. Coconut water is high in, potassium, magnesium, and calcium. Potassium helps maintain water balance, stimulates metabolism of proteins and carbohydrates, helps muscles use glycogen, prevents muscle fatigue and enables normal muscle contraction. Magnesium participates in the conversation of ATP, decreases pain, prevents muscle cramps and spasms. Calcium helps muscles contract and work properly. Rather than pulling calcium out of

your bones, coconut water can preserve your bone by supplying the calcium for you.

**Pink Himalayan Sea Salt** is high in sodium. Since coconut water is low in sodium, pink Himalayan sea salt is a great companion to coconut water powder to get the full spectrum of electrolytes naturally. It also provides additional potassium, magnesium, and calcium. Sodium helps maintain water balance, activates thirst response, prevents water intoxication and hyponatremia, prevents cramps, enables normal muscle contraction. Also enables nerve impulse transmission and maintains normal blood pressure.

## CONCLUSION

The new AminoFast<sup>TM</sup> Series is designed to optimize your goals no matter what your workout is. From the endurance athlete, to a power athlete to the everyday gym-goer, there is an AminoFast<sup>TM</sup> product that will take them beyond what they could accomplish without it. Limitations such as low energy, fatigue and exhaustion can drastically impair the success of an individual workout. Furthermore, muscle loss, muscle damage and delayed muscle recovery can create setbacks for the overall desired outcomes. The unique formulation of the entire series makes AminoFast<sup>TM</sup> the ultimate breakthrough intraworkout supplement that significantly counteracts all the negative elements of any workout.

**REFERENCES**

1. Furuyashiki T, Tanimoto H, Yokoyama Y, Kiaura Y, Kuriki T, Shimomura Y. Effects of ingesting highly branched cyclic dextrin during endurance exercise on rating of perceived exertion and blood components associated with energy metabolism. *Biosci Biotech Biochem.* 78; 2117-2119, 2014.
2. Haff GG, Lehmkuhl MJ, McCoy LB, Stone MH. Carbohydrate Supplementation and Resistance Training. *J Strength Cond Res.* 17; 187-196, 2003.
3. Howatson G, Hoad M, Goodall S, Tallent J, Bell PG, French DN. Exercise-induced muscle damage is reduced in resistance-trained males by branched chain amino acids: a randomized, double blind, placebo controlled study. *Amino Acids.* 9; doi: 10.1186/1550-2783-9-20, 2012.
4. MacLean DA, Graham TE, Saltin, B. Branched-chain amino acids augment ammonia metabolism while attenuating protein breakdown during exercise. *Am J Physiol.* 267; E1010-E1022, 1994.
5. Negro M, Giardina S, Marzani B, Maxatiko F. Branched-chain amino acid supplementation does not enhance athletic performance but affects muscle recovery and the immune system. *J Sports Med Phys Fitness* 48; 347-351, 2008.
6. Rennie MJ, Bohe J, Smith K, Wackerhage H, Greenhaff P. Branched-Chain Amino Acids as Fuels and Anabolic Signals in Human Muscle. *J Nutr.* 136; 264S-268S, 2006.
7. Shimomura Y, Murakami T, Nakai N, Nagasaki M, Harris RA. Exercise Promotes BCAA Catabolism: Effects of BCAA Supplementation on Skeletal Muscle during Exercises. *J Nutr.* 134; 1583S-1587S, 2004.
8. Shimomura Y, Yamamoto Y, Bajotto G, Sato J, Murakami T, Shimomura N, Kobayashi H, Mwatari K. Nutraceutical Effects of Branched-Chain Amino Acids on Skeletal Muscle. *J Nutr.* 136; 529S-532S, 2006.
9. Shiraki T, Kometani T, Yoshitani K, Takata H, Nomura T. Evaluation of Exercise Performance with Intake of Highly Branched Cyclic Dextrin in Athletes. *Food Sci Tech Res.* 21; 499- 502, 2015.
10. Takii H, Yakii Y, Kometani T, Nishimura T, Nakae T, Kuriki T, Fushiki T. Fluids Contain a Highly Branched Cyclic Dextrin Influence the Gastric Emptying Rate. *Int J Sports Med.* 26; 314- 319, 2005.

11. Waldron M, Whelan K, Jeffries O, Burt D, Howe L, Patterson SD. The effects of acute branched-chain amino acids supplementation on recovery from a single bout of hypertrophy exercise in resistance-trained athletes. *Appl Physiol Nutr Metab.* 42; 630-636, 2017.
12. Rutherford JA, Spriet LL, Stellingwerff T. The Effect of Acute Taurine Ingestion on Endurance Performance and metabolism in Well-Trained Cyclists. In *J Sport Nutr Exerc Metab* 20(4); 322- 329, 2010.
13. Geiss KR, Jester I, Falke W, Hamm M, Waag KL. The effect of taurine-containing drink on performance in 10 enduranceathletes. *Amino Acids.* 7; 45-56, 1994.
14. Fritz, IB. McEwen B. Effects of carnitine on fatty-acid oxidation by muscle. *Science.* 129; 334-335, 1959.
15. Gutierrez-Hellin J, Del Cosao J. Effects of p-Synephrine and Caffeine Ingestion on Substrate Oxidation during Exercise. *Med Sci Sports Exerc.* 50(9); 1899-1906, 2018.