IMPORTANCE OF PROTEIN FOR ULTRA-ENDURANCE ATHLETES

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Ascendancy of Carbohydrates

Recognition of the importance of carbohydrates for athletes dates back to 1925 when top athletes running the Boston marathon used carbohydrate feeding to prevent the decline in blood glucose and improve performance. However the notion that carbohydrate feeding was important for athletes was not fully appreciated until the late 1960s shortly after the advent of the biopsy needle which allowed histological and biochemical studies of human muscle before, during and after exercise. This early research led to the understanding of the importance of muscle glycogen, the storage form of carbohydrate in muscles, as a fuel for active muscle during prolonged exercise and made the connection between glycogen depletion and fatigue(1, 2). Researchers discovered that manipulating an athlete's training combined with a high carbohydrate diet several days prior to exercise (carbohydrate loading) significantly increased muscle glycogen levels and delayed fatigue(3). Subsequent work throughout the 1970s and continuing through to the present day have confirmed that carbohydrate feeding during exercise improves prolonged endurance performance by preventing low blood sugar (hypoglycemia), sparing glycogen, and maintaining high rates of carbohydrate oxidation. However up until recently there was little interest in the effect of protein for the endurance athlete.

The Power of Protein

Protein is derived from the Greek word for primary. Strength and power athletes know all too well the primary role protein plays in building muscle mass, but endurance athletes don't need the extra bulk. Does that mean protein should be given less priority? Most definitely not! Here are 5 reasons that endurance athletes, especially those involved in ultra-endurance events lasting several hours, should seriously consider protein key to their success.

1. Enhance performance

At the end of the day what really matters to competitive athletes is *performance*. Several recent studies have indeed shown that adding protein to carbohydrates can help you reach the finish line faster. I'm not talking about an isolated anomaly either; at least half a dozen studies point to a performance benefit. In one study highly trained cyclists completed a bout of exercise to deplete muscle glycogen levels. Immediately after the exercise and 2 hours into recovery they were provided one of three beverages: a commercial carbohydrate-based fluid replacement drink (31 g carbs), a commercial high carbohydrate drink (73 g carbs), and a beverage matched for energy that contained both carbohydrate (63 g carbs) and protein (14 g protein). After 4 hours into recovery, the cyclists improved their performance in a ride to exhaustion test when they consumed carbohydrate with protein by 51% compared to carbohydrate alone (4). In another recent study, trained cyclists rode to exhaustion on 4 separate occasions. During each trial they consumed either: a carbohydrate beverage with added protein (carb-prot), a matched carbohydrate beverage (carb), a matched carbohydrate beverage with additional carbs to match the calories provided by protein (carb-carb), and a placebo (water). They cycled the longest with the carb-prot beverage (126 min); with the next best performance in the carb-carb trial (121 min) followed by the carb (118 min) and water (107 min) trials. Interestingly, the carb-prot trial also had lower levels of muscle damage markers. Consistent with less muscle damage, the carb-prot trial had increased muscle strength 24 hours after exercise compared to the other trials indicating better recovery (5). At least four other studies have shown that protein added to carbohydrate enhances endurance performance (6-9).

2. Boost synthesis of skeletal muscle proteins

Second to performance, the next most important reason to consume protein is for its critical role in recovery promoting an anabolic signal to increase synthesis of the many different proteins that make up muscle. Prolonged endurance exercise causes significant protein breakdown to provide fuel for exercise, which may be offset by adding protein. Protein may aid recovery from exercise by providing amino acid

building blocks for protein synthesis that would otherwise need to be broken down from existing muscle. In this way, protein augments repair and remodeling of tissue, speeds recovery and ultimately helps maintain muscle mass and optimal functioning of muscle. Here's how it all works. When you ingest protein, your body breaks the amino acid bonds during digestion so they can be absorbed into the bloodstream. Amino acids are then transported to different parts of the body to provide the building blocks to construct and repair your muscles, tissues, bones, cartilage, nervous system, and organs. Keep in mind the proteins in your body are in constant flux, being both torn down and built up, and this whole process is radically accelerated during ultra-endurance exercise. The key to keeping protein breakdown and synthesis in balance with such demanding physical exertion is to bump up protein synthesis greater than or equal to protein breakdown by consuming protein. Performing a single bout of resistance or endurance exercise increases protein synthesis and breakdown, but the end result is still a negative protein balance. That single fact is a major reason to ingest protein, which clearly pushes the balance in a highly positive direction whether it is resistance or endurance exercise (10). If protein ingestion creates a positive protein balance even for endurance athletes, then why don't they develop large muscles like bodybuilders? Studies have shown that in trained athletes resistance exercise stimulates synthesis of contractile proteins which contribute to expansion of muscle size, whereas endurance exercise stimulates synthesis of other protein such as mitochondria that function in aerobic (oxidative) metabolism and contribute less to total muscle size (11). What does this mean for endurance athletes? Simply put, the amino acids provided by protein serve as the building blocks for building muscle proteins that contribute to enhanced performance. If you do not provide the amino acids in your diet, the body breaks down its own muscle proteins to provide the amino acids to increase protein synthesis whether its proteins associated with contraction or mitochondrial function.

3. Decrease muscle damage

Prolonged exercise is associated with a profound metabolic and mechanical stress, especially the continuous pounding that occurs with each running stride. The physical tearing of membranes and the normal organized structure of muscle proteins within the cell, in combination with the biochemical stress associated with accelerated rates of metabolism, results in significant disruption to normal functioning of muscle. These processes contribute to delayed muscle soreness and eventually decreased functional capacity of muscle for several hours and days after exercise. Many studies indicate that protein helps dampen the overall stress response. In one study protein added to carbohydrate reduced muscle damage by an average of 27 % and muscle soreness by 30 % in runners (12). In another study, researchers found that compared to a carbohydrate only supplement that adding protein reduced markers of muscle damage and improved muscle performance the day following exercise in cyclists (13).

4. Speed glycogen synthesis

Refilling the glycogen tank after exercise can help recovery and prepare for the next day's challenges. Research studies show a beneficial effect of ingesting protein and/or amino acids in combination with carbohydrate on glycogen synthesis after cycling exercise compared to the same amount of carbohydrate (14,15). In comparison to a carbohydrate only beverage, when athletes consumed a carbohydrate-protein drink immediately after and 2 hr post exercise, they had a 128% greater storage of muscle glycogen and 55% greater performance during a subsequent exercise test (16). The effects on glycogen synthesis appear to be related to a more rapid replenishment during the window of time right after exercise (17).

5. Augment fuel utilization and prevent fatigue

Although protein is generally considered to be an inefficient fuel source and contribute minimally to the overall energy demands of exercise, during ultra-endurance events protein oxidation can become significant. Protein ingestion during a marathon was shown to increase protein oxidation during exercise (18), and thereby potentially spare blood glucose and muscle glycogen, and contribute to an overall anti-catabolic effect by preventing muscle protein breakdown (19). There are 3 amino acids called branched chain amino acids (BCAAs) that are used as fuel for muscles. The BCAAs (leucine, isoleucine, valine)

are essential and make up about one-third of muscle proteins. They are oxidized in proportion to energy expenditure so the demand for them increases several-fold with prolonged ultra-endurance events. There levels in blood and muscle drop significantly during exercise, and therefore of all the amino acids in protein these are the most important to consume. One other benefit of providing a rich source of BCAAs is preventing central fatigue. A decline in BCAA results in an increase in the plasma free tryptophan (f-TRP) to BCAA which facilitates increased uptake of tryptophan in the brain that get converted to serotonin. Increase in the concentration of serotonin can impair central nervous system function during prolonged exercise, a phenomena called central fatigue (20). Consuming BCAAs during exercise can influence the ratio of f-TRP to BCAA to decrease serotonin levels and thereby delay central fatigue.

Go for Whey

Nearly all the studies showing positive effects of protein for endurance athletes have used whey in some form. Whey has several unique qualities that make it an attractive protein source for athletes.

- Complex protein source with a high prevalence of essential amino acids, particularly the BCAAs like leucine, which rapidly stimulates protein synthesis.
- 10% leucine which directly activates a critical compound in muscle cells called the mammalian target of rapamycin (mTOR) that turns on protein synthesis.
- Digested and absorbed quickly resulting in a more rapid increase in plasma amino acids, which results in a larger and more rapid increase in protein synthesis.
- Chronic ingestion of whey results in improved body composition including both increased lean body mass and decreased fat mass.
- Whey protein improves blood glucose control.
- Whey protein has antioxidant effects because it is a unique rich source of cysteine and thiol groups (3-4 times higher than soy) that are rate-limiting for synthesis of glutathione (GSH), one of the most important nonenzymatic antioxidant defense systems.
- Whey has positive effects on immune function which could be attributed to a variety of whey fractions such as lactoferrin, glutamine, immunoglobulins, and other peptides (eg, lysozome, β-lactoglobulin, and β-lactalbumin).

Supreme Protein Bars: No Other Bar Compares

Needless to say, considering all the evidence above, Supreme Protein has emerged as the clearly superior choice for everyone from high-intensity athletes to ordinary health-conscious people. Its appearance in the protein bar marketplace changed the rules for every other bar out there (many of which no longer exist, primarily because of Supreme Protein's profound effect on customers' expectations of how a protein bar should taste and support peak health.) It's that premium quality, along with the gourmet candy bar taste, that makes Supreme protein bars the clear choice for athletes looking to maximize their performance and recovery. You can find them at major retailers such as CVS, Vitamin Shoppe, GNC, Wal-Mart, 7-11, Circel K, and countless others. Want to know more? Go to www.supremeprotein.com and read more about them.

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