

RECOVERY NUTRITION

Part I: Acute Post-Workout Recovery

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The nutritional supplement industry has quickly become a multi-billion dollar industry. From weight loss to muscle gain, each of these promises to be the “magic pill”. Quite possibly one of the most important supplements for any person engaging in regular physical activity is the post workout recovery shake. According to Berardi (2003) “strength and endurance training and competition promote a host of physiological benefits, both types of exercise stress the body to a large degree. Not only are muscle substrates (stored carbohydrate/glycogen, stored amino acids, and stored phosphagens like ATP and phosphocreatine) depleted, but also protein status becomes negative, muscles suffer structural damage, blood cortisol levels rise, and immune function is compromised. Fortunately, the body is designed to respond to these changes by providing a short post exercise period in which all these negative effects can be remedied as long as proper nutrition is provided, and fast (3).”

During and after bouts of intense exercise, the human body can deplete itself of vital nutrients, electrolytes, and water, elevating the levels of catabolic hormones circulating throughout the bloodstream. While in this catabolic state, the body provides a window of opportunity to immediately replenish these nutrients and return to a state of homeostasis, or near-homeostasis. Studies have shown (Esmarck 2001, Cribb 2006, Ivy 2002) immediate ingestion (within ten minutes post workout) of a recovery shake can have profound effects with regards to replenishment of nutrients, when compared to shakes ingested greater than one hour post workout. Not only is there an increased rate of replenishment of plasma/muscle glycogen and muscle creatine stores, research has also provided data on immediate increases in muscle fiber cross sectional area (Esmarck et al 2001), decreases in protein degradation (Bird et al 2006),

and restoration of anabolic hormonal profile (Kraemer et al 2006, Bird et al 2006). Each of these factors contributes toward the abatement of catabolic hormones while restoring the body to an anabolic state.

The hormones cortisol, insulin, and testosterone are three of the major hormones affected by exercise and post workout recovery supplementation. During times of stress (physical, mental, emotional) the body has been shown to change its cortisol/testosterone ratio, with greater increases in settings of hypo-hydration/dehydration (Maresh et al 2006), such as those found after bouts of intense exercise with minimal recovery. The net effect of this hormonal ratio change may lead a catabolic state, where muscle strength, power and endurance can be reduced (Coutts et al 2007) over time. The proper maintenance of this hormonal ratio must be a priority in any training protocol, and one of the first steps toward recovery after intense bouts of exercise is proper post workout recovery nutrition.

Protein

During a workout muscle proteins are broken down (protein degradation), while it is during the recovery period that these proteins are then re-synthesized. Immediately following intense training, protein ingestion has been shown to decrease protein degradation by up to 26% when compared to a placebo group (Bird et al 2006). Various studies have concluded that amino acid supplementation, when combined with proper resistance training, can result in greater increases of fat free mass, muscle strength, body composition, muscular endurance, myofibrillar protein, and hormonal expression (Willoughby et al 2007, Kerksick et al 2006, Antonio et al 2000). Understanding that protein/amino acid supplementation can restore and hypertrophy previously degraded muscle proteins, and that the ingestion of these proteins immediately following a workout can increase this effect, which type of protein is best consumed during this window of opportunity to maximize anabolic results.

Whey protein is one of the most popular forms on the market today, with the other being soy. Whey is a fast digesting form of protein derived from milk. According to Biorie et al (1997) “whey protein was found to induce shorter, but more dramatic increases in plasma amino acid levels(5)”. In a separate study, Dangin et al (2002) concluded that “whey protein stimulated amino acid oxidation and protein synthesis without modifying proteolysis (14)”, providing further evidence toward the body’s need for this fast acting protein immediately following intense exercise. The other form of protein derived from milk is Casein, making up approximately 80% of the protein content in milk. Unlike whey, casein is a slowly digested protein allowing for prolonged plasma amino acid levels, which can result in reduced protein degradation over longer periods of time. Boirie et al (1997) also compared the effects of ingestion of whey protein vs casein. The research findings expressed data showing that whole body protein breakdown was 34% less after casein ingestion when compared to the whey. According to Antonio, “casein has a lower anabolic effect (31% vs 68%) when compared to whey. However, casein has a very profound anti-catabolic effect; meaning that this protein inhibits protein breakdown (2).”

With this information, it can be safe to conclude that the ideal protein to ingest immediately post intensive workout is a combination of both whey and casein. The whey will provide the body with immediate protein re-synthesis, while the casein provides long term protein rebuilding and anti-catabolic effects. According to Kerksick et al (2006), “the combination of whey and casein protein promoted the greatest increases in fat free mass after 10 weeks of heavy resistance training (20).”

Carbohydrate

Immediately following an intensive exercise bout, muscle glycogen, blood sugar, and insulin levels have decreased. From this, the body may be hypoglycemic as well as dehydrated, two factors known to put the body into a catabolic state. The ingestion of simple carbohydrates immediately following intensive workout can create an immediate anabolic rebound, stimulating the production of insulin, which in turn will increase the absorption of glucose and amino acids back into the muscle, thus bringing the body back to an anabolic state. Studies by Ivy et al (2002) and Tarnopolsky et al (1997) have shown this benefit of immediate carbohydrate consumption following intensive exercise.

In their study, Ivy et al (2002) compared the ingestion of carbohydrate alone, versus the ingestion of carbohydrate and protein immediately following intensive exercise. The data concluded greater replenishment of muscle glycogen following carbohydrate and protein ingestion. Bird et al (2006) had similar findings, expressing “the synergistic effect of carbohydrate and essential amino acid ingestion maximizes the anabolic response presumably by attenuating the post-exercise rise in protein degradation (4).” These studies provide further evidence toward the ingestion of a combination of simple carbohydrates and protein immediately following intensive exercise.

Electrolytes and Water

During bouts of intensive exercise the body can lose large amounts of sweat, up to 1.5 liters per hour, putting the body into a state of possible dehydration. With this loss of sweat comes a loss of electrolytes, of particular importance is sodium, which is known to increase fluid retention. Without the replenishment of sodium during the post workout time frame, the body can become progressively more dehydrated due to decreased osmolarity. Maughan et al (1994)

examined the effects of electrolyte fluids vs carbohydrate fluid immediately post exercise. They found the electrolyte group returned to proper levels of re-hydration much sooner than the carbohydrate group. Without the replenishment of electrolytes, the body may not properly re-hydrate, further increasing the chances of a prolonged catabolic state.

Anti-Oxidants

Anti-oxidants have been known to defend the body against oxidative stress, which may be linked as a possible cause for diseases such as Alzheimers, Parkinsons, arthritis, and complications from diabetes. With the stresses placed on the body during intense exercise bouts, there is a possibility for production of excess free radicals, which may cause the body to fall into a catabolic state. In theory this forms the basis for the argument toward exogenous anti-oxidant supplementation during the post workout time frame. According to Clarkson et al (2000), “whether the body’s natural antioxidant defense system is sufficient to counteract the increase in reactive oxygen species with exercise or whether additional exogenous supplements are needed is not known, although trained athletes who received antioxidant supplements show evidence of reduced oxidative stress (10).” Tiidus et al (1998) and Konig et al (2001) had similar but less conclusive findings, explaining that antioxidant quantities found in healthy, balanced diets may meet the requirements to counteract the oxidative stresses created by exercise. Tiidus (1998) found that exogenous consumption of antioxidants during the post workout period “may even be counterproductive, as it may limit neutrophil function during the inflammatory response, which may inhibit subsequent muscle repair (29).”

Understanding the role of antioxidants and their effects on oxidative stress, individuals must make their own educated decision on whether or not to supplement with exogenous antioxidants during the post workout time period.

Glutamine

Often referred to as the “essential” non-essential amino acid. According to Ivy “glutamine is the most nitrogen rich amino acid, supplying 35 percent of the nitrogen that muscle cells use to synthesize proteins (17).” Though the body can produce adequate amounts of this protein, exogenous sources may be effective during times of high physical or adrenal stress. In order to recover and supercompensate from a stressful workout, repair of immune function and muscle tissue is of top priority. Keast et al (1995) found excessive decreases of plasma glutamine in advanced male athletes performing two a day interval sessions for 10 days. The authors concluded, “reduced plasma glutamine concentrations may provide a good indication of severe exercise stress (19).” In separate studies, Walsh et al (1998), Parry-Billings et al (1992), Rowbottom et al (1996), Castell et al (1997), and Bowtell et al (1999) all found plasma glutamine levels to be a possible indicator of exercise stress, immune function, and overtraining.

According to Ivy, “recent research suggests that glutamine may also promote protein synthesis by activating metabolic pathways through cell volumization. Protein synthesis proceeds more quickly when muscle fibers are enlarged or swollen (similar to the effect of weight training). Glutamine draws water and salt into muscle cells, thereby expediting protein synthesis (17).”

Conclusion

Athletes and trainees have many supplement choices to choose from today. Becoming well-informed and well-educated consumers is of utmost importance when dealing with matters of health, particularly what one puts into their body. Consumers must be wary, as there are numerous studies and research articles that are funded by the very same supplement company promoting the product. Third party research articles and papers provide the most current and

unbiased information on which supplements actually achieve the benefits they claim, and which do not.

With regards to Post Exercise Recovery Nutrition, it is clear that the body may fall into a catabolic state after intensive bouts of exercise. Based on scientifically proven research findings, proper recovery nutrition can play a tremendous role in returning the body from this state of catabolism, and eventually allow it to achieve new levels muscular growth, strength, and human performance. Now that we know what to do post workout, the question then becomes, what to do for pre and during workout nutrition. That is the topic of Recovery Nutrition Part II.

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