Does Consuming Whey Protein Before and After Resistance Training Alter Net Protein Synthesis?

It has been well documented that a combination of essential amino acids (EEA) and carbohydrates before a resistance training bout results in a significant elevation in muscle anabolism. Pre-exercise supplementation has also been shown to result in greater muscle protein anabolism when compared to supplementation immediately, one hour, and three hours post exercise. While this data appears to suggest that supplementation can result in a greater anabolic response to the training bout, little data exists looking at intact proteins such as whey protein.

Recently researchers from the University of Birmingham examined the effects of consuming whey protein before and after an acute bout of resistance training on muscle anabolism. Twenty grams of whey protein was consumed immediately prior to exercise and one hour after exercise based upon previous research which demonstrated positive anabolic effects in response to the combination of EAA and carbohydrates. The exercise bout consisted of 10 sets of eight repetitions of leg extensions at ~80% of 1 RM. Muscle biopsies were taken from the vastus lateralis immediately before, one hour after, and five hours after the resistance training bout. Blood samples were taken at selected time points before, during, and after the training bout.

The first major finding was that the ingestion of 20 g of protein before and after the training session induced an anabolic response. However, there were no differences between the ingestion time points, which would suggest that the timing of ingestion of whey protein is not as important as it is when EEA and carbohydrates are ingested. The second major finding was that arterial amino acid concentration only increased by ~30% when whey protein was consumed prior to training. This increase was 70% less than that seen with the consumption of EAA and carbohydrates. Even though the net amino acid balance shifted from negative to positive for both ingestion time points, there was no significant increase in amino acid uptake. Based upon these data, the researchers concluded that the consumption of whey protein does not respond in the same manner as EAA and carbohydrate supplements. Instead, the timing of EAA and carbohydrate supplements is more crucial for inducing the anabolic response. The authors also suggested more research is needed to explore the effect of whey protein supplementation timing.

Tipton KD, Elliott TA, Cree MG, Aarsland AA, Sandford, AP, Wolfe RR. (2007). Stimulation of net muscle protein synthesis by whey protein ingestion before and after exercise. *American Journal of Physiology—Endocrinology and Metabolism*, 292:E71 – 76.

Hydroxy-Methylbutyrate (HMB) Supplementation Improves Aerobic Performance and Body Composition

Several studies have suggested that Hydroxy-Methylbutyrate (HMB) may improve lean body mass, strength, and lipid oxidation when combined with a resistance training program. Additionally, HMB has been demonstrated to reduce proteolysis (protein degradation) and acute damage to muscle structures as a result of eccentric running. As a whole, very few studies have looked at the effects of HMB supplementation on aerobic training adaptations. Recently, researchers from the University of Sherbrooke examined the effects of five weeks of HMB supplementation coupled with a three times a week interval training regime. The interval training program consisted of five intervals performed at the individual's maximal velocity for 50% of the time to exhaustion for that velocity. Recovery between each interval was performed at 60% of maximal. Each interval and its corresponding recovery summed to 100% of the time to exhaustion. Each session contained a five minute warm-up and recovery performed at 50% of the individual's maximal running velocity. Supplementation consisted of the consumption of three grams per day over the five weeks. Results of this investigation revealed that the combination of interval training and HMB supplementation resulted in significantly greater increases in maximal oxygen consumption. There were no differences in body composition changes between groups. Based upon these results it was concluded that the addition of an HMB supplement to an interval training program results in significant improvements to selected components of aerobic performance.

Lamboley CR, Royer D, Dionne IJ. (2007). Effects of beta-hydroxy-beta-methylbutyrate on aerobic-performance components and body composition in college students. *International Journal of Sport Nutrition and Exercise Metabolism*, 17:56 – 69.

Is Muscle Glycogen an Important Concern for Athlete's Who Want to Stimulate Muscle Hypertrophy?

It is generally accepted that a high carbohydrate diet is important for endurance athletes as it allows them to train at a higher level, thus resulting in greater physiological adaptations that potentially could lead to superior performances. Conversely, less attention has traditionally been focused on carbohydrate consumption in strength/power athletes. Recent research has suggested that low levels of muscle glycogen can result in a disruption of the mechanisms related to protein translation. This ultimately could result in impairments in the hypertrophic response to a resistance training regime. While preliminary data seems promising, further research is still warranted to strengthen this contention. Therefore, researchers from Australia recently explored the effects of muscle glycogen concentration and an acute bout of resistance training on the early response genes responsible for promoting muscle hypertrophy.

Seven highly trained athletes were recruited for this investigation. The subjects performed 1-legged cycling in order to deplete muscle glycogen in one leg (LOW). The other leg was utilized as the control condition (NORM). The following day the subjects performed unilateral resistance training. Muscle biopsies were taken at rest, immediately after the resistance training bout, and three hours after recovery.

When the two legs were compared the LOW leg exhibited significantly lower muscle glycogen levels when compared to the NORM leg. The resistance training program resulted in a significant reduction of muscle glycogen in both legs (NORM = -28.3%; LOW = -47.2%). When looking at genes related to carbohydrate metabolism the NORM leg exhibited higher levels than the LOW leg. Interestingly, the LOW leg exhibited lower levels of transcriptional activity of genes that promote muscle hypertrophy when compared to the NORM leg. Additionally, myogenic factors and insulin like growth factors were also suppressed in the LOW leg when compared to the NORM leg. In conclusion the authors suggested that performing resistance training with low muscle glycogen concentrations does not enhance the activity of genes related to muscle hypertrophy. This data may further suggest that low carbohydrate diets may actually result in reduced hypertrophic responses associated with resistance training. Therefore, strength/power athletes who are looking to increase muscle mass should consider the carbohydrate content of their diet to be very important.

Churchley, EG, Coffey VG, Pedersen DJ, Shield A, Carey KA, Cameron-Smith D, Hawley JA. (2007). Influence of preexercise muscle glycogen content on transcriptional activity of metabolic and myogenic genes in well-trained humans. *Journal of Applied Physiology*, 102:1604 – 1611.

Does the Combination of β-Alanine and Creatine Monohydrate Supplementation Improve Aerobic Power, Ventilatory Threshold, Lactate Threshold, and Time to Exhaustion?

Research exploring the effects of dietary supplements is prevalent in the scientific literature. One of the most studied supplements is creatine monohydrate. The ergogenic effects of creatine supplementation are well established. Recently, evidence has been presented to suggest that β-alanine supplementation improves high intensity performance. However, little research has been conducted to explore the effects of combining creatine and β-alanine supplementation on performance. Fifty-five men were recruited for this investigation. Four groups consisting of 1) a placebo treatment (34 g of dextrose), 2) creatine treatment (5.25 g creatine + 34 g dextrose), 3) β-alanine treatment (1.6 g β-alanine + 34 g dextrose), and 4) a creatine and β-alanine (5.25 g creatine + 1.6 g β-alanine + 34 g dextrose) treatment were established. All treatments were identical in taste and appearance. The supplements were consumed four times per day for six days and then twice per day for 22 days. Subjects underwent a graded exercise test on a cycle ergometer prior to and immediately after the 28 days of supplementation. There were no significant differences between the treatment groups for any of the markers of aerobic performance. However, the creatine + β-alanine group demonstrated significant increases post supplementation in the lactate threshold, power output at lactate threshold, oxygen consumption at lactate threshold, and percent VO_2 max at which lactate threshold occurred when compared to the pre-supplementation values. Based upon these finding the authors concluded that the combination of creatine and β-alanine supplements may offer some promise. The author's conclusions should be examined with caution as it is important to reiterate that no statistical significance was noted between the treatment groups. Therefore at this time more research is warranted

in order to determine the efficacy of the use of β-alanine or creatine and β-alanine.

Zoeller RF, Stout JR, O'Kroy J, Torok DJ, Mielke M. (2007). Effects of 28 days of beta-alanine and creatine monohydrate supplementation on aerobic power, ventilatory and lactate thresholds, and time to exhaustion. *Amino Acids*, 33: 505 – 510.

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