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Mini Term Paper: Whey Protein and It's Effect on Muscle Mass in Males Undergoing Resistance Training

When one looks on the shelves at stores such as GNC, stores connected to athletic facilities or merely those of young male athletes hoping to build muscle, one frequently sees numerous protein supplements. The protein powders such as whey protein claim to make people bigger and bulkier, without reporting how or why. This paper aims to examine how whey protein has an effect on muscle mass, if it does at all. In order to reveal the specific effects of whey protein on muscle, it is important to recognize certain terms and fundamentals regarding protein. First of all, proteins consist of twenty amino acids. These amino acids are the building blocks for the formation of new muscle tissue. Of these twenty, nine are considered essential, which we need from our diets and our body cannot produce, (Applegate, 19). Whey protein, which is a mixture of proteins isolated from whey, the liquid material that is created from a byproduct of cheese consumption contains these essential amino acids (Hulmi et. al). Previous studies have shown that, with all other variables remaining constant, increasing amino acid intake will increase muscle mass (Wilson, 18). The nine essential amino acids, however, are the rate limiting nutrients for muscle growth to occur. With resistance training, protein turnover rates are increased, making it essential to consume adequate protein in order to obtain a positive net protein balance (ACSM, 714).

This prompted researchers to ask, how does whey protein supplementation affect muscle mass for healthy males undergoing resistance weight training? Three studies have demonstrated this effect. The first study presented examines the effect of whey protein on the binding protein known as mTOR. The second study demonstrates supplementation of

whey protein on muscle recovery and tissue breakdown. The final study examines the effect of whey protein supplementation on overall net protein synthesis, which when positive, leads to greater muscle hypertrophy.

Mammalian target of rapamycin, is a binding protein also known as mTOR, which stimulates protein synthesis. A different beta protein which is produced in skeletal muscle called myostatin opposes mTOR, and is shown to inhibit muscle hypertrophy. Few studies have been carried out that fully examine the effects of whey protein on mTOR following resistance exercise.

The purpose of the metabolic study "Resistance exercise with whey protein ingestion affects mTOR signaling pathway and myostatin in men", conducted by Hulmi et, al, was to examine the effects of whey protein ingestion on mTOR for short and long-term responses to resistance training.

In this metabolic, double blind study 27 previously untrained men with an average age of around 25 were divided into 3 groups; protein, placebo, and control. Each participant was told to follow their regular Finnish diet, and follow their normal moderate-level physical activity regimen, which consisted of daily activities such as walking, jogging, or swimming. The protein and placebo groups participated in a resistance-training program in which their muscle biopsies were taken both before and after 21 weeks of bi-weekly resistance- training.

Compared with the control group, the protein and placebo groups both had an increase in body mass following 21- weeks of resistance training. Only the protein group, however, saw an increase in muscle thickness halfway through the resistance-training regimen, whereas the placebo group saw an increase only after the full training regimen

of 21 weeks. Also, an increase in the production of mTOR was seen after resistance training only in the protein group, but a decrease in the muscle- hypertrophy inhibitor myostatin protein occurred only after resistance exercise in the placebo group.

The study concludes that resistance exercise without whey protein, is shown to decrease the muscle myostatin, which in turn prevents inhibition of muscle hypertrophy. While resistance exercise also stimulates an increase in mTOR, whey protein increases and prolongs the mTOR signaling response in muscle, thus contributing to greater muscle hypertrophy.

Protein stimulates mTOR, which in turn leads to greater muscle hypertrophy, but does it have an effect on muscle recovery? Fast recovering muscles allow for more strength training shortly after the muscle has been damaged, which in turn increases muscle hypertrophy. Because the rate of protein turnover substantially increases after resistance training, it is essential that one must maintain a positive net balance of protein during the recovery period.

The purpose of the study "Whey protein isolate attenuates strength decline after eccentrically-induced muscle damage in healthy individuals" conducted by Cooke et. al, was to examine the effects of short-term consumption of whey-protein supplements on muscle recovery from exercise induced muscle damage.

In this metabolic double-blind study, 17 healthy, untrained males underwent a resistance-training program for two weeks in which they did 4 sets of 10 repititions of resistance exercise on the leg extension, leg press, and leg flexion exercise machines. They were split into two groups, one group took a carbohydrate supplement following resistance exercise, and the other group took a whey protein isolate. The subjects were

tested for strength levels and levels of the enzyme lactate dehydrogenase, or LDH. Higher levels of this enzyme are associated with greater tissue breakdown.

Results demonstrate that subjects who took the whey protein isolate were able to maintain their strength levels 3 and 7 days into recovery, as compared to the carbohydrate group. Additionally, unlike the carbohydrate group, the whey protein group also had lower plasma LDH activity during recovery.

Due to the essential amino acid content of whey proteins, and lowered plasma LDH activity that resulted, whey proteins are effective in maintaining muscle mass in healthy individuals because of the essential amino acid content of the protein, which is similar to that of the skeletal muscle, and through lessening the damage to the muscle by lowering the plasma LDH activity.

Carbohydrates alone may not have much of an effect on muscle hypertrophy, but how will carbohydrates, when ingested with whey protein effect muscle protein synthesis? Because athletes and resistance trainers often ingest whey protein with other macronutrients such as carbohydrates, it is important to examine the effects of whey protein when coupled with carbohydrates on protein synthesis following resistance exercise.

The purpose of the metabolic study “Minimal whey protein with carbohydrate stimulates muscle protein synthesis following resistance exercise in trained young men”, conducted by Tang et. al, was to examine the effects of whey protein on muscle protein turnover following resistance exercise.

In this metabolic double blind study, eight healthy resistance trained men were divided into 2 groups, each of which participated in a resistance- exercise training

program, consisting of a unilateral leg press and knee extensions. After training, the whey group, ingested a beverage with carbohydrates and protein, consisting of 10g of whey protein and 21g of carbohydrate. The carbohydrate group drank a beverage consisting of 21g of carbohydrate and 10g of maltodextran. Following resistance exercise and beverage consumption, subjects received injections of a tracer amino acid and then received a muscle biopsy to measure protein synthesis. Blood samples were also drawn in the subjects to analyze amino acid content.

While amino acid content decreased slightly in the carbohydrate beverage group following beverage consumption and resistance exercise, in the whey protein group amino acid content actually increased, reaching a peak at 60 minutes after drinking the beverage and then declining steadily. Even after the decline, the whey group had higher amino acid concentrations at each measured time than the carbohydrate group.

The results of this study demonstrate that unlike with a carbohydrate only beverage, a minimal dose (10g) of whey protein ingested with 21g of carbohydrate leads to a positive net protein balance after resistance exercise, which stimulates muscle protein synthesis. Over time, this leads to muscle hypertrophy.

When the body has a positive nitrogen balance, and amino acid content is higher, muscle mass will increase. These studies show the effects of whey protein on muscle mass in individuals undergoing resistance weight training. The first study shows that whey protein increases and prolongs the mTOR signaling response in muscle, which contributes to greater muscle hypertrophy. The second study demonstrates that whey proteins are effective in maintaining muscle mass in healthy individuals because of the essential amino acid content of the protein, which is similar to that of the skeletal muscle,

and through lessening the damage to the muscle by lowering the plasma LDH activity. The final study uses a minimal dose of whey protein with carbohydrate to demonstrate that a minimal dose (10g) of whey protein ingested with 21g of carbohydrate leads to a positive net protein balance and stimulates muscle protein synthesis, which, over time, leads to muscle hypertrophy. All in all, we can see that whey protein, when ingested along with resistance training, prolongs the mTOR signaling response, lowers the plasma LDH activity which decreases tissue breakdown, and contributes to a positive net protein balance- all of which lead to greater muscle hypertrophy.