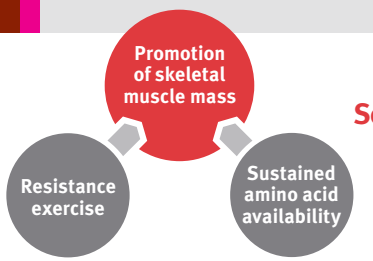
PROTEIN BLEND INCREASES AND PROLONGS POST-EXERCISE MUSCLE PROTEIN ANABOLISM

A soy-dairy blend increases amino acid influx to muscle



Soy-dairy blend continued to deliver amino acids to the muscle, 1-2 hours after workout, for growth & repair, as compared to whey, which delivered amino acids in a rapid but un-sustained manner, 20-40 minutes following consumption.

Overview

- The sports nutrition market is, in part, kept strong by its debates on what is the best program to follow to build muscle. By now, we all agree that the combination of resistance exercise PLUS providing adequate high quality protein is key for promoting increased muscle mass and strength.
- Muscle growth and muscle strength increase when adequate nutrition is provided following resistance training. Protein is a key nutritional component needed to promote muscle growth. Several clinical studies have shown that individual proteins like soy, whey, and casein help resistance-trained people achieve significant muscle growth. These three proteins have unique characteristics and combining them may create an opportunity to optimize muscle growth.
- Resistance exercise and essential amino acids from protein exert separate and combined effects on skeletal muscle protein synthesis (MPS) and important signaling proteins in skeletal muscle, known as mTORC1 signaling. mTORC1 signaling is thought to be essential in regulating muscle protein synthesis.

The Study

RATIONALE

Consuming protein-containing foods increases the availability of amino acids at rest or after exercise. This enhances amino acid transport to skeletal muscle. However, it is unknown whether alterations in amino acid availability from consuming dietary proteins with different rates of digestion can prolong the skeletal muscle net protein balance across the leg (an indicator of overall muscle protein anabolism) as well as enhance amino acid transport rates and transporter expression. This innovative study utilizes stable isotopic methods to demonstrate that resistance exercise in the fasted state combined with increased amino acid availability from consumption of a soy-dairy blend enhances and extends the transport rate of amino acids from circulation into the muscle cell.

APPROACH

This study systematically evaluates several measures of skeletal muscle amino acid transport and muscle protein anabolism after exercise, during the work-out recovery period. The only difference between each group is the composition of the protein beverage consumed after the work-out, either soy-dairy blend or whey.

METHODS

SUBJECTS

Sixteen young healthy recreationally active individuals completed the double-blind, randomized clinical trial. The baseline characteristics of these 16 subjects did not differ.

PRODUCTS

Blend: 25% DuPont™ Danisco® SUPRO® soy protein isolate, 50% caseinate, 25% whey protein isolate

Whey: 100% whey protein isolate

The amounts of protein given via a beverage to each subject was based on lean body mass (measured by dual-energy X-ray absorptiometry). The amount of leucine was balanced so that each individual received at least 1.8 grams of leucine from the protein sources (previous whey protein studies measuring post-resistance training muscle synthesis did not balance leucine). The protein beverages were consumed one hour following leg resistance exercise.

EXERCISE

Subjects performed high-intensity leg resistance exercise consisting of eight sets of 10 repetitions at 55% (set 1), 60% (set 2) 65% (set 3) and ~70% (sets 4-8) of the participants previously determined one repetition maximum with three minute rest between sets.

TESTING

An established stable isotope tracer infusion method was used to measure the muscle protein synthesis rate (calculated as the Fractional Synthetic Rate-FSR) that occurred following resistance leg exercises and protein consumption.

Muscle biopsies were taken at baseline and one, three and five hours after exercise (previous studies only measured one time point and did not use two biopsies to get an accurate stable baseline FSR).

Muscle protein synthesis was calculated as FSR by measuring the incorporation rate of the amino acid tracer into the proteins (Δ protein bound enrichment over time) and by calculating the synthesis rate using the precursor-product model.

STUDY OUTCOMES

After consumption of a soy-dairy blend, amino acid delivery was prolonged and reached its highest point 2-3 hours after consumption.

- Similar to previous studies, these data demonstrated that consuming whey protein leads to a rapid yet short-lived increase in amino acids delivery to the muscle, after exercise.
- This study shows that the soy-dairy blend released a steady rise in amino acids, resulting in a prolonged positive net balance of amino acids in the muscle.
- Consumption of the blend prolonged amino acid delivery twice as long as whey, which returned to resting values one hour following post-exercise ingestion.
- The muscle net balance with the blend was greater than with whey at both 60 and 120 minutes post-ingestion.
- Tracer balance became more positive than at fasting levels after ingestion of both the blend and the whey.
  - Blend was more positive at 20, 40, 60, 80, 100 and 120 minutes
  - Whey was only positive at 20 and 40 minutes

DELIVERY BENEFITS

Whey: Whey protein exhibits a rapid increase in amino acid net balance that is short-lived. Amino acids levels return to resting values around one hour following post-exercise ingestion.

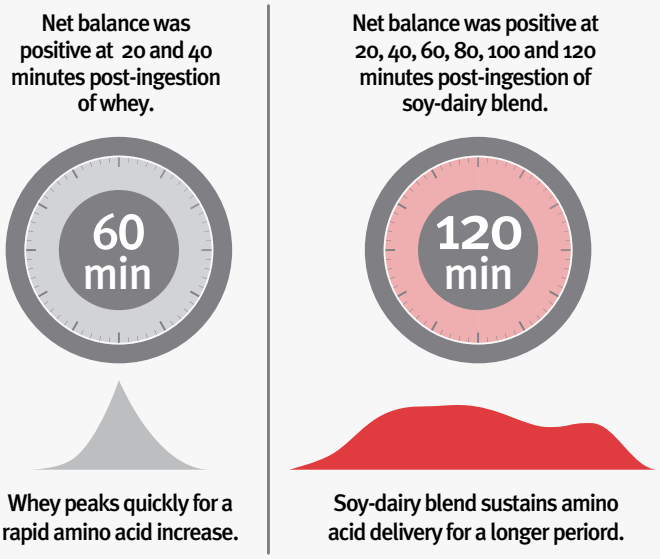
Blend: The soy-dairy blend incorporates the fast delivery benefits of whey with the sustained delivery of casein, and bridges the two with isolated soy protein.

- The soy-dairy blend had a less rapid rise in amino acid balance across the leg, but sustained a positive net balance to two hours post-ingestion. Additionally, the positive net balance in the blend was greater than whey at 60 and 120 minutes post-ingestion.
- This difference between groups suggest less muscle breakdown in the blend during the 1-2 hours post-ingestion period.

NET BALANCE

The soy-dairy blend prolonged positive net balance.

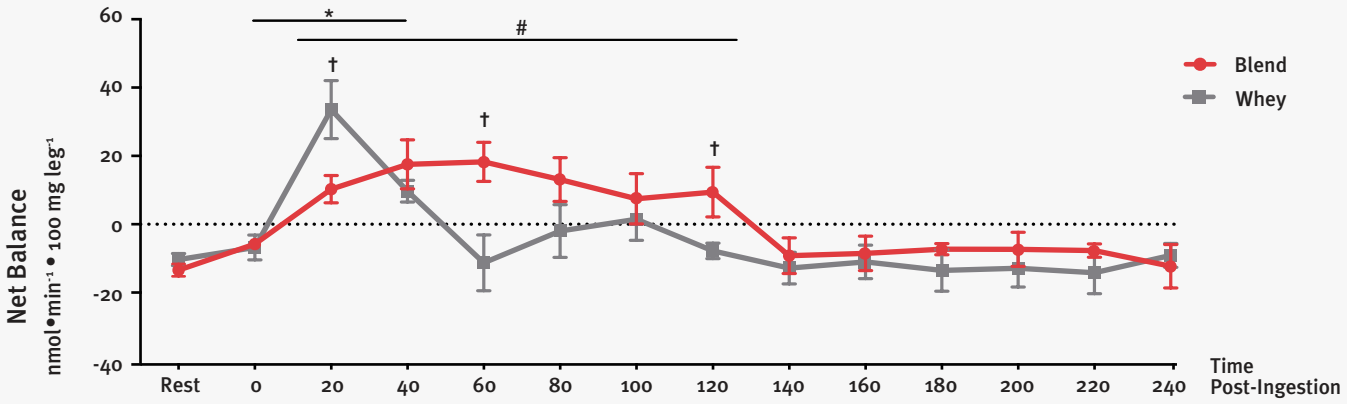
- Net balance became less negative at 0 minutes in whey and was positive at only 20 and 40 minutes post-ingestion as compared to Rest ($p < 0.05$). With the blend, the net balance became positive at 20, 40, 60, 80, 100 and 120 minutes post-ingestion as compared to Rest ($p < 0.05$).
- Whey only resulted in more positive net balance than the blend at 20 minutes, whereas the soy dairy protein blend resulted in an extended and more positive net balance than whey at one and two hours post ingestion



MUSCLE PROTEIN SYNTHESIS

Both the soy-dairy blend and whey increased mixed muscle protein synthesis and mTORC1 signaling to a similar extent following resistance exercise, as previously published.

Skeletal muscle net protein balance across leg (indicator of overall muscle protein anabolism)



NOVEL FINDINGS OF THIS RESEARCH

- Increased post-exercise positive net balance (an indicator of overall muscle protein anabolism) across the leg was prolonged with soy-dairy blend ingestion during the acute post-exercise recovery phase (0-2 hours post-ingestion) as compared to whey.
- Dietary protein ingestion of the blend and whey increased post-exercise amino acid transport into muscle and amino acid transporters associated with the regulation of mTORC1 signaling and muscle protein synthesis.

FINDINGS CONSISTENT WITH EXISTING LITERATURE

- This study confirms that protein is important for muscle recovery following resistance exercise and that a blend of proteins may help extend amino acid availability to muscle.
- This study indicates that soy-dairy blend can improve positive net balance in the leg (through potential reduction in muscle breakdown) when consumed following resistance exercise.
- The study confirms ingestion of the soy-dairy blend after resistance exercise stimulates skeletal muscle amino acid transport rates during post-exercise recovery.
- The study confirms that post-exercise ingestion of protein containing adequate leucine (~1.8g) and sufficient amino acid substrate (from both essential and non-essential amino acids) can prolong MPS in the 3-5h post-exercise period.

UNIQUE AMINO ACID PROFILES OF SOY AND DAIRY PROTEINS

- Whey protein has a higher level of leucine than soy and casein while soy protein has higher levels of arginine and glutamine than whey.
- Leucine has been identified as an important nutrient signal for inducing the muscle protein synthesis pathway through mTORC1 signaling.
- Glutamine and arginine are natural signals for growth hormone release, and thus, play an important role in building muscle.
- Glutamine concentrations are lower in over-trained or chronically fatigued athletes compared to healthy, trained athletes and non-athletes. Glutamine plays a role in the immune system and is a precursor of glutathione, an antioxidant protecting cells from free radical damage. Isolated soy protein has been reported to induce antioxidant effects that could help with muscle recovery.
- These unique characteristics make a soy-dairy blend different from the individual proteins and may promote some muscle health advantages compared to the individual protein sources.
- Combining proteins with varying digestion rates can sustain the post-exercise net protein balance.

REFERENCES

1. Reidy PT, Walker DK, Dickinson JM, Gundermann DM, Drummond MJ, Timmerman KL, Cope MB, Mukherjea R, Jennings K, Volpi E, and Rasmussen BB. Soy-dairy protein blend and whey protein ingestion after resistance exercise increases amino acid transport and transporter expression in human skeletal muscle. *Journal of Appl Physiol.* doi:10.1152/japplphysiol.01093.2013.
2. Reidy PT, Walker DK, Dickinson JM, Gundermann DM, Drummond MJ, Timmerman KL, Fry CS, Borack MS, Cope MB, Mukherjea R, Jennings K, Volpi E, and Rasmussen BB. Protein blend ingestion following resistance exercise promotes human muscle protein synthesis. *Journal of Nutrition* 143: 410-416, 2013.

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