

How Leucine in Whey Helps Prevent Muscle Loss

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STORY AT-A-GLANCE

- › The loss of muscle mass that occurs with age is known as sarcopenia, the most obvious cause of which is inactivity
- › Your muscles need sufficient amounts of protein. Poor digestion can impede your ability to absorb protein, thereby contributing to sarcopenia
- › Whey protein has been shown to stimulate muscle protein accretion and stave off sarcopenia the best, in part due to its higher leucine content, which helps regulate the turnover of protein in your muscle
- › Whey protein also contains the master antioxidant glutathione. Glutathione is thought to play an important role in sarcopenia specifically, as patients with sarcopenia tend to have higher levels of oxidative stress
- › The type of exercise you do can also make a big difference. Blood flow restriction (BFR) training is one of the best ways to prevent sarcopenia, and is the safest form of strength training for those who are frail and elderly

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The loss of muscle mass that occurs with age is known as sarcopenia, the most obvious cause of which is inactivity. Sarcopenia can progress at a rate of approximately 0.8% skeletal muscle loss per year from the fifth decade in adult life.¹ It has an estimated

prevalence of 10% in adults older than 60 years,² rising to more than 50% in adults older than 80 years.^{3,4}

Your diet also plays a role, as your muscles need sufficient amounts of protein to stay viable, as does your ability to digest and absorb protein. As noted in a 2011 paper⁵ in the American Journal of Nutrition:

"Sarcopenia has been attributed to a diminished muscle protein synthetic response to food intake. Differences in digestion and absorption kinetics of dietary protein, its amino acid composition, or both have been suggested to modulate postprandial muscle protein accretion."

In other words, while you need protein to build and maintain muscle, some protein is more easily digested and absorbed than others, so eating the right kind of protein can make a difference in your risk for sarcopenia.

Whey protein, a byproduct of cheese production, has long been acknowledged as an excellent source of protein. In this 2011 study, in which whey protein was compared to casein and casein hydrolysate, whey protein was found to stimulate muscle protein accretion (and hence stave off sarcopenia) the best – in part due to its higher leucine content.

The type of exercise you do can also make a big difference. I now believe blood flow restriction (BFR) training is one of the best ways to prevent sarcopenia. Taken together, leucine supplementation through whey and BFR can go a long way toward protecting your muscles as you age.

Leucine Regulates Protein Turnover in Muscle

One of the reasons why leucine is so important for the prevention of sarcopenia is because it helps regulate the turnover of protein in your muscle. According to a 1975 paper⁶ in The Journal of Clinical Investigation, leucine may also "play a pivotal role in the protein-sparing effect of amino acids." As explained in a more recent study,⁷ published in 2017:

"Protein ingestion produces a strong anabolic stimulus that elevates muscle protein synthesis. The ability of a serving of protein to stimulate muscle protein synthesis (MPS) is dependent on absorption and blood kinetics of amino acids, amount of protein ingested, and the amino acid composition of the protein source.

Only the essential amino acids (EAA), especially leucine, initiate an immediate increase in MPS. Being a rapidly digested protein with a high leucine content, whey has been shown to stimulate MPS more than equal amounts of casein and soy in the first hours after exercise ...

At the molecular level the mechanistic target of rapamycin complex 1 (mTORC1) and its substrates ... are believed to largely be responsible for the protein synthetic response to resistance exercise and protein intake, with resistance exercise potentiating the effect of protein ingestion."

In other words, the most effective way to optimize muscle building is to use a combination of resistance training followed by a protein meal, with leucine-rich whey being one of the most efficient.

Ori Hofmekler, author of "Unlock Your Muscle Gene: Trigger the Biological Mechanisms That Transform Your Body and Extend Your Life," is an expert on how to use food to build muscle and improve your health, and we have previously discussed the profound benefits of whey protein for muscle building in particular.

It is important to understand, though, that simply taking leucine is likely to be ineffective, as demonstrated by a recent Harvard study.⁸ In it, men over the age of 65 with a daily intake of 0.8 grams of protein per kilo per day were compared to men receiving 1.3 grams of protein per kilo per day. They found the higher protein group did not increase lean body mass, muscle strength or physical function, most likely because they were not exercising.

The Importance of Glutathione for Prevention of Sarcopenia

Whey protein also contains another really important health component: glutathione. While many whole foods contain glutathione or its precursors, organic grass fed whey protein is one of the richest sources of this "master antioxidant."

Glutathione is found in every cell of your body. It protects your cells from free radical damage, and is especially important for liver health. It differs from other antioxidants in that its intracellular and has the unique ability to optimize the activity of all other antioxidants.

It plays a crucial role in detoxification, and protects your cells from the damaging effects of radiation, chemicals and environmental pollutants. It's also an essential factor in energy utilization and healthy immune function, and glutathione deficiency has been linked to a wide range of health problems, including Alzheimer's⁹ and Parkinson's,¹⁰ heart disease,¹¹ autoimmune diseases,¹² inflammatory conditions¹³ and mitochondrial dysfunction.¹⁴

Glutathione is thought to play an important role in sarcopenia specifically, as patients with sarcopenia tend to have higher levels of oxidative stress.¹⁵ As noted in the 2012 review,¹⁶ "Rationale for Antioxidant Supplementation in Sarcopenia:"

"Sarcopenia is an age-related clinical condition characterized by the progressive loss of motor units and wasting of muscle fibers resulting in decreased muscle function.

The molecular mechanisms leading to sarcopenia are not completely identified, but the increased oxidative damage occurring in muscle cells during the course of aging represents one of the most accepted underlying pathways.

In fact, skeletal muscle is a highly oxygenated tissue and the generation of reactive oxygen species is particularly enhanced in both contracting and at rest conditions.

It has been suggested that oral antioxidant supplementation may contribute at reducing indices of oxidative stress both in animal and human models by

reinforcing the natural endogenous defenses ...

Antioxidants are substances able to inhibit the rate of oxidation. Mainly, antioxidant enzymes (e.g., catalase, superoxide dismutase (SOD), glutathione peroxidase, glutathione reductase) work to maintain a state of balance preventing the transformation of ROS and to convert them into more stable molecules (like water and molecular oxygen)."

Prevent Muscle Wasting With BFR

While high-quality protein intake is important, to effectively build and maintain muscle you also need strength training. Unfortunately, many elderly individuals shy away from resistance training for fear of injury.

BFR is ideal in such situations, as the amount of weight you use is so low that your risk for injury is minimal. It is important to know that BRF involves exercising your muscles while partially restricting arterial inflow and fully restricting venous outflow in either both proximal arms or legs.¹⁷ Venous flow restriction is achieved by using thin elastic bands on the extremity being exercised.

By restricting the venous blood flow, you create a relatively hypoxic (low oxygen) environment in the exercising muscle, which in turn triggers a number of physiological benefits, including the production of hormones such as growth hormone and IGF-1, commonly referred to as "the fitness hormones."¹⁸

It also increases vascular endothelial growth factor (VEGF), which acts as "fertilizer" for growing more blood vessels and improving their lining (endothelium).

I believe BRF is one of the best strategies available to address the epidemic of sarcopenia,¹⁹ and for most people who are not competitive athletes it may be the only form of resistance training they need.

It's important to realize that sarcopenia is not just cosmetic, and it's not just about frailty. Your muscle tissue, which makes up about half of your body's tissues, is a

metabolic organ, an endocrine organ. Your muscle tissue makes cytokines and myokines, and is a sink for glucose.

Insulin resistance and Type 2 diabetes accelerate sarcopenia, and research shows glucose fluctuations are independently associated with this condition. As noted in one 2019 study,²⁰ "glucose fluctuations were significantly associated with a low muscle mass, low grip strength, and slow walking speed."

BFR Effectively Counteracts Sarcopenia

The effectiveness of BFR for the prevention and reversal of muscle wasting is directly addressed in an April 2019 study²¹ in the Journal of Cachexia, Sarcopenia and Muscle:

"Muscle wasting leads to significant decrements in muscle strength, cardiorespiratory, and functional capacity, which increase mortality rates. As a consequence, different interventions have been tested to minimize muscle wasting.

In this regard, blood flow restriction (BFR) has been used as a novel therapeutic approach to mitigate the burden associated with muscle waste conditions.

Evidence has shown that BFR per se can counteract muscle wasting during immobilization or bed rest. Moreover, BFR has also been applied while performing low intensity resistance and endurance exercises and produced increases in muscle strength and mass.

Endurance training with BFR has also been proved to increase cardiorespiratory fitness. Thus, frail patients can benefit from exercising with BFR due to the lower cardiovascular and joint stress compared with traditional high intensity exercises.

Therefore, low intensity resistance and endurance training combined with BFR may be considered as a novel and attractive intervention to counteract muscle wasting and to decrease the burden associated with this condition."

Leucine Dosage and Timing

As mentioned, leucine is a branched-chain amino acid that serves multiple functions, one of which is signaling the mTOR mechanism, which causes protein to be created and builds your muscle. However, according to Hofmekler, for optimal results you need far higher amounts of leucine than the recommended daily allowance.

The reason for this is because most of the leucine is used up as an energy substrate or building block rather than an anabolic agent. The typical requirement for leucine to maintain body protein is 1 to 3 grams daily. However, to optimize its anabolic pathway, Hofmekler insists you need somewhere between 8 to 16 grams of leucine per day, in divided doses.^{22,23}

Getting that amount of leucine from your regular diet could be pretty difficult. For example, one egg will provide you with 0.5 grams of leucine,²⁴ which means you'd have to eat about 16 eggs to reach the 8-gram minimum.

For most, that simply wouldn't be possible and would overdose you on protein (105 grams of protein from the eggs alone). High-quality whey, on the other hand, contains about 10% leucine (10 grams of leucine per 100 grams of protein).²⁵ So, 80 grams of whey protein will give you 8 grams of leucine.

Ideally you'll want to consume the whey about 30 to 60 minutes before exercise, and again about an hour after your workout. This will help increase both fat burning and muscle building.

A 2010 study²⁶ found that consuming whey protein (20 grams of protein per serving) 30 minutes before resistance training boosts your body's metabolism for as much as 24 hours after your workout.

Other Health Benefits of Whey Protein

Whey protein has undergone extensive study, revealing an impressive array of benefits over and above its ability to support healthy muscle growth. For example, studies show

Whey consumption may also:

- Help lower blood pressure and improve vascular function if you're overweight and/or have high blood pressure²⁷
- Support normal blood sugar levels and boost insulin sensitivity in Type 2 diabetics²⁸
- Reduce inflammation,²⁹ including inflammation associated with inflammatory bowel disease (IBD)³⁰ – In the case of IBD, researchers have suggested its protective actions may be due to its ability to stimulate intestinal mucin synthesis and modify the composition of the gut microbiome
- Help normalize your weight – Not only is whey protein very filling, thereby reducing hunger pangs^{31,32,33} it also boosts metabolism³⁴ (allowing you to burn more calories) and helps maintain lean muscle mass while shedding excess fat stores³⁵

Guidelines for Buying High-Quality Whey

Whey derived from cheese manufacturing that uses raw grass fed milk is the highest quality whey you can possibly find today. One of the most important components of the whey is glycomacropeptides (GMP), which have amazing immune components that are critically important for your gut flora.

However, only whey produced from raw milk cheese contains GMP. Other varieties do not. Whey isolate is a clearly inferior form of whey that should be avoided, because once the fat has been removed, you lose some of the most important components of its immunological properties. So, to ensure you're getting a high-quality product, make sure the whey you're buying is:

Organic (no hormones or genetically engineered ingredients)	Grass fed
Made from unpasteurized (raw) milk	Cold processed (as heat destroys whey's fragile molecular structure)

Minimally processed	Full of rich, creamy flavor
Water soluble	Sweetened naturally, not artificially
Highly digestible – Look for medium chain fatty acids (MCTs), not long chain fatty acids	

Sarcopenia Is Not an Inevitable Outcome of Aging

While muscle loss occurs with age, it's not an inevitable outcome – provided you take proactive measures. To summarize, the way you prevent it is by regularly engaging in some form of resistance training, and BFR has many advantages that makes it an ideal choice.

This is especially true for those who are older, frail or struggling with a condition that makes regular strength training difficult or potentially dangerous. In addition to that, you'll want to make sure you're getting enough high-quality protein.

Organic grass fed whey protein is ideal, as it provides high amounts of both leucine and glutathione, both of which are important for muscle growth and maintenance.

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