

Soya Protein in Sports Nutrition

Food plays a role in muscle preservation and muscle gain during exercise

It has been proposed that appropriate food intake, if timed optimally, can facilitate maximum training outcomes. Fluid intake is key to maintain hydration, carbohydrates intake is important to help restore muscle glycogen and protein must be consumed to obtain optimal muscle growth; however, timing of consumption and the precise amounts of each of these nutrients required for maximum muscle growth on an individual basis are not clearly understood. The bottom line is that intake of a high-quality, complete protein is an important part of an exercise programme to help preserve muscle mass and promote muscle gain.

Soya protein: the only widely available plant protein that supplies a complete essential amino acid profile

Dietary protein helps stimulate muscle growth (especially after resistance exercise) by providing essential amino acids necessary for the synthesis of new tissue.¹⁻² Numerous studies have shown that soya protein supports increased muscle mass during resistance training in men and women.³⁻¹¹ These studies also show soya protein to be as good or better than other protein sources in maximizing strength when combined with resistance training.

Soya protein, a high quality protein can be used effectively for the maintenance, repair, and synthesis of skeletal muscle proteins in response to training according to a joint statement by the American College of Sports Medicine, the American Dietetic Association and Dietitians of Canada.¹²

Dietary essential amino acids from protein stimulate muscle growth after resistance exercise

Dietary protein, including soya protein, provides indispensable amino acids necessary for protein synthesis in muscle and other tissues. The accretion of muscle mass in response to dietary protein and resistance training has recently been reviewed.¹⁻² Both muscle protein breakdown and synthesis are increased in response to exercise. Amino acid intake further stimulates muscle protein synthesis after exercise as a consequence of stimulating amino acid transport into the intramuscular compartment.²

Considerable evidence suggests that protein helps build strength in conjunction with an exercise programme.

Soya protein supports muscle development and increased strength during resistance exercise training.



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A variety of studies show soya protein can play an important dietary role for individuals hoping to increase muscle mass, as part of a resistance training programme. For example, in a six week study, Candow, et al. found that soya and whey protein both promoted muscle gain in male and female untrained young adults.³ Similar findings were reported by Brown et al. in a nine week study measuring lean mass gain in experienced male weightlifters; soya protein was as good as whey protein for lean mass gain. In addition, soya also promoted a favourable effect on oxidative status⁹ an observation that was also reported by Bazzoli, et al. in a four week study.¹³ Tang et al. found whey and soya protein to markedly stimulate muscle protein synthesis acutely in comparison to casein, although whey was somewhat greater than soya.¹⁴ Long-term studies are needed to determine if there are meaningful clinical differences in the ability of high-quality proteins such as soya, whey and casein to stimulate muscle growth in response to resistance exercise. There is, however, no doubt that all of these high quality proteins can help individuals in a training/exercise programme meet protein needs.

Protein Quality (PDCAAS) of Selected Proteins*

Isolated Soy Protein (ISP)*	1.00
Casein	1.00
Whey protein concentrate	1.00
Egg white	1.00
Beef	0.92
Pea flour	0.69
Peanut meal	0.52

* Values for Solae™ SUPRO® Brand Isolated Soy Protein provided by Solae as determined through actual analysis.
Protein Digestibility Corrected Amino Acid Score.
Protein Quality Evaluation, Report of the Joint FAO/WHO Expert Consultation.
Rome: FAO Food and Nutrition Paper No. 51, 1991.

Soya protein: a high quality, complete protein

Soya protein is a high quality, complete protein and has been conclusively demonstrated to support the synthesis of muscle tissue during a resistance exercise training programme. Studies show soya protein is as good or better than other proteins for increasing strength during resistance training. For this reason, soya protein is popular among athletes and bodybuilders.

Casein, whey protein, and soya protein isolate are all complete proteins¹⁵⁻¹⁶ with a Protein Digestibility Corrected Amino Acid Score (PDCAAS) of 1.00.

Combining weight training with protein intake after exercise to increase muscle mass

A nutrition regimen that accelerates muscle amino acid availability early after resistance exercise is vital for promoting muscle growth. When resistance exercise is followed by increased amino acid availability, the muscle protein synthesis rate is increased more than with exercise or amino acid intake alone.¹⁷⁻¹⁹ The greatest window of opportunity to gain muscle appears to be within the first three hours after resistance exercise. When weight training is combined with feeding protein during the early hours after exercise it leads to significant increases in muscle mass compared to delaying the same feeding.²⁰⁻²¹ A delay in protein availability may result in failure of your weight training plan, leading to muscle loss or no gain.²²

Comparative studies between soya protein isolate and whey protein show similar increases in muscle mass.



Comparison of Protein Sources for Muscle Gain²³

Author	Study Length (wk)	Protein	Lean Body Mass Gain (kg)	Statistically Different (p ≤ 0.05)
Brown et al., 2004	9	Whey protein ISP	+1.3 +1.2	NO
Candow et al., 2005	6	Whey protein ISP	+2.5 +1.7	NO
Kalman et al., 2007	12	Whey protein ISP	+0.5 +0.5	NO
Hartman et al., 2004	12	Skim milk ISP	+3.2 +2.9	NO
Hartman et al., 2007	12	Skim milk ISP	+3.9 +2.8	YES
Cribb et al., 2006	10	Whey protein Casein	+5.0 +0.8	YES

Abbreviations: wk = week; kg = kilograms; ISP = Isolated soy protein
Adapted from: G. Paul, Journal of American College Nutrition, 2009²¹.



Soya protein Isolate (SPI) ingestion promotes muscle growth equal to whey protein^{3-4,9} whereas whey protein outperforms casein.²¹ Several studies fail to show any significant differences between subjects consuming soya protein isolate or whey protein while undertaking an weight training programme (table).

Many studies examine the benefits of soya protein isolate, whey and casein alone. Each protein source has unique attributes that hold specific advantages:

- Different digestion rates—relate to ability to stimulate muscle protein synthesis
- Different amino acid profiles
- Presence of naturally occurring antioxidants—which may enhance muscle mass gain and muscle recovery after exercise.

Combining the unique attributes through blending soya protein isolate, whey protein and casein may create the opportunity for a

successful weight training plan that maximizes muscle gain.

Consuming protein blends can benefit athletes and active individuals²³

Consuming protein blends (soya, whey and casein) can help athletes and active individuals build muscle with exercise and recover faster after exercise. Soya protein isolate, whey, and casein are three popular proteins used in ready-to-drink and powdered beverages as well as nutrition bars. Although all are complete proteins, each brings something unique to help athletes reach their training goals. Rather than following a complicated supplementation programme that includes multiple protein sources taken throughout the day, many sportsmen and sportswomen are consuming products that contain a protein blend which can provide the benefits of multiple proteins in a single offering.

Soya protein isolate, whey protein and casein appear to have different

digestion rates. Whey protein is considered a “fast” protein because it is rapidly digested and leads to a large, acute rise in plasma amino acids.²⁴ Casein is referred to as a “slow” protein since the modest increase in plasma amino acids is more gradual and prolonged.²⁴ Data indicate that circulating amino acids peak later after ingestion of soya protein isolate than whey protein (150 min versus 75 min) and remain elevated longer after ISP.²⁵⁻²⁶ soya protein isolate is more of an “intermediate” protein in terms of digestion rate.

Emerging research suggests that combining proteins that have different absorption rates like soya protein isolate, whey, and casein can prolong delivery of absorbed amino acids to muscle, which is key to supporting muscle growth and recovery. Amino acid concentrations in blood peak somewhat later following soya protein isolate ingestion compared to whey, but its digestion rate is quicker than casein. Thus, ingesting a combination of the

three proteins may help prolong the “anabolic window” or the amount of time muscle growth is stimulated by the muscle uptake of amino acids coming from the ingested proteins. In a recent preclinical study, sedentary rats responded better to a soya-dairy blend for increased muscle synthesis compared to whey protein alone.²⁷ A subsequent randomised clinical study indicates that a soya-dairy blend can induce optimal muscle synthesis when consumed following resistance training.²⁸

Amino acids in soya protein could provide specific benefits to athletes

Branch-chain amino acids (BCAA) such as leucine and other amino acids like glutamine and arginine, are critical for their role in the body when it comes to sports performance. Isolate soya protein is rich in glutamine and arginine whereas whey protein and casein contain more of the branched-chain amino acids.

BCAA can be used as an energy source during exercise. BCAA are oxidised by muscle during exercise to provide energy once short-term glycogen stores are expended.²⁹⁻³⁰ Leucine is of particular interest to strength athletes for its ability to stimulate skeletal muscle protein synthesis.¹⁷ Whey protein has higher leucine and total BCAA concentrations than casein and soya protein isolate.²³ However, whey protein and soya protein isolate elicit similar muscle protein synthesis rates³¹ and both are better than casein acutely. Therefore, digestion rate may be a larger determinant of the anabolic response to these proteins after exercise.

Soya protein has about 30% more

glutamine and 300% more arginine compared to whey.³² Glutamine and arginine are natural signals for growth hormone release, and thus, play an important role in building muscle.³³⁻³⁵ Arginine is known for its role in blood flow regulation; an increase in muscle blood flow can supply a higher proportion of amino acids to the muscle.³⁶ Muscle glutamine concentrations are directly correlated with muscle protein synthesis rates³⁷ suggesting that glutamine plays a role in regulating muscle protein balance. Glutamine plays a role in the immune system and is a precursor of glutathione, an antioxidant that protects cells from free radical damage.³⁸ Glutamine concentrations are lower in over-trained or chronically fatigued athletes compared to healthy, trained athletes and non-athletes.³⁹ Therefore, the amino acids found in soya protein isolate could provide specific benefits to athletes.

Natural bioactive substances that enhance antioxidant activity are found in soya protein isolate

Antioxidants have long been researched for their potential ability to reduce muscle soreness and muscle damage after unaccustomed exercise. Exercise can create an imbalance between oxidant and antioxidant levels, a situation known as oxidative stress. Oxidative stress from exercise has been proposed to damage enzymes, protein receptors, lipid membranes, and DNA.⁴⁰⁻⁴³ Exercise stimulates the production of lipid peroxides through the initiation of oxidant stress and promotes the breakdown of these compounds by affecting enzyme activities related to glutathione metabolism.⁴⁴ Therefore, antioxidant activity



Evidence suggests that soya protein may help reduce oxidative stress during or after exercise.

has the potential to help minimize damage caused by oxidative changes during and after exercise. The antioxidant effect inherent to soya protein has the potential to aid in exercise recovery.

Soybeans are natural sources of flavonoid antioxidants called isoflavones. The antioxidant activity of soya isoflavones is well documented. Many review papers discussing the health benefits of soya protein and/or isoflavones describe the antioxidant properties of these compounds as one of their possible protective mechanisms.⁴⁵⁻⁴⁹ These studies show that soya protein isolate with naturally occurring isoflavones has the ability to enhance the antioxidant status, especially in young, healthy individuals.⁵⁰ This enhanced antioxidant status may help protect muscle tissue from oxidative damage from exercise.

Soya does not alter estrogen or testosterone concentrations

A misconception exists that soya contains estrogen. Soya does not contain the hormone estrogen but it does contain isoflavones. These compounds are not the same as estrogen, but because their chemical

structure is somewhat similar, they have been referred to as a plant estrogens. There is no scientific evidence that typical use of soya protein exerts any unwanted effects on hormone levels, muscle development, strength training or physical characteristics of the body.

Although the chemical structure of isoflavones to estrogen, the two function very differently in the body. Numerous studies with healthy, young men show that soya protein does not increase estrogen concentrations in the blood.^{4, 51-54} In fact, one study indicates it may prompt a slight decrease in this hormone.⁵⁵

Numerous studies have also demonstrated that soya protein does not cause a decrease in blood testosterone concentrations in healthy men.⁵⁶ One study that reported a decrease in blood testosterone concentrations was strongly criticized by several experts in a letter to the editor of the journal that published it.⁵⁴ Twelve men (25-47 years of age) consumed 56 g/d of soya protein powder for 28 days.⁵⁷ The researchers reported the average testosterone concentration decreased during the study. However, these results were heavily influenced by one of the subjects who began the study with a much higher testosterone level (approximately 3-fold higher) than the other participants. The testosterone concentration of this individual fell precipitously during the study while there was little change among the other 11 men. When analysis was completed removing that subject, the results no longer showed a decrease in blood testosterone concentrations. A subsequent meta-analysis that considered all randomised clinical trials showed no decrease in

testosterone with an average of 25 grams of soya protein intake per day.⁸

In summary, the overwhelming majority of studies support the conclusion that consumption of soya protein does not decrease testosterone concentrations in healthy men. This conclusion is consistent with the lack of evidence that soya protein exerts estrogenic effects in healthy men.⁵⁶

Soya is an excellent protein source for bodybuilders and recreational athletes

Soya protein is a high quality, complete protein that provides all the essential amino acids needed for growth and maintenance in humans. Soya protein effectively supplies essential amino acids to muscle for the synthesis of new muscle, especially after exercise training. Clinical studies show that soya protein is as good as other sources of protein for increasing strength during physical training programmes. These findings have been observed in a variety of populations, including:

- **Romanian Olympic endurance athletes who consumed 1.5 g/kg body weight soya protein isolate for an eight week study.**⁵
- **Young men and women (age 18-35 years) who consumed 1.2 g/kg body weight soya or whey protein for six weeks.**³
- **Young men (18-30 years of age) supplied with 500 ml of a fat-free soya beverage, fat-free milk or a placebo for twelve weeks.**⁶
- **Men (65 years of age) who consumed a soya-containing diet (0.6 g protein/kg body weight) or a beef-containing diet with the same amount of protein for twelve weeks.**⁷

No studies were identified that showed another source of protein

was superior to soya in supporting strength development during resistance training. Exercise has been shown to create oxidative stress in muscle tissue. Dietary antioxidants have the potential to help minimize damage caused by oxidative changes during and after exercise. Soya contains natural antioxidants and consumption improves antioxidant status of the body and this effect may protect exercising muscle.²³

There is no scientific evidence to suggest that intake of soya protein isolate or isoflavones in recommended amounts results in any undesirable physiological changes. Soya protein does not cause estrogenic effects in males. The overwhelming majority of available scientific evidence demonstrates that soya protein does not decrease testosterone concentrations or increase estrogen levels in healthy young men or other segments of the population. Comprehensive review papers published by experts have concluded that the consumption of soya protein and/or isoflavone supplements in recommended amounts is safe and likely to have health benefits.⁵⁹⁻⁶⁰ Rigorous scientific data, as interpreted by academic experts, does not confirm the anecdotal, often biased information disseminated on the internet and other venues.

High-protein diets have been popular throughout history. Although earlier investigations in this area involved supplementation with individual amino acids more recent work has shown that intact high-quality proteins such as whey, casein, or soya are effectively used for the maintenance, repair, and synthesis of skeletal muscle proteins in response to training.

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