



AIS SPORTS SUPPLEMENT FRAMEWORK

ISOLATED PROTEIN SUPPLEMENTS

What is it?

Protein occurs in all living cells and has both functional and structural properties, accounting for ~15-20% of total body mass. Approximately half of the body's protein is present as skeletal muscle, but protein is also an important building block of other tissues, including bone, cartilage, skin and blood as well as functional molecules such as enzymes and hormones. Each protein is made up of a special combination of amino acid building blocks.

Protein has been a nutrient of great interest and debate in the world of sports nutrition for many decades. Its role in facilitating muscle building and repair has made it an obvious focus of attention by athletes and coaches. Within scientific circles, there has been lively discussion about the protein requirements of athletes and others committed to daily exercise. This has finally been resolved with the following findings.

- > daily requirements for protein are increased due to a regular commitment to exercise and to support the synthesis of new proteins that accompanies the adaptive response to each workout or event. Indeed, the protein targets for athletes in heavy training are in the range of 1.2-1.6 g/kg body mass daily¹, which is up to double the amount recommended for sedentary populations.
- > these recommendations apply equally to endurance, team and strength/power athletes since high level exercise promotes a specific increase in different proteins according to the stimulus of the exercise session.
- > protein targets are now set-in terms of the spread of protein over the day rather than the total protein target, since optimal protein synthesis occurs for at least 24 hours after exercise. Athletes are encouraged to include a small serve of protein rich foods at 3-5 eating occasions each day. For example, three main meals, a post-training snack and a pre-bed or mid-meal snack. Targets of 0.3-0.4 g/kg typically equate to 15-30 g of protein at each meal or snack.
- > The highest recommendations for protein (1.6-2.4 g/kg body mass daily) are targeted to athletes who are undertaking weight loss programs. Such athletes usually desire to achieve "high quality weight loss" in which they reduce fat mass but retain muscle mass.²

Protein foods are widely found in the Australian diet and Western eating patterns. Indeed, most athletes easily achieve total daily protein intake targets, even without considering protein supplementation. However, to optimise dietary protein intake, consideration should be given to the quality of protein food choices, and the timing and distribution of protein intake throughout the day.³

Proteins are found in both animal and plant foods with the major sources in the Australian diet being meat, fish and poultry (32%), cereals and cereal-based foods (26%), plus dairy foods (20%).⁴ Since the amino acid profile of animal proteins is closer to that of humans, they are generally considered to be of higher biological value (HBV). Such protein sources typically provide higher amounts of all the essential amino acids, including leucine, which is the amino acid primarily responsible for turning on protein metabolism. Plant based proteins generally have lower digestibility and lower amounts of essential amino acids. However, any negative implications of this may potentially be overcome by simply increasing total protein intake, using an array of plant-based protein sources (e.g. cereal proteins and legumes) to complement their amino acid profiles and/ or blending plant and animal-based proteins sources at a meal.⁵

What does it look like?

- > Protein supplements are among the most popular, available and steadily increasing supplement products, with projections of a world-wide market value of \$US21.5 billion by 2025. Sports nutrition is the major application for protein supplements and the fastest growing sector is plant protein supplements.
- > Protein supplements are available as stand-alone products in the form of powders, bars and ready to drink shakes. More recently, there has been a trend for the fortification of commercial foods with protein isolates (e.g. breakfast cereals, food bars). A range of different forms and sources of protein supplements is found (see Table on next page).



Type of protein	Comment
Whey (dairy)	<ul style="list-style-type: none"> > High biological value protein that makes up 20% of the content of dairy protein > High in branched chain amino acids, including leucine > The practical significance between different forms of whey protein is minimal, with a 30 g serve of any form providing ~21-27 g of protein and total energy content from ~450-580 kJ. > The small amount of lactose in WPC may be a consideration for athletes who are particularly intolerant to lactose. <p>Concentrate [WPC]</p> <ul style="list-style-type: none"> > The cheapest form of whey, containing 70-80% protein by weight along with small amounts of carbohydrate and fat. <p>Isolate [WPI]</p> <ul style="list-style-type: none"> > Higher cost due to further filtration to increase the protein content (typically 90% of product weight). Contains minimal amounts of carbohydrate and fat. <p>Hydrolysate [WPH]</p> <ul style="list-style-type: none"> > The most expensive form. Further processing is undertaken to break down the intact proteins found in WPC or WPI into short chain peptides (often described as 'pre-digested') with claims of faster uptake
Casein (Dairy)	<ul style="list-style-type: none"> > High biological value protein that makes up 80% of the content of dairy protein > May be purchased as casein, calcium caseinate or casein hydrolysates (see whey) > Clots in the acidic environment of the stomach, slowing the digestion and delivery of amino acids to the body. Often recommended as a night-time feed for sustained release but research confirming specific value of casein over other protein sources at supper is lacking
Egg Albumin (Egg white)	<ul style="list-style-type: none"> > High biological value protein with absence of fat and carbohydrate > Used to be the most popular protein supplement until replaced by the cheaper dairy proteins > Often readily available as an egg white product from supermarkets for addition into prepped foods it provides a readily accessible high biological value protein source that does not require third party batch testing
Soy	<ul style="list-style-type: none"> > High biological value protein that is rapidly digested > Cheaper than whey and is often added to protein bars > Available as soy concentrate or soy isolate (see whey) > Lower in leucine than whey, but this can be resolved by fortification with leucine
Other plant proteins (examples) Hemp, Pea, Chickpea, Rice	<ul style="list-style-type: none"> > Lower biological value proteins: may be purchased as single source or blended proteins > Biological value can be increased by mixing sources, fortifying with leucine and other amino acids or increasing the serve size

Protein supplements can be broadly classified according to their nutrient profile as either providing protein only (as a single protein source or a protein blend) or with the targeted addition of other ingredients

- > **Carbohydrate:** found in multi-purpose mixed-macronutrient or recovery products targeting refuelling as well as protein support.
- > **Fat:** added to 'weight gain' or 'bulking' formulas in order to provide a high kilojoule supplement for those with increase energy needs.
 - Note that products with such profiles have a diluted protein content in comparison to protein supplements, as well as a reduced micronutrient content compared to food.
 - See fact sheet on mixed macronutrient supplements.
- > **Individual amino acids including branched chain amino acids, leucine, glutamine etc.** May be valuable in fortifying the lower leucine content of plant protein supplements but unnecessary in animal protein sources or as an isolated supplement themselves.
- > **Evidence based performance ingredients (creatine, caffeine, beta alanine etc).** Although these ingredients may have proven value in sports nutrition, benefits are specific to the scenarios and protocols of use. The doses provided in protein powders may not be optimal or able to be used correctly. It is preferable for such ingredients to be sourced as individual products so that the athlete retains control over when and how they are used.
- > **Other ingredients.** Some protein powders contain ingredients with minimal evidence of benefits, including some that are likely to be harmful or banned in sport. In general, multi-ingredient products of this nature should be avoided since they are unnecessarily expensive and increase the potential for inadvertent doping/contamination.



How and when do I use it?

- > The decision to use a protein supplement should only come after consideration of several factors including the athlete's training load and goals, lifestyle commitments, daily energy requirements, existing meal plan, practicalities of post-exercise scenarios, and available finances.
- > A 'food first' policy should apply to all supplements, but especially to protein needs, because of the array of high biological value protein-rich foods that are available in most environments. Many of these food choices are able to meet multiple sports nutrition goals and nutrient targets. Nevertheless, well-considered uses of protein supplements may include:
 - When the delivery of rapidly digested proteins is a priority, such as in the period immediately after key workouts
 - As a means of fortifying existing meals or snacks which are traditionally low in protein (e.g. breakfast or pre-bed snack)
 - As an alternative to whole foods and bulky meals when appetite is poor.
 - When the facilities to store or prepare a food form of protein are not available, or the quality and accessibility of protein-rich foods in the local environment are limited (e.g. travel to locations with questionable food safety or contamination issues)
 - During specialised weight loss programs where a higher protein intake within an energy-restricted diet is required to optimise the retention/increase in lean mass
- > Depending on the athlete's size, energy requirements and other nutrition goals, it is likely that a dedicated supplement providing a 20-40 g protein per serve will meet the needs of most situations in sports nutrition
- > The potential for protein supplements to be used in conjunction with whole foods to boost the total content of a meal or snack (e.g. an ingredient in a smoothie, or a cereal bowl) should be considered in view of expense, overall nutrient intake and overall "food first" principles.

Are there any concerns or considerations?

Unnecessary expense

Although protein is an important part of most eating occasions, this does not necessitate the use of protein supplements. A "food first" approach can often identify suitable protein-rich foods and drinks to meet the targets and practical considerations for each meal/snack. Even when the convenience of a protein supplement warrants its considered use, the athlete can minimise the cost by choosing the simplest product (i.e. a concentrate or isolate) rather than more expensive brands based on hydrolysates or containing extra (unnecessary) ingredients. Another cost-saving strategy is to use the protein supplement as an ingredient that enhances a meal or snack rather than a stand-alone product.

Effect on overall nutrient intake and nutrition goals

It can be easy to become reliant on supplements to meet protein intake targets without realising the differences between foods and supplements. Most protein-rich foods provide a range of other important nutrients to our diets (e.g. calcium, iron, zinc, vitamins and essential fatty acids) and over-reliance on protein supplements can reduce the athlete's ability to achieve overall nutrient needs. The use of compact protein forms such as drinks and bars may allow an athlete with high-energy needs to eat more than their appetite would typically allow. While this is useful in some scenarios (e.g. post-exercise, during periods of growth or targeted weight gain), it may not be a helpful strategy for all athletes or scenarios.

Unnecessary and harmful ingredients

Some protein powders contain unnecessary ingredients, including products that are harmful or banned. A recent consumer report from the USA⁶ conducted independent testing of popular protein supplements and noted that many contained detectable levels of contaminants such as heavy metals (e.g. lead, cadmium, mercury, arsenic) and BPA (a toxic by-product of plastics manufacture). While this survey has been criticised due to the lack of peer review, it is a reminder that foods absorb such contaminants from their growth environment and/or during the manufacturing process; these are magnified in the case of concentrated supplements. In general, it is recommended that consumption of protein supplements be limited to 1-2 serves a day and that third party, batch tested protein supplements be sourced. That said, batch testing confirms the absence of WADA banned substances, not other contaminants like heavy metals.

Allergy risk

Protein products may contain tree nuts, milk, soy and other allergens that some athletes may need to avoid.



Where can I find more information?

Sports Dietitians Australia

www.sportsdietitians.com.au/factsheets/supplements/protein-supplementation

Gatorade Sports Science Institute

www.gssiweb.org/docs/default-source/sse-docs/burd_sse_194_v6.pdf?sfvrsn=2

Supplement safety information and batch tested product list

[Supplements in sport | Sport Integrity Australia](#)

References

1. Phillips SM, Chevalier S, Leidy HJ. (2016). Protein requirements beyond the RDA: Implications for optimising health. *Appl Physiol Nutr Metab*, 41, 565-72.
2. Hector AJ, Phillips SM. (2018). Protein recommendations for weight loss in elite athletes: A focus on body composition and performance. *Int J Sport Nutr Exerc Metab*, 28, 170-177.
3. Phillips SM, van Loon LJ. (2011). Dietary protein for athletes: From requirements to optimum adaptation. *J. Sports Sci*, 29, 29-38.
4. Gillen JB, Trommelen J, Wardenaar FC, Brinkmans NYJ, Versteegen JJ, Jonvik KL, Kapp C, de Vries J, van der Borne JJGC, Gibala MJ, van Loon LJC. (2017). Dietary protein intake and distribution patterns of well-trained Dutch athletes. *Int J Sport Nutr Exerc Metab*, 26, 105-114.
5. Berrazaga I, Micard V, Gueugneau M, Walrand S. (2019). The role of the anabolic properties of plant versus animal-based protein sources in supporting muscle mass maintenance: A critical review. *Nutrients*, 11, 1825.
6. Clean Label Project 2018 survey of Protein Powders: <https://www.cleanlabelproject.org/protein-powder/>

The Australian Institute of Sport (AIS) Supplement Framework is an initiative of the Australian High Performance Sport System. The AIS acknowledges the support of members of the National Institute Network (NIN) and National Sporting Organisations (NSO) and their staff in delivering content expertise. This information is intended to help athletes, coaches and scientists make evidence-based decisions about the use of supplements and sports foods. Before engaging in supplement use, we recommend that each individual refer to the specific supplement policies of their sporting organisation, sports institute or parent body, and seek appropriate professional advice from an accredited sports dietitian (www.sportsdietitians.com.au).

Athletes should be aware that the use of supplements may have doping implications. Athletes are reminded that they are responsible for all substances that enter their body under the 'strict liability' rules of the World Anti-Doping Code. Some supplements are riskier than others. The Sport Integrity Australia (SIA) app is a useful resource to help mitigate the risk of inadvertent doping by helping to identify supplements that have been batch-tested. The SIA App provides a list of more than 11,000 batch-tested products. We recommend that all athletes consult the educational resources of SIA regarding the risks associated with supplements and sports foods. While batch-tested products have the lowest risk of a product containing prohibited substances, they cannot offer you a guarantee that they are not contaminated (www.sportintegrity.gov.au/what-we-do/supplements-sport).

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