

Whey Protein:

Waste Product of the Past is Nutritional Powerhouse of the Future

In the past 20 years, whey protein has gone from being a waste product of cheese-making to a highly valued product rich in nutritional and functional properties. Whey is now used in various products – infant formulas, food supplements, sport bars and beverages – to meet a variety of health goals for people of all ages. Knowledge and application of the health benefits of whey protein often lags behind the research, however. This monograph summarizes the best substantiated health benefits of whey protein.

By “whey” of an introduction

Whey is one of the two proteins in cow’s milk, making up about 20% of the total protein content. Whey proteins refer to a group of individual proteins or fractions that separate out from the casein during cheese-making. These fractions are purified to different concentrations, depending on the end composition desired, and can vary in their content of protein, lactose, carbohydrates, immunoglobulins, minerals and fat. Selection of a whey product will be determined by the nutritional applications and goals desired (see table). The most common forms of whey protein used in high protein bars, beverages, and supplements are the concentrate (WPC) or the isolate (WPI).

Whey protein is a complete, high quality protein with a rich amino acid (AA) profile. It contains the full spectrum of AAs including essential AAs (EAAs) and branched-chain AAs (BCAAs) which are important in tissue growth and repair. Leucine is a key BCAA in protein synthesis and has recently been identified as playing a critical role in insulin and glucose metabolism. The EAAs and BCAAs in whey protein are not only present in higher concentrations than in other protein sources such as soy, corn and wheat, they are also efficiently absorbed and utilized.

Body composition

Due to its high concentration of EAAs and BCAAs, whey protein has been shown to help individuals maintain muscle tissue. This can be particularly important for seniors, active individuals and those trying to maintain or lose weight.

Seniors

By preserving or increasing lean body mass, older adults can protect themselves against undesirable changes in body composition as well as many ailments that are usually associated with aging such as heart disease, stroke, diabetes and other conditions.

Sarcopenia – muscle loss associated with aging – affects an overwhelming 30% of seniors in the United States. Research in older adults suggests that whey protein may minimize sarcopenia by stimulating postprandial protein synthesis and limiting body protein loss.^{1,2} Physical activity, specifically resistance training, combined with consumption of whey protein has additional benefits on muscle protein synthesis. Ingesting 10-20 grams of whey protein after activity can improve protein synthesis in seniors, presumably due to the high levels and efficient absorption of EAAs and leucine.^{3,4}



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Weight management

Whey protein can play an important role in weight management. Specific factors in whey protein are being investigated for their ability to promote weight loss by increasing satiety, influencing glucose homeostasis, and maintaining lean body mass:

Calcium – recent clinical trials and epidemiological studies have shown that adequate intakes of calcium may protect against excess adiposity and assist in weight loss efforts.^{5,6} Epidemiological studies link low calcium intakes to an increased risk of obesity.⁷

Lactose – the primary sugar in whey products – has a low glycemic index which assists in controlling hunger and promoting weight loss. Lactose has minimal effect on blood sugar levels and insulin response, making it ideal for people with type 2 diabetes.

Protein – has been shown effective in increasing satiety and modulating energy intakes,⁸ which may result in a loss of body fat and weight. Several studies have shown whey protein to be more effective than soy, egg and meat proteins in suppressing food intake.^{9,10} For these reasons, incorporating whey protein into the diet could be an ideal solution for the many consumers interested in high protein, moderate carbohydrate diets.

Branched-chain amino acids – specifically leucine – play a unique role in metabolic regulation by increasing fat loss and promoting lean muscle tissue in conjunction with an exercise program.¹¹

Sports nutrition

Many athletes consume whey protein for its rich branched-chain amino acid (BCAA) content. Because the demand for BCAAs increases with endurance exercise, whey protein is an ideal way to replace these BCAAs to enhance protein synthesis and muscle growth during the recovery period. Whey proteins are particularly effective at stimulating muscle protein synthesis rates because the AA profile in whey is almost identical to that of skeletal muscle.¹² In addition, the relatively high levels of EAAs in whey proteins are effective at stimulating protein synthesis in adult muscle.¹³

Recent studies suggest that whey proteins can help improve lean body mass and performance in athletes on a resistance training regimen:

- 20 grams of whey protein per day for 12 weeks was shown to enhance glutathione status (an antioxidant), improve athletic performance and decrease body fat percentage in healthy young adults.¹⁴
- 60 grams of whey protein per day for 12 weeks was effective at decreasing fat mass and increasing lean body mass in overweight men following a calorie-restricted diet and resistance training program.¹⁵
- Resistance-trained men given whey protein supplements (1.5 g/kg body wt/day) for 11 weeks showed improvements in strength and double the gain in lean body mass compared to groups supplemented with carbohydrate, creatine or a combination of creatine and whey protein supplement.¹⁶

Table: Definitions and Uses of Different Types of Whey Protein (percentages by weight)

Product	Protein concentration	Lactose	Fat	Notes and applications
Whey powder	11 - 14.5%	63 - 75%	1 - 1.5%	Produced by taking whey directly from cheese production, clarifying, pasteurizing and drying. Used in breads, bakery and snack items and dairy foods.
Whey protein concentrate (WPC)	25 - 89% (most commonly available as 80%)	4 - 52%	1 - 9% (as protein concentration increases, fat, lactose and mineral content decreases)	The most common and affordable form of whey. Used in protein beverages and bars, bakery and confectionary products, dairy foods and other nutritional food products.
Whey protein isolate (WPI)	90 - 95%	0.5 - 1%	0.5 - 1%	Used in protein supplementation products, protein beverages, protein bars, other nutritional food products.
Hydrolyzed whey protein concentrate	>80% (hydrolysis used to cleave peptide bonds.)	<8%	<10% (varies with protein concentration)	Used in sports nutrition products.
Hydrolyzed whey protein isolate	>90%	0.5 - 1%	0.5 - 1%	Highly digestible form containing easy-to-digest peptides that reduce risk for allergic reaction in susceptible individuals. Commonly used in infant formulas and sports nutrition products.

Immunity

Whey proteins are unique in their ability to optimize a number of aspects of the immune system, primarily by boosting glutathione (GSH) levels in various tissues. GSH, the centerpiece of the body's antioxidant defense system, protects cells against free radical damage, pollution, toxins, infection and UV exposure. GSH levels are typically depressed in individuals with cancer, HIV, chronic fatigue syndrome and other immune-compromising conditions. GSH also decreases with age and may be partially responsible for diseases such as Alzheimer's disease, cataracts, Parkinson's disease and arteriosclerosis. Thus, incorporating whey proteins into the diet may protect the health of not just those with a compromised immune system but those of all ages.

Specific components in whey thought to play a role in enhancing the immune system include:

Cysteine – an amino acid found in high levels in whey proteins, cysteine is involved in the intracellular production of GSH.

Lactoferrin – has been shown to exhibit immune-modulating activity through both antimicrobial and antitoxin activity;¹⁷ it may also provide protection against viruses such as hepatitis, cytomegalovirus and influenza.¹⁸

Immunoglobulins – may confer disease protection to infants through passive immunity, and to adults by promoting the activity level of the immune system.¹⁷

BCAAs – are metabolized in the muscle to manufacture glutamine, a precursor to GSH and another important component of the immune system.

The role of the practicing health professional

Steps that health professionals can take to help clients benefit from whey protein include:

1. Identify patients and clients who would benefit from incorporating whey proteins into their diets:

Athletes and physically active individuals – to improve lean body mass and performance and provide a high quality protein source for muscle repair. Consider teenagers involved in organized sports as well as adults who are active on a regular basis.

Older adults – to maintain muscle mass to optimize mobility, prevent falls and remain independent longer.

Dieters – to steer weight loss towards fat, sparing lean tissue, and to help increase metabolism. Bariatric patients benefit from the high quality, easy digestibility and absorption of whey protein.

People with a stressful lifestyle – to maintain optimal levels of glutathione (GSH) for a healthy and stronger immune system. Factors that place undue stress on our bodies include smoking, a high-powered career, chronic sleep deprivation, aging and exercise, all of which can result in reduced GSH levels.

Those with a compromised immune system – to maintain or increase levels of GSH to improve immune health and help ward off illness. Individuals with cancer, HIV, burn victims and post-surgical patients are obvious candidates, yet healthy individuals concerned about the upcoming flu season may also benefit.

- Determine the level of whey protein needed** to reap the benefits, according to client's clinical conditions and/or nutrition goals. For generally healthy individuals attempting to improve their immunity or maintain a healthy weight, 20-25 grams per day of whey protein isolate (WPI) or whey protein concentrate (WPC) is adequate. Athletes looking to speed muscle recovery require higher levels of protein each day, frequently consuming at least twice this amount. Patients with Crohn's disease, undergoing cancer therapy, and those recovering from burns or surgery may need higher amounts due to elevated protein requirements. Aim for a whey protein content of at least 20-30% of total daily protein.
- Teach client how to identify high quality whey protein** on product labels. Products labeled as WPI or WPC80 (which contains 80% concentrate) should be selected. If lactose is a concern, select an isolate which has little to no lactose.
- Identify areas where whey protein could be added** to their diet with only minor changes in habits. Whey protein powder can easily be added to a morning shake or smoothie, or into yogurt, cottage cheese, juice or sports drinks, mashed potatoes, instant oatmeal, or sprinkled on breakfast cereal. If they consume an energy bar as an afternoon snack, encourage whey protein-based bars. The powder can be used as a protein fortifier in meatloaf, soup, sauces, and instant pudding. Visit www.biprousa.com for recipes and additional suggestions.
- Review whey protein products** that are readily available on the market today – bars, beverages and powders – and where whey protein can be purchased – in health food stores, at many grocery stores as well as on the internet.
- Provide clients with the handout** (*Whey Protein: Nutritional Powerhouse*), included in this monograph, for a summary of the health benefits of whey protein

and additional suggestions on how to incorporate it into their diets. Alternatively, the handout can be downloaded from www.dairycouncilofca.org/hp/ under the Health Professionals section.

7. Follow up with clients.

a. For those who initially agreed to adopt this dietary change, providing additional suggestions, encouragement and confirmation of the health benefits will help establish it as a long-term habit. Health benefits can be confirmed by quantifying endpoints such as body weight and body composition (using a simple bio-impedance instrument, skinfold calipers or simply measurement of waist and hip circumference). Improvements in immunity and athletic performance can be assessed in a qualitative fashion by asking how they feel, how their energy level has been, whether they've been able to ward off colds and sickness, and how their training plan is going.

b. Those who were not willing to make a change immediately may be more receptive at a later date. Assessing a client's readiness to change a dietary habit is critical to implementing that change. Knowing whether they are at the pre-contemplative, contemplative, preparation, action or maintenance phase will determine how much and what type of information you share with them. By moving them further along the continuum, eventually they will be ready to move ahead with your expert recommendations.

8. Document clients' progress and be ready to share success stories with others (ensuring confidentiality, of course). The more we learn and share individual results, the more others can benefit as well!

Call to action

The variety and availability of products incorporating whey protein as a primary ingredient will undoubtedly increase as research continues to substantiate the health benefits and as the consumer becomes increasingly aware of these benefits. By staying abreast of this research and being informed of the specific types of whey protein products and their components you will be in a strong position to make the most appropriate recommendation to meet the needs and goals of individual clients and patients.

Additional resources

For additional information on health benefits of whey protein and products containing whey protein, contact the Whey Protein Institute at www.wheyoflife.org or (866) 949-9439.

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For questions or comments contact us at info@dairycouncilofca.org