March 2013 Issue

Milk Proteins: Packing a Powerful Nutritional Punch

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Today's Dietitian
Vol. 15 No. 3 P. 26

Evidence shows high-quality proteins, such as milk proteins, promote satiety, weight maintenance, muscle synthesis, and blood glucose control.

For many years, nutrition professionals didn't consider protein a priority for most Americans. The thought was that most people consume more than enough to prevent protein deficiency.

But now a new perspective is gaining momentum. A growing body of research shows that a greater intake of protein may increase muscle synthesis, decrease muscle breakdown, boost satiety, and improve glycemic control, thereby enhancing muscle function and mobility, as well as assist in preventing and treating certain chronic diseases. The evidence regarding many of these health benefits focuses on high-quality proteins, including milk proteins, which many food manufacturers are adding to various dairy and nondairy products to enhance their nutritional value and improve consumers' health.

Optimal Health vs. Preventing Deficiency

For optimal health, evidence shows Americans may need more protein than previously thought. Protein is the major structural component of all cells in the body and functions in the form of enzymes, transport carriers, and hormones. The body requires a steady supply of the nine essential amino acids from dietary protein to synthesize new proteins and balance the rate of protein breakdown. The Recommended Dietary Allowance (RDA) for protein, 0.8 g/kg of body weight per day for those aged 19 and older, is based on the minimal amount of protein required to prevent protein deficiency, not necessarily the optimal amount to promote health. The Institute of Medicine's Acceptable Macronutrient Distribution Range (AMDR) for protein goes from 0.8 to at least 2.5 g/kg of body weight per day (or 10% to 35% of total calories from protein).

Since protein needs are a function of lean tissue mass, not calorie intake, protein requirements should be calculated in terms of body weight rather than as a percentage of calories. This is critical with lower energy intakes: When calorie intake is low and protein needs are calculated as a percentage of calories, the amount of protein may be inadequate. Moreover, when energy needs aren't met, protein becomes an alternate fuel source, which may increase protein requirements.

Distribution and Timing

It's true that most Americans get plenty of protein: 1.2 to 1.3 g/kg/day, according to Douglas Paddon-Jones, PhD, a professor in the department of nutrition and metabolism at The University of Texas Medical Branch. However, providing the body with optimal protein goes beyond consuming a set amount per day. The body can use only a certain amount of protein at a time and can't stockpile it for later use. "We need to get protein through a meal-driven approach," he says.

Research shows that 30 g of protein increases muscle synthesis by about 50%.1 Preliminary research suggests that the type, timing, and distribution of protein intake throughout the day are key. To maximize the potential for muscle growth and repair and provide other benefits such as satiety and glucose control, it's best to distribute protein intake throughout the day; for example, 30 g of high-quality protein (about 4 oz) consumed at breakfast, lunch, and dinner.2,3

Quality Counts

High-quality, or complete, proteins are comprised of all nine essential amino acids—those that the human body can't manufacture on its own—in proportions similar to amino acid requirements. According to the 2010 Dietary Guidelines Advisory Committee report, animal products provide a greater quantity and quality of protein than plant products. This is particularly important when protein needs are high, such as during periods of growth and metabolic stress. Eating various plant foods may provide the full array of amino acids, but plant foods may not provide enough calories, which may result

in muscle catabolism to meet energy needs.

High-Quality Proteins
Milk, yogurt, and cheese are excellent sources of high-quality proteins. Individual milk proteins have a wide range of potential health benefits and functional properties. In milk, approximately 80% of the protein is casein and 20% is whey. Both casein and whey proteins are rich sources of peptides that significantly lower blood pressure in those with hypertension and may contribute to satiety and regulate food intake.4

Whey protein has the highest biological value (the proportion of absorbed protein that's retained in the body for maintenance and growth) of any protein, which means it's highly usable by the body. Whey protein also is one of the richest sources of leucine, an essential and branched-chain amino acid that triggers initiation of muscle protein synthesis.

Other milk proteins also exhibit a wide range of bioactive properties. For example, caseinophosphopeptides, glycomacropeptides, and lactoferrin help reduce the risk of dental caries.5

Casein and Whey
In light of protein's health benefits, manufacturers are isolating various milk proteins, such as milk protein concentrates (MPCs), whey protein isolate (WPI), hydrolyzed whey protein, and whey permeate, and using them as ingredients in dairy and nondairy foods, and beverages such as milk, yogurt, energy bars, and cheese to boost their protein content.

MPCs
MPCs are complete dairy proteins that contain both casein and whey proteins. They're produced from milk by a series of processes, including ultrafiltration, evaporation, and drying, and are available in protein concentrations ranging from 40% to 89%. MPCs with higher concentrations of proteins can be used to enhance a product's protein content without adding significant levels of lactose and contribute valuable minerals such as calcium, magnesium, and phosphorus. MPC ingredients are desirable to fortify nutritional beverages, frozen desserts, cultured products, and others with protein and calcium.

Whey protein can be isolated from milk or the whey by-product of cheese making. Whey protein concentrate (WPC) is manufactured by drying the material from the removal of sufficient nonprotein components from pasteurized whey, resulting in a product that contains 25% or more protein.

WPI is manufactured by drying pasteurized liquid whey and removing nonprotein components (lactose, fat, and some vitamins and minerals) through various separation techniques, resulting in a product that contains 90% or more protein. Because WPI contains little lactose, those with lactose intolerance may be able to eat products containing it. Products with WPI ingredients include infant formula and sports drinks.

Hydrolyzed whey protein, also called whey protein hydrolysates, is whey protein that has been treated with enzymes to break down either the protein into peptides and free amino acids or the lactose into simple sugars. It's most commonly used in infant formulas, some sports drinks, and medical protein supplements to improve digestibility and reduce the allergen potential.

Whey permeate (also called dairy product solids, deproteinized whey, or modified whey) is a coproduct of the production of WPC, WPI, ultrafiltered milk, MPC, or milk protein isolate. Whey permeate usually contains 65% to 85% lactose, 8% to 20% minerals, 3% to 8% protein, and 1.5% fat. Delactosed permeate is a by-product created by removing lactose from permeate. It contains about three times as much mineral content as permeate and about 60% lactose. Whey permeate enhances browning and flavor while improving moisture retention and reducing sodium levels. It's commonly found in bakery products, instant soups, and milk-based drinks.

The Research: Milk Protein and Health
Recent research shows that protein intake at levels above the RDA but within the AMDR may help achieve and maintain a healthful body weight by increasing satiety and thermogenesis (the energy required to digest, absorb, and dispose of the nutrients from food), and improving body composition,

and it can play a role in the treatment and prevention of obesity, osteoporosis, type 2 diabetes, heart disease, and sarcopenia.2,6 One study found better weight maintenance and fat reductions in moderately obese subjects who consumed a low-fat, high-protein diet containing either casein or whey following a weight-loss program compared with a low-fat, high-carbohydrate diet.7

Satiety, Blood Glucose Control, and Metabolic Syndrome

Satiety may lead to weight loss because of reduced calorie consumption over time. Calorie for calorie, protein is more satiating than carbohydrates or fat under most conditions.8 Different forms of protein, such as casein, whey, and soy, have been shown to have differing effects on satiety. Some studies show that higher intakes of casein and whey boost satiety, although their effect on food intake later in the day varies. Whey protein is digested faster and causes a quick release of circulating amino acids, whereas casein is digested more slowly and provides a more consistent release. These circulating amino acids affect certain hormones that influence appetite. Emerging evidence suggests leucine may enhance satiety; therefore, the satiety effect of whey may be caused in part by leucine.9

According to a 2011 Nestle Nutrition Institute research review, consumption of dairy products and their milk proteins improves satiety, and reduces food intake and blood glucose response when consumed alone or with carbohydrate, and milk proteins contribute to the maintenance of a healthful body weight and the control of factors associated with metabolic syndrome, such as high blood pressure, elevated triglycerides, and fasting blood sugar.10

Heather Leidy, PhD, an assistant professor in the department of nutrition and exercise physiology at the University of Missouri, agrees that both casein and whey proteins promote satiety but says the research is mixed as to whether one elicits a greater satiety effect than the other. Leidy's research indicates that consuming a protein-rich meal suppresses the regions in the brain responsible for food cravings and the motivational drive to eat.11

Thermogenesis

The fact that dietary protein increases thermogenesis to a greater extent than carbohydrate or fat is well documented in the literature. Studies have shown that both casein and whey have a thermogenic effect.12 Coupled with the ability of milk protein to promote muscle mass, calorie expenditure may increase slightly and have a positive effect on weight management.

Body Composition and Muscle Preservation

Maintaining muscle mass is important for long-term metabolic health, preventing weight regain following weight loss, and avoiding sarcopenia. Accumulating research indicates that higher protein diets may favorably affect body composition by increasing fat loss and preserving or increasing lean muscle mass during weight loss and weight maintenance. Consumption of animal proteins, especially those from dairy, seem to better support muscle protein synthesis and improved body composition compared with plant proteins. A recent meta-analysis of 22 clinical trials suggests that increased protein intake through milk/whey protein supplements boosts muscle mass and strength during resistance exercise in both younger and older adults.13

The Meal-Based Approach

Nutrient-rich meals that incorporate various foods from several protein sources in adequate amounts optimize the potential for muscle protein synthesis and weight maintenance, decrease chronic disease risk, and contribute to overall nutrient intake. Nutrition professionals can help clients get the protein they need when they need it by conveying the importance of consuming about 30 g (4 oz) of high-quality protein at each meal and providing related meal suggestions and recipes.

Americans understand the benefits of protein, according to the International Food Information Council Foundation's 2012 Food & Health Survey: Eighty-eight percent know that protein helps build muscle; 60% agree protein can help people feel full; and 60% believe a high-protein diet can promote weight loss. Nearly six of 10 consider protein when making a decision about buying packaged food or beverages. However, the focus for many (47%) is eating more protein during an evening meal rather than during other meals or snacks during the day.

On average, Americans consume about 12 g of protein per day at breakfast, 23 g at lunch, 35 g at

dinner, and 11 g from snacks. “The biggest obstacle—or opportunity—is breakfast,” Paddon-Jones says. “Breakfast items such as eggs, Greek yogurt, and a latté are great, but a lot of us need something convenient and simple.” He recommends adding WPC, WPI, or skim milk powder to foods such as a fruit smoothie but to avoid whey supplements that target bodybuilders because they contain other ingredients that aren’t necessary.

Food first is the best approach, says Nancy Rodriguez, PhD, RD, CSSD, FACSM, a professor of nutritional sciences and the director of sports nutrition programs at the University of Connecticut, although protein supplements have their place. “There are some situations where protein supplements may be beneficial, such as for 50-, 60-, and 70-year-old people who don’t have high energy needs but need to increase protein intake,” she explains. “The caution with using protein supplements is that the calories count. Whey supplements wouldn’t necessarily promote weight loss; you have to look at total calorie intake.”

Foods naturally rich in high-quality proteins include lean meats, poultry, fish, seafood, dairy foods, and eggs. Leucine is found in dairy foods, legumes, beef, salmon, shrimp, chicken, eggs, and nuts such as peanuts, almonds, and walnuts. Milk protein ingredients are added to some foods that are naturally rich in high-quality protein, such as milk and yogurt, to further enhance their nutrition profile or add functionality (see below).

Greek yogurt is particularly high in protein: 13 to 18 g per 6 oz, about twice the amount of regular yogurt. The authentic straining process packs in both casein and whey, according to Kara Lydon, RD, LDN, health communications manager for Chobani. “Like milk, Greek yogurt contains a higher ratio of casein to whey protein: about three to one,” she says. Lydon suggests always having a convenient source of high-quality protein on hand, such as nuts, string cheese, or Greek yogurt. Chobani’s website (www.chobani.com (http://www.chobani.com/)) offers recipes, a recipe ingredient conversion chart, and cooking videos.

Cottage cheese has the highest amount of leucine of any dairy food, according to Laura Hershey, MBA, RD, health and nutrition manager for Daisy Brand Cottage Cheese. It contains about 14 g of protein (more protein per ounce than Greek yogurt) and 1.3 g of leucine per 1/2 cup, and is about 90% casein and 10% whey. Daisy Brand Cottage Cheese’s website (www.daisybrandhealth.com (http://www.daisybrandhealth.com/)) includes food pairing suggestions, recipes developed by RDs, and patient education materials.

A relatively new product on the market is Core Power, a low-fat, lactose-free milk that contains 26 g of protein, including 21 g of casein and 5 g of whey, per 11.5-oz serving. Through a cold-filtration process, the milk solids in fresh milk, such as protein and calcium, are concentrated.

Core Power currently is marketed as a recovery beverage for athletes, but David Grotto, RD, LDN, a consultant for Core Power and the author of ***The Best Things You Can Eat***, also sees applications for nursing home residents, and diabetes and cancer patients. To get more protein, Grotto suggests clients should have Core Power with breakfast as well as high-protein breakfast foods such as Southern-style oatmeal (a whole egg mixed into oatmeal), Greek-style yogurt, or whey protein powder added to regular yogurt. “Have a diversified portfolio of protein,” he says. “Variety really is the spice of life.”

Most important, according to Rodriguez, is to have good-quality protein in every meal—distributed evenly throughout the day—to ensure people get the essential amino acids. “Casein and whey both contribute to the amino acid pool,” she says. “As long as you get adequate amino acids, your body is less likely to go to its own muscle and break it down to replenish and maintain the body’s amino acid pool. Minimizing the breakdown of muscle is always a good thing.”

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Protein-Enhanced Foods
Products containing milk and whey protein ingredients are available at retail stores. Manufacturers add milk and whey protein to energy bars, drink mixes, yogurt, and beverages. Most protein-enhanced bars and beverages contain 8 to 30 g of protein per serving. Milk protein concentrate, whey protein concentrate, and whey protein isolate also are available in powder form and can be added to recipes or beverages, smoothies, oatmeal, yogurt, soups, sauces, and dips.

Manufacturers use milk protein ingredients for three general applications: to add viscosity, texture, and taste to products and provide a clean label listing fewer ingredients with familiar names; to provide significant nutritional value to nutrition bars, beverages, and fresh dairy products; and to offer the health benefits that bioactive proteins provide.

In light of the interest in health and wellness, and the fact consumers are demanding more value from their food and beverage products, the use of dairy proteins in the US market has increased and demand has accelerated across the globe, according to the US Dairy Export Council. The global whey market outperformed most nutrition sectors, growing 20% in 2011, mostly due to high-end products such as whey protein concentrates, isolates, and hydrolysates.

— KGS

Sample Menu

30 g protein three times/day

Breakfast (31 g protein)
Yogurt parfait made with 1 cup Greek yogurt (22 g), 1/2 cup granola (4 g), 1 banana, sliced (1 g), and 1/4 cup walnuts (4 g)

Lunch (31 g protein)
1 1/2 cups Mushroom Swiss Meatball Soup* (29 g); mixed greens with balsamic dressing (0 g); whole grain roll (2 g); apple (0 g); beverage

Dinner (36 g protein)
3 oz salmon (22 g); 1 cup brown rice (5 g); 1/2 cup acorn squash (1 g); mixed greens with Italian dressing (0 g); 1 cup milk (8 g)

**For this and other whey protein-containing recipes, visit http://wheyprotein.nationaldairycouncil.org (http://wheyprotein.nationaldairycouncil.org/).*

— KGS

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