How dietary protein intake promotes wound healing

Careful assessment and adequate intake ensure patients' protein needs are met.

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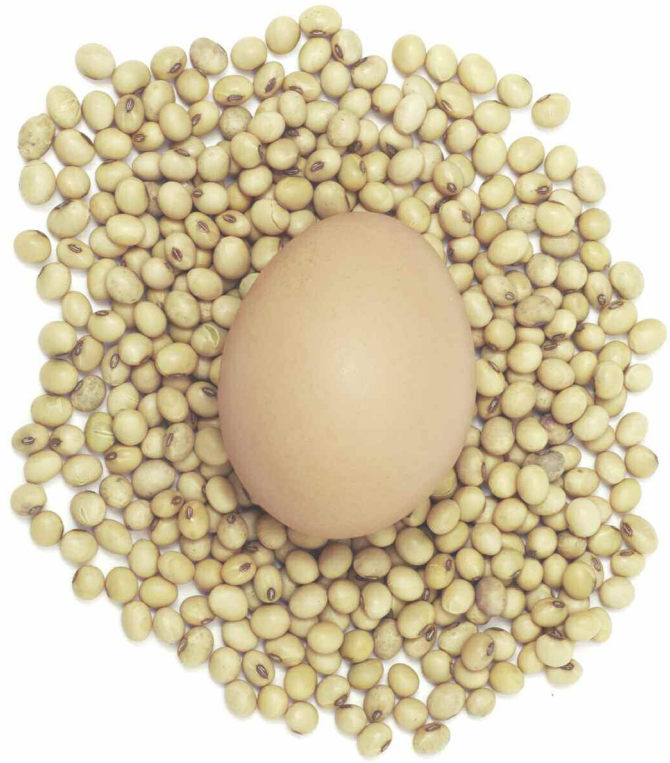
Nutrition is a critical factor in the wound healing process, with adequate protein intake essential to the successful healing of a wound. Patients with both chronic and acute wounds, such as postsurgical wounds or pressure ulcers, require an increased amount of protein to ensure complete and timely healing of their wounds.

Elderly patients with wounds pose a special challenge because of their decreased lean body mass and the likelihood of chronic illnesses and insufficient dietary protein intake. To promote a full recovery, wound care clinicians must address the increased protein needs of wound patients, especially elderly patients.



Understanding protein structure and function

Protein comes from the Greek word *protos*, which means "first" or "primary," reflecting the body's fundamental need for this nutrient. Amino acids, the basic constituents of protein, are required for many wide-ranging body functions. Proteins function as enzymes for chemical reactions; hormones for chemical messaging; buffers to regulate acid-base balance; antibodies for the immune system; transporters, such as albumin, hemoglobin, transferrin, and retinol-binding protein, of substances in the blood; and acute-phase responders that guide the body's response during acute critical illness.

Proteins also play structural roles, as the contractile proteins actin and myosin found in cardiac, skeletal, and smooth muscle and as the fibrous proteins collagen, elastin, and keratin. During the proliferative phase of wound repair, collagen deposition is crucial to increase the wound's tensile strength. Forty percent of the body's protein occurs in skeletal muscle—the major component of lean body mass, the metabolically active tissues of the body. Lean body mass declines with age and critical illness, significantly compromising the body's ability to carry out all the necessary functions of protein.

Amino acids

All of the body's 20 amino acids have the same basic structure—a central carbon, at least one amino group (-NH_2), at least one carboxylic acid group (-COOH), and a side chain group that makes each amino acid unique and determines its functional role in the body.

Sometimes classified by their properties, such as net charge and polarity, amino acids commonly are classified as either *essential* (or indispensable) or *nonessential* (or dispensable).

The nine *essential* amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. Because the body can't synthesize essential amino acids, it's necessary to obtain them from the diet.

The 11 remaining amino acids are *nonessential* because the body can synthesize them using existing carbon skeletons and free amino groups. However, some nonessential amino acids are considered conditionally essential when a specific condition prevents the body from synthesizing a particular amino acid, including genetic conditions, such as phenylketonuria, and immature organ function during infancy and adulthood. In some individuals, demand for these amino acids rises during times of metabolic stress (as when a patient has a chronic wound) and the body's production may not keep up with increased demands. Requirements for the nonessential amino acids glutamine and arginine increase during wound healing, although specific recommendations for dietary intake amounts are not yet established. Glutamine acts as a precursor for nucleotide synthesis, which is essential for rapidly proliferating cells during wound healing. Arginine promotes wound healing by increasing collagen deposition and improving both nitric oxide production and nitrogen retention and immune function.

Assessing patients' protein needs

The recommended amount of 0.8 g protein/kg body weight is based on the needs of healthy adults. Elderly patients may require a higher baseline protein intake of 1 g/kg. However, many patients, including those with wounds, don't fall into the "healthy adult" category and have even higher protein needs.

It's known that adequate protein is crucial for proper wound healing, but the precise amount isn't established. Postsurgically, 1 to 1.5 g protein/kg is recommended, but this may vary with the extent of the surgical wound. For patients with pressure ulcers, the recommendation is also 1 to 1.5 g/kg; those with deep ulcers or multiple pressure-ulcer sites may need 1.5 to 2 g/kg. For patients with large burn wounds, protein requirements sometimes reach 1.5 to 3 g/kg to offset extensive protein loss through urine and burn-wound exudate.

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When determining the protein needs of a wound patient, it's necessary to consider additional factors, such as preexisting protein-energy malnutrition, renal impairment, or other critical illnesses. The best strategy is to evaluate the patient as a whole and use clinical judgment based on:

- a physical examination for signs of catabolism
- a dietary history to determine typical protein intake
- a weight history to find out if unintended weight loss has occurred
- laboratory values, such as serum albumin, to identify catabolism and inflammation.

It's also necessary to consider the depth

Protein content of food groups

This table shows the amount of protein per serving for each of the six food groups.

Protein source	Protein content (g)
Meat, poultry, eggs, fish (1 oz)	7 g
Milk (8 fl oz)	8 g
Breads and starches*	3 g
Vegetables (½ C)*	0 to 2 g (legumes have highest content)
Fruits (½ C)*	Trace amounts
Fats	0

*Incomplete protein

and total body surface areas of the patient's wounds.

Helping patients meet their protein needs

Patients who aren't eating a well-balanced diet probably aren't consuming enough protein to heal their wounds. Getting enough protein is particularly problematic in elderly patients for a variety of reasons—the higher cost of high-protein foods, strong food preferences and intolerances, difficulty chewing or swallowing fibrous foods, and fear of consuming high-fat and high-cholesterol protein. Also, loneliness, fatigue, depression, polypharmacy, dental problems, and other problems can interfere with meal preparation and oral intake.

To promote adequate protein intake, clinicians should give patients flexibility in their diet and encourage them to consume foods they enjoy that are easy to prepare and economically feasible. A diet that's too restrictive may seem unappealing and could lead to decreased intake and unintended weight loss. Keep in mind that adequate calories are also important for wound healing; otherwise, the body uses protein calories to provide glucose for energy production instead of tissue repair.

Complete vs. incomplete proteins

Animal products are complete proteins because they contain all the essential amino acids. Whole eggs, with their full amino-acid profile, are the gold-standard protein against which all other protein sources are compared. Eggs generally are cheaper than other high-protein foods, making them a convenient and easy-to-prepare choice for elderly patients. Other complete proteins include beef, poultry, fish, milk, cheese, and yogurt.

Soy products are unique among plant foods in that they're complete protein sources. Most plant proteins are considered incomplete because they contain too little of one or more of the essential amino acids, which are termed the "limiting" amino acids. Combining foods with different limiting amino acids can improve the quality of plant protein sources, such as combining grains with legumes or legumes with seeds. It isn't necessary to combine incomplete proteins at each meal, but it's important to eat them the same day at other meals. (See *Protein content of food groups*.)

Strategies to boost protein intake

The best way to increase protein intake is to treat your patients as individuals and find out what foods they would accept and prefer. Tips for increasing protein include:

- adding diced meat to soups, salads, and casseroles
- using milk powder in hot cereals, scrambled eggs, and mashed potatoes
- choosing desserts that contain eggs, such as sponge cake, custard, and bread pudding.

To consume the higher protein amounts needed for wound healing, some patients may require supplementation. The most common way to supplement protein is to use an oral nutritional supplement bever-

Comparison of oral nutritional supplements

This chart can help clinicians determine protein intake for patients using nutritional supplements, but the product label always contains the most accurate information.

Supplement*	Kilocalories	Protein (g)	Serving size
Boost®	240	10	8 fl oz
Boost® High Protein	240	15	8 fl oz
Boost Plus®	360	14	8 fl oz
Carnation® Breakfast Essentials™ Drink	250	14	10 fl oz
Ensure®	250	9	8 fl oz
Ensure Clear™	180	10	9 fl oz
Ensure® High Protein	210	25	14 fl oz
Ensure® Muscle Health	250	13	8 fl oz
Ensure Plus®	350	13	8 fl oz
Pro-Stat® Sugar Free	90	15	30 mL
Pro-Stat® Sugar Free AWC	100	17	30 mL

*The information in this table was obtained from these product websites:
- www.boost.com/nutritional-drinks/boost-original?gclid=COi9_uKDj7gCFegWMgodfWIA1Q
- www.carnationbreakfastessentials.com
- www.ensure.com
- www.pro-stat.com

age or protein module, such as protein powder or liquid protein. (See *Comparison of oral nutritional supplements*.)

When evaluating these products for cost-effectiveness, keep in mind that 8 fl oz of whole milk has 150 calories and 8 g protein. Variety in supplementation is key, because most patients tire quickly of the same supplement day after day. Many different protein supplement products are available, including high-protein cookies, gelatins, and nutrition bars. Adding protein powder to soups, sauces, and milk shakes is an easy way to increase protein intake.

Patient education that emphasizes the importance of protein intake can help patients achieve the highest level of dietary compliance and the best clinical outcomes. ■

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