Nutrition Pearls: Gem Quality Information on the Latest Hot Topics in Nutrition

by Nancy Collins, PhD, RD, LD/N, FAPWCA

Nutrition pearls are small nuggets of information that convey some of the most important and newest information related to wound healing. The pneumonic PEARLS is easily remembered because it represents six important concepts where nutrition and wound healing intersect.

PEARLS stands for:

P: Protein
E: Energy
A: Amino acids
R: RDAs/RDIs
L: Laboratory data
S: Sarcopenia

Protein

Protein is important because it is the only nutrient containing nitrogen. It is responsible for the synthesis of enzymes involved in wound healing as well as collagen synthesis. Protein is needed at every step of the wound healing process. When a patient does not consume an adequate supply of protein and calories over time, the result is protein-energy malnutrition (PEM). Often this manifests itself as unintended weight loss (UWL), which is one of the reasons it is so important to monitor each patient’s body weight on a regular basis.

The question of how much protein is required each day is one that permeates the literature with both pro-protein and anti-protein camps. The Recommended Dietary Allowance (RDA) of protein according to U.S. government standards is 0.8 grams per kilogram (2.2 pounds) of ideal body weight for the adult. Those who believe the RDA is sufficient point out that too much protein may lead to various ailments such as osteoporosis, cancer, kidney disease, and cardiovascular issues from the high saturated fat content of certain high protein meats. Those who feel the RDA is woefully...
inadequate believe that while the RDA may be sufficient for the average sedentary adult, it is certainly not enough for optimal health and well-being in many populations. They point to athletes, elderly persons and those with sickness and infirmities as just three groups who may require much greater amounts. Patients with chronic and nonhealing wounds are routinely given additional protein in order to promote a positive nitrogen balance. Most clinicians recommend between 1.2 and 1.5 grams per kg. For a 140-pound patient, this means consuming between 11 and 14 ounces of protein each day. In order to reach this level, most patients require supplementation. A modular protein supplement is an easy solution. Table 1 lists factors to consider when selecting a protein supplement.

**Energy**

Energy is another word for calories. If a patient consumes an inadequate amount of energy over a period of time, the result is UWL. The problem with UWL is that often, the lost weight is not fat but metabolically active lean body mass.

UWL in the wound population is frequently driven by a stress response to the wound. When the body is under stress, whether physical or psychological, its fight-or-flight mechanism is amplified. The initial insult leads to local and generalized inflammation and an increase in the level of stress hormones, particularly catecholamines and cortisol. At the same time, the body experiences a decrease in the level of anabolic hormones (human growth hormone and testosterone). This hormonal imbalance leads to a catabolic state, in which the body breaks down lean body mass to release...
energy to meet increased demands. Working harder and faster than usual to fight off the stressor and regain homeostasis causes both body temperature and metabolic rate to increase, or the hypermetabolic state. This leads to an increased demand for glucose, which may be met by gluconeogenesis or rapidly breaking down lean body mass as a means of obtaining more energy.

For these reasons it is important for a patient to meet his or her energy needs each day. There are a multitude of interventions that may be used, including provision of favorite and culturally appropriate foods, recipe modification to provide more nutrient-dense foods, socialization at mealtime, proper positioning and assistance, use of oral nutrition supplements (ONS), use of appetite stimulants, and patient education emphasizing the importance of proper nutrition in wound healing.

Amino Acids

A polypeptide chain is comprised of three categories of amino acids. Indispensable amino acids (IAA), also known as essential amino acids, are not synthesized by humans and must come from the diet. Dispensable amino acids (DAA), also known as nonessential amino acids, are produced by the body in sufficient amounts under normal, healthy conditions. Conditionally indispensable amino acids (CIAA) are produced in sufficient amounts by healthy individuals. However, in the presence of certain disease states or underlying physiological stress such as nonhealing wounds, supplementation often is required to achieve an adequate supply of CIAAs. Two CIAAs that are often supplemented are arginine and glutamine.

Some of the latest information about amino acids explores the relationship between arginine, glutamine and leucine and a cellular protein called target of rapamycin (TOR), which is involved in the cell signaling for protein synthesis and wound healing.

TOR is protein kinase that functions as a central element in signaling pathways involved in cell growth and proliferation, as well as in pathways of protein breakdown. mTOR stands for mammalian target of rapamycin. mTOR was discovered when rapamycin was tested as a cell growth inhibitor and a potential anti-cancer agent. Amino acids are involved because arginine, glutamine and leucine all activate mTOR signaling. This is consistent with what is known about the roles of these amino acids in promoting anabolic
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processes, such as in wound healing. Evidence is accumulating to show that when the mTOR pathway is somehow disrupted, wound healing is altered. An unplanned medical experiment first demonstrated a link between the mTOR pathway and wound healing. A study by Buhaescu and associates \(^1\) showed that when transplant patients were given an anti-rejection medication, it had an unexpected adverse side effect—impaired wound healing. The drug was found to inhibit mTOR. Normal mTOR function is vital for normal wound healing. Excessive mTOR activity leads to excessive scarring, such as keloids. Inhibition or underexpression of mTOR is associated with poor wound healing. The amino acids arginine, glutamine and leucine each can activate mTOR.

Vitamin C and zinc are perhaps the two most common individual micronutrients associated with wound healing. Vitamin C is water soluble, meaning the body does not store it so it must be supplied each day. Vitamin C is needed for the hydroxylation of proline and lysine during collagen synthesis. It is also needed for carnitine production for fatty acid metabolism and to give tensile strength to newly built collagen. Symptoms of vitamin C deficiency may develop rapidly but reverse quickly with treatment. Some of the consequences of a vitamin C deficiency include lack of secretion of procollagen chains, wrong amino acid sequences and increased blood cell fragility.

Zinc is needed for all enzymatic reactions and in a deficiency state, there may be a low rate of epithelialization as well as decreased wound healing and collagen strength. Urinary losses of zinc increase with stress and weight loss. Body stores may be depleted in patients with malnutrition, chronic diarrhea and chronic corticosteroid use. Before supplementing, consider that (above 40 mg day, excess zinc may interfere with wound healing via affecting lysyl oxidase, an enzyme involved in collagen synthesis. Excessive zinc also interferes with copper and iron absorption and metabolism. It is important to remember that there is no magic combination of supplements that will make up for generalized poor nutrition and inadequate oral intake.

**Laboratory Data**

When evaluating laboratory or biochemical data, it is important to note the date on which the labs were drawn. If the labs are several months old, they may not reflect the patient’s current situation. However, the reverse is also true. Daily labs may be too frequent to detect any true changes in nutritional status; small daily changes are often the result of hemoconcentration fluctuations. It is also important to note if the patient had a recent blood transfusion in which case some labs may be more reflective of the donor rather than the patient.
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Historically, serum proteins—albumin, prealbumin, transferrin and retinol-binding protein—were used to measure malnutrition. C-reactive protein (CRP), total lymphocyte count and serum total cholesterol are not serum proteins but sometimes are used as indicators of malnutrition. Normal ranges for these lab tests are listed in Table 2. Despite the standard use of lab tests to help diagnose malnutrition, experts have no consensus about which, if any, biochemical markers identify malnutrition, especially in the frail, elderly population. Current thinking suggests that hepatic proteins are not indicators of nutritional status but rather indicators of morbidity and mortality and recovery from acute and chronic disease. Changes in albumin, prealbumin or transferrin should not be used to suggest changes in protein status in individuals with acute or chronic inflammatory states.2

Although laboratory values taken singly or together may provide some clues to nutritional status, they probably do not provide sufficient information to identify malnutrition or evaluate the success of nutrition interventions. The good news is that there is an effort underway to identify and document malnutrition. In 2012 the Academy of Nutrition and Dietetics (Academy) and the American Society for Parenteral and Enteral Nutrition (ASPEN) released a joint consensus statement titled “Characteristics Recommended for the Identification and Documentation of Adult Malnutrition (Undernutrition).”3 This groundbreaking article will likely change the world of adult malnutrition as we know it. The authors propose the three-pronged etiology-based definition of malnutrition that was adopted by the international consensus committee: starvation-

Nearly 3.6 million people in the United States have sarcopenia, putting them at increased risk for physical disability and frailty.4
Sarcopenia

Sarcopenia often is defined as an age-related shift in body composition, specifically the loss of muscle mass. The word sarcopenia has Greek origins and literally means “poverty of flesh.” As we age, we naturally lose muscle mass and replace it with fat—anyone over the age of 45 can tell you how the body changes. Nearly 3.6 million people in the United States have sarcopenia, putting them at increased risk for physical disability and frailty. People who are obese also can suffer this loss of muscle mass. In this case, we term it sarcopenic obesity. Although sarcopenia

Table 1

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<th>Considerations when selecting a modular protein supplement</th>
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<td>• Form&lt;br&gt;  – Liquid or powder</td>
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<tr>
<td>• Final volume</td>
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<td>• Nutrient density</td>
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<td>• Palatability</td>
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<td>• Ease of administration</td>
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<td>• Use in tube feedings</td>
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Table 2

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<th>Normal laboratory values of selected nutrition indicators</th>
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<td><strong>Lab test</strong></td>
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<tr>
<td>Albumin</td>
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<td>Prealbumin</td>
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<tr>
<td>Retinol-binding protein</td>
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<tr>
<td>C-reactive protein</td>
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<tr>
<td>Cholesterol</td>
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<tr>
<td>Transferrin</td>
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<td>Total lymphocyte count</td>
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Sources:

Table 3

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<th>Proposed Etiology-Based Definitions of Malnutrition</th>
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<td>1. Malnutrition in the Context of Social or Environmental Circumstances (starvation-related malnutrition). This may be pure starvation due to financial or social reasons, or could be caused by anorexia nervosa.</td>
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<td>2. Malnutrition in the Context of Acute Illness or Injury. Examples include organ failure, pancreatic cancer, rheumatoid arthritis or sarcopenic obesity.</td>
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<td>3. Malnutrition in the Context of Chronic Illness. Examples include major infections, burns, trauma or closed head injury.</td>
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References:
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