

Diabetic Wound Healing Through Nutrition and Glycemic Control

Nancy Collins, PhD, RD, LD/N, FAPWCA & Colleen Sloan, RD, LD/N

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Diabetes has quickly become one of the most complex health challenges of the 21st century. In 2010, a total of 10.9 million US residents ages 65 years and older were reported to be living with diabetes.¹ Currently, it is the seventh-leading cause of death in the US, totaling 4.6 million deaths in 2011 (with healthcare expenditures reaching more than \$471 billion.)² A condition that increases one's risk for heart disease and stroke, diabetes is also the leading cause of kidney failure, new cases of blindness among adults, and non-traumatic lower-limb amputations. Approximately 15% of individuals who live with diabetes develop a foot ulcer, and 84% of this population will end up with lower-leg amputations.³ Several factors can disrupt wound healing. Without proper nutrition, a normal wound can rapidly become a chronic, infected wound. However, it is possible for wound care providers to reduce the huge economic burden and life-threatening complications of diabetes by implementing timely, easy-to-use interventions. Comprehensive diet and nutrition management have been shown to promote optimal glycemic control and facilitate wound prevention and healing. As such, all healthcare professionals should know how to adequately manage blood glucose levels to support wound healing in patients living with diabetes. This article explains how uncontrolled blood sugar impairs wound healing and offers practical nutrition recommendations and guidelines that promote healing, as well as simple suggestions to prevent further complications and comorbidities.

Effect of Diabetes

Diabetes often causes slow-healing wounds that can worsen rapidly — with elevated blood glucose levels serving as the initial barrier to healing. Thus, achieving optimal glycemic control is imperative. Hyperglycemia stiffens arteries, causes cell walls to become rigid, and makes blood vessels become narrow. As a result, red blood cell permeability and flow is reduced, causing oxygen and nutrient deficits in the wound. Without oxygen, macrophage mobility is diminished and granulation tissue growth is limited, which causes a prolonged inflammatory phase.⁴ Impaired cell migration, inadequate leukocyte function, and insufficient collagen synthesis are the main causes for poor or delayed wound healing.⁵ Persistent hyperglycemia lowers the efficiency of the immune system, decreases sensory nerve function, and increases the development of infections. When blood glucose levels are persistently elevated, the process by which white cells are attracted to the site of an infection (chemotaxis) and the ingestion of bacteria by white cells (phagocytosis) are compromised.⁶ Protein-calorie malnutrition and the consequent body composition changes are additional considerations in wound healing, as are patient weight and nutritional status. Whether overweight (eg, sarcopenic obesity) or malnourished, adequate nutrition is vital to healing. Targeting the underlying cause of delayed healing is as important in promoting optimal outcomes as is treating the wound topically. Proper nutrition plays a key role in managing blood glucose levels and wound healing. The role of the registered dietitian (RD) is to evaluate patient nutritional needs and provide an individualized diet that strives to achieve glycemic, lipid, and blood pressure control. The following suggestions aim to provide the basics of a carbohydrate-controlled diet designed to control glucose levels and weight while minimizing the risk of other comorbidities:

1. Providing Adequate Calories

The process of wound healing is very energy-demanding. Energy needs are increased to support the immune response and regeneration of new tissue. If patients have an existing nutritional deficiency, wound care interventions may become less effective, making it important to address and optimize nutrition early on. Malnutrition is linked to more complications and infections, resulting in increased duration and frequency of hospital admissions. Individual energy needs depend on a variety of factors, making it necessary to adjust according to age, gender, nutritional status, comorbid conditions, activity level, severity of the wound, and stage in the healing process. Currently no evidenced-based recommendations exist for energy requirements. However, the European Pressure Ulcer Advisory Panel (EPUAP) and the National Pressure Ulcer Advisory Panel (NPUAP) recommend a minimum of

30–35 kcal/kg/day.⁷ Patients who are losing weight or are underweight may benefit from additional calories to ensure adequate wound healing and halt further weight loss. A well-balanced diet that incorporates the macronutrients — carbohydrates, protein, and fat — provides the energy needed.

2. Encouraging Weight Loss (As Needed) In order to maintain A1c levels below 7%, changes to diet and physical activity levels are recommended to facilitate weight loss, which is a proven means to improve glycemic control and reduce complications.⁸ If patients are willing and ready to make dietary changes, encourage them to eat at regular times every day. Suggest they cut calories from beverages by drinking water, unsweetened tea, artificially sweetened drinks such as Crystal Light,[®] or seltzer water with lemon or lime juice. Discuss appropriate snacking throughout the day. Snacking on the right foods can keep blood sugar stable and prevent overeating at the next meal. Think of snacking as an opportunity to optimize nutritional intake and increase energy levels. Some good snacks include ½ c. almonds or other nuts, 3 c. lite popcorn, five whole wheat crackers with one piece of string cheese, or celery sticks with 1 tbsp. peanut butter.

3. Fueling with Carbohydrates

Carbohydrates are the main and first source of cellular energy during wound healing. A diet with sufficient carbohydrate calories prevents the oxidation of protein for energy. An inadequate supply of carbohydrates can lead to muscle wasting, loss of subcutaneous tissue, and poor wound healing. Distribute carbohydrates evenly throughout the day to prevent fluctuations in blood sugar. Whole grains, fruits, and vegetables with complex carbohydrates are the preferred source. With the help of an RD, patients can become familiar with the various types of carbohydrates and how many they should consume daily.

4. Healing with Protein

Protein provides the foundation for tissue growth, cell renewal, and repair resulting from a wound. Insufficient dietary protein can slow the rate and quality of wound healing. The preferred source is complete proteins, such as meat, poultry, fish, eggs, milk products, and soybeans. The EPUAP and the NPUAP recommend 1.25–1.5 g/kg/day.⁷ For a 150-lb male, this equates to 85–102 g of protein/day. To put this into perspective, a 6-oz steak has roughly 54 g protein, one egg has 7 g protein, and 1 cup of milk has 8 g protein. Use caution when recommending excessive amounts of protein (>2 g/kg/day) for individuals with pre-existing renal or hepatic conditions.

5. Supplementing (As Needed) Encourage whole, fresh foods — they offer all of the required nutrients for wound healing, along with the additional benefits of phytonutrients and antioxidants. However, if patients are unable to consume adequate calories, a ready-to-drink high-calorie/high-protein oral nutritional supplement (eg, Glucerna[®]) can fill the nutritional gaps. Add milk or cheese to foods to enrich daily meals and increase protein and energy intake. Consider a daily multivitamin for patients who live with comorbid diabetes and chronic or nonhealing wounds. Additional supplementation of vitamin A, vitamin C, and zinc is typically only warranted in the presence of a deficiency.

6. Devising an Action Plan

Diabetes and wounds sometimes become a dangerous combination. A lack of glucose control combined with a poor diet can lead to nonhealing wounds and eventual amputation. However, with appropriate nutritional interventions, it is possible to have wounds heal properly while helping to prevent future wounds. Healthcare professionals should closely monitor dietary patterns to ensure increased protein and energy needs are met. With frequent meals and “smart snacking,” blood glucose levels can be controlled to promote normal wound healing. It is imperative to identify malnutrition early and implement appropriate strategies for correcting any nutritional deficits. If patients would benefit from weight loss, recommend appropriate lifestyle modifications. If patients require a more individualized plan, consult an RD, who can provide dietary counseling and guidance. Encourage well-balanced meals and frequent blood sugar monitoring to help prevent patients from becoming another diabetic statistic. *Nancy Collins is founder and executive director of*

Nutrition411.com and Wounds411.com (NCtheRD@aol.com). Colleen Sloan is a clinical dietitian at JFK Medical Center, Atlantis, FL, and nutrition expert at community-based workshops and food demonstrations.

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