Nutrition Q&A

Estimating Caloric Needs to Promote Wound Healing

Nancy Collins, PhD, RD, LD/N

Q: How can I estimate the number of calories a patient with a wound requires each day?

A: Patients with wounds have elevated caloric needs. If caloric needs are not met, the patient may lose weight and wound healing may be impaired. Accurately calculating the caloric needs of a patient with a wound is important for ensuring that his or her nutritional regimen is adequate. Before estimating caloric needs, however, you need to understand the process of metabolism and how caloric needs are determined and influenced.

Total Energy Expenditure

Total caloric needs may be thought of as the amount of fuel required to support all of a patient's energy expenditures, known as the total energy expenditure (TEE) (Figure 1). The largest portion of energy is needed to support the body's basal metabolism. Basal metabolism, the body's unconscious metabolic process (such as heart beat, respirations, maintenance of body temperature, nerve impulses, and hormonal regulation)[1] represents approximately 60% to 75% of a person's total metabolism.[2] It is the number of calories a person would burn if he were awake but at rest all day. Basal metabolism determines the basal metabolic rate (BMR) or the basal energy expenditure (BEE). Age, gender, body size and composition, body surface area, and genetics all affect BMR. Some sources use the terms resting metabolic rate (RMR) or resting energy expenditure (REE) to describe basal metabolism.

The second portion of energy expenditure is for voluntary activity, and the final portion is expended to digest, absorb, and metabolize nutrients, known as the thermic effect of food.[2]

During illness, injury, or times of stress, the body may become hypermetabolic, a condition in which the BMR may be markedly increased and nutrients may be inefficiently used. This is due to the hormonal response that releases catecholamines and other catabolic hormones.[3] A typical patient with a wound requires additional calories to offset the hypermetabolic response triggered by the wound.

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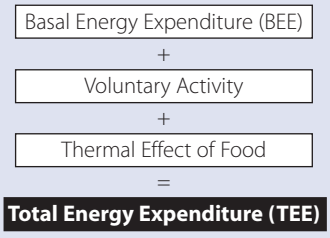
Figure 1. COMPONENTS OF TOTAL ENERGY EXPENDITURE (TEE)



Using Standards as Estimates

Caloric needs may be calculated or measured. Calculations use standard equations, tables, or nomograms. Perhaps the simplest way to calculate caloric needs is by using a standard number of kcals/kg of body weight per day. The typical standards are 25 to 30 kcals/kg/day for normal individuals; 30 to 35 kcal/kg/day for patients with moderate illness, injury, or malnutrition; and 35 to 40 kcals/kg/day for patients with critical illness or injury. Guidelines from the Agency for Health Care Policy and Research (now the Agency for Healthcare Research and Quality)[4] state that approximately 30 to 35 kcals/kg/day are required for most patients with wounds to achieve a positive nitrogen balance (Figure 2).[4] This method provides only an estimate of caloric needs.

Harris-Benedict Equation

A more precise estimate of caloric needs can be obtained by using a mathematical formula. Although there are many different published formulas, the one most commonly used is the Harris-Benedict Equation. This equation was originally published in 1919 and, although it has some detractors, is widely used in health care facilities today. This equation takes into account gender, age, weight, and height to arrive at the estimated BEE (Table 1). The BEE must be adjusted for activity and injury level; activity factors are usually 1.2 for patients confined to bed and 1.3 for patients out of bed. Injury factors have more

Table 1. HARRIS-BENEDICT EQUATION

Men: BEE (kcal) = 66.5 + 13.75 W + 5.0 H – 6.78 A
Women: BEE (kcal) = 655 + 9.56 W + 1.85 H – 4.68 A
(W = weight in kilograms, H = height in centimeters, A = age in years)

Figure 2. COMPARISON OF 2 METHODS TO ESTIMATE CALORIC NEEDS

Patient A is a 78-year-old woman weighing 110 pounds and standing 61 inches tall. She has a Stage II pressure ulcer on her coccyx and reddened heels. Her medical history includes hypertension and heart failure. She is out of bed each day and uses a wheelchair for mobility.

Method 1: kcals/kg/day	Method 2: Harris-Benedict Formula
30 – 35 kcal/kg/day for moderate stress and Stage II pressure ulcer	61 inches x 2.54 centimeters per inch = 154.94 cm
110 pounds/2.2 pounds per kg = 50 kg	655 + 9.56 (50) + 1.85 (154.94) – 4.68 (78) =
30 kcal/kg x 50 kg = 1500	655 + 478 + 287 – 365 =
35 kcal/kg x 50 kg= 1750	1055 kcal to meet her BEE
Patient A requires between 1500 and 1750 kcal/day to meet her TEE.	1.3 Activity Factor
	1.2 Injury Factor
	Patient A requires 1055 x 1.3 x 1.2 = 1646 kcal/day to meet her TEE

variance and are based on the practitioner's judgment (Table 2). Figure 2 shows a comparison between calculating kcals/kg/day and the Harris-Benedict Equation.

Direct and Indirect Calorimetry

The most precise way to measure BEE is by using either direct or indirect calorimetry. Direct calorimetry monitors the amount of heat produced by a subject placed inside a structure large enough to permit moderate amounts of activity. These structures are called whole room calorimeters.[2] Indirect calorimetry calculates metabolic rate from the oxygen consumption of the patient. Oxygen consumption measurements are typically done with a medical device called a metabolic cart. These devices are relatively expensive ($20,000 to $50,000), require technical expertise to operate, and require routine maintenance and calibration.

HealtheTech, Golden, CO, has developed MedGem, an inexpensive handheld device that can measure BEE. MedGem is a portable indirect calorimeter that accurately measures respiratory airflow and oxygen consumption (VO_2) and calculates BMR (kcal/day). Sensors in the MedGem accurately measure the volume of air, oxygen content, temperature, barometric pressure, and relative humidity. The device is simple to use and plugs into any wall outlet to self-calibrate. Each test takes approximately 10 minutes.

In addition, the S/5 Critical Care Monitor from Datex-Ohmeda, Tewksbury, MA, provides continuous gas exchange/metabolics information, among other functions, for patients in the intensive care or other critical care units. This bedside monitoring system is used with mechanically ventilated patients to measure and analyze gas exchange (oxygen and carbon dioxide) and assess energy needs. Measurements are done once every minute.

Determining the precise level of a wound patient's hypermetabolism is often difficult, which makes developing appropriate nutritional goals a challenge. Devices such as MedGem and the S/5 Critical Care Monitor provide individualized information that can be used to formulate customized nutritional care plans.

Understanding the process of metabolism is essential for accurately estimating a patient's caloric needs. Without this information, it will be extremely difficult to evaluate whether the patient's nutritional regimen is adequate. Close monitoring of a patient's caloric needs compared with his or her actual intake will help you provide timely and appropriate nutritional care. ●

Table 2. ACTIVITY AND INJURY FACTORS

Activity Factors	
Confined to bed = 1.2	Normal, healthy activity = 1.5
Out of bed = 1.3	
Injury Factors	
Minor surgery = 1.0 to 1.2	Severe infection = 1.4 to 1.8
Major surgery = 1.1 to 1.3	Sepsis = 1.6 to 1.8
Major skeletal or blunt trauma = 1.35	Burn (<20% BSA) = 1.2 to 1.5
Head trauma = 1.6 to 1.8	Burn (20% – 40 % BSA) = 1.5 to 1.8
Mild infection = 1.0 to 1.2	Burn (> 40% BSA) = 1.8 to 2.0
Moderate infection = 1.2 to 1.4	

BSA = body surface area
Source: Florida Dietetic Association. Handbook of Medical Nutrition Therapy: The Florida Diet Manual. 2000 ed. Tallahassee, FL: Florida Dietetic Association; 2000. p I1.7.

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