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Protein Requirements in Illness: Considerations for Acute Care Nurse Practitioners

Shannon McMahon, MS, RD, LD, Linda Knol, PhD, RD, LD, Alice L. March, PhD, FNP, CNE, Jodie Bilbrey, MS, RD, Sarah L. Morgan, MD, RD, FADA, FACP, and Jeannine Lawrence, PhD, RD, LD

ABSTRACT

This retrospective chart review (N = 150) examined weight, height, urinary urea nitrogen, and feeding method in acutely ill adults. Using 2 evidence-based approaches, estimated protein needs were compared with laboratory-measured protein requirements. Comparisons were significantly associated for normal weight patients ($r = 0.21$, $P = .03$) but not for patients who were obese ($r = 0.10$, $P = .49$), showing that the use of body weight and standard formulas to calculate protein needs may not be appropriate for individuals who are obese. Considerations for individual patients should be considered. More research is needed to determine how to accurately estimate protein during acute illness in patients who are obese.

Keywords: acutely ill adults, obesity, protein needs, urinary urea nitrogen

Nurse practitioners (NPs) in acute care settings are charged with providing safe and holistic care to increasingly complex patients. One facet of care is that NPs must have a working understanding of the nutritional needs of the acutely ill patient. In particular, the NP must understand protein needs, how those needs vary by body weight, and how protein usage is affected by acute illness. Even though the acute care NP may work in an interprofessional team with registered dietitians, the primary responsibility for the coordination of that care often falls to the NP.

The application of standardized, disease-based protein recommendations to any acutely ill patient is problematic but is even more difficult in patients who are obese (body mass index [BMI] $\geq$ 30.0). Obesity is a disease state,[1] which brings with it a chronic inflammatory process, increasing the need for adequate protein.[2] Thus, there is a need to know if acutely ill patients who are obese have different protein needs when compared with those of normal weight. In addition, people who are obese may have comorbid conditions that warrant additional considerations in the assessment and determination of protein needs.

The obesity epidemic has challenged NPs to reassess old approaches to care and generate new standards of practice for patients who are obese. Improving clinical practice requires the use of evidence-based guidelines. Protein requirements in obesity and illness are not yet clearly established and are not well understood. Urinary urea nitrogen (UUN) can be used to estimate protein use during an acute illness, along with certain formulas designed to adjust for body weight. Thus, measuring UUN in people of differing body types (normal weight and obesity) may help to establish guidelines for estimating these needs. This retrospective chart review demonstrates an urgent need to examine how protein requirements for people who are obese could best be predicted.

RESEARCH QUESTIONS

There are 2 research questions to consider. First, what is the relationship between body weight and dietary protein needs in acutely ill patients, as measured by a

24-hour UUN test? Second, what is the relationship between measured protein needs and estimated protein needs in acutely ill patients who are obese?

REVIEW OF THE LITERATURE

Protein is a vital macronutrient necessary for energy metabolism, digestion, blood clotting, vision, antibody formation, acid-base balance, and fluid regulation. It is also a key ingredient for growth, repair, and replacement of tissue.[3] In times of illness and stress, adequate protein intake (or supplementation) can decrease the rate of muscle loss, improve immune function, and support recovery.[4] Protein needs are associated with body composition, particularly obesity. An increase in adipose tissue results in a significant increase in body fat and a slight increase in lean body mass, which may affect these metabolic processes. Protein requirements for supporting health and promoting healing during an acute illness are well established for normal weight individuals[5] (BMI, 18.5-24.9), yet there is a dearth of literature regarding protein requirements for obese patients (BMI $\geq$ 30.0).[6,7]

The first nitrogen balance studies, conducted as early as 1907, typically used small groups of healthy males who were of normal weight to determine the required protein needs to support general good health but not ill health.[8,9] Nitrogen balance studies were then tailored for actual patient use in subsequent clinical studies that focused on specific disease states, thus generating protein recommendations (in g/kg) based on the patient diagnosis but not body weight.[10,11]

Protein needs are typically obtained in 1 of 2 ways. Measured needs are derived from laboratory tests. In the absence of measured needs, protein needs can be estimated using established calculations that incorporate factors such as height, weight, and injury. Currently, the most common laboratory test used to measure nitrogen balance in the clinical setting is a 24-hour UUN test.[12] The UUN is a quick, simple, and inexpensive way to measure the catabolism of lean tissue and is the commonly accepted method of estimating nitrogen balance in clinical care patients.[12-14] A 24-hour UUN test measures only the urea excreted in the urine; therefore, a standard formula has been developed to calculate protein loss from all sources using the results of the 24-hour UUN test with the addition of 4 g protein. This accounts for the loss of urea through feces, sweat, hair, skin, nails, creatinine, uric acid, and ammonia.[15]

In healthy subjects, UUN accounts for about 80% to 90% of urinary nitrogen losses, but illness stressors alter the production of urea and the results of the UUN test. Depending on the disease and type of stress, the amount of urinary urea accounted for by UUN can vary widely, falling well below or above the average.[14] The urine collection technique and metabolic factors also affect the accuracy of 24-hour UUN results. For example, spills and leaking catheters result in inaccurate samples, and conditions such as edema, dialysis, renal insufficiency, and gastrointestinal bleeding alter test results.[12,16] It is possible that a shorter collection period (6-12 hours) would help address some of these concerns.[12] Despite the possible variances in UUN results, the test can still be used in conjunction with other assessment tools to monitor protein status and determine the best course of nutritional treatment for the patient.[14]

Current, well-developed protein guidelines specifically targeting acutely ill patients who are obese are lacking. Additionally, even fewer research-supported recommendations for protein provision exist for critically ill patients who are obese and who may be receiving intentional hypocaloric feeding protocols. Guidelines suggest protein replacement of $\geq$ 2.0 g/kg ideal body weight (IBW) for patients with a BMI of 30.0 to 39.9 kg/m^2 and $\geq$ 2.5 g/kg IBW for those with a BMI $>$ 40.0 kg/m^2.[17] However, it is common practice to calculate a body weight adjustment in lieu of the patient's actual body weight to estimate protein needs.[6] The approaches include the use of IBW or adjusted body weight (ABW). The development and validation of body weight adjustment factors are not well documented. Data used to evaluate energy requirements are the basis for these body weight adjustment factors, yet little research supports their use in the determination of protein needs of patients who are obese.[18,19]

A common method for adjusting body weight in the United States is to calculate IBW using the Hamwi formula (males = 106 pounds for the first 60 inches + 6 pounds for every inch greater than 60 inches; females = 100 pounds for the first 60 inches + 5 pounds for every inch greater than 60 inches).[18]