

Nutritional Implications of LTC Resident Physiology

Introduction

Protein energy malnutrition (PEM) and pressure ulcers (PUs) remain a significant problem in long term care (LTC) residents despite the adaptation of nutritional supplements of various protein and energy sources including modular protein supplements.^{1,2} As the 65 years and older population in the US increases to 71.5 million by 2030³ the increase in those at risk for PEM and PUs will impact LTC facilities and residents to an even greater degree. Treating wounds is costly for the facility and distressing for residents who suffer the pain and complications of delayed healing.

Making the right decisions about nutrition intervention for LTC residents is complicated by the fact that much of what we know about protein requirements is based on studies of animals, children and healthy adults. Limited information is available about the specific nutritional implications for this generally elderly and physiologically frail group. Even such an otherwise helpful guideline as the Protein Digestibility Corrected Amino Acid score (PDCAAS) is based on the requirements of the preschool– age child.⁴ As discussed more fully below, there are at least three significant practical factors to be considered when determining appropriate nutritional intervention for LTC residents.

1. Ease of Consumption and Density of Nutrients

In addition to their generally frail condition, LTC residents often exhibit poor appetites and digestion accompanied by a functional degree of anorexia. Fundamental to achieving protein and energy sufficiency is the amount of protein and energy actually consumed and utilized by the body. Providing nutrient dense, low volume, easily consumed supplementation is an important consideration for elderly residents. The inability of LTC residents to easily consume large volume preparations of reconstituted modular powdered proteins (e.g. 6 g protein, 25 Kcal/120-180 ml) may be a contributing factor to PEM and impaired wound healing. Selecting a well-tolerated supplement that delivers maximal protein and energy in minimal volume (e.g. 15 g protein, 100 Kcal) may help in achieving positive clinical outcomes.

2. Adequate Digestion and Protein Utilization

Decreased acid secretion leads to poor nutrient digestion and absorption, which impairs the nutritional status of the elderly.⁵ Bowel management issues are widespread among LTC residents. Protein metabolism is dependent upon proper digestion wherein protein is hydrolyzed into amino acids-peptides. Amino acids that move beyond the terminal ileum are less likely to be absorbed for use in protein synthesis and may pass out of the body or be absorbed by bacteria.⁶ Providing fully hydrolyzed (pre-digested) protein may be the most effective way to mitigate the effects of inadequate absorption caused by poor digestion.

3. Importance of Conditionally Indispensable Amino Acids (IAA)

The conditionally indispensable amino acids' critical role in achieving nitrogen balance is particularly important in older, physiologically stressed adults. IAA requirements diminish with age from 30% of protein in early childhood to 11% in adulthood. Conversely, dispensable amino acids may become an increasingly greater proportion of protein intake.⁷ The conditionally IAA's, in particular, assume an important role for LTC residents with pressure ulcers, many of whom exhibit compromised immune functions and whose pathophysiological state may cause these AA's to become indispensable. The relative importance of nitrogen and the conditionally indispensable amino acids is significant. It is possible to consume adequate amounts of each of the IAAs yet not achieve nitrogen balance.⁸ Nitrogen-rich supplements, such as collagen, contain a high proportion of arginine, proline, hydroxyproline, glycine and hydroxylysine, which can enhance the diet composition for residents whose IAA and calorie requirements are being met, while sparing the IAA's for protein synthesis.⁸ The only published clinical trial to study the effects of protein supplementation on pressure ulcers among nursing home residents showed 96% greater healing, as evidenced by a reduction in the Pressure Ulcer Scale for Healing (PUSH) tool scores, among those receiving a concentrated, fortified, collagen protein hydrolysate supplement rich in high nitrogen, conditionally indispensable amino acids (Pro-Stat), compared to the control group receiving standard care, including other commercially available protein supplements.⁹

Selecting a protein supplement that is a good source of IAA's, non-specific nitrogen and conditionally IAAs is important to achieving positive clinical outcomes among LTC residents.

Conclusion

Protein sufficiency is ultimately determined by the amount of amino acids actually consumed and utilized. The body is largely indifferent as to the source. Ease of consumption (compliance), density of nutrients, pre-digestion of protein molecules, the combination of indispensable and conditionally indispensable amino acids, as well as the amount of energy provided, are all important to achieving positive clinical outcomes for LTC residents. There are significant differences in the ease with which various supplements address these needs. For example, from a purely practical standpoint, a resident would need to consume *and fully digest* 90 to 180 ml by volume of reconstituted whey powder concentrate, when prepared according to directions, in order to receive the benefits of 15 grams of supplemental protein. This may be no easy task for someone who is not consuming even a basic diet and has digestion problems. By contrast, the same amount of *pre-digested* protein is provided in just 30 ml of Pro-Stat. When compared to Pro-Stat Profile, which is formulated specifically for residents with inadequate IAA consumption and provides the IAA pattern recommended by the IOM, residents would need to consume and fully digest 140 to 280 ml by volume of reconstituted whey powder to access the IAA's provided in 45 ml of pre-digested Pro-Stat Profile. Accessing the same total amount of the conditionally indispensable amino acids would require so much more volume of reconstituted whey powder as to be practically intolerable for most LTC residents.

The historically poor record of resident compliance with the most common types of protein supplementation and the lack of long-term statistical improvement in the incidence of PEM and PUs among LTC residents underline the need for newer, more practical and effective approaches such as the concentrated, pre-digested protein in Pro-Stat. The physiological realities of long term care residents demand that the very real and practical issues of appetite, digestion, compliance and nitrogen balance all be addressed in order to achieve positive clinical outcomes.

¹ Demling, RH, Involuntary weight loss, wound healing, and optimal nutritional interventions. Journal of American Medical Directors Association. 2001;2 (4): H2-H4.

² Lyder, Courtney H, Implications of Pressure Ulcers and Its Relation to Federal Tag 314. Annals of Long-Term Care – ISSN: 1524-7929-Volume 14 – Issue 4-April 2006. pages 19-24.

³ United States Census Bureau 2006. Current populations reports. Available at [Http://www.census.gov](http://www.census.gov)

⁴ FAO/WHO Expert Consultation. Protein Quality Evaluation: Food and Agriculture Organization of the United Nations. Rome: Food and Agriculture Organization: 1991. FOA Food and Nutrition Paper, No 51.

⁵ Bates C.J., Benton D, Biesalski HK, et al. Nutrition and Aging: A Consensus Statement. Journal of Nutrition Health and Aging. 2002; 6(2): 103-116

⁶ Schaafsma G. The protein digestibility-corrected amino acid score. Journal of Nutrition. 2000;130:1865S-1867S

⁷ Reeds PJ, Dispensable and indispensable amino acids for humans. Journal of Nutrition. 2000;130:1835S-1840S

⁸ Castellanos VH, Litchford M, Campbell W. Modular protein supplements and their application to long-term care. Nutrition in Clinical Practice.2006;21: 485-504

⁹ Lee SK, Posthauer ME, Dorner B, Redovian V, Maloney J. Pressure ulcer healing with a concentrated fortified collagen protein hydrolysate supplement: a randomized controlled trial. Advances in Skin and Wound Care 2005;19:92,94-96