Sufficient protein for our elders?1,2

D Joe Millward

Nutritional requirements for protein are arguably the best researched of all nutrients, and a new report on such was recently published by the WHO/FAO/UNU (1). However, such recommendations have always engendered vigorous debate with recent advocacy for the view that protein intakes above the Recommended Dietary Allowances may have benefit for adults, especially the elderly population (2). This comes at a time when animal protein consumption and production is reemerging as a global issue in the context of the environment, the rapid growth in consumption in the emerging economies, and increasing food insecurity (3). The new report did identify gaps in the knowledge base, particularly for the elderly population, in terms of both the minimum requirement for general health and well being and the optimum intake for healthy aging persons, especially with respect to sarcopenia and osteoporosis, which are potentially disabling conditions (1).

The protein requirement for adults was derived from a meta-analysis of nitrogen balance studies in healthy adults (4), which identified no significant age effects but included only one relevant study. The WHO/FAO/UNU (1) reviewed reports of reanalysis and aggregation of earlier nitrogen balance data suggesting that minimum protein requirements do increase with age. However, it accepted the view of a rigorous reassessment of such reports and all other available data (5) that no convincing evidence exists for a change in the protein requirement with age. This conclusion was confirmed by a more recent study in this issue of the Journal (6).

Nitrogen balance studies of younger and older men and women, measured after 14 d of adaptation, have been reported. Linear regression of the 3 protein intakes on nitrogen balance indicates intakes for nitrogen equilibrium of 0.59 g · kg⁻¹ · d⁻¹, with no significant age or sex effects, especially when calculated on the basis of fat-free mass. This value is within the range of the Estimated Average Requirement proposed in the new report, ie, 0.66 g · kg⁻¹ · d⁻¹ (1).

The nitrogen balance approach is the only available method with a conceptually straightforward endpoint (ie, nitrogen equilibrium), although it suffers from a lack of precision and the possibility of systematic error (1, 5). Thus, intakes above the requirement often result in an unrealistic positive balance that is not explained by weight or fat-free mass gains. Campbell et al (6) fed intakes of 0.5, 0.76 and 1 g · kg⁻¹ · d⁻¹ and reported positive nitrogen balances at the high and medium intakes and even at the lowest intake for the older women (6). As discussed by the WHO/FAO/UNU (1), any systematic positive error (eg, loss of nitrogen through an as yet unquantified route, such as nitrogen gas), would result in an overestimation of the true protein balance and an underestimation of the intake for true equilibrium. However, without evidence of the extent of any unmeasured nitrogen losses, and how they change with intake, we cannot correct for them. It does mean that the physiologic significance of the changes in balance in this new study are uncertain, being mainly in the positive range, and that lower protein intakes should have been fed to allow study within the more physiologically realistic negative balance range. In this respect, this study cannot be classed as definitive in terms of the absolute magnitude of the requirement, only that it is likely to be independent of age.

Are our elders protein deficient? If the adult protein requirement is a fixed function of weight and independent of sex or age, then elders, especially women, require more protein-dense diets than do younger adults or children to meet both protein and energy requirements (1, 7). This is because basal metabolic rate (BMR), and hence energy requirement, decreases with age and is lower in women than in men at any level of physical activity. Thus, the protein requirement expressed in relation to the energy requirement (P:E requirement ratio) increases with age, especially in women, and elderly women are most vulnerable to any diet marginal in protein. Data from the National Health and Nutrition Examination Survey (NHANES) indicates an approximate prevalence of deficiency, ie, intakes below the Estimated Average Requirement for protein (1) of 5–6% for older men and women (8). Given the problem of underreporting, the true level of deficiency will be much lower than this. In the United Kingdom, the National Diet and Nutrition Survey of elders (≥65 y) (9), after the exclusion of unphysiologic recorded energy intakes (≤1.35 x predicted BMR, 66% of all surveyed), my analysis (unpublished data) indicates an average protein intake (adjusted to an ideal weight; 8) of 1.24 g · kg⁻¹ · d⁻¹, with no change with age within the cohort and an intake range (0.63–2.38; n = 467). This indicates a virtually zero prevalence of deficiency. Also, regression of protein on energy intakes indicates that energy intakes of 1.35, 1.7, and 2 x BMR would provide protein intakes of 1.15, 1.31, and 1.44 g · kg⁻¹ · d⁻¹. Notwithstanding the assumptions associated with such an analysis, it does appear that, at least in the

1 From the Division of Nutritional Sciences, Faculty of Health and Medical Sciences, University of Surrey, Guildford, Surrey, United Kingdom.

2 Reprints not available. Address correspondence to DJ Millward, Division of Nutritional Sciences, Faculty of Health and Medical Sciences, University of Surrey, Guildford, Surrey GU2 7XH, United Kingdom. E-mail: d.millward@surrey.ac.uk.

United Kingdom, protein intakes for those aged ≥65 y cannot be described as low by any standards.

Such intakes, if correct, are clearly not preventing sarcopenia and osteoporosis. However, no protein intake–related mechanism of sarcopenia has been identified, and any beneficial influence of protein on bone health (eg, through insulin-like growth factor I–mediated anabolic influences) has not been quantified (1). Although 1-[14C]leucine balance studies show that whole-body postprandial protein utilization is no different in elderly than in younger adults (10), a postprandial anabolic resistance to amino acids has been reported in the skeletal muscle of the elderly (11), which could account for sarcopenia. However, according to the work of Campbell et al (12), resistance exercise reverses sarcopenia at relatively low protein intakes (ie, safe level of 0.8 g \( \cdot \) kg\(^{-1} \cdot \) d\(^{-1} \)), and such training responses are not improved by higher protein intakes or influenced by protein quality (13). Indeed high levels of aerobic exercise have long been known not to prevent sarcopenia, even though they are, assumedly, accompanied by high food and hence protein intakes. My own highly speculative view is that sarcopenia results from reduced tension on muscle as bones slightly shorten with age.

Thus, the key to health and active longevity may be sufficient appropriate exercise and healthy eating to ensure adequate intakes of protein and most other key nutrients to maintain muscle and bone strength and mobility. The demand for animal protein will no doubt continue to grow in the emerging economies, because meat is a preferred food in most societies. How much protein is needed will certainly continue to be debated, but whether global demands can be met is another story (3).

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REFERENCES