



Introduction to Protein Summit 2007: Exploring the Impact of High-Quality Protein on Optimal Health¹⁻⁴

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Dietary protein recommendations have traditionally been based on preventing deficiency [ie, the Recommended Dietary Allowances (RDAs)] (1) as opposed to promoting optimal health (2). The RDA is defined as the amount of a particular nutrient that would satisfy the needs of almost all (98%) of the specified population. The RDA is not the requirement of an individual or even a mean for individuals, which has led to some misinterpretation. Rather, the RDA is the amount of the nutrient that is almost certain to be adequate for all individuals in a specified population, except those with the very highest requirement. Misinterpretation has also occurred because different sets of requirement values have been derived by other organizations and countries, which, although equivalent to those produced by the National Academies of the United States, have used different nomenclature (3). This nomenclature is illustrated in **Table 1**.

Determination of the requirement for a nutrient requires the identification of an index of adequacy that can be determined experimentally. In the case of protein, the approach that has been used by the various expert groups is to analyze the published literature describing studies of nitrogen balance at intakes above and below the estimated requirement in healthy subjects. The intake corresponding to zero nitrogen balance is taken as the average requirement (4). The 2 most recent reports, the Dietary Reference Intakes (United States/Canada) (1) and the United Nations (World Health Organization/Food and Agriculture Organization) (5), have extended the meta-analysis of all suitable published data on nitrogen balance at several nitrogen intakes by Rand et al (4). The estimated value for the RDA for all adults is $0.80 \text{ g protein} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$, whereas the estimated average requirement is $0.66 \text{ g protein} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$ (1, 4, 5).

Appropriate interpretation of these values is important. Whereas intakes equal to the estimated average requirement will only allow 50% of the population to achieve nitrogen balance, the RDA is the amount of protein intake that will enable protein balance to be achieved in almost all (98%) individuals. The main use of the RDA is for evaluating populations and the adequacy of food supply, not for assessing the adequacy of intake of the individual. This is an intake that is above the requirement for most individuals, which, therefore, will tend to allow the body protein (nitrogen) content to increase. The experimental data obtained in nitrogen balance studies for requirement show a linear relation between intake and balance, yielding positive balances at higher intakes than the requirement (4). This result has often been discounted as artifactual, because of limitations of the nitrogen balance technique. Nonetheless, although adults are expected to be in neutral balance, ie, not growing on average,

there is substantial literature documenting significantly positive nitrogen balances in subjects consuming protein intakes that are much higher than the requirement (1, 5, 6). This finding suggests the possibility that higher protein intakes might be associated with some benefit.

Research continues to reinforce the importance of higher protein intakes to various health outcomes such as weight management, diabetes, and cardiovascular disease. Further, results from emerging science based on newer, more sensitive methodologies, suggest the need to rethink the approach taken to derive recommendations for dietary protein (2). Protein Summit 2007: Exploring the Impact of High-Quality Protein on Health was a scientific meeting at which 52 internationally recognized experts in protein research convened to

- discuss the collective body of scientific evidence for the role of dietary protein in optimizing health for the adult populations;
- differentiate between the amount of dietary protein needed to meet minimal needs versus a recommended intake for optimal health, muscle maintenance, and disease prevention;
- consider whether the current body of science for protein is consistent with current dietary guidance and intake recommendations;
- identify areas of scientific agreement regarding the health benefits of dietary protein; as well as areas for further research;
- contemplate a contemporary directive regarding recommended quantity and quality of dietary protein intake as needed, given this group's collective understanding of emerging research in this area; and
- identify gaps that exist in the research to develop investigative initiatives that highlight the importance of protein in optimal health.

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TABLE 1
International nutrient requirement nomenclature¹

	USA	UN	UK	EU
Average	EAR	Average requirement	EAR	ARI
Average + 2SD	RDA	Safe level of intake	RNI	PRI
Average - 2SD	—	—	LRNI	LTI

¹ EAR, estimated average requirement, ARI, average requirement intake, RNI, reference nutrient intake, PRI, population reference intake, LRNI, reference nutrient intake, LTI, lower threshold intake.

During the Keynote presentation, Dr. Robert Wolfe provided an overview of key points central to the Summit, including the fact that protein, as a required nutrient, was not specifically addressed in deliberations associated with the 2005 Dietary Guidelines. It is well known that the current recommendations for protein intake are based primarily on data aimed to identify the minimal amount of protein needed to achieve nitrogen balance. Given the limitations of this classic methodology and the recent advances in our understanding of protein use based on more contemporary methods (ie, stable isotope methodology), a reevaluation of protein requirements in the context of optimal health is a worthwhile initiative.

The literature on the effects of higher dietary protein content has been reviewed by the International Dietary Energy Consultancy Group (6), by the World Health Organization/Food and Agriculture Organization (5), and by Millward (7) to assess the potential for both benefit and harm. The recent Dietary Reference Intake Panel also sought evidence for the upper level for protein intake (8). There appears to be an upper limit for the ability to oxidize protein and excrete the nitrogen as urea (9), which, in extreme cases (eg, intakes of 3–4 times the requirement), can lead to a wasting condition, described in past centuries as *rabbit starvation*, in people whose intake was limited to lean meat (10). However, there seems to be little evidence of harm with less extreme intakes in the context of the total diet. Indeed, the weight of evidence suggests either a benefit or no harm (5) with protein intakes of 3–4 times the requirement. Although high protein intakes have previously been cited as a causal factor in the age-related decline in renal function, bone calcium loss, kidney stones, cardiovascular disease, and cancer, on further examination these fears have in general proved not to be of concern (1, 5). An acceptable macronutrient distribution range (1) for protein in adults lies between the RDA and the upper limit associated with capability for urea synthesis (ie, 0.8–3.5 g · kg⁻¹ · d⁻¹).

Consumption of protein at levels in excess of the RDA, but still within the acceptable macronutrient distribution range, may confer benefits beyond simply the prevention of deficiency, such as reducing the risk of certain diseases (ie, obesity and diabetes) and delaying the onset or progression of muscle loss with aging (ie, sarcopenia). Indeed, the lower and upper levels of the present daily reference intakes—the RDA and acceptable macronutrient distribution range, respectively—represent a range of intakes as a percentage of total calories across the life span. Perhaps the goal of future dietary reference intakes should not be for populations to simply meet their needs to prevent protein deficiency but rather to achieve a level of protein intake to promote optimal health.

The Summit participants recognized that the science considered in the context of the Summit's objectives is not without controversy and acknowledged limitations to the scope of this

meeting. Therefore, participants were challenged to provide thoughtful discussion, provoking inquisition and constructive criticism of the aforementioned objectives for the purpose of advancing the science of protein nutrition and to move the thinking on protein forward to ensure that emerging research is accurately applied to future public health initiatives.

In preparation for Protein Summit 2007, the Steering Committee, along with 3 different working groups, reviewed and compiled the relevant published literature for the focus areas of the Summit. The resulting thought papers provided background, facilitated discussion, and served as a starting point for the group's work during the daylong workshop. The agenda consisted of 3 sessions: the role of protein in optimal health, minimum versus optimum protein intake, and the assessment of protein quality. A representative from each working group highlighted the major points of each review paper to set the framework for later discussion. A reaction panel followed each working group session to explore key insights, research needs, and unanswered questions as well as implications for population guidance. A question and answer session that involved all Summit participants and the respective working group members and panelists then ensued. Research and education needs specific to each area were identified through facilitated breakout sessions. At the end of the meeting, major points of consensus, insights for future research, and needs specific to education for the purpose of advancing protein nutrition in the context of future public health initiatives were presented by a representative of each breakout group.

This supplement reflects the thoughtful discussions, intellectual explorations, general consensus, and future directions for protein-specific targets as identified by the scientific community whose research represents various perspectives regarding the role of dietary protein in improving human health. The first paper addresses the common belief that Americans over consume protein by providing estimates of current protein intake for various populations based on recent National Health and Nutrition Examination Survey 2003–2004 data. Readers will note that one outcome of discussions at the Summit was the identification of a body of research specific to several chronic diseases and aging that warranted individual consideration. Therefore, this supplement provides comprehensive reviews of the potential for habitual consumption of protein intakes in excess of the RDA to be of benefit to weight management, sarcopenia, bone health, cardiovascular disease, and type 2 diabetes. Because various indispensable amino acids have garnered attention as nutrients involved in metabolic regulation, it is necessary to consider protein quality in discussions regarding the benefit of high protein intakes. Therefore, attention should also be focused on protein quality assessment in a more contemporary sense. The last paper presents areas of consensus and topics for future research that resulted from the Summit.

Protein Summit 2007 provided a unique opportunity for researchers from around the world with expertise in the area of human protein metabolism to meet the challenge set forth by the Steering Committee to establish a rationale for reevaluation of the current recommendations for protein intakes in light of existing science clearly documenting benefits of this essential nutrient. Summit participants exceeded expectations by generating a number of points of agreement to set the stage for future research initiatives that will enhance the understanding of the role of high-quality protein in the diet. It is important to note that this

meeting, the respective objectives and outcomes, and subsequently the contents of this supplement target the adult population. Therefore, it would be worthwhile to extend similar efforts to infants and young children, as well as pregnant and lactating women, in a future Protein Summit.

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