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Introduction to Protein Summit 2.0: continued exploration of the impact of high-quality protein on optimal health[1–4]

Nancy R Rodriguez

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In 2007, >40 nutrition researchers from the United States and around the world gathered for the first Protein Summit to discuss the role of protein in human health and to explore the misperception that Americans overconsume protein. This meeting was instrumental in shifting the conversation from one that focuses on meeting the current daily protein recommendation for adults to a more diverse dialogue on optimal protein needs for human health. Proceedings from the first summit were published as a supplement in the *American Journal of Clinical Nutrition* (1), and articles from the supplement have been downloaded >70,000 times. Since that time, the scientific literature has expanded with research indicating that higher protein intakes contribute to better diet quality, healthy weight management, improved body composition, and maintenance of or increased lean body mass for certain populations. The importance of these outcomes in the context of public health initiatives for general adult populations, active individuals, and aging adults, as well as continued research regarding the potential metabolic and health benefits of routinely consuming protein in excess of the current Recommended Dietary Allowance (RDA),[5] but well within the Acceptable Macronutrient Distribution Range (AMDR), provided the foundation for Protein Summit 2.0, which was held 2–3 October 2013 in Washington, DC.

More than 60 nutrition scientists, health experts, and nutrition educators joined the 8-member steering committee of Protein Summit 2.0 to consider dietary protein's role in

- weight management, including satiety and healthful diet adherence;
- metabolic activity, as well as its impact on renal function and bone health;
- healthy aging, including prevention of muscle loss and management of sarcopenia; and
- establishing a foundation to build healthier diets within energy (calorie) goals.

The meeting was organized to facilitate an interactive dialogue and to explore the unique opportunities for protein's role in human health, and to consider approaches to effectively enable Americans to optimize protein intake for improved health outcomes. Established and emerging protein researchers from 5 different countries, nutrition communicators, and key leaders in the nutrition community attended the meeting. Current evidence specific to the role of dietary protein in areas significant to health and longevity was presented and contemplated to advance the science and to manage the effective communication of respective protein recommendations to the consumer.

In brief, presentation of the scientific evidence in each of the first 3 aforementioned areas consisted of a panel of experts and a reaction panel of notable scientists and health professionals to encourage an intellectual exchange that probed the existing literature and challenged the summit's directives. Constructive criticism was invited, and various perspectives sought to strengthen the knowledge base, explore the research findings, and consider the implications. Furthermore, this component of the 2-d meeting was designed to ignite robust dialogue and generate new questions for future research.

The first day of Protein Summit 2.0 explored the unique opportunities for protein's role in human health and focused on how to help Americans optimize protein intake for improved health. In addition, ways to work with health care practitioners to effectively translate and apply the scientific findings to consumer lifestyles were addressed.

Day 2 of the meeting convened small groups of scientists, practitioners, and nutrition educators for each of the topic areas addressed during the first day of the meeting to distill the information presented, highlight specific points for further exploration, and thoughtfully consider the meeting's various discussions. This phase of the meeting resembled a workshop in which ample opportunity was provided for individual groups, as well as the assembly in total, to debate key points, align research

[1] From the Department of Nutritional Sciences, University of Connecticut, Storrs, CT.

[2] Protein Summit 2.0 was hosted by Purdue University, Ingestive Behavior Research Center; the University of Missouri, Department of Nutrition and Exercise Physiology and Nutritional Center for Health; and the Reynolds Institute on Aging and University of Arkansas for Medical Sciences.

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[4] Address correspondence to NR Rodriguez, Department of Nutritional Sciences, Unit 4017, 3624 Horsebarn Hill Road Extension, University of Connecticut, Storrs, CT 06269-4017. E-mail: nancy.rodriguez@uconn.edu.

[5] Abbreviations used: AI, Adequate Intake; AMDR, Acceptable Macronutrient Distribution Range; DRI, Dietary Reference Intake; EAR, Estimated Average Requirement; RDA, Recommended Dietary Allowance.

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and communication needs, along with other conclusions, and to generate this comprehensive summit proceedings.

A primary issue raised at the outset of Protein Summit 2.0 was the need for a clear understanding of the terminology and appropriate application of the Institute of Medicine's Dietary Reference Intakes (DRIs) for protein (2). Although >10 y have passed since the DRIs for protein were published (2), misunderstandings related to DRIs for nutrients continue to prevail (3). The DRIs are a quantitative set of nutrient intake values, which include the RDA, Estimated Average Requirement (EAR), Adequate Intake (AI), and Tolerable Upper Intake Level (2).

The RDA is "the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a particular life stage and gender group" (2). The RDA for protein, which is based primarily on nitrogen balance studies, is 0.8 g/kg body weight per day for adults aged 19 y and is established from the EAR for protein (0.66 g/kg body weight per day) plus a safety variance of >20%. The EAR is defined as "the average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group" (2). Scientists are calling for more research to better define the EAR and its variance and ultimately the RDA for protein. An AI is used when scientific evidence is insufficient to determine an EAR, and thus RDA; accordingly, there is no AI for protein. Nor is there a Tolerable Upper Intake Level, which is defined as "the highest average daily nutrient intake level that is likely to pose no risk of adverse health effects to almost all individuals in the general population" (2), for protein or any amino acids because of insufficient data. Intended applications of the DRIs include assessing nutrient inadequacies and planning nutrient intakes, with the RDA considered the appropriate benchmark for individuals, whereas the EAR is intended for groups (4).

The Institute of Medicine also established an AMDR for protein of 10–35% of energy for adults (2). This range is associated with a reduced risk of chronic diseases, while providing adequate intakes of essential nutrients. Although primarily for individuals, the AMDR can be used to assess a population's adherence to recommendations and to determine the proportion of the population that falls outside the AMDR range. For the purpose of Protein Summit 2.0 and the resulting translation piece for this supplement, the AMDR also provides a useful template for macronutrient distribution in diets designed for improved health and well-being.

The articles in this supplement highlight various perspectives on the interpretation of the research, including points of controversy and areas of consensus, challenges in conducting and evaluating the research, gaps in the science, and potential implications for supporting dietary guidance to increase adults' consumption of protein above the current RDA for specific health outcomes.

The overview on protein's role in weight management by Leidy et al. (5) addresses the modest beneficial effects of protein on diet-induced thermogenesis and resting energy expenditure; some of the behavioral and environmental factors influencing weight management; the importance of small changes in dietary protein intake on energy intake; short- (<12 wk) and long-term clinical studies of higher-protein, energy-reduced diets on weight loss and body composition; dietary protein's influence on satiety (a feeling of fullness); and how adherence to energy-reduced diets influences protein's effect on weight loss. Findings suggest that weight-loss diets containing higher protein (i.e., 1.2–1.6 g/kg body weight per day or 90–150 g) lead to modest, but relevant, improvements in body weight over the short term (≤12 wk) compared with standard-protein (higher-carbohydrate) diets.

Researchers point out that small changes in weight are often underappreciated, even though they are associated with beneficial health results. Dietary protein consistently increases satiety, but whether this is associated with a reduction in subsequent food (energy) intake is unresolved. Emerging research suggests that protein's beneficial effect on weight loss may depend on adherence to energy-reduced diets. Challenges, such as how to define a meal vs. a snack and how best to express protein intakes (e.g., g/kg body weight per day, g/d, percentage of daily energy intake), are identified. In addition, gaps in the science are acknowledged. Among questions raised are how to integrate the findings to increase protein intake into meaningful health messages, what barriers exist to increasing protein intake, and how a recommendation to consume more protein for weight loss will influence protein choices.

The review of protein's role in metabolic function by Layman et al. (6) suggests that daily protein intake to ~1–1.2 g/kg is beneficial for various metabolic functions. Support for this higher protein intake is derived from short-term studies with measurable outcomes and relates to muscle health (muscle protein synthesis and muscle mass, strength, and function). In addition to total protein, the amount of protein consumed at each meal throughout the day may favorably affect muscle protein synthesis and metabolic responses in muscle. Emerging science supports a protein intake for adults of 25–30 g/meal and ≥2.2 g of the essential amino acid leucine to achieve maximal muscle protein synthetic rates. Because physical activity enhances muscle protein synthesis, the researchers suggest that protein recommendations be linked to physical activity. Among the challenges identified are definitions of terms such as "high" and how best to express protein intakes for practical and clinical applications. Renal function and bone health outcomes in response to higher protein intakes are summarized. Gaps in the research include the number of meals per day when framing protein intakes on a per-meal basis and factors influencing the minimum threshold of leucine to trigger muscle protein synthesis.

In their article on protein's role in healthy aging, Paddon-Jones et al. (7) examine the hypothesis that the progression of sarcopenia (age-related muscle loss) may be slowed or prevented in older healthy adults who consume adequate amounts of high-quality protein at each meal in combination with physical activity or exercise. The science reviewed suggests that older adults' muscle is less responsive to lower amounts of protein and amino acids than that of younger adults. As a result, modestly higher intakes of high-quality protein (1.0–1.5 g/kg per day), evenly distributed throughout the day, may maximally stimulate muscle protein synthesis, thereby contributing to maintaining muscle mass in older adults. Future research is needed to determine protein and leucine thresholds, what causes anabolic resistance to low protein intakes in older adults, and who best benefits from various protein interventions or combinations of therapies (protein intake and exercise) to prevent or manage sarcopenia.

Researchers considered whether recommending higher protein intakes in middle-aged men and women may favorably affect muscle health over the long term. Other voids in the literature include assessment and evaluation of functional outcomes in older adults who habitually consume more protein in their diets and the challenge of increasing protein intake in this population given their lifestyle (e.g., low physical activity, small meals/snacking) and socioeconomic factors.

A common premise of the first Protein Summit and Protein Summit 2.0 is establishing protein as a foundation for healthier diets given the requisite energy intake for weight management: weight maintenance, weight loss, or weight gain. Phillips et al. (8) consider the contribution of food sources of protein commonly consumed, both animal- and plant-based, to nutrient intake (including nutrients that are underconsumed), nutrient adequacy, and diet quality without exceeding energy needs. If the basic concepts of the most recent assembly of experts in the field are embraced in an approach to improve the nutritional status of individuals, then it is critical to develop strategies that help individuals achieve diet plans that go beyond simply meeting the RDA (9). In this regard, practical considerations for increasing protein intake, as well as improving protein quality in the context of nutrient-dense foods to achieve nutritional adequacy and potentially reduce the risk of certain chronic diseases, will require creative thinking for consumer-friendly tactics that are practical and embedded in nutrition education efforts and public health initiatives.

Protein Summit 2.0 perpetuated the evaluation of and encouraged the debate focused on current recommendations for dietary protein consumption in the framework of recent scientific evidence. By implementing a format that involved panel discussants and respective reaction panels for the primary research areas of weight management, metabolic health, and aging, concepts and directives outlined in the original Protein Summit (1) were further developed. The meeting format elicited a productive intellectual exchange to identify potential evidence-based recommendations for dietary guidance, direct feasible educational outcomes and public health approaches, and further research efforts specific to dietary protein given the acknowledged limitations and newly generated questions.

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