

Nutrition Research Advances and Practice Innovations: The Future Is Very Bright

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THE HEALTHY EATING INDEX (HEI), A MEASURE OF overall dietary quality, allows researchers to assess, at a population level, compliance with the Dietary Guidelines for Americans (DGA) and the relationship between total diet quality and health outcomes. The 2015-2020 DGA¹ are the current, prevention-focused nutrition and health policies of the United States. The DGA provide direction to policymakers and professionals as they design and implement nutrition-related programs and initiatives and conduct research to protect and improve the health and well-being of the American public. As Congressionally mandated directives, the DGA have major influence on the nation's vast network of food programs, health care and nutrition services, and the research and educational activities overseen by the Department of Health and Human Services (DHHS) and the US Department of Agriculture (USDA). The DGA also have the potential to inform public health programming and professional practice at all levels where they influence the nutritional status and health of individuals, communities, and the entire population. Therefore, the DGA are an essential resource for nutrition and dietetics practitioners and others who seek to improve the nutrition-related well-being of individuals and communities they serve and attempt to reverse the prevalent diet-related problems of Americans.

DHHS and USDA federal officials formulated the 2015-2020 DGA using the Scientific Report of the 2015 Dietary Guidelines Advisory Committee (DGAC).^{2,3} To inform its research, the 2015 DGAC established a broad conceptual framework² based on the socioecologic model⁴ and applied it systematically to summarize current evidence on the following: major problems with food quality, safety, and sustainability; nutrition and related health priority areas; the multiple levels of influence on diet and other lifestyle behaviors; key relationships between dietary patterns, total diet quality, and health outcomes from childhood to adulthood; and effective

nutrition intervention methods to improve dietary and related lifestyle behaviors (particularly physical activity), reduce chronic disease risk, and enhance health outcomes at individual and population levels. USDA and DHHS officials translated the DGAC research findings and recommendations into the 2015-2020 DGA and laid out research-driven strategies to achieve each of the five cornerstone public policy guidelines: follow a healthy eating pattern across the life span; focus on variety, nutrient density, and amount; limit calories from added sugars and saturated fat and limit sodium; shift to healthier food and beverage choices; and support healthy eating patterns for all. The 2015-2020 DGA advance beyond earlier DGA editions in two major ways: by documenting the influence of the total diet, including its overall quality, patterns of food and beverage intake, and nutrient density, on health outcomes across the life span and by advocating for the design, implementation, and evaluation of innovative, research-driven, *personalized* preventive nutrition and lifestyle interventions that help Americans achieve healthy dietary patterns at individual and population levels. The 2015-2020 DGA are consistent with current expert clinical practice guidelines for the prevention and treatment of overweight and obesity, cardiovascular disease, and diabetes,⁵⁻⁹ which underscore the strength of evidence on the influence of nutrient-dense dietary patterns on major health outcomes and advocate for *personalized* nutrition and lifestyle interventions implemented by multidisciplinary teams of registered dietitian nutritionists, physicians, exercise physiologists, and behaviorists. Similarly, evidence-based nutrition and health policies are found today in many nations worldwide.¹⁰⁻¹² Registered dietitian nutritionists can confidently apply the 2015-2020 DGA in research, clinical, public health, and community settings and should strive to monitor their successes.

The trio of articles¹³⁻¹⁵ in this issue of the *Journal* present a key method, the HEI-2015, for assessing progress toward the 2015-2020 DGA food and nutrient recommendations. The HEI-2015 is a composite index of overall diet quality that uses the 2015-2020 DGA as its referent standard of nutrition-related excellence and healthy eating. In this highly coherent sequence of articles, the authors describe the development, evaluation, and applications of the HEI-2015. Each article is highly informative and clear, nearly suggesting in its elegance and clarity that research of this nature is easy to accomplish. To be sure, it is quite the contrary. This research is highly complex and challenging and to the great credit of these investigators, has been carried out thoroughly and successfully and elaborated on in detail for the benefit of the *Journal* audiences of researchers, public policy experts, and practicing professionals. The HEI has been updated every

5 years since 2005, in parallel with revisions to the DGA, which have been mandated since 1985 by Congress to inform US health and nutrition policy.¹⁻³ The importance of the HEI is evident, as Krebs-Smith and colleagues¹³ note, by its applications to almost 300 research and practice publications since it was first introduced by Kennedy and colleagues.¹⁶

The first article in this series¹³ (pp 1591-1602) outlines the steps taken to update the HEI-2010¹⁷ and prepare a HEI-2015 scoring system to reflect compliance with the 2015-2020 DGA food and nutrient recommendations. HEI-2015 contains 13 food and nutrient constituents (compared with 12 in HEI-2010). Each constituent of the scoring system represents a priority area of the 2015-2020 DGA and reflects the common characteristics of a healthy dietary patterns identified by the 2015 DGAC. This article describes each of the HEI-2015 constituent food and nutrient categories as well as its 100-point scoring system, including referent standards for each component of the total score. The HEI-2015 uses a density approach that assesses the relative intake of each dietary constituent. For most components, intakes are quantified in terms of calorie density (eg, cup equivalents per 1,000 kcal for fruit and vegetable intake or percent of energy from saturated fats or added sugars). An exception is the fatty acids component, which is measured as the ratio of polyunsaturated and monounsaturated fatty acids to saturated fatty acids. These methods for deriving HEI-2015 scores are key in that they allow its application and ease of use across many areas of research. The report also describes the rationale for equal weighting of each component of the scoring system and the steps to be taken to derive scores not only for the constituent categories of the index, but also for calculating the overall HEI score. A comparison is made between HEI-2015 and its predecessors HEI-2010 and HEI-2005.¹⁸ Methods are also presented for graphing HEI-2015 component scores using a radar graph approach that can be used to examine differing patterns or maps of dietary quality at different or similar overall HEI score levels. Graphs of this nature can provide a comparison of how the dietary intakes of one of more populations differ and how a group's intake shifts over time. The graphs are further designed to display how intakes of HEI constituents might vary, although the overall HEI-2015 score is identical or similar. The authors offer advice on how HEI scores and radar graphs can be interpreted and emphasize that it is particularly critical to use the numerical scoring system in surveillance and research activities. In addition, they present a descriptive method for interpreting HEI-2015 scores using a letter grading system. Grades A to D are assigned to the upper deciles of the score (90 to 100 gets an A, 80-89 gets a B, and so on) and F is assigned to an HEI-2015 score of 59 or below. The authors acknowledge that descriptive grading like this should never replace numerical scores and that if used, should be presented descriptively and only in combination with numerical HEI scores.

This author suggests that descriptive grading systems only be applied very carefully and further suggests, perhaps not at all. Letter grades can be misinterpreted and may discourage consumers, particularly when—as in the case of the US population—current levels of overall dietary quality would get very low grades. Indeed, the 2015 DGAC² estimated the mean US population HEI score (based on the 2010-HEI) to be 57 out of a total 100 points (ranging from a HEI score of 48 among

adolescents to 66 in adults aged 51 years and older). Reedy and colleagues¹⁴ peg the current population mean HEI-2015 score at 56.6 (63 and 55 in the oldest and youngest subgroups, respectively). The estimated scores of the mean overall dietary quality in the population and most of its subgroups would receive the lowest possible letter grades. In interpreting these estimates, this author believes it would be beneficial to consider positive, more research-driven approaches that follow the 2015 DGAC and 2015-2020 DGA recommendations. The current DGA¹ (and 2015 DGAC report²) calls for motivating consumer messaging, creative interventions that personalize healthy dietary pattern intervention strategies to better meet the health-related needs and personal preferences of an individual, and innovative approaches to establish healthy food environments that support the sustainable adoption of dietary patterns of high overall quality and nutrient density at community levels.

The article by Reedy and colleagues¹⁴ (pp 1622-1633) presents the methods and levels of testing carried out to establish the construct validity, reliability, and criterion validity of HEI-2015. Three levels of testing were accomplished. First, the scoring system was applied to a set of four exemplary menus that were based on dietary patterns known to be of relatively high overall quality, including USDA Food Patterns¹⁹; the National Heart, Lung, and Blood Institute Dietary Approaches to Stop Hypertension (DASH) diet²⁰; two sets of sample menus from Harvard Medical School Healthy Eating Pyramid²¹; and the American Heart Association 2005 No-Fad diet.²² Construct validity testing was performed by assessing the performance of the HEI-2015 scoring system in successfully characterizing the high quality of these healthy dietary patterns. The results demonstrated complete success. HEI-2015 scores for each of these healthy dietary patterns ranged from 87.8 to 100, indicating high overall dietary quality and the construct validity of the index. At the next level of testing, National Health and Nutrition Examination Survey 2011-2012 data were used to compare HEI-2015 scores across population subgroups to see whether meaningful differences could be detected as another measure of construct validity. Mean HEI-2015 scores and ranges demonstrated reasonable variation across the subgroups examined, including groups of individuals stratified by age, sex, and smoking status. Further testing with National Health and Nutrition Examination Survey data showed the multidimensionality of the HEI components and the internal consistency of the HEI-2015 score. As a final assessment of criterion validity, data sets from the National Institutes of Health-AARP Diet and Health Study were examined and showed that individuals in the highest quintiles of HEI-2015 scores had a 13% to 23% decreased risk of all-cause mortality, as well as cancer and cardiovascular disease mortality. Overall, these analyses provide sufficiently conclusive data to establish the reliability and validity of the HEI-2015 scoring system.

The article by Kirkpatrick and colleagues¹⁵ (pp 1603-1621) describes the history of the HEI further and examines potential applications of HEI-2015 in surveillance, epidemiology, community intervention, and clinical trial research. It also offers guidance for researchers on how to approach analysis and interpretation of HEI data. The complexity of food and nutrient databases employed in HEI analyses is acknowledged and the potential high intensity of statistical

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