

Dietary Guidelines in the 21st Century— a Time for Food

Dariusz Mozaffarian, MD, DrPH

David S. Ludwig, MD, PhD

THE DISCOVERY OF SPECIFIC DIETARY INSUFFICIENCIES as the cause of human disease played a central role in the development of modern nutritional science.

In 1753, one of the first clinical trials showed that citrus fruit could prevent scurvy in sailors, leading to the identification of vitamin C as essential for health. By the mid-20th century, protective effects of many nutrients for deficiency diseases had been shown, including thiamine (beriberi), niacin (pellagra), vitamin D (rickets), vitamin A (night blindness), iron (anemia), and iodine (goiter).

Early population-wide dietary guidelines therefore emphasized prevention of nutrient deficiencies. This emphasis assumed special urgency with the food shortages of the Great Depression and World War II, impelling the League of Nations, British Medical Association, and US Department of Agriculture to create new minimum requirements for calories, protein, calcium, phosphorus, iron, and various vitamins.¹ Consequently, the first recommended dietary allowances (RDAs) were formulated in 1941, establishing a scientific basis for modern dietary guidelines.² These efforts set a precedent, followed to this day, for the creation of guidelines by first considering nutrient targets and then translating these targets into food recommendations.

Dietary Guidelines in the Age of Chronic Disease

By the 1970s, the contribution of diet to the increasing burdens of cardiovascular disease, diabetes, obesity, and cancer was known. In response, the goals of dietary guidelines evolved to include prevention of not only nutrient deficiencies but also chronic diseases. For implementation, this new emphasis borrowed heavily from precedent. Accordingly, the Dietary Guidelines for Americans of 1980 remained primarily nutrient-focused, including advice to “avoid too much fat, saturated fat, cholesterol,” “eat foods with adequate starch and fiber,” “avoid too much sugar,” and “avoid too much sodium.” International guidelines were similarly nutrient-focused,³ and advances in nutritional science paralleled and reinforced emphasis on individual nutrients.

Despite its initial appeal, attempts to extend the nutrient deficiency–based approach for prevention of chronic diseases have been problematic. The RDAs are methodologically and conceptually inappropriate for this purpose,¹ necessitating formulation of other measures such as adequate

intakes and acceptable macronutrient distribution ranges. However, these newer nutrient-based metrics are hampered by imprecise definitions and inconsistent usage. Moreover, translation of nutrient-based targets to the public has proven difficult. Few individuals can accurately gauge daily consumption of calories, fats, cholesterol, fiber, or salt.

Nutritional science has advanced rapidly, and the evidence now demonstrates the major limitations of nutrient-based metrics for prevention of chronic disease. The proportion of total energy from fat appears largely unrelated to risk of cardiovascular disease, cancer, diabetes, or obesity.⁴⁻⁶ Saturated fat—targeted by nearly all nutrition-related professional organizations and governmental agencies—has little relation to heart disease within most prevailing dietary patterns.⁷ Typical recommendations to consume at least half of total energy as carbohydrate, a nutrient for which humans have no absolute requirement, conflate foods with widely divergent physiologic effects (eg, brown rice, white bread, apples). Foods are grouped based on protein content (chicken, fish, beans, nuts) despite demonstrably different health effects. With few exceptions (eg, omega-3 fats, *trans* fat, salt), individual compounds in isolation have small effects on chronic diseases.⁸ Thus, little of the information found on food labels’ “nutrition facts” panels provides useful guidance for selecting healthier foods to prevent chronic disease.

The Need for a New Approach

In contrast with discrete nutrients, specific foods and dietary patterns substantially affect chronic disease risk, as shown by controlled trials of risk factors and prospective cohorts of disease end points.⁹ Fruits, vegetables, whole grains, and nuts are consistently associated with lower risk of disease. Fish consumption reduces risk of cardiac mortality, belying categorization with other protein sources. Conversely, processed meats, packaged and fast foods, and sugar-sweetened beverages increase chronic disease risk. The effects of foods likely reflect complex, synergistic contributions from and interactions among food structure, preparation methods, fatty acid profile, carbohydrate quality (eg, glycemic index, fiber content), protein type, micronutrients, and phy-

Author Affiliations: Division of Cardiovascular Medicine and Channing Laboratory, Brigham and Women’s Hospital and Harvard Medical School (Drs Mozaffarian and Ludwig), Departments of Epidemiology (Dr Mozaffarian) and Nutrition (Drs Mozaffarian and Ludwig), Harvard School of Public Health, and Optimal Weight for Life Program, Children’s Hospital (Dr Ludwig), Boston, Massachusetts.

Corresponding Author: Dariusz Mozaffarian, MD, DrPH, 665 Huntington Ave, Bldg 2-319, Boston, MA 02115 (dmozaffa@hsph.harvard.edu).

tochemicals. Healthy eating patterns share many characteristics, emphasizing whole or minimally processed foods and vegetable oils, with few highly processed foods or sugary beverages. Such diets are also naturally lower in salt, *trans* fat, saturated fat, refined carbohydrates, and added sugars; are higher in unsaturated fats, fiber, antioxidants, minerals, and phytochemicals; and are more satiating. Thus, a focus on foods increases the likelihood of consuming more healthy nutrients and fewer calories and decreasing chronic disease risk, whereas the opposite has arguably occurred through decades of nutrient-focused guidelines.

The nutrient-based approach may foster dietary practices that defy common sense. Countless highly processed products are now marketed in which refined carbohydrate replaces fat, providing an aura of healthiness but without actual health benefits. School nutrition guidelines specify a minimum number of total calories but a maximum proportion of fat calories, and foods like gelatin desserts and sugar-sweetened low-fat milk have been used to achieve these nutrient targets. Based primarily on consideration of a few nutrients, a national obesity prevention program categorizes whole-milk yogurt and cheese with donuts and french fries as foods to eat occasionally; sautéed vegetables and tuna canned in vegetable oil with processed cheese spread and pretzels as foods to eat sometimes; and fresh fruits and vegetables with trimmed beef and fat-free mayonnaise as foods to eat almost anytime.¹⁰ Taking the nutrient approach to self-serving extremes, the food industry “fortifies” highly processed foods, like refined cereals and sugar-sweetened beverages, with selected micronutrients and recharacterizes them as nutritious. These marketing ploys provide little public health benefit and could potentially produce harm.⁸

Recently, dietary guidelines have begun to advocate fruits and vegetables based on evidence of their intrinsic health benefits rather than nutrient targets per se.^{2,3} Otherwise, the process of formulating dietary guidelines still principally begins with multiple nutrient targets and then attempts to translate these targets to food-based recommendations. A major shift is needed to novel, evidence-based strategies in which foods comprise the principal dietary targets.

A transition to food-based guidelines does not mean abandoning decades of nutritional science. Biological nutrient requirements should not be ignored but, rather, used to inform application of food-based guidelines, especially in special populations or regions with endemic food shortages or clinical nutrient deficiencies. Much also remains to be discovered regarding the biological effects of specific nutrients, alone and in combination, and such scientific research should continue.

The prevailing nutrient-focused approach has broad consequences, influencing food-labeling priorities, school lunch and low-income food assistance policies, industry and restaurant product formulations, and public perceptions of healthier vs unhealthy foods. This focus contributes to confusion, distracts from more effective strategies, and promotes marketing and consumption of processed products that nominally meet

selected nutrient cut points but undermine overall dietary quality. The relatively recent focus on nutrients parallels an increasing discrepancy between theory and practice: the greater the focus on nutrients, the less healthful foods have become. As national and international organizations update dietary guidelines, nutrient targets should largely be replaced by food-based targets. Such change would facilitate translation to the public, correspond with scientific advances in chronic disease prevention, mitigate industry manipulation, and remedy widespread misperceptions about what constitutes healthful diets.

Although this approach may seem radical, it actually represents a return to more traditional, time-tested ways of eating. Healthier food-based dietary patterns have existed for generations among some populations. Modern nutritional science now provides substantial evidence for how foods and food-based patterns affect health, guiding the design of more effective approaches for the prevention of chronic disease.

Financial Disclosures: Dr Mozaffarian reports receiving honoraria or travel reimbursement from the US Food and Drug Administration, World Health Organization, Food and Agricultural Organization of the United Nations, International Life Sciences Institute, Aramark, Unilever, SPRIM, and Nutrition Impact for speaking at scientific conferences and consulting on dietary topics; royalties from UpToDate; grants from GlaxoSmithKline, Sigma Tau, Pronova, and the National Institutes of Health for an investigator-initiated trial of fish oil; and grants from the National Institutes of Health for diet-related research and mentoring. Dr Ludwig reports receiving royalties from a book about childhood obesity and grants from foundations and the National Institutes of Health for obesity-related research, mentoring, and patient care.

Funding/Support: Dr Ludwig is supported in part by career award K24DK082730 from the National Institute of Diabetes and Digestive and Kidney Diseases.

Role of the Sponsors: The funding sources had no role in the preparation, review, or approval of the manuscript.

Disclaimer: The content of this Commentary is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Additional Contributions: We thank Walter Willett, MD, DrPH, Department of Nutrition, Harvard School Public Health, and Marion Nestle, PhD, MPH, Department of Nutrition, Food Studies, and Public Health, New York University, for their critical reading of an earlier version of the manuscript. Neither received compensation for their contributions.

REFERENCES

1. Harper AE. Evolution of recommended dietary allowances—new directions? *Annu Rev Nutr.* 1987;7:509-537.
2. US Department of Health and Human Services. Dietary guidelines for Americans. <http://www.health.gov/dietaryguidelines/>. Accessed April 21, 2010.
3. World Health Organization; Food and Agricultural Organization. *Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint WHO/FAO Expert Consultation (Report 916)*. Geneva, Switzerland: World Health Organization; 2003.
4. World Cancer Research Fund/American Institute for Cancer Research. *Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective*. Washington, DC: American Institute for Cancer Research; 2007.
5. Tinker LF, Bonds DE, Margolis KL, et al; Women's Health Initiative. Low-fat dietary pattern and risk of treated diabetes mellitus in postmenopausal women. *Arch Intern Med.* 2008;168(14):1500-1511.
6. Sacks FM, Bray GA, Carey VJ, et al. Comparison of weight-loss diets with different compositions of fat, protein, and carbohydrates. *N Engl J Med.* 2009;360(9):859-873.
7. Mozaffarian D, Micha R, Wallace S. Effects on coronary heart disease of increasing polyunsaturated fat in place of saturated fat. *PLoS Med.* 2010;7(3):e1000252.
8. Bjelakovic G, Nikolova D, Gluud LL, et al. Mortality in randomized trials of antioxidant supplements for primary and secondary prevention. *JAMA.* 2007;297(8):842-857.
9. Heidemann C, Schulze MB, Franco OH, et al. Dietary patterns and risk of mortality from cardiovascular disease, cancer, and all causes in a prospective cohort of women. *Circulation.* 2008;118(3):230-237.
10. National Heart, Lung, and Blood Institute. We Can! Ways to Enhance Children's Activity and Nutrition. <http://www.nhlbi.nih.gov/health/public/heart/obesity/wecan/downloads/go-slow-whoa.pdf>. Accessed April 30, 2010.