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Foods, Nutrients, and Health: As Modern Nutrition Science Evolves, When Will Our Policies Catch Up?

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In recent years, tremendous advances in nutrition science have upended many historical paradigms.¹ First, a large body of evidence has established the relevance of specific foods and overall dietary patterns, rather than isolated single nutrients (e.g., total fat, vitamin E), for cardiovascular and metabolic health.² Second, dietary habits are now known to influence diverse, complex molecular and physiologic pathways, making clear that their full health effects cannot be extrapolated from any single surrogate outcome (e.g. total cholesterol).¹ Third, for long-term risk of obesity, growing evidence indicates that food quality may be more relevant than calorie-counting: different foods have calorie-independent effects on complex modulators of long-term weight regulation including hunger, satiety, brain reward, metabolic responses, hepatic fat synthesis, adipocyte function, metabolic expenditure, and the microbiome.¹

Yet, as the science has moved away from oversimplified paradigms, our policies have not kept up. Many current priorities remain rooted in outdated notions (Table). For instance, whereas scientific advances have established the lack of health effects of reducing the total fat content of foods or overall diets, and the corresponding beneficial effects of healthy fats, ^{1–3} low-fat foods are often still encouraged, while fat-rich healthful foods are shunned. To address obesity, many policies focus on comparing and selecting foods based on calorie content, rather than modulating effects on long-term weight control, leading to paradoxical and detrimental decisions. Thus, whole milk is banned in US public schools, while chocolate skim milk is allowed. Nut-rich snack bars are censured for being too high in fat. Fat-free salad dressing – a contrived concoction of starch, sugar, and salt – is recommend over healthy, phenolic-rich vegetable oils. Why are these paradoxical policies and guidelines so common? With a bit of history, their origins become more clear.

Modern nutrition science is remarkably young. While several milestones could be selected, one reasonable birthdate is 1932, when the first vitamin, vitamin C, was isolated. In 1747, Captain James Lind had observed that citrus fruits might protect against scurvy.⁴ This led British sailors to add lemon and lime juice to their rations – and thus to their famous nickname: “Limeys.” Yet, many remained skeptical, and it was not until 1932, nearly 200 years later, that nutrition science could definitively document that vitamin C was scurvy’s cause – and cure.

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Over the next 2 decades, a convergence of scientific and geopolitical events amplified this initial focus on single-nutrient deficits. First, waves of research discoveries established the causes/cures of other major deficiency diseases: e.g., thiamine (beriberi), niacin (pellagra), vitamin A (night-blindness), vitamin D (rickets). At the same time, the Great Depression and World War II led to real and feared food shortages, greatly intensifying the concern for dietary deficits. Together, these events produced the first Recommended Dietary Allowances (RDAs), created during the 1941 “National Nutrition Conference on Defense” convened by President Franklin Roosevelt to prepare for war; and the first US national Food Guides (precursors to the Dietary Guidelines), the major focus of which was to minimize population deficiencies in selected vitamins and nutrients.^{5, 6}

It was not until the late 1970s – truly recent times – that major dietary guidelines and prevalent nutrition science began to seriously focus on chronic diseases, such as cardiovascular diseases, obesity, diabetes, and cancers.⁶ In a remarkably brief period, successes in agriculture, food processing, distribution, and fortification had largely conquered single-nutrient deficiencies in high-income nations. In their place, a growing epidemic of chronic diseases was recognized. Yet, after decades of focus on and success with curing deficiency diseases, single-nutrient paradigms dominated scientific and policy approaches. New research methods for studying chronic diseases – which by nature develop and manifest over years or decades – were in their infancy. Thus, scientists and policy makers were both accustomed to reductionist approaches and possessed comparatively limited evidence on diet and chronic diseases, e.g. from crude cross-national/ecologic comparisons, early animal experiments, and short-term studies of crude surrogate outcomes (e.g., total cholesterol), mostly in middle-aged men.

Together, these factors produced oversimplified conclusions. Scientists and policy makers intuitively followed earlier methods that had been successful in reducing deficiencies: identify the relevant nutrient, establish its target intake, and translate this as a simple message. Thus, saturated fat and dietary cholesterol were oversimplified as “the” causes of CHD; and total fat (and, more recently, total calories), as “the” cause of obesity. Accordingly, the 1980 Dietary Guidelines for Americans remained nutrient-focused: “avoid too much fat, saturated fat, and cholesterol; eat foods with adequate starch and fiber; avoid too much sugar; avoid too much sodium.”

Fortunately, as with other sciences, modern nutrition advanced rapidly. Remarkable progress occurred in research methodology, including delineation of the strengths, weaknesses, and appropriate interpretations of varied study designs and methods in nutrition.⁷ These methodologic advances were accompanied by, and contributed to, a tremendous increase in the scope of relevant evidence. A PubMed search for the terms “diet” and “cardiovascular” reveals 3,129 publications from 1961–1980, 9,809 from 1981–2000, and 27,284 from 2001–present. Respective values for diet and diabetes are 3,771, 10,324 and 32,287; and for diet and obesity, 3,894, 9,220 and 39,755. The growth in the quality and quantity of nutrition science has been staggering.

It is crucial for our nutrition policies and guidelines to catch up to this modern science. Some progress has been made. In 2013, the American Diabetes Association substantially

revised its dietary guidelines, focusing on food-based recommendations and minimizing or eliminating several macronutrient targets.⁸ In 2015, the Heart and Stroke Foundation of Canada determined that, “guided by nutrient claims, consumers may be choosing and over-consuming products that are less healthy” and shifted its guidance to emphasize greater intakes of minimally processed foods and fewer highly processed and highly refined foods, confectionaries, sugary drinks, processed meats, and snack foods.⁹ They removed any recommended target intake for saturated fat, concluding that, “there is emerging evidence to suggest that the health effects of saturated fat could vary depending on the food sources. ... While science continues to evolve, it is important to note that the overall quality of one’s diet, combined with the types, qualities and quantities of foods, have more impact on health than any single nutrient such as saturated fat.”

The report of the 2015 US Dietary Guidelines Advisory Committee also included substantial new emphasis on foods and dietary patterns, with much less focus on prior nutrient-based priorities such as total fat and dietary cholesterol.² Unfortunately, the report also retained some outdated nutrient emphases, such as on limiting total saturated fat (as opposed to guidelines based on the health effects of different food sources) and on prioritizing low-fat dairy (when growing evidence suggests whole-fat dairy may have similar or even greater health benefits¹⁰). Worse, in the government’s translation of this independent scientific advice to the final Dietary Guidelines, other scientifically sound recommendations were dropped. For instance, emphases to reduce refined starch, sugar, and processed red meat were replaced with industry-friendly statements about seeking a variety of foods, even sugary beverages and processed meats, as long as one’s diet remained within isolated nutrient targets.

Such reductionist, single-nutrient guidelines are generally not based on sound evidence, are confusing and impractical for the public, and invite industry manipulation and marketing of unhealthful foods. In some cases, focusing on nutrients can be helpful. For example, because the same food can be consumed with higher or lower levels of additives such as salt, trans fat, or excess added sugar, setting target levels for additives in guidelines and quality standards is important. Otherwise, to provide sound guidance, minimize confusion, and improve public health, our policies must shift away from isolated nutrients and simplistic surrogate outcomes toward foods and their complex, multi-layered molecular and physiologic effects. It is time for our nutrition policies and guidelines to catch up to the modern science.

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Table.

Selected Examples of Scientifically Outdated Dietary Policies and Priorities.

U.S. Dietary Guidelines	Extensive focus on “calorie control,” “low-fat”, “lean” choices
U.S. Affordable Care Act	Mandates labeling of total calorie values on restaurants menus nationwide
U.K. Front-of-Pack “Traffic Light” Label on Packaged Foods	Total calories and total fat are the first two items
U.S. Food and Drug Administration	Recently revised the Nutrition Facts panel to create even greater emphasis on total calories Sent a formal violation letter to nut-rich “Kind” bars for claiming healthfulness but being “high-fat” *
U.S. National School Lunch Program	Has banned whole milk, yet allows chocolate (sugar-sweetened) skim milk
National Institutes of Health Dietary Guidelines For Kids and Families	Recommends fat-free salad dressing, diet soda, trimmed beef Cautions against eggs, all vegetables with added fat, whole milk, tuna fish canned in oil, nuts
Recommended Dietary Allowances (RDAs)	RDAs for total fat and types of fat not updated since 122002, and thus not incorporating the tremendous new evidence published after 2000
Diabetes Prevention Program (DPP)	Major dietary emphases are eating fewer calories and reducing fat

* Following a recent petition by Kind, the FDA reversed its stance, concluding that, in light of evolving nutrition research, they need to redefine their definition of “healthy” and that, in the interim, Kind bars can continue to use words like “healthy” in their advertising. (<http://www.npr.org/sections/thesalt/2016/05/10/477514200/why-the-fda-is-reevaluating-the-nutty-definition-of-healthy-food>)

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