

Dietary patterns: from nutritional epidemiologic analysis to national guidelines^{1–3}

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Identifying the optimal diet (or diets) for chronic disease prevention is a public health priority. Traditionally, nutrition research has focused on single nutrients or specific foods, although individuals do not consume nutrients or foods in isolation. Thus, recent nutritional epidemiologic studies have shifted to dietary pattern analysis, which describes the overall diet; the foods, food groups, and nutrients included; their combination and variety; and the frequency and quantity with which they are habitually consumed (1). Among the most prominent methods to assess dietary patterns are a priori numerical indexes, which measure adherence to a dietary pattern that has been predefined on the basis of previous scientific evidence. Often, multiple indexes describe variations of the same dietary pattern (e.g., Mediterranean diet score) or use different scoring and weighting schemes, such as population-specific intakes [e.g., Dietary Approaches to Stop Hypertension (DASH)⁴] versus fixed cutoffs for recommended intakes (e.g., Alternate Healthy Eating Index). Another approach is to empirically derive common patterns of foods that tend to be consumed together by using principal components analysis or that explain the largest variation in intermediate outcomes such as biomarkers of diseases by using a statistical approach called reduced rank regression (2).

Despite different approaches to deriving dietary patterns, common elements—nutrients and foods—emerge over and over and are likely to be drivers of the observed effects. Yet, isolating these foods and nutrients may not provide a realistic picture of what people eat in combination and the impact on health: it is likely the cumulative and interactive effects of multiple components of diet that predict disease, and when one component of the diet changes, it is typically substituted by another. Not only do dietary patterns encompass the totality of a diet, they allow for multiple ways to achieve a healthy diet. Thus, public health guidelines and recommendations may be most easily translated into eating behaviors when described by the composite measure of diet quality encompassed in dietary patterns.

Although observational studies of dietary patterns and health outcomes are often cost-effective and allow for wider exposure ranges and longer follow-up in which clinical endpoints can be observed, testing the efficacy of dietary patterns through randomized controlled trials of intermediate endpoints provides a complementary evidence base. One approach is controlled intervention trials, in which all food is provided to participants over the course of weeks or months. These studies allow more precise definition of the dietary exposures tested. Prominent examples include the evaluation

of the effects of the DASH diet with and without sodium and a corresponding reduction in blood pressure (3, 4). The long-term benefit of such a dietary pattern is affirmed in large cohort studies showing that adherence to the DASH-style pattern is associated with decreased risk of cardiovascular disease (CVD) outcomes (5).

Long-term trials of dietary pattern interventions on hard endpoints are rare because of their prohibitive cost and lack of dietary compliance in the long run. One exception is the PREDIMED (Prevención con Dieta Mediterránea) trial (6), which included >7000 participants with CVD risk factors and which compared advice to follow a low-fat diet (control) with advice to follow a Mediterranean-style diet along with the provision of either olive oil or nuts. Compared with the control group, both intervention groups experienced an approximate 30% decrease in cardiovascular events after 4 y of follow-up. The results from this landmark trial, together with consistent observational evidence on higher Mediterranean diet scores and lower incidence of CVD in large cohorts (7), provide convincing evidence to support the health benefits of the Mediterranean diet in primary prevention of CVD.

As methods to assess dietary patterns are refined and the evidence base is strengthened, the advantages that dietary patterns offer as an approach for informing public health recommendations are increasingly being recognized. For example, the 2015 Dietary Guidelines Advisory Committee (DGAC) focused its evidence review and recommendations on healthful dietary patterns instead of individual nutrients or foods in its recently released scientific report (8). The DGAC noted remarkable consistency in the findings over a wide range of disease outcomes and across different dietary pattern assessment methods. Overall, the report identified that a “healthy dietary pattern is higher in vegetables, fruits, whole grains, low- or nonfat dairy, seafood, legumes, and nuts; moderate in alcohol (among adults); lower in red and

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⁴ Abbreviations used: CVD, cardiovascular disease; DASH, Dietary Approaches to Stop Hypertension; DGAC, Dietary Guidelines Advisory Committee; PREDIMED, Prevención con Dieta Mediterránea.

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processed meat; and low in sugar-sweetened foods and drinks and refined grains.” The healthy dietary pattern described by the DGAC is similar to current dietary recommendations in other countries, including the United Kingdom (9).

In this issue of the Journal, Reidlinger et al. (10) conducted a randomized trial to test the efficacy of the current United Kingdom dietary guidelines on biomarkers of CVD risk. The authors report clinically significant benefits on blood pressure and ratio of total to HDL cholesterol of a 12-wk dietary intervention when compared with a “traditional British” dietary pattern. Smaller beneficial effects on high-sensitivity C-reactive protein and body weight were also observed. The recommendations for intervention participants included reductions in sodium, saturated fat, and added sugars and increased consumption of oily fish, fruit and vegetables, and whole grains. Targets were achieved through dietitian advice and provision of low-saturated/*trans*-fat margarine, high-oleic-acid cooking oil, and other incentive foods such as brown rice, nuts, tinned fish, and whole-grain breakfast cereal. Adherence was assessed through diet records and biomarkers of intake.

In this study, control participants were also provided with supplemental foods such as a butter-based spread, palm oil-derived cooking oil, cookies, and refined breakfast cereal. Thus, control participants consumed new and additional sources of refined carbohydrate and *trans* and saturated fat characteristic of a traditional British diet. This difference in quality of fat and carbohydrate may have accounted, in part, for the primary benefits of the intervention diet on blood pressure and ratio of total to HDL cholesterol observed in this study. However, as the authors note, the greater consumption of saturated fats was the main difference from baseline in the control group. By contrast, in addition to improving the quality of dietary fat, at follow-up the intervention group also achieved higher protein and dietary fiber intakes, slightly higher potassium intake, and lower added sugar and sodium intakes. Although this was a short-term trial, the overall improvement in diet quality in the intervention group is likely to confer long-term benefits on CVD risk.

Given the similarities between the United Kingdom dietary guidelines and the recommendations from other countries, the results of this study provide relevant evidence to policy makers and health professionals both within and beyond the United Kingdom. The study represents an important step forward in dietary pattern research because few randomized trials have tested the effect of adherence to a diet consistent with national guidelines on CVD risk in a healthy population. In parallel, concerted efforts have been made to standardize dietary patterning methodology across various population-based cohorts, which have the advantage of examining long-term health outcomes (11). Establishing a robust evidence base for the di-

etary patterns described by national guidelines is essential to test the public health relevance of these guidelines. Not only do dietary guidelines provide science-based advice to promote health and reduce chronic diseases that are highly visible to the public but they also serve as an anchor point for national food and nutrition policies.

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