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Are dietary patterns useful for understanding the role of diet in chronic disease?[1,2]

Paul F Jacques and Katherine L Tucker

The application of epidemiologic methods to nutrition is fraught with complications because of the highly interrelated nature of dietary exposures. For this reason, it is often difficult to separate out the specific effects of nutrients or foods despite the common practice of examining the role of single nutrients or foods in relation to disease risk. For example, diets high in fiber tend to be high in vitamin C, folate, various carotenoids, magnesium, and potassium. So when we see associations between fiber and disease risk, can we be certain that the relation is not a consequence of folate or carotenoid intake? The use of foods or food groups might help to capture some of the complexity of diet that is often lost in nutrient-based analyses, but similar problems exist with foods. For example, whole-grain consumption is inversely associated with meat and positively associated with vegetable, fruit, and fish consumption. When we see that whole-grain intake is associated with lower disease risk, can we be certain that the association is not due to differences in red meat or fruit and vegetable consumption? Even if we choose to adjust for intakes of other nutrients or foods, our ability to accomplish the adjustment can be limited when these intakes are highly correlated.

Even more important might be the fact that by trying to parse the effect of components of a diet, one might miss associations between diet and disease because the effects of the individual components are examined against the background of average risk associated with other nutrients or foods. Adjustment for the other nutrients would provide little help in this case. Moreover, analyses of individual nutrients and foods often ignore the many potential interactions between components of a diet and disease risk; even if one wishes to consider such interactions, enormous sample sizes may be required to assess multiple interactions.

One might also argue from the perspective of public health that a nutrient- or food- based approach to examining disease risk might seem backward. Why not identify healthy eating patterns and then study the components of those diets? As is often stated by our colleagues in nutrition, "We don't eat nutrients, we eat foods." This statement can be amended to say that not only do we eat foods but we eat them in certain patterns. These patterns may be a consequence of our cultural and ethnic heritage and of many environmental factors, including the availability of foods, our ability to purchase and prepare foods, the numerous advertisements for foods, and, one hopes, the efforts of the government and the nutrition community to foster healthy diets.

In raising this issue we do not, in fact, propose a novel approach. The examination of dietary patterns and disease has been with us for some time (1) but has not received the same level of consideration that nutrient- and food-based analyses have. In this issue of the Journal, Fung et al (2) advance this approach by examining the relation between 2 dietary patterns, the so-called prudent and Western patterns, and biomarkers of cardiovascular disease risk. The 2 identified dietary patterns are fairly gross characterization of the diets in this cohort. Within the prudent dietary pattern there may be other identifiable dietary patterns that are more or less strongly associated with some of the biomarkers considered in this article. In addition, these observed patterns might not be readily transferred to other populations, although similar patterns were reported previously (3). Despite these potential limitations, this article is an important contribution not only because of its findings but also because it provides added evidence that dietary patterns can be strongly related to measures of health.

The dietary patterns used by Fung et al (2) are based on factor analysis. This data reduction method identifies independent vectors of variables in a correlation matrix and provides scores that allow individuals to be ranked in terms of how closely they conform to the total pattern. A strength of this approach is the ability to summarize behavior across several variables simultaneously into a small number of orthogonal variables. A limitation is the fact that results can be sample specific and strongly affected by subjective analytic decisions.

Other methods have also been used to relate dietary patterns and disease risk. An approach based on cluster analysis places individuals into different pattern groups, maximally separated in multidimensional space according to all variables entered. This approach can produce straightforward groupings with meaningful descriptions, which have been shown to relate to other health or behavioral indicators (4–6). Like factor analysis, however, this method has been criticized because results are dependent on the individual sample and on decisions about variable input formats.

Factor analysis and clustering approaches might work well within populations by identifying the major dietary patterns of a particular sample, but these patterns might not necessarily represent ideal diets. Moreover, we have little experience with

[1] From the Jean Mayer US Department of Agriculture, Human Nutrition Research Center on Aging at Tufts University, Boston.

[2] Reprints not available. Address correspondence to PF Jacques, JM-USDA HNRC at Tufts University, 711 Washington Street, Boston, MA 02111. E-mail: paul@hnrc.tufts.edu.

the stability of dietary patterns based on factor and cluster analysis across population groups. Although the population specificity and lack of stability of dietary patterns would make it difficult to compare results across studies, dietary patterns do reflect the actual practices in the population under study and as such provide useful information. Different groups do eat differently and it is not realistic, therefore, to expect methods like these to be tightly reproducible.

A third approach, which has long been used to classify and describe dietary patterns, involves the use of diet-quality scores based on recommended diets or dietary guidelines (1). A recent comprehensive index of diet quality is the healthy eating index, which combines multiple aspects of diet in relation to guidelines into a single score (7). Another index that predicted mortality in a large cancer study simply counts the number of recommended food groups included in individual diet patterns at least once per week (8).

There is still an important role in nutritional epidemiology for the study of individual nutrients and foods, but these analyses face many limitations. For example, despite extensive observational evidence that individual nutrients might be associated with disease risk, large randomized controlled trials focusing on individual nutrients have not been very successful in showing the hypothesized effects of those nutrients (9–12). However, the Dietary Approaches to Stop Hypertension (DASH) trial, which assessed the relation between modification of dietary patterns and hypertension (13), and the Lyon Diet Heart Study, which examined the effect of a Mediterranean-type diet on survival and cancer risk (14), showed strong effects of dietary modification. The use of dietary patterns should ultimately prove to be an informative and powerful means to augment our understanding of the role of diet in chronic disease. The state of that methodology is currently limited by the complexity inherent in dietary data. Further work to assess the power and stability of various approaches should improve the utility of these approaches. Their appropriate use should provide assurance that existing dietary recommendations do indeed have concrete health results and, in the process, may lead to new hypotheses.

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