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Defining dietary consumption: is the sum greater than its parts?

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The collection of dietary data has been viewed as a major challenge to nutritional epidemiologists. The analyses of these data are equally challenging. In this issue of the Journal, 3 methods were used to analyze dietary data: 2 focused on dietary patterns, and a third focused on a predefined healthy eating index. Each method looks beyond the single nutrient or food and attempts to capture the broader picture of diet that is hypothesized to discriminate between health and disease.

The idea that foods eaten together may be more important than any single food or nutrient is not new. The history of applying statistical methods to reduce dietary data into something more meaningful than isolated dietary components was introduced in 1982 by Schwerin et al (1) when food habits were examined with nutritional health. Nine years later, in 1991, Randall et al (2) suggested that dietary patterns might be associated with other high-risk health behaviors. In 1998, Slattery et al laid the foundation for current studies using factor analysis to define dietary patterns and assess those patterns with colon cancer (3) The question of interest was, “Can eating patterns characterize the diet-associated disease risk better than any one food or nutrient?” Since then, Hu and others (4–6) have applied the methods described by Slattery to a variety of health outcomes and almost universally came up with the same answer to the original question, yes they do.

The underlying concept of using dietary patterns is one of data reduction or consolidation into a meaningful representation of total dietary consumption that is easy to analyze and requires fewer comparisons than does examining an array of individual foods and nutrients. Exploratory factor analysis used in the article by Flood et al (7) is similar to previously reported factor analysis-generated dietary patterns. The basis for defining dietary patterns stems from the data themselves and is meant to describe the underlying dietary characteristics of the population being studied. Although earlier studies focused on dietary patterns derived from groups of similar foods, Flood et al used 181 foods in the analysis. The loading to the 3 major patterns reported were smaller than previously reported, most likely because of the number of foods entered. However, eating patterns reported by Flood et al were similar to those initial eating patterns proposed in 1998. Although the names of a given factor are arbitrary, similar findings suggest that a more Western-style diet, labeled as “meat and potatoes” in the study by Flood et al, increase the risk of colon cancer.

Whereas exploratory factor analysis is based on statistical methods using the data to define dietary characteristics of the population and then seeing whether these underlying dietary patterns are associated with health indicators, predefined “dietary patterns” as in the article by Nettleton et al (8) take a different approach. In the study by Nettleton et al, like the study by Gao et al (9), healthy dietary patterns or the healthy eating index are based on a

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predefined diet that is hypothesized as being beneficial for health. Diet diversity, the Healthy Eating Index, the Diet Quality Index, and the Dietary Guidelines for Americans are some of the predefined categorizations of diet quality assessed with health (10–12). These indexes are based on the literature and, although inconsistent, they suggest that certain foods should contribute to some aspects of health. The results of these approaches vary depending on the outcome being assessed. Indicators of diet quality may play an important role for some, but not all, health conditions.

What do dietary patterns and indicators of diet quality tell us from both a biological and a public health perspective? Dietary patterns and indicators of diet quality are methods of data reduction that let the investigator summarize diet in a broader manner than any single nutrient or food. This makes sense in that foods and nutrients are not eaten in isolation, and the isolated assessment of associations can be misleading, especially if consumption of similar foods really influence the biological processes. On the other hand, exploratory factor analysis that is used to define dietary patterns can help consolidate the data to identify important elements contained within the data. For instance, if a dietary pattern appears associated with an outcome, one can also ask whether a specific component of that dietary pattern influences risk. An example of this approach is dietary folate or *trans* fatty acids, which are associated with several diseases but are components of a prudent or Western-style dietary pattern. These nutrients have unique biological properties that may contribute to the disease association beyond that of the general pattern of food consumption. The public health message that comes from a dietary pattern or diet quality approach is often clearer and easier to follow than recommendations that stem from individual foods and nutrients. This is especially true when one considers the inconsistent associations reported for most foods and nutrients, despite seemingly consistent associations for dietary patterns.

In 1998, when we proposed the idea of applying exploratory factor analysis as a method to consolidate data for disease risk assessment, the utility of the method was unknown. As Martinez et al (13) noted in an invited Commentary in 1998, many crucial decisions are made by the investigator when deciding how to analyze dietary data, especially when using exploratory factor analysis. A major issue raised by Martinez et al was whether results could be reproduced using these statistical methods. Wade Hampton Frost characterized epidemiology in 1936 as “something more than the established fact” that “includes their orderly arrangement into chains of inference which extend more or less beyond the bounds of direct observation. Such as those chains are well and truly laid guide investigation to the facts of the future; those that are ill made fetter progress. But it is not easy, when divergent theories are presented, to distinguish immediately between those which are sound and those that are merely plausible.” In 1998 we stated that the utility of the method could only be determined by applications in the future. The assessment in 2008 is that it is plausible and it does help to guide investigations that improve our understanding of the associations between diet and disease.

REFERENCES

1. Schwerin HS, Stanton JL, Smith JL, Riley AM Jr, Brett BE. Food, eating habits, and health: a further examination of the relationship between food eating patterns and nutritional health. Am J Clin Nutr 1982;35(suppl):1319–25. [PubMed: 7081115]
2. Randall E, Marshall JR, Graham S, Brasure J. High-risk health behaviors associated with various dietary patterns. Nutr Cancer 1991;16(2):135–51. [PubMed: 1796009]
3. Slattery ML, Boucher KM, Caan BJ, Potter JD, Ma KN. Eating patterns and risk of colon cancer. Am J Epidemiol 1998;148(1):4–16. [PubMed: 9663397]
4. Terry P, Hu FB, Hansen H, Wolk A. Prospective study of major dietary patterns and colorectal cancer risk in women. Am J Epidemiol 2001;154(12):1143–9. [PubMed: 11744520]

5. Hu FB, Rimm EB, Stampfer MJ, Ascherio A, Spiegelman D, Willett WC. Prospective study of major dietary patterns and risk of coronary heart disease in men. Am J Clin Nutr 2000;72(4):912–21. [PubMed: 11010931]

6. Hu FB, Rimm E, Smith-Warner SA, et al. Reproducibility and validity of dietary patterns assessed with a food-frequency questionnaire. Am J Clin Nutr 1999;69(2):243–9. [PubMed: 9989687]

7. Flood A, Rastogi T, Wirfält E, et al. Dietary patterns as identified by factor analysis and colorectal cancer among middle-aged Americans. Am J Clin Nutr 2008;88:176–84. [PubMed: 18614739]

8. Nettleton JA, Schulze MB, Jiang R, Jenny NS, Burke GL, Jacobs DR Jr. A priori– defined dietary patterns and markers of cardiovascular disease risk in the Multi-Ethnic Study of Atherosclerosis (MESA). Am J Clin Nutr 2008;88:185–94. [PubMed: 18614740]

9. Gao SK, Beresford SAA, Frank LL, Schreiner PJ, Burke GL, Fitzpatrick AL. Modifications to the Healthy Eating Index and its ability to predict obesity: the Multi-Ethnic Study of Atherosclerosis. Am J Clin Nutr 2008;88:64–9. [PubMed: 18614725]

10. Drescher LS, Thiele S, Mensink GB. A new index to measure healthy food diversity better reflects a healthy diet than traditional measures. J Nutr 2007;137(3):647–51. [PubMed: 17311954]

11. Sorenson AW, Wyse BW, Wittwer AJ, Hansen RG. An Index of Nutritional Quality for a balanced diet. New help for an old problem. J Am Diet Assoc 1976;68(3):236–42. [PubMed: 55430]

12. Fogli-Cawley JJ, Dwyer JT, Saltzman E, et al. The 2005 Dietary Guidelines for Americans and risk of the metabolic syndrome. Am J Clin Nutr 2007;86(4):1193–201. [PubMed: 17921402]

13. Martinez ME, Marshall JR, Sechrest L. Invited commentary: factor analysis and the search for objectivity. Am J Epidemiol 1998;148(1):17–9. [PubMed: 9663398]