British Journal of Nutrition (2001), **85**, 133–134 DOI: 10.1079/BJN2000282

Invited commentary

Dietary patterns and mortality

Studies in human subjects are inherently more relevant to man than studies in animals or *in vitro* systems. This realisation has propelled epidemiology into the forefront of research concerning aetiology of diseases and even outcome. Since nutrition is the second, after infectious agents, most important exogenous cause in human nosology, nutritional epidemiology constitutes *de facto* one of the most important tools of aetiological research. Yet the maturation of this discipline has been slow, possibly because the exposure (diet) in nutritional epidemiological studies is extremely complex, covering several hundreds of foods and nutrients, not to mention additives and contaminants that may confound each other, as well as generate intricate interactions. Indeed, it was not until 1989 that the distinct methodological core of the discipline was defined (Willett, 1989, 1998).

Meanwhile, nutritional epidemiology has flourished notwithstanding some misdirected efforts or occasional mishaps. Several hundreds, perhaps thousands, of papers have explored the nutritional epidemiology of the most common diseases, including CHD (Willett, 1998) and several forms of cancer (Willett & Trichopoulos, 1996; World Cancer Research Fund and American Institute for Cancer Prevention, 1997). However, although very many studies have examined the association between food groups or nutrients on the one hand and specific diseases or total mortality on the other, very few investigations have focused on what is probably of most interest to most people: which dietary pattern maximises longevity.

There are several reasons that have long hindered the undertaking of such studies. One of them, perhaps minor, is the technical difficulty in undertaking case–control studies of late or early death, irrespective of the cause. Another, far more important, is the difficulty of assessing, or indeed defining, what is meant by a dietary exposure pattern. The task did not become easier when it was recognised that full interpretability of dietary intakes requires the simultaneous assessment of total energy intake (Willett & Stampfer, 1986).

Two general approaches have been used for the development of an overall descriptor of a dietary pattern. The first approach, so called '*a posteriori*', relies on the specific dietary data at hand. The other approach, so called '*a priori*' builds on previous knowledge concerning the favourable or adverse health effects of various dietary constituents. The main techniques used in the '*a posteriori*' approach is principal component analysis, which is strictly mathematical, and related factor analysis, which requires statistical modelling. The common objective of both techniques is to transform the original large set of correlated variables into a new smaller set of uncorrelated variables, which are called principal components or factors. These new variables are linear combinations of the original variables and are derived in decreasing order of importance, so that the first component accounts for as much as possible of the total variation in the original data, the second component accounts for as much as possible of the remaining variation, and so on. The fewer principal components that can be used to accommodate the available information and the clearer their biomedical meaning, the more successful the application of the technique. Details of these methods can be found in several statistical textbooks. They have been used in epidemiology by, among others, Gex-Fabry *et al.* (1988) for descriptive purposes, Prevost *et al.* (1997), to identify correlates of the principal dietary components, Hu *et al.* (1999) for validation purposes, and Kumagai *et al.* (1999) to evaluate the association of food intake pattern with all-cause mortality.

The '*a priori*' approach focuses on the calculation of a graded score, the maximum (or minimum) value of which describes, as well as possible, the ideal diet as conceptualised on the basis of the best available scientific evidence. This scientific evidence may be derived from studies concerning food groups, individual food items, or even nutrients, in relation to individual diseases, weighted by the population frequency of the latter. It may also rely on the ecological evidence emerging from the study of various dietary cultures that appear to protect against, or enhance, premature morbidity and mortality. These two alternative ways of calculating the *a priori* score have been termed respectively the 'bottom-up' and 'top-down' procedures and they can complement each other or lead to very similar results (Trichopoulos *et al.* 2000). The former procedure was used in the late 1980s by Nube *et al.* (1987), whereas the latter was introduced in the mid 1990s by Trichopoulou *et al.* (1995), who have been among the early advocates of the Mediterranean diet (Helsing & Trichopoulou, 1989).

Both the *a posteriori* and the *a priori* approaches have strengths and weaknesses. In the former, the decision about the set of principal components or factors that will be used to describe a dietary pattern does not rely on generally agreed criteria. Variable, and maybe equally well-justified, decisions may lead to different numbers of principal components or factors, and it is not impossible for an investigator to be biased towards the set of principal components that is more compatible with his or her scientific beliefs. The calculation of a score following the *a priori* approach is also fraught with uncertainties and difficulties, including the inability to define cut-off points for high consumption *v.* low consumption of the foods or food groups incorporated in the score. On the other hand, the *a priori* method is more amenable to Popperian refutation that underlies contemporary epidemiology (Buck, 1976), whereas the *a posteriori* approach appears more open to data-derived hypotheses.

It is clear that the health effects of overall dietary patterns are of paramount importance in nutritional epidemiology and that there is no simple way to adequately harvest the dietary exposure information in an epidemiological investigation. The study by Osler *et al.* (2000) is important for several reasons, the most prominent of which are its prospective cohort design, its reliance on well-organised health information systems and the fact that dietary pattern assessment was done, for the first time, by both a predefined healthy food index and two data-derived patterns, the prudent and the western. The fact that the healthy food index and the prudent pattern have generated mutually compatible results, suggestive of increased protection with increased consumption, adds confidence to current dietary recommendations. On the other hand, the surprising lack of a statistically significant association of the Western dietary pattern with mortality may indicate that, in this population this pattern is important mainly to the extent that it can reduce the consumption of more beneficial foods. At a time when there is high demand for evidence-based medicine, it is comforting to know that sound data support many of our dietary recommendations.

Dimitrios Trichopoulos
Harvard School of Public Health
Boston, MA
USA
Pagona Lagiou
Department of Hygiene and Epidemiology
University of Athens Medical School
Athens
Greece

References

Buck C (1976) Popper's philosophy for epidemiologists. *International Journal of Epidemiology* **5**, 97–98.

Gex-Fabry M, Raymond L & Jeanneret O (1988) Multivariate analysis of dietary patterns in 939 Swiss adults: sociodemographic parameters and alcohol consumption profiles. *International Journal of Epidemiology* **17**, 548–555.

Helsing E and Trichopoulou A (editors) (1989) The Mediterranean diet and food culture: a symposium. *European Journal of Clinical Nutrition* **43**, Suppl. 2, 1–92.

Hu FB, Rimm E, Smith-Warner SA, Feskanich D, Stampfer MJ, Ascherio A, Sampson L & Willett WC (1999) Reproducibility and validity of dietary patterns assessed with a food-frequency questionnaire. *American Journal of Clinical Nutrition* **69**, 243–249.

Kumagai S, Shibata H, Watanabe S, Suzuki T & Haga H (1999) Effect of food intake pattern on all-cause mortality in the community elderly: a 7-year longitudinal study. *Journal of Nutrition Health Aging* **3**, 29–33.

Nube M, Kok FJ, Vandenbroucke JP, van der Heide-Wessel C & van der Heide RM (1987) Scoring of prudent dietary habits and its relation to 25-year survival. *Journal of the American Dietetic Association* **87**, 171–175.

Osler M, Heitmann BL, Gerdes LU, Jorgensen LM & Schroll M (2000) Dietary patterns and mortality in Danish men and women: prospective observational study. *British Journal of Nutrition* **85**, 219–225.

Prevost AT, Whichelow MJ & Cox BD (1997) Longitudinal dietary changes between 1984–5 and 1991–2 in British adults: association with socio-demographic, lifestyle and health factors. *British Journal of Nutrition* **78**, 873–888.

Trichopoulos D, Lagiou P & Trichopoulou A (2000) Evidence based nutrition. *Asia Pacific Journal of Clinical Nutrition* (In the Press).

Trichopoulou A, Kouris-Blazos A, Walhqvist ML, Gnardellis Ch, Lagiou P, Polychronopoulos E, Vassilakou T, Lipworth L & Trichopoulos D (1995) Diet and overall survival in elderly people. *British Medical Journal* **311**, 1457–1460.

Willett W (1989) *Nutritional Epidemiology*, 1st ed. New York, NY: Oxford University Press..

Willett W (1998) *Nutritional Epidemiology*, 2nd ed. New York, NY: Oxford University Press..

Willett W & Stampfer MJ (1986) Total energy intake: implications for epidemiologic analyses. *American Journal of Epidemiology* **124**, 17–27.

Willett WC & Trichopoulos D (1996) Nutrition and cancer: A summary of the evidence. *Cancer Causes Control* **7**, 178–180.

World Cancer Research Fund and American Institute for Cancer Prevention (1997) Food. In *Nutrition and the Prevention of Cancer: A Global Perspective*. Washington, DC: World Cancer Research Fund and American Institute for Cancer Prevention.