

Invited Commentary

Dietary patterns: the importance of sex differences

(First published online 3 January 2012)

Diet is an important, modifiable risk factor for many chronic diseases. It is notoriously difficult to measure accurately and observational studies have shown contradictory evidence. These conflicting results are primarily due to the complexities of the diet, the considerable inter-correlations between nutrients and the biological interactions between them. Dietary patterns obtained using principal components analysis (PCA) are a potential means of overcoming the inherent problems of assessing individual foods and nutrients by taking advantage of these inter-correlations to reduce a complex data set into a smaller number of variables representing underlying dietary patterns in the population. While not a replacement for existing methods, dietary patterns are now being accepted as a complementary means of evaluating the relationship between diet and disease.

PCA is by far the most popular method of obtaining dietary patterns employed to date⁽¹⁾ and many studies have been published that derived dietary patterns in adults using this approach. Despite this, few researchers have paid attention to any potential differences in the dietary patterns obtained according to sex. This is surprising given the well-documented differences in disease risk that exist between men and women⁽²⁾ and the different nutritional requirements of the sexes⁽³⁾.

There are conflicting results in the literature regarding differences in dietary patterns and sex. Many studies have reported no differences in dietary patterns between men and women⁽⁴⁾. On the other hand, a number of studies have reported significant differences in dietary pattern scores according to sex. However, on the whole, these studies did not consider that different dietary patterns may exist in the two sexes^(4–6). In addition, the majority of these studies were based on samples from the general population and the men and women under investigation were not necessarily a part of a family unit or cohabiting. It is quite conceivable that differences exist in the dietary patterns obtained between men and women, regardless of living in the same household. Two studies have reported dietary patterns obtained separately in men and women^(7,8). The study by McNaughton *et al.*⁽⁸⁾ reported similar patterns in men and women from the 1946 British birth cohort, although there were slight differences in the order in which the patterns were extracted and the foods loading most highly associated with each pattern. Mishra *et al.*⁽⁷⁾ reported similar patterns in men and women, but also a number of sex differences in their study

of 6680 Australian adults. However, this study obtained fifteen different dietary patterns in men and fifteen in women; with this number of patterns, it is more likely that differences would be evident. Neither of these studies made any direct comparison between sexes in terms of the strength of the relationships between the dietary patterns.

We recently reported that similar, but not identical, dietary patterns were obtained in a sample of mothers and their partners from the Avon Longitudinal Study of Parents and Children (ALSPAC), a large UK birth cohort study⁽⁹⁾. Additionally, in the patterns that were quantitatively similar, we reported high correlations between scores. In line with these results, the study by Lioret *et al.*⁽¹⁰⁾ published in this issue of the *British Journal of Nutrition* examines the dietary patterns in a sample of first-time parents. Importantly, the study highlights the differences in those patterns between mothers and fathers. The study collected data from a sample of 454 Australian mother–father pairs taking part in the Melbourne Infant Feeding Activity and Nutrition Trial (InFANT) Program. For each set of parents, four dietary patterns were obtained, and subtle qualitative differences were found across the board. In both mothers and fathers, two patterns were given the same label based on the foods that loaded highly on them: ‘High-energy and snack and processed foods’ and ‘High-fat foods’. One additional pattern was identified in each group: ‘Cereals and sweets’ in the mothers and ‘Potatoes and vegetables’ in the fathers. Substantial overlap existed in the remaining mothers’ ‘Fruits and vegetables’ pattern and fathers’ ‘Fruits’ pattern. As highlighted by Lioret *et al.*⁽¹⁰⁾ it is interesting that both our study⁽⁹⁾ and theirs identified a pattern that loaded highly on vegetables and potatoes (the ‘traditional’ pattern in ALSPAC and the ‘Potatoes and vegetables’ in the InFANT program). Most notably, this difference was evident only in men. These food groups were associated with the ‘Fruits and vegetables’ pattern in women in the Australian study and with the ‘Health conscious’ pattern in the women in ALSPAC. Again, in line with the ALSPAC study, Lioret *et al.* report that the patterns that were qualitatively similar showed strong correlations between men and women.

It is perhaps not surprising that high correlations were evident between quantitatively similar patterns for men and women in these studies. Traditionally, women are the decision makers regarding household nutrition and literally put the food on the table for their family. With this in mind, similar studies of the general population examining men or women

who were not in partnership would potentially show greater differences in their underlying dietary patterns.

Studies of individual foods and/or nutrients have often failed to provide conclusive evidence of causality, primarily due to the interactions that exist between them, which cannot be readily accounted for in any statistical analysis. Exploiting dietary pattern methodologies to the full could help to unravel the complex relationships between the foods we ingest and the myriad of health outcomes experienced. The paper by Loiret *et al.* adds to the evidence to suggest that it is important that researchers consider the differences in dietary patterns between the sexes, and not just in the scores calculated from the PCA but the patterns themselves and the foods that are associated with them. This is particularly important when looking within a family setting and more specifically when examining the influences of parental lifestyle on the health and well-being of their children. Further work within ALSPAC, the InFANT program and other relevant cohorts will help to elicit the effects of maternal and paternal dietary patterns on children's eating behaviours and future health status. Regardless of the family unit, given the differences in disease risk between the sexes, it would be prudent to consider men and women individually when examining the effects of dietary patterns on disease risk.

Given the albeit subtle differences that appear to be apparent in men's dietary patterns compared to women's when using the data reduction technique of PCA, public health messages may need to be sex-targeted in order to best promote more healthy dietary patterns.

I declare no conflict of interest.

Kate Northstone
University of Bristol
Bristol BS8 2BN

UK
email kate.northstone@bristol.ac.uk

References

1. Northstone K (2008) Dietary patterns obtained using principal components analysis in the mothers and children from the Avon Longitudinal Study of Parents and Children. PhD Thesis, University of Bristol.
2. Barrett-Connor E (1997) Sex differences in coronary heart disease. Why are women so superior? The 1995 Ancel Keys Lecture. *Circulation* **95**, 252–264.
3. Department of Health (1991) *Dietary Reference Values for Food Energy and Nutrients in the United Kingdom*. London: HMSO.
4. Newby PK, Muller D, Hallfrisch J, *et al.* (2004) Food patterns measured by factor analysis and anthropometric changes in adults. *Am J Clin Nutr* **80**, 504–513.
5. Beaudry M, Galibois I & Chaumette P (1998) Dietary patterns of adults in Quebec and their nutritional adequacy. *Can J Pub Health* **89**, 347–351.
6. Costacou T, Bamia C, Ferrari P, *et al.* (2003) Tracing the Mediterranean diet through principal components and cluster analyses in the Greek population. *Eur J Clin Nutr* **57**, 1378–1385.
7. Mishra G, Ball K, Arbuckle J, *et al.* (2002) Dietary patterns of Australian adults and their association with socioeconomic status: results from the 1995 National Nutrition Survey. *Eur J Clin Nutr* **56**, 687–693.
8. McNaughton SA, Mishra GD, Branwell G, *et al.* (2005) Comparability of dietary patterns assessed by multiple dietary assessments: results from the 1946 British Birth Cohort. *Eur J Clin Nutr* **59**, 341–352.
9. Northstone K & Emmett P (2010) Dietary patterns of men in ALSPAC: associations with socio-demographic and lifestyle characteristics, nutrient intakes and comparison with women's dietary patterns. *Eur J Clin Nutr* **64**, 978–986.
10. Lioret S, McNaughton SA, Crawford D, *et al.* (2011) Parents' dietary patterns are significantly correlated: findings from the Melbourne Infant Feeding Activity and Nutrition Trial (InFANT) Program. *Br J Nutr* **108**, 518–526.