Letters to the Editors

The effects of sugar-beet fibre and wheat bran on iron and zinc absorption in rats

The dietary habits and patterns of Third World countries imposed on them by economic and financial constraints have now been acclaimed as being universally beneficial (Cannon, 1990). Thus the World Health Organization (1990) stated that the health needs of the population are best met by a high carbohydrate – low fat diet, rich in starchy foods (e.g. cereals, tubers and pulses) including a substantial intake of vegetables and fruits. A daily fibre intake of 30 g/d has also been recommended (World Health Organization, 1990). It is important that the negative aspects of this eating habit are considered along with the recommendations. This is particularly necessary because of the mineral imbalances characteristic of the people who have, over the years, subsisted on such diets (Hercberg *et al.* 1987). It was therefore pertinent to read the article entitled 'The effects of sugar-beet fibre and wheat bran on iron and zinc absorption in rats' by Fairweather-Tait & Wright (1990). The authors reported that the addition of 1 g sugar-beet fibre (Beta fibre) to 3 g semi-synthetic diet resulted in a 54% increase in Fe and a 39% increase in Zn absorption in rats. I quite agree with the feeding of the semi-synthetic diet to the rats for 2 weeks before the introduction of the test diet, as it has been demonstrated that the Fe contents of previous diets do influence Fe absorption from test diets (Fairweather-Tait & Wright, 1984). However, I feel strongly that the $FeSO_4.7H_2O$ component of the semi-synthetic diet should be excluded in the formulation of the test diets. Hence, the semi-synthetic diet contributed 34 and 42% of the total Fe in the Beta fibre and wheat bran diets respectively. These values are significant and therefore make the interpretation of the results difficult, particularly because the total non-haem Fe in the diet forms a common pool in the gastrointestinal tract in which there is complete isotopic exchange of Fe (Bjorn-Rasmussen *et al.* 1973). It is quite difficult to envisage the proportion of the test Fe that is absorbed. Apart from the low phytate level in Beta fibre, the various carbohydrate components could in fact be enhancing the $FeSO_4.7H_2O$ fraction of the test diet. I presume the interaction in the gut of the food components will be more complex than when the test diet provides the only source of Fe. Since the Beta fibre has a naturally high level of Fe, i.e. 326 μg/g, would it not be appropriate to determine the availability of this Fe source alone? Perhaps it could even be fed as a component of a standard typical breakfast meal. What do the authors think about the practice of substituting test food items in semi-synthetic meals with reference to human diets? Couldn't the test meals be administered to the rats, as is done in human ^{59}Fe availability studies? I agree with the authors that the preliminary results should be interpreted with caution in the application to man.

G. O. LATUNDE-DADA
Department of Biochemistry,
Obafemi Aurolowo College of Health Sciences,
Ogun State University,
Ago-Iuroye, Nigeria

Bjorn-Rasmussen, E., Hallberg, L. & Walker, R. B. (1973). Food iron absorption in man. II. Isotopic exchange of iron between labeled foods and between a food and an iron salt. *American Journal of Clinical Nutrition* **26**, 1311–1319.

Cannon, G. (1990). *Healthy Eating: The Experts Agree.* London: Consumers' Association.

Fairweather-Tait, S. J. & Wright, A. J. A. (1984). The influence of previous iron intake on the estimation of bioavailability of Fe from a test meal given to rats. *British Journal of Nutrition* **51**, 185–191.

Fairweather-Tait, S. J. & Wright, A. J. A. (1990). The effects of sugar-beet fibre and wheat bran on iron and zinc absorption in rats. *British Journal of Nutrition* **64**, 547–552.
Hercberg, S., Galan, P. & Dupin, H. (1987). Iron deficiency in Africa. *World Review of Nutrition and Dietetics* **54**, 201–236.
World Health Organization (1990). *Diet, nutrition and prevention of chronic diseases: Implications for policy and action in developed and developing countries.* Geneva: WHO.

Reply from Fairweather-Tait and Wright

We thank Dr Latunde-Dada for her interest in our paper. From the outset we should have perhaps made it clearer that the aim of our preliminary study was to look at possible differences in iron and zinc bioavailability from a meal to which a fibre supplement had been added, either as wheat bran or a newly marketed source of sugar-beet fibre. We were not attempting to measure the bioavailability of Fe and Zn in either wheat bran or sugar-beet fibre alone. Rather, we were interested in the effects that these fibre supplements would have on dietary mineral bioavailability. Dr Latunde-Dada feels strongly that the $FeSO_4.7H_2O$ component in the semi-synthetic diet should be excluded in the formulation of the test diets. We see the problem in a different light, namely the unfortunate fact that both fibre preparations contained significant amounts of associated Fe or Zn which necessitated the modification of the mineral content of control diets. Though Dr Latunde-Dada is obviously correct in claiming that it is 'quite difficult' to envisage the proportion of 'test iron' absorbed ('test iron', from her perspective, being Fe solely from the fibre source) she would no doubt concede that our conclusion that sugar-beet fibre appears positively to promote Fe (and Zn) absorption is valid. Her letter reiterates the concept that Fe from both semisynthetic diet and fibre source would form a 'common pool' in the gastro-intestinal tract in which there would be complete isotopic exchange of Fe with the extrinsic ^{59}Fe radiolabel. Since the size of the Fe pools for control and fibre-supplemented groups were similar, any differences in Fe absorption in the fibre-supplemented groups, relative to controls, reflect the effects or otherwise of the additional fibre source. We must admit that the positive effect of the sugar-beet fibre surprised us, as we thought that, at best, it would have no effect at all. Since the commercial preparation of sugar-beet fibre contains an associated high level of Fe, we would not disagree with Dr Latunde-Dada's suggestion that the availability of the associated Fe *per se* should be investigated, nor with her view that the various carbohydrate components could be enhancing Fe absorption from any common Fe pool.

Dr Latunde-Dada asks about the practice of substituting test food items in semi-synthetic meals with reference to human diets. Since humans and rats have different eating patterns and likes and dislikes for certain foods, it is difficult to simulate accurately the human situation. Having said that, we take the view that the rat is a good model for initial studies, but that wherever possible these should be extended to include isotopic or long-term feeding studies in humans. Apart from the simplicity, speed and control of initially using the rat model, it makes ethical sense to have some idea of the potential effects of any new food component before undertaking studies in humans.

SUSAN J. FAIRWEATHER-TAIT AND ANTHONY J. A. WRIGHT
Department of Nutrition, Diet and Health,
AFRC Institute of Food Research,
Norwich NR4 7UA

Issues relating to nutrient analysis

Analysis of dietary intake data has been greatly simplified by the development of microcomputer-based nutrient analysis systems. However, many attendant problems need to be resolved. There are several reports that differences among nutrient databases exist, even when the same data source is used, and that such intra-database variability has led to significant differences in both macro- and micro-nutrient analyses yielded by such systems (Frank *et al.* 1984; Shanklin *et al.* 1985; Nieman & Nieman, 1987). In theory, there should be no differences between nutrient analysis systems if programs follow nutritional principles and a nutrient database with a common data source is used. However at present, nutrient databases can be easily modified and are usually user-expandable. Thus, discrepancies among databases with a common source may arise from the use of different updating practices (e.g. timing of updates), sources of supplemental data (private, industrial or government), assumptions about the effect of storage/preparation on the nutrient composition of foods, and from the use of different estimates of nutrient composition when analytical data were unavailable or non-existent: random data entry errors may also contribute to differences (Shanklin *et al.* 1985; Eck *et al.* 1988). Intra-database variability may complicate attempts to compare dietary intake data even when analyses are performed by systems sharing a common original database. It is, therefore, important to demonstrate consistency and comparability between nutrient analysis systems (programs and databases) before nutrient results from different studies can be compared with confidence.

A possible way to eliminate intra- and inter-nutrient database variability is to instigate a quality control (QC) system in which all users of nutrient analysis systems could participate. To this end, the development of a British nutrient analysis program appraisal system, similar to the diagnostic model developed by Hoover & Perloff (1981) in the United States, would be warranted. That system was designed to review systematically the contents and performance of nutrient analyses programs (Hoover & Perloff, 1983). The establishment and use of such a system would have several advantages, e.g. users of nutrient analysis systems would be able to (1) verify the performance of their systems against a standard reference system; (2) detect and correct system errors before embarking on large-scale and costly analyses, and (3) have confidence in the standard of their analyses before submitting data for publication. Furthermore, the instigation of such a QC program would be a step towards ensuring that published nutrient intake data were comparable.

An opportunity to establish a nutrient analysis QC program has arisen by the development of the UK National Nutrient Databank, the computer files of which are maintained by the Royal Society of Chemistry (RSC). The updates of McCance and Widdowson's original data for microcomputer-based nutrient analysis systems, which are available from the RSC, are protected; i.e. amendment of the data in line with later published updates is not permitted. By strict adherence to this regulation, the reliability and validity of dietary intake assessments would be improved considerably, ensuring that at least the core nutrient data of individuals using the RSC database was similar. The situation would be further enhanced if it were mandatory to submit details of all additions to the RSC database to a regulatory body before such changes could be implemented. Such a body would be in the position to document each new addition according to a standard criterion and perhaps ascribe a quality index and/or a confidence code to the data (Stewart, 1983; Southgate & Greenfield, 1988). The registration of submitted data in this manner would facilitate the establishment of a reliable referencing system. The collection of data at one centre would also expedite the acquisition and interchange of high-quality food

composition data, and would eliminate (for individual users) the time-consuming process of finding and evaluating dietary data. More importantly, it would help ensure that differences between results obtained during nutrition surveys are real and not due to idiosyncrasies of the nutrient analysis programs/database systems used.

At present, there appear to be no standard criteria for referencing nutrient analysis systems. Indeed, no guidelines are given in the Directions to Contributors section of the *British Journal of Nutrition* for the proper referencing of such nutrient analysis systems. On examination of recent papers dealing with nutritional surveys (*BJN*, vol. 61, no. 1, 1989; vol. 64, no. 1, 1990 inc.), this lack of a consistent referencing system was evident. In general, omission of the name and version of the nutrient analysis program used or the use of unpublished programs is not uncommon. When it is stated that 'computerized composition data based on tables from *McCance and Widdowson's The Composition of Foods* (Paul & Southgate, 1978) were used', may one assume that the nutrient data had not been modified in any way by the authors? Many authors do, commendably, reference the source of supplementary data. However, when 'unpublished results' are referenced as a source of nutrient information, how can the validity of the resulting analyses be determined? Perhaps it is time that the rigorous standards expected of all scientific methods should also be applied to nutrient analysis methodology. The adoption of a standard referencing procedure is urgently needed, with the minimum information required being: (1) name, version and publication data of the nutritional analysis program used; (2) source(s) of the database nutrient information, and (3) full details of modifications made to the existing nutrient information and of additions made to the database. This will not resolve all problems but, in the short-term, would go some way to allowing readers to judge the quality and validity of nutrient data.

COLETTE SHORT
Human Nutrition Unit
Rowett Research Institute
Aberdeen AB2 9SB

Eck, L. H., Klesges, R. C., Hanson, C. L., Baranowski, T. & Henske, J. (1988). A comparison of four commonly used nutrient database programs. *Journal of the American Dietetic Association* **88**, 602–604.
Frank, G. C., Farris, R. P. & Berenson, G. S. (1984). Comparison of dietary intake by two computerized analysis systems. *Journal of the American Dietetic Association* **84**, 818–819.
Hoover, L. W. & Perloff, B. P. (1981). *Model for Review of Nutrient Data Base System Capabilities*. Columbia: University of Columbia–Missouri Printing Services.
Hoover, L. W. & Perloff, B. P. (1983). Computerized nutrient data bases: II. Development of model for appraisal of nutrient data base system capabilities. *Journal of the American Dietetic Association* **82**, 506–508.
Nieman, D. C. & Nieman, C. N. (1987). A comparative study of two microcomputer nutrient databases with the USDA Nutrient Data Base for Standard Reference. *Journal of the American Dietetic Association* **87**, 930–932.
Paul, A. A. & Southgate, D. A. T. (1978). *McCance & Widdowson's The Composition of Foods*, 4th Edition, London: H.M. Stationery Office.
Shanklin, D., Endres, J. M. & Sawicki, M. (1985). A comparative study of two nutrient data bases. *Journal of the American Dietetic Association* **85**, 308–313.
Southgate, D. A. T. & Greenfield, H. (1988). Guidelines for the production, management and use of food composition data: an Infoods project. *Food Sciences and Nutrition* **42F**, 15–23.
Stewart, K. K. (1983). The state of food composition data: an overview with some suggestions. *Food and Nutrition Bulletin* **5**, 30–39.

This letter was the one referred to in the Editorial in the *British Journal of Nutrition* (1991), **65**, 93–94.