

# Potential micronutrient deficiency lacks recognition in diabetes

Over the last two decades, an additional 'tool' to measure nutrient intake has been introduced by the UK Government. This is the ground-breaking National Diet and Nutrition Survey (NDNS),<sup>1</sup> which has revealed widespread risk of micronutrient deficiency. For each NDNS, about 2000 people are selected at random from postal codes to reflect the age, sex, income, and geographical distribution of the UK population. Responders are asked to record and weigh everything they eat for a week and daily intakes of nutrients are calculated from food composition tables. The first survey, published in 1990, was of adults (19–64 years of age). This was so successful that it was followed by surveys of children aged 1.5–4.5 years (1995), adults aged 65 years and over (1998), young people aged 4–18 years (2000), and a second adult survey (2003).

The daily dietary target intakes for vitamins and minerals used by the NDNS are the RNIs (Reference Nutrient Intake).<sup>2</sup> RNIs are set for the following groups of the UK population: males and females who were subdivided by age, and females subdivided by pregnancy and lactation. Other than age, no account is taken of body size or ethnicity in setting micronutrient targets. Biological variability determines that nutrient requirements will vary between individuals within each human group (for example, adult men or adult women). To account for this variation, the group RNI for each nutrient is set as the mean physiological requirement of the group plus two standard deviations. This value covers the requirements of 97.5% of a group population. However, individuals with nutrient requirements below the RNI are rarely identified because routine laboratory tests for most nutrients are not readily available. Therefore, as intakes of vitamins and minerals marginally in excess of physiological requirements pose no hazard to health, the RNI is used in practice as the target daily intake for the individual.

Daily nutrient targets are, at best, only approximate estimates when applied to individuals. Targets such as RNIs are derived

in clinical studies from measurements of the physiological requirements of representative individuals of a human group. However, the individuals studied are healthy people, which adds uncertainty to RNI predictions of nutrient requirements under disease conditions.

While mean intakes of nutrients published in the NDNS reports were, with a few notable exceptions, above the RNI, large numbers of individuals failed to achieve them. Examples are many, but typically, and throughout the lifecycle, more women failed than men and there was a high failure rate among older people for a range of nutrients, including zinc (approximately 60% failure), calcium (30% failure in women), and folic acid (51% for women and 25% for men). Furthermore, plasma vitamin D showed 'frank' deficiency for >35% of older people in institutions. Teenage females showed the greatest RNI failure: for example, calcium (76%), magnesium (97%), zinc (72%), and folate (52%). All human groups are at risk of nutrient deficit to some degree. For example, the average intake of selenium — a nutrient important for proper immune function — is only 50% of the RNI in the UK.<sup>3</sup>

Although a 'healthy' diet is theoretically capable of providing adequate amounts of all the nutrients humans need, in reality many people fail to meet the requirements. Even when eating a 'healthy' diet, lack of exercise can be a limiting factor, because energy intake needs to be commensurate with energy expenditure to avoid obesity. The continuing decline in energy intake in the UK since World War II is of great concern to nutritionists. According to the National Food Survey,<sup>4</sup> average energy intake since the year 2000 is only 60% of that in the 1960s, with comparable reductions in calcium and iron intakes. A low food intake combined with suboptimal eating patterns jeopardises micronutrient intake, therefore widening the gap between intake and requirements.

Positive trial outcomes of multinutrient supplementation on slowing cognitive decline and reducing risk of heart disease, stroke, and colon cancer have prompted

leading researchers to favour dietary supplementation. Thus, the Harvard Medical School's 'prudent' diet to prevent chronic disease recommends, a daily multinutrient supplement for 'most people'.<sup>5</sup> In an extensive review on the health benefits of micronutrients published in *JAMA*, the authors concluded that a daily multinutrient supplement would be a wise choice for most adults.<sup>6</sup> However, no dietary supplement should be used as an excuse for poor food choice: in particular, no supplement can replace the health benefits of a diet abundant in phytochemicals, such as flavonoids provided by fruit and vegetables. These components are highly antioxidant, capable of reducing inflammation and reducing the risk of chronic disease, according to clinical studies.

It is important to remember that RNIs are set for healthy individuals, and nutrient requirements are likely to be higher in disease, including diabetes. There is evidence that people with diabetes are prone to low magnesium status<sup>7</sup> and clinical trial data suggest that magnesium supplementation may improve glycaemic control.<sup>8</sup> People with diabetes may also be deficient in zinc,<sup>9</sup> a mineral with multiple roles in insulin homeostasis. Chromium is also undersupplied by the modern diet and supplements of the trace element can improve glycaemic control in diabetes.<sup>10</sup>

Some medications used to treat diabetes can increase nutrient requirements. For example, metformin can increase the risk of vitamin B12 deficiency.<sup>11</sup> In our hawthorn study<sup>12</sup> the volunteers with diabetes fared better nutritionally than participants in the 2003 NDNS;<sup>1</sup> however, many failed to achieve the RNI for one or more nutrients: 71% failed to reach recommended intakes for vitamin D, 46% for selenium, 29% for iodine, 27% for vitamins A and E, and 16% for magnesium. The possibility of multinutrient deficit is largely overlooked in diabetic care, even though clinical studies indicate that good nutrient status may slow the progress of the disease. Further information on the effects of nutrient

deficit on diabetic control from a GP perspective can be found in *Natural Approaches to Diabetes*.<sup>13</sup>

Despite the evidence of widespread nutrient deficiency among individuals with diabetes,<sup>14</sup> and the knowledge that several nutrients are implicated in glycaemic control, no multinutrient intervention studies for diabetic control have been undertaken. Only one multinutrient supplement study on diabetic subjects has been reported and this showed a reduced rate of infection.<sup>15</sup> That the intervention in this study enhanced diabetic patient outcome may hopefully inspire others to undertake multinutrient intervention studies aimed at investigating effects on glycaemic and lipaemic control in diabetes.

The less that people eat as a consequence of a sedentary lifestyle, the more inadequate nutrient intake becomes and the greater the risk of deficiency. Furthermore, if the diet is low in fruit and vegetables, wholegrains, oily fish, and/or dairy products, intakes of some nutrients are bound to be lower than target values, posing a challenge to health. This is especially so among individuals with high nutrient requirements, such as those with diabetes. Although still considered to be controversial by some, taking a daily

multinutrient supplement would bridge the gap between intake and requirements and ensure that nutrient target intakes are met.

#### Ann F Walker

Senior Lecturer in Human Nutrition,  
University of Reading

#### REFERENCES

- 1 Department of Health, NDNS (National Diet and Nutrition Survey). *People aged 65 years and over. Young people aged 4 to 18 years. Adults aged 19 to 64 years*. London: The Stationery Office, 1998, 2000, 2003.
- 2 Department of Health. *Dietary reference values for food energy and nutrients for the UK. Report on Health and Social Subjects No 41*. London: Stationery Office, 1991.
- 3 Jackson MJ, Broome CS, McArdle F. Marginal dietary selenium intakes in the UK: are there functional consequences? *J Nutr* 2003; **133**(5 Suppl 1): 1557S–1559S.
- 4 NFS data: National Food Survey. <http://statistics.defra.gov.uk/esg/publications/nfs/dataset/nutshist.xls> (accessed 29 Nov 2006).
- 5 Willett WC, Skerrett PJ. *Eat, drink and be healthy: the Harvard Medical School guide to healthy eating*. London: Simon & Schuster, 2004.
- 6 Fairfield KM, Fletcher RH. Vitamins for chronic disease prevention in adults: scientific review. *JAMA* 2002; **288**(14): 1720.
- 7 Tosiello L. Hypomagnesemia and diabetes mellitus: a review of clinical implications. *Arch Intern Med* 1996; **156**(11): 1143–1148.
- 8 Rodriguez-Moran M, Guerrero-Romero F. Oral magnesium supplementation improves insulin sensitivity and metabolic control in type 2 diabetic subjects: a randomised double-blind controlled trial. *Diabetes Care* 2003; **26**(4): 1147–1152.
- 9 Schmidt LE, Arfken CL, Heins JM. Evaluation of nutrient intake in subjects with non-insulin-dependent

diabetes mellitus. *J Am Diet Assoc* 1994; **94**(7): 773–774.

- 10 Anderson RA, Cheng N, Bryden NA, *et al*. Elevated intakes of supplemental chromium improve glucose and insulin variables in individuals with type 2 diabetes. *Diabetes* 1997; **46**(11): 1786–1791.
- 11 Adams JE, Clark JS, Ireland JT, *et al*. Malabsorption of vitamin B12 and intrinsic factor secretion during biguanide therapy. *Diabetologia* 1983; **24**(1): 16–18.
- 12 Walker AF, Marakis G, Simpson E, *et al*. Hypotensive effects of hawthorn for patients with diabetes taking prescription drugs: a randomised controlled trial. *Br J Gen Pract* 2006; **56**(527): 437–443.
- 13 Brewer S. *Natural approaches to diabetes*. London: Piatkus Books, 2005.
- 14 Matteucci E, Passera S, Mariotti M, *et al*. Dietary habits and nutritional biomarkers in Italian type 1 diabetes families: evidence of unhealthy diet and combined vitamin-deficient intakes. *Eur J Clin Nutr* 2005; **59**(1): 114–122.
- 15 Barringer TA, Kirk JK, Santaniello AC, *et al*. Effect of a multivitamin and mineral supplement on infection and quality of life. A randomised, double-blind, placebo-controlled trial. *Ann Intern Med* 2003; **138**(5): 365–371.

#### ADDRESS FOR CORRESPONDENCE

##### Ann F Walker

Senior Lecturer in Human Nutrition,  
Hugh Sinclair Unit of Human Nutrition,  
School of Chemistry, Food Biosciences  
and Pharmacy, University of Reading,  
PO Box 226, Reading, RG6 2AP.  
E-mail: a.f.walker@reading.ac.uk

## Malaria in the UK: new prevention guidelines for UK travellers

Malaria is a major disease worldwide, with around 300 million cases and 1 million deaths annually.<sup>1</sup> The transmission of malaria is diminishing in some countries, such as the Indian subcontinent, probably due to a combination of better living conditions, education, urbanisation, and better water management which reduce the numbers of mosquito vectors. In Africa, transmission remains at a high level. The effectiveness of drugs locally-used for treatment, such as pyrimethamine plus sulphadoxine (Fansidar® [Roche]) is now so significantly reduced that the UK guidelines

no longer recommend this drug for emergency standby treatment.<sup>2</sup> Artemisinin drugs are widely used for treatment in Africa but have not been investigated for use as prophylactic drugs. Only one artemisinin combination drug (co-artemether; Riamet® [Novartis]) is licensed in European countries, but is not for prophylactic use. A small proportion of *Plasmodium vivax* parasites in Indonesia, and occasionally in East Africa, have shown evidence of resistance to chloroquine.<sup>3</sup> This is rare, and does not alter the recommendations for prophylaxis in the guidelines.

Malaria is the most common tropical infection imported into the UK, with around 1500 to 2000 notified cases each year.<sup>2</sup> However, informal surveys conducted by the Malaria Reference Laboratory and by Infectious and Tropical Diseases Centres suggest that notified cases represent only about half of all diagnosed cases. Between nine and 15 deaths from malaria occur each year, but the numbers recovering from severe or life-threatening malaria are unknown.

While a minority of cases occur in visitors from overseas, almost 60% of reported