VULNERABLE VITAMINS IN THE UK DIET

Michèle Sadler
BSc PhD RPHNutr
Consultant
Nutritionist
Rank Nutrition Ltd

In 2008, The Scientific Advisory Committee on Nutrition (SACN) reported that, despite evidence of positive changes in the British diet, there were a number of areas of dietary concern (1). Based on the findings of the National Diet and Nutrition Survey (NDNS), these included evidence of low intakes and status for a number of vitamins among certain population groups.

Assessed as the proportion of each age group with intakes below the lower reference nutrient intake (LRNI), which is only sufficient for the 2.5% of the population with the lowest requirements, the nutrients of concern highlighted in the report were vitamin A (for children and adults), riboflavin (for adolescents, younger men and adult women) and folate (for female adolescents and older adults).

LATEST NDNS SURVEY DATA FOR VITAMINS

Since 2008, the format of the NDNS has changed to a continuous cross-sectional survey for people aged 1.5 years and over, and the current methodology is based on a four-day dietary diary with estimated weights for the quantities eaten. This is in contrast to the previous surveys that were based on a seven-day weighed dietary diary.

The latest data set covers a three-year period (2008/9-2010/11) and includes data for over 3,000 adults and children (2). What do the latest data from the rolling programme tell us about the UK population's vitamin intakes and is there still any cause for concern?

Comparing average daily intakes against the reference nutrient intake (RNI) shows that intakes of most vitamins are close to or above 100 percent of the RNI for all age and sex groups, except for vitamin D. However, this does not provide much information about inadequate intakes. The method used to assess this in the UK is to compare the proportion whose average intake is below the LRNI.

Against this measure, it is clear that the previous areas of concern still remain to be addressed (Table 1), with vitamins A and D, riboflavin and folate remaining the most vulnerable vitamins in the UK diet. Thirteen percent of adolescents (11 to 18 years) had vitamin A intakes (from food sources only) below the LRNI, 21 percent of adolescent girls (11 to 18 years) and 12 percent of women (19 to 64 years) had riboflavin intakes below the LRNI and six percent of adolescent girls had folate intakes below the LRNI. While the proportion of adults taking at least one dietary supplement during the four-day recording period was 23 percent (19 to 64 years) and 39 percent aged 65+ years, inclusion of vitamin intakes from dietary supplements had little effect on the proportion with intakes below the LRNI.

NDNS NUTRIENT STATUS DATA

Intake data does not give information about functional or clinical deficiency - this can only be determined from biochemical indicators and functional markers. The NDNS survey (2) collects blood status indicators for vitamins C, B1, B2, B6, B12, A (retinol and carotenoids), D and E. For certain nutrients, however, there is a debate as to which markers are the best indicators and where the cut-offs should be set, which influences estimates of the proportion of the population with low or adequate status.

Michèle provides nutrition consultancy services to the food industry. She has a BSC in Nutrition (University of London), a PhD in Biochemistry and Nutritional Toxicology (University of Surrey), and is a Registered Nutritionist.

The latest NDNS data (2) provides evidence of low vitamin D status in adults (19 to 64 years) and adolescents (11 to 18 years). The proportion with 25-OHD concentrations below the lower threshold of adequacy (25nmol/L) for vitamin D adequacy was 20 percent of adolescents (11 to 18 years) and 18 percent of adults (19 to 64 years). This clearly has implications for bone health and potentially for immune status. There is, however, a debate as to whether the cut-off for inadequate vitamin D status should be set at a higher level and hence the number of people with insufficient vitamin D status may be underestimated by the current measure.

In addition, a high proportion of adolescents and adults have erythrocyte glutathione reductase activation co-efficient (EGRAC) values that are above the upper threshold (1.30) for normal riboflavin status. In this case, there is a debate as to whether the cut-off is set too low, such that the number of people with inadequate status may be overestimated.

The measurement of markers for other vitamins gave little cause for concern, including for vitamin A.

EUROPEAN DATA

An assessment of European intake data for eight Member States (Belgium, Denmark, France, Germany, the Netherlands, Poland, Spain and the UK), compared with UK and Nordic nutrition recommendations, also suggests that vitamins A, riboflavin and D are vulnerable vitamins for certain population groups in various of these countries, along with vitamin E (3). Overall, this study highlighted that, except for vitamin D, current intakes of vitamins from foods contributes little risk of low intakes in all age and gender groups, but the analysis provides information about the likelihood of inadequacy country by country and for particular subgroups of the population.

ASSESSING THE RISK OF INADEQUATE INTAKES

Assessing the risk of inadequate intakes will be dependent on the accuracy of the intake measurement. Dietary intake data is notoriously open to inaccuracies, for example, due to inaccurate recording, inaccurate assessment of the quantity eaten, changing the typical diet by virtue of having to keep a record and under-reporting. Though the NDNS is now based on a four-day inventory

with estimated weights, it still remains one of the most robust surveys of its type.

The risk of inadequate intakes is also dependent on the accuracy of the assessment of dietary requirements, in this case the UK dietary reference values (DRVs). The current UK DRVs were set over 20 years ago in 1991 (4). Robust data on which to set the values was in many cases lacking and there has been no systematic approach to obtain more complete data in the interim. In the UK, SACN is currently reviewing DRVs for vitamin D intake and is due to issue its report in 2014 (5). Meanwhile, the European Food Safety Authority (EFSA) has been tasked with setting European DRVs for micronutrients and for vitamins has so far issued draft opinions for biotin (6) and pantothenic acid (7) that are out for consultation and has proposed final values for vitamin C (8). DRVs for vitamin C vary across Member States ranging from 40mg/day in the UK to 110mg/day in France. EFSA has proposed a Population Reference Intake (PRI) of 110mg for men and 95mg for women, with average requirements (AR) of 90mg/day and 80mg/day, respectively. Additional requirements in pregnancy are +10mg/day and during lactation +60mg/day, making a total requirement for a breastfeeding mother of 155mg/day. Requirements proposed for children and adolescents are based on body weight scaling and the PRIs range from 20mg/day for one- to three-year olds, to 100 and 90mg per day for adolescents (males/females, respectively). Assessing UK vitamin C intakes against these higher benchmarks is likely to give a different picture with regard to the adequacy of UK intakes.

Table 1: Proportion of participants with average daily intakes* of vitamins from all sources (including dietary supplements) below the LRNI, by sex and age (four years upwards)

	Average daily intake below the LRNI (%)							
	Boys		Men		Girls		Women	
Age (years)	4-10	11-18	19-64	65+	4-10	11-18	19-64	65+
Vitamin								
Vitamin A	5	12	8	3	4	14	5	1
Thiamin	0	0	0	0	0	0	0	0
Riboflavin	1	8	4	5	1	20	11	2
Niacin¶	0	0	0	0	0	0	0	0
Vitamin B6	0	0	0	0	0	0	0	0
Vitamin B12	0	1	1	0	0	2	1	1
Folate	0	2	2	0	0	6	3	3
Vitamin C	0	1	1	2	0	1	1	0

LRNI: lower reference nutrient intake
*Combined three-year data for years 2008/9 to 2010/11
¶ Niacin equivalents

There is also the question of how to assess the inadequacy of population intakes. Comparing dietary intakes against the LRNI and the RNI is not a very sensitive indicator and does not tell us too much about the true prevalence of inadequacy. The EAR cut point method, i.e. the percentage of subjects with intakes below the estimated average requirement (EAR), has been recommended as a better indicator of the true level of inadequacy (9), and it would be interesting to understand how the NDNS survey vitamin intake data would fare against this particular measure.

CONCLUSIONS

The NDNS data suggests that pockets of low vitamin intake do exist in the UK and in other European Member States. The most vulnerable vitamins in the UK diet are A, B2, D and folate, with additionally vitamin E in some European Member States.

As we require less energy on account of more sedentary lifestyles, nutrient density needs to increase to ensure that adequate intakes of vitamins are consumed. Hence, a key health message is for people to engage in more physical activity to increase their energy requirements. This will mean that more food and drinks can be eaten without gaining weight, from which higher intakes of vitamins can be obtained.

We also await a further task of EFSA which is to provide guidance on the translation of nutrient-based dietary advice into guidance on food-based dietary guidelines, i.e. the contribution of different foods or categories of foods to an overall diet to help maintain good health through optimal nutrition. This will be particularly helpful for providing consumers with messages about the quality of their diet and helping to ensure that more of the population is consuming a sufficient intake of vitamins.

References
1 SACN (2008). The Nutritional Wellbeing of the British Population. London: TSO. ISBN 978 0 11 243114 5
2 DH & FSA (Department of Health and Food Standards Agency 2012). National Diet and Nutrition Survey - Headline results from Years 1, 2 and 3 (combined) of the Rolling Programme (2008/2009 - 2010/11) Edited by: Bates B, Lennox A, Prentice A, Bates C, Swan G
3 Mensink GBM, Fletcher R, Gurinovic M et al (2012). Mapping low intakes of micronutrients across Europe. Brit J Nutr 2012, doi:10.1017/S000711451200565X
4 DH (1991). Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. London: HMSO
5 www.sacn.gov.uk/meetings/working_groups/vitamin/index.html
6 EFSA (2013). [Draft] Scientific Opinion on Dietary Reference Values for biotin: www.efsa.europa.eu/en/consultations/call/131104.pdf
7 EFSA (2013). [Draft] Scientific Opinion on Dietary Reference Values for pantothenic acid: www.efsa.europa.eu/en/consultations/call/131104a.pdf
8 EFSA (2013). Scientific Opinion on Dietary Reference Values for Vitamin C. EFSA Journal 2013; 11(11): 3418
9 De Lauzon B, Volatier JL and Martin A (2004). A Monte Carlo simulation to validate the EAR cut-point method for assessing the prevalence of nutrient inadequacy at the population level. Public Health Nutrition 7(7): 893-900