

**ASSESSING THE INTAKE OF VITAMINS AND MINERALS IN CHILDRENS DIETS****Issue**

1. The Board has had discussions on the setting of maximum levels of vitamins and minerals in food supplements in September 2005, July 2006 and September 2006. These discussions took place in advance of the European commission bringing forward proposals for setting levels in food supplements. These proposals are currently expected by the end of 2007. During its discussions in September 2005 the Board questioned how much was known about safe levels of daily dosages for children. It was noted that this is a difficult area and that little research has been undertaken. It was agreed that further investigation should be undertaken to identify the current knowledge on intakes of vitamins and minerals through the diet for children.
2. Information on the dietary intake of vitamins and minerals for children was obtained through the National Diet and Nutrition Survey (NDNS) survey and provided to the Board in July 2006. The Board considered that this was very broadly-based and suggested that the Paediatric British National Formulary (PBNF) and work in the field of paediatric medicine might provide additional insight into this area. Officials have, therefore, drawn on a variety of information sources including the PBNF, the House of Lords Report on Paediatric Medicines, NDNS, research funded by the FSA and existing Government advice, to provide additional information on children's requirements for and intakes of vitamins and minerals, and to review the available sources of data on toxicity of high dosages in children.

**Background*****Evidence regarding the Effect of high intake of Vitamins and Minerals in Children***

4. There are relatively few studies on the effects of excess nutrients that have been carried out in adults and fewer in children. There are some examples in case reports from the literature, for example, very young children are more susceptible to minerals such as sodium or potassium since their kidneys are immature, and they are unable to excrete it. Studies on neonatal animals suggest that neonates can be both more and less sensitive to toxicants.
5. Adult human toxicity data associated with high intakes of nutrients have been obtained from epidemiology studies and from unexpected effects of intervention trials such as the study in smokers, which revealed that supplementation with beta-carotene increased rather than decreased the risk of lung cancer. Some information is also obtained from metabolic or nutritional balance studies in adult

volunteers. Children, however, would not be used in intervention or other investigative studies to the same extent as adults. Children would be normally only involved in studies related to, for example, the correction of deficiency where adverse effects would be unlikely as the doses used would be based on nutritional requirement on an individual basis.

6. Food supplement products, unlike medicines, are not assessed by standard regulatory studies in laboratory animals. Therefore in general, no chronic/lifetime studies or other relevant animal studies exist that can be extrapolated to human populations. The available studies consider the mechanism of action and metabolism of individual nutrients.
7. The European Food Safety Authority (EFSA) is currently carrying out safety assessments, on data submitted by manufacturers, for sources of vitamins and minerals for use in food supplements, foods for particular nutritional uses and foods intended for the general population. Where data are available for children, these are included in the assessment process.

### ***Evidence from the field of Medicine***

8. Vitamin and mineral preparations are available as medicines for treatment of deficiencies in children. The Paediatric British National Formulary provides guidance on vitamin and mineral dosages for treatment of deficiency disease in children, but recommends that the use of vitamins as general 'pick-me-ups' is of unproven value and that mega-vitamin therapy can be harmful.
9. There is a lack of evidence on the toxicity of medicines for children due to practical and ethical considerations. The House of Lords Report on the proposed EC Regulation of Paediatric Medicines, published in 2006, has highlighted that between 50–90% of medicines have not been tested or authorised for use on children and neonates. The proposal combines regulation of clinical trials for children and incentives to encourage the pharmaceutical industry to develop and submit for approval medicines specifically for children. Research on developing clinical trials for medicines for children may provide invaluable data that could be extrapolated for application to the assessment of food supplements for children in the future, by the provision of more detail on how children's bodies cope with toxic effects.

### ***Assessing Differences between Children and Adults***

10. There are a few general principles, outlined below, that may need to be considered when assessing possible differences in the effects of excess nutrients on children compared to adults.
11. *Why children may be more sensitive than adults:* There may be greater exposure to the nutrient due to lower body weight and size of children. Growing and

developing organ systems may be more sensitive to adverse effects. For example, the renal system may be immature reducing ability to excrete a micronutrient. Immature enzyme or related systems may affect metabolism within the body, perhaps decreasing detoxification and excretion.

12. *Why children may be less sensitive than adults:* Children have higher requirements due to growth, which could make excess nutrient intake less likely than in adults. Some repair systems are more efficient. Immature enzyme or related systems, affecting metabolism within the body, may decrease the production of toxic metabolites. Excretion may be proportionally greater in children due to increased blood flow in the liver.
13. *How risk assessments are applied for children:* In the absence of data specific to children, a 10-fold uncertainty factor is often applied to account for inter-individual variation and it is necessary to consider whether this would account for differences in the susceptibility of adults and children. Some authorities use an additional uncertainty factor in their risk assessment to account for possible increased sensitivity of children but this approach is not necessarily scientifically justified, and could lead to deficiency if applied to dietary intake of micronutrients.

### ***Recommended Dietary Intake***

14. In 1991 the Committee on Medical Aspects of Food Policy (COMA) recommended dietary reference values (DRV) for food energy and nutrients for groups of people including children. Most of the requirements for children can be achieved through a healthy balanced diet.
15. Recommendations by COMA (DH 1991, 1994, 2002) form the basis of the Department of Health advice on infant/children feeding. The Department of Health recommends a daily supplement dose of vitamins A, C and D for: breastfed infants from 6 months (or from 1 month if there is any doubt about the mother's vitamin status during pregnancy); formula-fed infants who are over 6 months and taking less than 500ml infant formula per day; and for children under 5 years of age, particularly those who are fussy eaters, Asian, African, Afro-Caribbean or Middle Eastern origin and those living in northern areas of the UK.

### ***Results from the NDNS on Children's Dietary Intakes***

16. The NDNS provides information on the dietary intakes and status of micronutrients from the 1995 survey of children aged 1½-4½ years and 2000 survey with children aged 4 to 18 years. The NDNS also provides data on supplement use.
17. The findings from the surveys provide evidence to show that some children have low or marginal intakes for some micronutrients e.g. vitamin A, magnesium,

calcium, potassium, zinc and iodine. Furthermore, low status was reported for vitamin D and iron.

- a. 12% of children aged 11-18 years had low biochemical vitamin D status. It is important to note that vitamin D is synthesised in the skin by exposure to UV sunlight, which is the main source of vitamin D.
- b. 8% of children under 5 years and 6% of children aged 11-18 years were anaemic as indicated by haemoglobin concentrations below threshold levels, 25% of girls aged 11-18 years showed biochemical evidence of low iron status.
- c. A fifth of children aged 1½-4½ years were reported to be taking supplements, mainly vitamins A, C and D and multivitamins.

### ***Reviews by Scientific Advisory Committee on Nutrition (SACN)***

18. As part of SACN's report on Folate and Disease Prevention (2006), the effects of folate on children were considered as part of the risk assessment.
19. SACN is currently reviewing dietary intakes of iron, including the health risks of low and high iron intakes on the nutritional and health status of the population which includes children.
20. SACN is also reviewing the NDNS data on the nutritional wellbeing of the UK population which includes children.

### ***Evidence considered by Expert Group on Vitamins and Minerals (EVM)***

21. The EVM considered evidence (where available) on vulnerable population sub-groups including children as part of its review on the evidence of safety of high doses of vitamins and minerals in supplements and fortified foods, however little data were available. The EVM noted that recommended safe upper levels for individual vitamins and minerals can be applied to children by scaling for body weights or body surface area as appropriate, unless it is specifically indicated that children are particularly vulnerable to the effect concerned or have a greater requirement.

### ***Agency Research on Children's Diets***

22. The Agency's N05 (Nutritional Status and Function) research programme has funded the following research projects investigating the diets of children:
  - a. The influence of diet in infancy on early growth, bone health and cognitive function (University of Southampton). This project is due to report in June 2007.

- b. The influence of maternal, infant and childhood diet on respiratory health in the first 6 years of life (University of Southampton). This project is due to report in 2010.
  - c. A systematic review of the effect of diet and nutritional status on behaviour, learning and performance of school aged children in UK and the developed world (University of Teesside). The findings from this review concluded that there is insufficient evidence to identify any effect of nutrition, diet and dietary change on learning, education or performance of school aged children.
  - d. Effects of early childhood diet on promotion of good mental health throughout adulthood (Human Nutrition Research, Cambridge). The findings of this project found no clear associations.
23. The Agency has also commissioned a broad range of research on vitamin D to investigate health implications on marginal status. These projects are due to report in 2008.
24. The Agency is funding a survey of children's diets in Scotland. This project is due report in May 2007 and it will be possible to extrapolate information on vitamin and mineral consumption from these data.

## **Conclusion**

25. Research has indicated that some children may have a low or marginal intake and/or status for some vitamins and minerals, in particular vitamins A, C and D. The Department of Health recommends supplementation with vitamins A, C and D, for certain age categories of children. SACN are currently undertaking reviews of the nutritional status of the UK population, including children, which will provide additional information for all age groups.
26. The problem when assessing the effects of excess nutrients in children is that there are relatively few data available specifically on children, due to practical and ethical problems of carrying out intervention studies on children. Where data is available for adults, dosage levels are estimated for children by scaling for body weights or body surface area as appropriate. A similar approach was used by the EVM when recommending safe upper levels for vitamins and minerals in food supplements. The proposed EC Regulation on the assessment of paediatric medicines includes regulation of clinical studies in children. These studies may provide additional insights into the way that the child's metabolism handles excess nutrients and lead to a clearer risk assessment process in recommending safe upper levels of vitamin and mineral supplements for children.

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