Dear Editor:

Recently, an assessment of the nutrient requirements for premature infant formulas was published in The Journal of Nutrition (1). Current knowledge has been considered to be inadequate for the assessment of minimum or maximum levels of molybdenum (Mo) intake. However, the determination of upper and lower limits of Mo content in formulas and pediatric parenteral nutrition has been supported recently (2).

For adults, Upper Intake Levels (UL) for Mo have been derived from the study of Fungwe et al. (3) in female rats, which established a No-Observed-Adverse-Effect Level (NOAEL) of 0.9 mg/(kg · d). A range of uncertainty factors for the extrapolation of data from experimental animals to humans resulted in the assessment of a UL of 10 mg/(kg · d) or 30 µg/(kg · d) (5), respectively. Despite concern about the infant’s capacity to deal with excess amounts of Mo, no UL has been set for infants.

Present directives and recommendations that may directly or indirectly affect the Mo intake in premature infants either do not regulate Mo intake, or do not prevent intakes exceeding the UL for adults in relation to body weight. In Europe, for example, the upper level of Mo intake has been set at 10 µg Mo/100 kcal for nutrients for special dietary purposes in infancy (6). An infant formula prepared in accordance with this directive, and the energy intake recommended for premature infants (1), may result in an Mo uptake >10 µg/(kg · d).

In addition, the WHO guidelines for drinking water quality propose an upper guideline value of 70 µg Mo/L (7). The maximum Mo intake in water used for powdered formula preparation exceeds 10 µg Mo/kg body weight at an intake ≥150 mL/kg body weight. This volume, however, is quite common in premature infants.

Unsupplemented infant formulas repeatedly contained >100 µg Mo/L (8–10). It was, however, not within the scope of the respective studies to investigate the reasons for the Mo concentrations observed. It cannot be excluded that they were caused by the Mo content of the raw material or by contamination.

A high percentage of absorption of Mo was observed in stable isotope studies in infancy (11), comparable to the results obtained in adults (12). Current knowledge, however, suggests a limited capacity in premature infants to handle excess Mo intake.

In balance studies in 14 premature infants with a median Mo intake of 10.4 µg/(kg · d) (13), the lowest retention observed was still three times the adequate intake (AI) for term infants [0.3 µg/(kg · d)] recommended by the National Academy of Sciences (5). Plasma concentrations assessed in parallel greatly exceeded those of healthy term breast-fed and (non-supplemented) formula-fed infants (13,14).

A significant correlation between urinary Mo and Mo intake has been observed in premature infants (10). It has been deduced (1) from this study that renal function was adequate to handle relatively high intakes of Mo. This conclusion is, however, insufficiently supported by the data presented. Although the quantitative urinary Mo excretion had adapted to higher intakes and had increased considerably, it was inadequate to prevent an increase in Mo retention.

Human milk supplies −0.3 µg Mo/(kg · d) (5), the recommended AI for the term infant. As outlined in the current report, a maximum intrauterine accretion rate of 1 µg/(kg · d) during the last trimester has been suggested (1). Nonregulation of the Mo content in formulas for premature infants or excessive supplementation of formulas may result in unnecessarily high intakes of this trace element.

Based on the concentration in human milk, a Mo intake of 0.2–0.4 µg/(kg · d) has been recommended for premature infants by the Canadian Pediatric Society (15). Friel et al. (16) speculated, on the basis of the results of their investigations, that an oral Mo intake of 4–6 µg/(kg · d) would be adequate to meet the low-birth-weight infants’ needs. The median intake of ≤2.3 µg/(kg · d) (10,13) did not ensure positive Mo balance in two groups of preterm infants studied. These results suggest that a minimum provision of Mo intake close to this level is needed. However, there is no evidence for the necessity of a Mo intake exceeding 5 µg/(kg · d).

The above range is covered by most of the formulas analyzed. In others, it may be achieved by a modification of current supplementation practice, the choice of the raw material or the systematic exclusion of substantial contamination. In conclusion, regulating the Mo concentration of infant formulas for premature infants is recommended.

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LITERATURE CITED

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