ABSTRACT

DAVIDSSON L. MANGANESE ABSORPTION: STUDIES IN HUMANS WITH SPECIAL REFERENCE TO INFANT DIETS. Department of Clinical Nutrition, Gothenburg University, Sahlgrenska Hospital, S-413 45 Göteborg, Sweden.

The aims of the study were to develop a method for studies of manganese (Mn) absorption in humans and to study Mn absorption from infant diets.

The method is based on extrinsic labeling of the diets with ^{54}Mn or ^{52}Mn and monitoring the whole-body retention in a whole-body counter. Highly reproducible figures for retention were found after repeated administration of the same labeled formula to six subjects while interindividual variation in Mn retention was shown to be substantial. Retention measurements from days 10-30 could be closely fitted to a single exponential function and Mn absorption was estimated by extrapolation from these measurements. To estimate the degree of absorption from retention measurements, allowance for the excretion of initially absorbed radioisotope has to be considered. However, the excretion rate of an intravenously administered dose of the nuclide could not be used to estimate Mn absorption from retention measurements since a difference was observed in turnover rate after oral and intravenous administration of ^{54}Mn.

The hypothesis that the difference in metabolic handling of Mn introduced via the diet or by intravenous injection could be due to different proteins carrying Mn in plasma was tested in a study in rats. Plasma proteins were separated, after oral and intravenous administration of ^{54}Mn, by fast protein liquid chromatography (FPLC) with a combination of anion exchange and gel filtration columns. SDS-polyacrylamide gradient gel electrophoresis (PAGGE) with Western blot was further used to confirm that transferrin is the major Mn binding protein in plasma, regardless of route of administration.

The validity of extrinsic labeling was studied in humans using a meal consisting of intrisically labeled (^{54}Mn) as well as extrinsically labeled (^{52}Mn) chicken liver. The results showed an excellent agreement between the retention of ^{54}Mn and ^{52}Mn and was regarded as a direct validation of the extrinsic labeling technique.

When Mn absorption from infant diets was studied in man, fractional Mn absorption from human milk was significantly higher than the absorption of Mn from cow's milk, whey-predominant cow's milk formula (with 12 mg Fe/L or without iron fortification, 2 mg Fe/L), and soy formula. No significant difference in Mn absorption was observed between cow's milk formula with 7 mg Fe/L and human milk. Soy formula was found to result in a significantly lower fractional Mn absorption than all other test meals. However, due to the differences in Mn content, the absorbed amount of Mn was significantly higher from the non-iron fortified cow's milk formula (2 mg Fe/L) compared to human milk while no significant differences were found for the other milks and formulas.

It is concluded that oral administration of a diet labeled with a gamma-emitting isotope of Mn and frequent measurements of whole-body retention during days 10-30 is sensitive enough to estimate Mn absorption in humans. The results regarding intra- and interindividual variation in Mn retention indicate that the best way to identify factors influencing Mn absorption is by using paired observations.

Key words: Manganese, ^{54}Mn, ^{52}Mn, human, retention, absorption, whole-body counting, intrinsic label, extrinsic label, infant diets.

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