Topical Area: Global Nutrition


Sun, Jun 9  12:45 PM – 1:45 PM  Location: Poster Board 23

Objectives:
Manganese (Mn) is the essential trace element (TE) in human nutrition, but high doses of Mn are toxic to the human mentation and induce brain extrapyramidal system. The main source of manganese is our diet, but there no available long-term biological indicator for assessing the Mn nutritional status. The aim of this study was to assess human manganese nutritional status by assessing its frequency distribution in the hair with a median derivatives bioassay.

Methods:
In this prospective, observational, cross-sectional, exploratory, and epidemiological study we have analyzed hair Mn (Mn) in 1073 apparently healthy adults (339 men, M and 734 women, W) from Zagreb, Croatia. Whole blood manganese (WB Mn) was assessed in a subsample of this population in 143 Women and 91 Men. Both hair and whole blood (short-term biological indicator) samples were analyzed for iron with the ICP MS at the Center for Biotic Medicine, Moscow, Russia: an ISO certified bioelements analytical laboratory. Hair Mn natural frequency distribution was analyzed with the median derivatives bioassay logistic sigmoid curve for men and women separately. The range of values below the linear segment of the sigmoid curve (adequate intake) was considered to reflect Mn deficiency, whereas values above that linear range indicate Mn dietary excess.

Results: Women and men have almost identical amount of Mn (median ♂ 0.234 µg·g⁻¹ vs. median ♀ 0.208 µg·g⁻¹). The physiologically adequate Mn linear segment range of the sigmoid curve was 0.090 – 0.749 µg·g⁻¹ for Men and 0.091 – 0.628 µg·g⁻¹ for Women. Similarly, both women and men have very similar amount of WB Mn (median ♂ 0.0109 µg·g⁻¹ vs median ♀ 0.0118 µg·g⁻¹). The physiologically adequate WB Mn linear range of the sigmoid curve was 0.0084 – 0.0169 µg·g⁻¹ for ♀ and 0.0079 – 0.0179 µg·g⁻¹ for ♂.

Conclusions: Human nutritional status of Mn in the population may be reliably assessed by analyzing its frequency distribution in the hair with the median derivatives bioassay. Our exploration indicates how it is possible to diagnose the subclinical states of both manganese nutritional deficiency and excess. When the Mn nutritional status is expressed in a range format it became possible to study simultaneously the subtle and complex multi-bioelement profile interactions within the adequate range of a bioelement intake.
Funding Sources: Institute for Research and Development of Sustainable Ecosystems, Zagreb, Croatia

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