

Manganese

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CORRESPONDENCE

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Abstract

Manganese is an essential element required at low doses for connective-tissue formation, bone development, and several enzyme cofactor roles. At excessive intake, manganese is a documented neurodevelopmental concern, particularly during the prenatal-and-early-childhood window when blood-brain-barrier permeability is highest. The neurodevelopmental dose-response is the reason manganese appears in the heavy-metals-and-infant-food literature even though it is an essential nutrient rather than one of the priority toxic metals (lead, total and inorganic arsenic, cadmium, total and methylmercury, nickel, aluminium, hexavalent chromium, tin).

1 | Overview

The principal dietary sources of manganese are whole grains, legumes, nuts, leafy vegetables, and some teas. Manganese in drinking water has been associated with childhood neurodevelopmental endpoints in epidemiological studies; this is a regulated concern in some jurisdictions (the EPA secondary MCL for manganese is anchored on aesthetic effects rather than health, but health-based advisory thresholds exist).

For infant formula and baby food, manganese is included in compositional requirements similarly to zinc — regulators set minimum and maximum permitted manganese contents per 100 kcal. Astolfi et al. 2021 evaluated manganese intake from powdered infant formula and reported formula means above the minimum compositional requirement and below the maximum (astolfi2021-italy-powdered-infant-formula-elements).

The Heavy Metal Index carries this page as a cross-metal context destination for source pages whose elemental surveys include manganese alongside the priority toxic metals. Manganese values in source pages are recorded for completeness as cross-metal context.

Ufelle & Barchowsky 2021 discusses manganese in chapter-level metal transport, excretion, and essential-metal context as cross-metal toxicology background.

2 | Frequently asked questions

Is manganese actually toxic, or is it a nutrient our bodies need?

Both. Manganese is an essential element required at low doses for connective-tissue formation, bone development, and as a cofactor for several enzymes. At excessive intake, however, it becomes a documented neurodevelopmental concern, which is why it appears in the heavy-metals-and-infant-food literature even though it is a nutrient rather than one of the priority toxic metals.

Which foods are the main dietary sources of manganese?

According to the page, the principal dietary sources of manganese are whole grains, legumes, nuts, leafy vegetables, and some teas.

Why is manganese a bigger concern for babies and young children?

The neurodevelopmental dose-response is of particular concern during the prenatal and early-childhood window, when blood-brain-barrier permeability is highest. This developmental sensitivity is why manganese is tracked in the infant-food literature alongside the priority toxic metals.

Should I worry about manganese in my drinking water?

Manganese in drinking water has been associated with childhood neurodevelopmental endpoints in epidemiological studies, and it is a regulated concern in some jurisdictions. The page notes that the EPA secondary maximum contaminant level for manganese is anchored on aesthetic effects rather than health, though separate health-based advisory thresholds exist.

Are there any limits on how much manganese is allowed in infant formula?

Yes. For infant formula and baby food, regulators treat manganese similarly to zinc by setting minimum and maximum permitted manganese contents per 100 kcal. Astolfi et al. 2021 evaluated manganese intake from powdered infant formula and reported formula means above the minimum compositional requirement and below the maximum (astolfi2021-italy-powdered-infant-formula-elements).

Why isn't manganese counted among the main toxic heavy metals like lead or arsenic?

Manganese is an essential nutrient rather than one of the priority toxic metals (lead, total and inorganic arsenic, cadmium, total and methylmercury, nickel, aluminium, hexavalent chromium, and tin). The Heavy Metal Index carries it as cross-metal context, recording manganese values from elemental surveys for completeness rather than as a primary toxic target (Ufelle & Barchowsky 2021).

References

- [1] Determination of 40 Elements in Powdered Infant Formulas and Related Risk Assessment
Maria Luisa Astolfi, Daniela Marotta, Vittoria Cammalleri, Elisabetta Marconi, Arianna Antonucci, Pasquale Avino, et al. · International Journal of Environmental Research and Public Health · 2021 · doi.org/10.3390/ijerph18105073
REVIEW
- [2] Toxic Effects of Metals (Chapter 23), in Casarett & Doull's Essentials of Toxicology, Fourth Edition
Ufelle AC and Barchowsky A · Casarett & Doull's Essentials of Toxicology, Fourth Edition. McGraw Hill Education · 2021 · www.-mhprofessional.com
TEXTBOOK

STATUS AND LICENCE

Editorially reviewed in-house; no external peer review has been completed on this reference. Published as a preprint with its review state tracked on the article page. Released under CC BY 4.0.

DATA AVAILABILITY

Every source behind this reference is listed with its own extraction record at <https://heavymetalindex.com/metals/-manganese#sources>, each linking to the ingest receipt, the extracted values, and the file hash of the document it was built from.

COMPETING INTERESTS

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