Rubidium

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CORRESPONDENCE

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KEYWORDS

heavy metals, food safety, dietary exposure

PUBLICATION HISTORY

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Abstract

This page draws on 2 peer-reviewed studies. The complete citation list is at the bottom of the page.

1 | Overview

This page is very thin because the evidence reviewed for it consists of two papers. One measured rubidium in transitional breast milk from 40 mothers in Mashhad, Iran 1. The other measured rubidium in brain regions linked to appetite in rats made obese with a high-calorie diet 2.

Both papers describe rubidium as able to stand in for potassium, including in the sodium-potassium pump 1 2. The breast milk study states that the necessity of rubidium for humans remains unproven, so no recommended intake exists to compare against 1.

2 | Toxicology

The cited evidence does not establish rubidium toxicity, a no-effect level or a tolerable intake. The breast milk study calls rubidium a potential toxic element, but on the basis of earlier literature, not its own data 1.

In 16 male rats, rubidium was higher in all nine brain regions examined in the obese group than in lean controls, by about 72% in the orbitofrontal cortex, 46% in the posterior lateral hypothalamus, 44% in the ventromedial hypothalamus and 35% in the amygdala 2. The authors state, from their earlier work, that the obese rats took in less rubidium from their diet, so the rise is not explained by intake. This is an association in an animal model, not evidence of harm.

3 | Typical exposure routes

The cited evidence does not establish dietary intake, drinking water exposure or body burden of rubidium in any population. The only measured route is breast milk for infants 1. That study's discussion quotes an earlier

estimate of mean rubidium intake of 2.2 mg/day for most countries, but this figure is cited from other work rather than measured 1.

4 | Food sources

The only food measurement in the cited evidence is human milk. In transitional breast milk collected 3 to 15 days after delivery from 40 healthy mothers in Mashhad, Iran, in 2011, rubidium averaged 32.176 ppm on a dry weight basis, which equals 32,176 µg/kg dry weight 1. Rubidium did not correlate with maternal age or weight or with infant weight, age or sex. The authors describe their mean as among the highest reported and note that differences in sample preparation and analysis may explain the gap.

STUDY / LOCATION	MATERIAL / DESIGN	METAL SPECIES	VALUE (UNITS AND BASIS)	N	INTERPRETATION / LIMITATION
1, Mashhad, Iran	Transitional breast milk, 3 to 15 days postpartum, dried, instrumental neutron activation analysis	total rubidium	mean 32.176 ppm (SD 21.193), median 28.195, range 8.660 to 107.210, dry weight	40	Dry weight only, so infant intake cannot be derived; single city and lactation stage; recovery not reported

5 | Regulatory limits

The cited evidence does not establish any regulatory limit, guideline value or reference range for rubidium in food, water or breast milk. The breast milk study notes that reliable reference ranges for most trace elements in human milk are not available 1.

6 | Testing

Breast milk was analyzed by instrumental neutron activation analysis: dried 300 mg portions were irradiated in a research reactor for 5 hours and rubidium was counted after 30 to 38 days of decay with a high-purity germanium detector, using an apple leaves reference material for quality control 1. No recovery was reported.

Rat brain sections were mapped by synchrotron X-ray fluorescence, with a rubidium detection limit of 0.000623 µg/cm2 2. Results are mass per area of thin sections, not concentrations per mass of tissue.

7 | Microbiome effects

The cited evidence does not establish any effect of rubidium on microbiomes.

8 | Vulnerable populations

The cited evidence does not identify populations at higher risk from rubidium. Breastfed newborns are the only group whose exposure source was sampled 1, and the study did not assess health outcomes.

9 | Mitigation

The cited evidence does not establish any removal, processing or remediation method for rubidium.

10 | Open questions

- Toxicology: no human or mammalian toxicity data and no tolerable intake.
- Typical exposure routes: no measured dietary intake, drinking water or biomonitoring data.
- Food sources: only transitional breast milk from one Iranian city; no data on any other food.
- Regulatory limits: no limit, guideline or reference range.
- Infant rubidium intake from breast milk, which needs wet weight values and milk volumes.
- Whether the high breast milk values reflect the analytical method or true local differences.
- What drives higher brain rubidium in obese rats, and whether it occurs in people.
- Microbiome effects: not studied.
- Vulnerable populations: not identified.
- Mitigation: not studied.

11 | What remains uncertain

The breast milk values come from one method in one city, are reported only on a dry weight basis, and lack a certified reference material or recovery check, so their accuracy and comparability are uncertain. The authors themselves say the results cannot yet be compared with other studies.

The rat study shows a consistent association between diet-induced obesity and brain rubidium, but in a small group of males, with values shown only in figures and dietary rubidium content taken from earlier work. Neither paper says anything about whether rubidium at these levels is harmful.

References

[1] Breast Milk Concentration of Rubidium in Lactating Mothers by Instrumental Neutron Activation Analysis Method
Khatami SF, Parvaresh P, Parvaresh P, Madani Kouchak SS, and Khorsandi J · Iranian Journal of Pediatrics 24(6): 692-696 · 2014 · pmc.ncbi.nlm.nih.gov
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[2] Increased rubidium levels in brain regions involved in food intake in obese rats
Szczerbowska-Boruchowska M, Chenczke A, Ruszczycki B, Wrobel P, Tokarczyk W, Stec P, et al. · Brain Structure and Function 230: 66 · 2025 · doi.org/10.1007/s00429-025-02930-8
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STATUS AND LICENCE

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DATA AVAILABILITY

Every source behind this reference is listed with its own source record at https://heavymetalindex.com/metals/rubidium#sources.

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