Wheat flour

Karen Pendergrass · Heavy Metal Index, Institute of Contaminant Standards

HEAVY METAL INDEX · INGREDIENT PROFILE October 2026
DOI 10.83376/hmi.ingredient.wheat-flour

CITE AS

Pendergrass, K. (2026). Wheat flour. Heavy Metal Index. https://doi.org/10.83376/hmi.ingredient.wheat-flour

CORRESPONDENCE

Corrections are logged publicly on the article page, each with its date, the affected value, and the source that resolved it.

KEYWORDS

heavy metals, food safety, dietary exposure

PUBLICATION HISTORY

This revision 2026-10-22.

Abstract

Wheat flour in the HMI library has 705 reported results for lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, B, Ba, Ca, K, Mg, Mo, Na, P, Rb, S and Sr from 29 sources. WHO GEMS/Food submissions reported lead in wheat flour from 521 results in 2 reporting regions, with a subgroup median of 10 µg/kg. In the US Total Diet Study, wheat flour had a median lead result below 4 µg/kg across 3 composites from 2018-2020.

1 | Wheat flour overview

Across 2 other studies of ordinary farms and markets, reported lead means and medians on an as-sold or fresh-weight basis ranged from 3 µg/kg (Spungen et al. 2024) to 150 µg/kg (Caridi et al. 2021).[3,5] For cadmium, 4 studies on an as-sold or fresh-weight basis reported means and medians from 6.56 µg/kg (Zhang et al. 2025) to 42 µg/kg (Spungen et al. 2024).[5,7]

For a buyer the practical points are the form bought, the basis a result is reported on, where the wheat flour came from and the laboratory's reporting limit. Testing finds contamination but does not remove it.

2 | What counts as wheat flour

This page covers wheat flour in 2 forms kept separate in every comparison: wheat flour (677 results) and wheat flour as sold (28 results).[1,2,3,4,5,6]

Results stay on the basis each source reports: as sold or fresh weight, dry weight, or unstated. Dry-weight, as-sold and unstated results are never pooled, and no moisture conversion is applied.

3 | How metals reach wheat flour

No study in the library compared wheat flour from contaminated and ordinary settings, so the routes by which metals reach it are not measured here.

4 | Which forms and regions measured lower

The HMI reference for lead in wheat flour pools 11 subgroup units from 2 sampling families, with a median of between 4.9 and 4.95 µg/kg and a middle half spanning below 4 (lower quartile) and 10 µg/kg (upper quartile).[1,2] for lead in wheat flour, the reference median was below 38.5 µg/kg, with a middle half from below 4 to below 73 µg/kg across 11 units.[6,14] for lead in wheat flour as sold, the reference median was below 20 µg/kg, with a middle half from below 12.4 to between 5 and 40 µg/kg across 42 units.[1]

Among GEMS/Food reporting regions, wheat flour had the lowest cadmium subgroup median in PAHO (22.7 µg/kg) and the highest in EMRO (23.8 µg/kg); reporting regions are markets, not growing areas.[1]

Targeted wheat flour as sold samples in EURO had cadmium lower at 12 µg/kg, against 20 µg/kg for EURO in the same study.[1]

In one study, lead across 15 groups of wheat flour ranged from 29 µg/kg (Autumn 2016) to 87 µg/kg (Autumn 2017); the lowest is the lowest observed in that study, not an established sourcing preference.[10] In another study, cadmium across 20 groups of wheat flour ranged from 6.56 µg/kg (Heilongjiang province/city, national sampling 2023-2024) to 22.7 µg/kg (Henan province/city, national sampling 2023-2024); the lowest is the lowest observed in that study, not an established sourcing preference.[7]

5 | Processing, cooking and preparation

No processing study for metals in this food is in the library yet.

6 | Mitigation for wheat flour

Lot testing against the applicable limit is the check that can be verified.

7 | Trade-offs and limits of controls

Metals do not move together, so a lot that passes a lead limit says little about cadmium, arsenic or nickel unless those are tested as well.

8 | Testing wheat flour for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 4 µg/kg (FDA Total Diet Study) to 200 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,2] Reporting limits for cadmium ranged from 1 µg/kg (FDA Total Diet Study) to 50 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,2] Reporting limits for total arsenic ranged from 0.4 µg/kg (Liang et al. 2019) to 300 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,9]

A useful lot result names the form, the basis and a quantification limit well below the limit that applies.

9 | Buying and verifying wheat flour

No maximum level for metals in wheat flour was verified from primary text for this page; buyers should confirm the limit that applies in the destination market.

10 | Exposure from wheat flour

No source in the library converted wheat flour concentrations into a verified estimate of intake for a defined population. Concentrations describe the food, not individual risk.

11 | Evidence review and remaining gaps

Every source record that names wheat flour was decided on its content: 29 occurrence extracted, 29 records in all. The occurrence table renders every extracted result; held values remain visible with their reason.

References identify the sources used in these answers. The Sources index preserves additional discovery links; inclusion there does not mean a source has been reviewed for this assessment. Corrections, completed searches, new direct evidence and changes in requirements should reopen the relevant answer.

12 | Wheat flour FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, B, Ba, Ca, K, Mg, Mo, Na, P, Rb, S and Sr in wheat flour, most often lead, cadmium and total arsenic.[1,2,3,4] WHO GEMS/Food submissions reported lead in wheat flour from 521 results in 2 reporting regions, with a subgroup median of 10 µg/kg.[1]

Among GEMS/Food reporting regions, wheat flour had the lowest cadmium subgroup median in PAHO (22.7 µg/kg) and the highest in EMRO (23.8 µg/kg); reporting regions are markets, not growing areas.[1]

Inorganic arsenic, the more toxic form, was measured in 6 results from 3 sources, far fewer than total arsenic.[1,15,16] Across 2 other studies of ordinary farms and markets, reported inorganic arsenic means and medians with the basis not stated ranged from 5 µg/kg (EFSA 2021) to 12.5 µg/kg (European Food Safety Authority (EFSA) 2014).[15,16]

References

[1] GEMS/Food Contaminants database heavy-metal exports
World Health Organization · GEMS/Food Contamination Monitoring and Assessment Programme · 2026 · extranet.who.int
DATASET

[2] FY2018-FY2020 TDS Elements Analytical Results
U.S. Food and Drug Administration · FDA Total Diet Study · 2022 · www.fda.gov
DATASET

[3] Evaluation of the Radiological and Chemical Risk for Public Health from Flour Sample Investigation
Caridi F, Acri G, Belvedere A, Crupi V, D'Agostino M, Marguccio S, et al. · Applied Sciences 2021, 11, 3646 · 2021 · doi.org/10.3390/app11083646
PEER-REVIEWED

[4] Physicochemical Quality and Heavy Metal Safety of White Wheat Flour: A Comparative Analysis of Local and Imported Products in the Kosovo Market
Krasniqi Z, Elshani A, Trajkovska B, and Pehlivani K · International Journal of Ecosystems and Ecology Science (IJEES) 16(2): 193-198 (2026) · 2026 · doi.org/10.31407/ijees16.226
PEER-REVIEWED

[5] Infants' and young children's dietary exposures to lead and cadmium: FDA total diet study 2018-2020
Spungen JH and et al. · Food Additives & Contaminants: Part A · 2024 · doi.org/10.1080/19440049.2024.2396910
PEER-REVIEWED

[6] Levels of selected essential and non-essential metals in wheat flour and health risk assessment among consumers in Ethiopia
Alemu A, Teshome E, and Yohannes M · Journal of Nutritional Science · 2022 · doi.org/10.1017/jns.2022.70
PEER-REVIEWED

[7] Safety Risk Assessment and Classification of Cadmium in Grain Processing Products
Zhang Q, Dou W, Wang Z, Xu X, and Jiang T · Foods 2025, 14(11), 1882 · 2025 · doi.org/10.3390/foods14111882
PEER-REVIEWED

[8] Human health risk assessment of arsenic and potentially toxic elements exposure in bread and wheat flour in Northeast Iran
Asadi Touranlou F, Ghasemi S, Gholian Aval M, Hashemi M, and Tavakoly Sany SB · PLoS ONE 20(7): e0327652 · 2025 · doi.org/10.1371/journal.pone.0327652
PEER-REVIEWED

[9] Analysis of Heavy Metals in Foodstuffs and an Assessment of the Health Risks to the General Public via Consumption in Beijing, China
Liang G, Gong W, Li B, Zuo J, Pan L, and Liu X · International Journal of Environmental Research and Public Health · 2019 · doi.org/10.3390/ijerph16060909
PEER-REVIEWED

[10] Measurement of the Toxic Trace Elements in Commercial Wheat Flours: Potential Health Risk via Dietary Intake
Noori SMA, Zadehdabagh R, Najafi N, Tishezan L, Zerehpoush M, Mousavi Jazayeri SMH, et al. · Journal of Chemical Health Risks 12(4), 713-724 · 2022 · doi.org/10.22034/jchr.2021.1935256.1354
PEER-REVIEWED

[11] Dietary Exposure to Toxic Metals (Cd, Pb and Hg) from Cereals Marketed in Madeira and the Azores
Rubio C, Gutiérrez AJ, Hardisson A, Martín V, Revert C, Fernandes PJP, et al. · Biological Trace Element Research · 2023 · doi.org/10.1007/s12011-023-03643-x
PEER-REVIEWED

[12] mycotoxins and heavy metals in rice, maize,
wheat flour marketed in Shanghai City Zuoyin Zhu, Wenbo Guo, Haisheng Cheng, Hanke Zhao, Jie Wang, Mohamed F. Abdallah, et al. · Peer-reviewed article · 2024 · doi.org/10.1016/j.jhazmat.2024.134695
PEER-REVIEWED

[13] Toxic Metals in Cereals in Cape Verde: Risk Assessment Evaluation
Rubio-Armendáriz C, Paz S, Gutiérrez ÁJ, Gomes Furtado V, González-Weller D, Revert C, et al. · International Journal of Environmental Research and Public Health 2021, 18, 3833 · 2021 · doi.org/10.3390/ijerph18073833
PEER-REVIEWED

[14] Grains, whole flour, white flour, and some final goods: an elemental comparison
Ertl K and Goessler W · European Food Research and Technology 2018, 244: 2065-2075 · 2018 · doi.org/10.1007/s00217-018-3117-1
PEER-REVIEWED

[15] Chronic dietary exposure to inorganic arsenic
EFSA, Arcella D, Cascio C, and Gómez Ruiz JA · EFSA Journal · 2021 · doi.org/10.2903/j.efsa.2021.6380
GOVERNMENT

[16] Dietary exposure to inorganic arsenic in the European population
European Food Safety Authority (EFSA) · EFSA Journal 2014;12(3):3597 · 2014 · doi.org/10.2903/j.efsa.2014.3597
GOVERNMENT

STATUS AND LICENCE

Editorially reviewed in-house; no external peer review has been completed on this ingredient profile. Published as an institutional technical report with its review state tracked on the article page. Released under CC BY 4.0.

DATA AVAILABILITY

Every source behind this ingredient profile is listed with its own source record at https://heavymetalindex.com/ingredients/wheat-flour#sources.

COMPETING INTERESTS

The Heavy Metal Index reports what the peer-reviewed and regulatory literature supports. It is operated separately from any certification program, does not evaluate or endorse brands, and does not use certification thresholds as evidence for the statements made here.

PUBLICATION HISTORY

This revision 2026-10-22. The full dated record is maintained at https://heavymetalindex.com/ingredients/wheat-flour.