Bread

Karen Pendergrass · Heavy Metal Index, Institute of Contaminant Standards

HEAVY METAL INDEX · INGREDIENT PROFILE October 2026
DOI 10.83376/hmi.ingredient.bread

CITE AS

Pendergrass, K. (2026). Bread. Heavy Metal Index. https://doi.org/10.83376/hmi.ingredient.bread

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

Bread in the HMI library has 776 reported results for lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, nickel, chromium, aluminum, tin, antimony, Co, Cu, Fe, Mn, Zn, V, Se, B, Ba, CrIII, CrVI, I, Mg, Na, Sr and Tl from 30 sources. WHO gems/food submissions reported lead in bread as sold from 6 results in 2 reporting regions, with a subgroup median of 7 µg/kg. For cadmium, GEMS/Food gave subgroup medians from 14 to 16.5 µg/kg from 8 results.

1 | Bread 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 40.7 µg/kg (Marín et al. 2018) to 330 µg/kg (Loutfy et al. 2012).[4,5] For cadmium, 3 studies on an as-sold or fresh-weight basis reported means and medians from 15.9 µg/kg (Marín et al. 2018) to 48.2 µg/kg (Loutfy et al. 2012).[4,5] Higher results came from contaminated or exposed settings rather than ordinary supply. Bread as sold from Barbari, traditional oven, after baking had Co higher at 50 µg/kg, against 25 µg/kg for all bread types, industrial oven in the same study.[8]

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

2 | What counts as bread

This page covers bread in 3 forms kept separate in every comparison: bread as sold (730 results), cooked bread (40 results) and bread flour or meal (6 results).[1,2,3,4,5,6] Foods made from bread that have their own pages, such as white bread, whole wheat bread and wholemeal bread, are covered there.

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 bread

The evidence on how metals reach bread comes from studies that compared exposed and ordinary settings. Bread as sold from Barbari, traditional oven, after baking had Co higher at 50 µg/kg, against 25 µg/kg for all bread types, industrial oven in the same study.[8] In another study, bread as sold from bread from bakeries using coal ovens, Jalingo had Fe higher at 757 µg/kg, against 423 µg/kg for bread from bakeries using electric ovens, Jalingo in the same study.[7]

These are observational comparisons from single studies; the size of the difference depends on the site, metal and distance.

4 | Which forms and regions measured lower

For cadmium, the HMI cooked reference median was lowest for bread (17.1 µg/kg) and highest for bread as sold (19.3 µg/kg); forms differ in water content, so this compares foods as sold or eaten, not uptake.[1,2] The hmi reference for lead in bread as sold pools 4 subgroup units from 2 sampling families, with a median of between 68.5 and 75 µg/kg and a middle half spanning below 7 (lower quartile) and 130 µg/kg (upper quartile).[1,2] cooked for lead in bread, the reference median was between 3.31 and 14 µg/kg, with a middle half from below 4 to between 5.5 and 32.5 µg/kg across 38 units.[1] for cadmium in bread as sold, the reference median was 19.3 µg/kg, with a middle half from between 7.5 and 9 to 22 µg/kg across 5 units.[1,2]

Among GEMS/Food reporting regions, bread as sold had the lowest cadmium subgroup median in WPRO (14 µg/kg) and the highest in EURO (16.5 µg/kg); reporting regions are markets, not growing areas.[1] For total arsenic, the lowest regional median was in WPRO (8.17 µg/kg) and the highest in EURO (225 µg/kg).[1]

Cooked targeted bread samples in EURO had cadmium lower at 8 µg/kg, against 16 µg/kg for EURO in the same study.[1] In another study, cooked targeted bread samples in WPRO had cadmium lower at 6.24 µg/kg, against 13.1 µg/kg for WPRO in the same study.[1]

In one study, lead across 38 groups of bread ranged from 10 µg/kg (bread brand O, bought from distribution outlet, Makurdi) to 660 µg/kg (bread brand E, bought from distribution outlet, Makurdi); the lowest is the lowest observed in that study, not an established sourcing preference.[11] In another study, lead across 5 groups of bread ranged from 5 µg/kg (food category composite 1_2) to 8 µg/kg (food category composite 1_1); the lowest is the lowest observed in that study, not an established sourcing preference.[12]

5 | Processing, cooking and preparation

Processed or prepared forms were compared only with unprocessed bread in the same study and group. Cooked bread (all samples) had lead lower at 6 µg/kg, against 7 µg/kg for the unprocessed form in the same group (bread as sold).[13] In another study, cooked bread (WPRO) had cadmium lower at 13.1 µg/kg, against 14 µg/kg for the unprocessed form in the same group (bread as sold).[1] cooked a third study found that bread (all samples (4 sampling occasions, composites)) had inorganic arsenic lower at 3 µg/kg, against 5 µg/kg for the unprocessed form in the same group (bread as sold).[14]

Forms differ in water content, so a per-kilogram difference is not by itself a measured removal or gain of metal.

6 | Mitigation for bread

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

7 | Trade-offs and limits of controls

Avoiding exposed growing areas lowered the metal measured in the studies available, but no study measured the cost or supply effect of doing so.[8] 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 bread for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 2 µg/kg (WHO GEMS/Food) to 80 µg/kg (Gacal et al. 2023), so a non-detect from a less sensitive method says much less.[1,15] Reporting limits for cadmium ranged from 2 µg/kg (WHO GEMS/Food) to 40 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1] Reporting limits for total arsenic ranged from 5 µg/kg (WHO GEMS/Food) to 100 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1]

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

9 | Buying and verifying bread

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

10 | Exposure from bread

No source in the library converted bread 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 bread was decided on its content: 30 occurrence extracted, 30 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 | Bread FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, nickel, chromium, aluminum, tin, antimony, Co, Cu, Fe, Mn, Zn, V, Se, B, Ba, CrIII, CrVI, I, Mg, Na, Sr and Tl in bread, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in bread as sold from 6 results in 2 reporting regions, with a subgroup median of 7 µg/kg.[1]

In the studies available, bread from contaminated or exposed settings carried more metal than bread from the same study's control.[7] bread as sold from bread from bakeries using coal ovens, Jalingo had lead higher at 296 µg/kg, against 181 µg/kg for bread from bakeries using electric ovens, Jalingo in the same study.[7]

For cadmium, the HMI cooked reference median was lowest for bread (17.1 µg/kg) and highest for bread as sold (19.3 µg/kg); forms differ in water content, so this compares foods as sold or eaten, not uptake.[1,2]

Among GEMS/Food reporting regions, bread as sold had the lowest cadmium subgroup median in WPRO (14 µg/kg) and the highest in EURO (16.5 µg/kg); reporting regions are markets, not growing areas.[1] For total arsenic, the lowest regional median was in WPRO (8.17 µg/kg) and the highest in EURO (225 µg/kg).[1]

Only comparisons between forms in the same study are available, not before-and-after measurements of the same bread.[13] cooked bread (all samples) had lead lower at 6 µg/kg, against 7 µg/kg for the unprocessed form in the same group (bread as sold).[13]

Inorganic arsenic, the more toxic form, was measured in 17 results from 6 sources, far fewer than total arsenic.[1,3,5,12,14,16] Across 2 other studies of ordinary farms and markets, reported inorganic arsenic means and medians on an as-sold or fresh-weight basis ranged from 4 µg/kg (Food Standards Agency 2014) to 6.2 µg/kg (Marín et al. 2018).[3,5]

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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.

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.

DATA AVAILABILITY

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

PUBLICATION HISTORY

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