Garlic

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Abstract

Garlic in the HMI library has 245 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 and As from 23 sources. WHO gems/food submissions reported lead in garlic as sold from 1,092 results in 5 reporting regions, with subgroup medians from 7.45 to 330 µg/kg. In the US Total Diet Study, garlic as sold had a median lead result below 4 µg/kg across 6 composites from 2019-2020.

1 | Garlic 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 12.9 µg/kg (Marín et al. 2018) to 2,500 µg/kg (Guerra et al. 2012).[5,6] For cadmium, 4 studies on an as-sold or fresh-weight basis reported means and medians from 0.14 µg/kg (Bora et al. 2022) to 120 µg/kg (Guerra et al. 2012).[4,5]

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

2 | What counts as garlic

This page covers garlic in 3 forms kept separate in every comparison: garlic as sold (237 results), garlic powder or ground (5 results) cooked and garlic (3 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 garlic

No study in the library compared garlic 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 garlic as sold pools 77 subgroup units from 4 sampling families, with a median of below 4 µg/kg and a middle half spanning below 4 (lower quartile) and 2,170 µg/kg (upper quartile).[1,2,3,8] for lead in garlic as sold, the reference median was between 19.3 and 27.5 µg/kg, with a middle half from below 15 to between 42.6 and 43.1 µg/kg across 8 units.[1] for cadmium in garlic as sold, the reference median was 300 µg/kg, with a middle half from 130 to 450 µg/kg across 9 units.[1,9,10]

Among GEMS/Food reporting regions, garlic as sold had the lowest lead subgroup median in WPRO (7.45 µg/kg) and the highest in EMRO (330 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in EURO (9 µg/kg) and the highest in EURO (80 µg/kg).[1] For total arsenic, the lowest regional median was in WPRO (1.8 µg/kg) and the highest in WPRO (23.1 µg/kg).[1]

In one study, lead across 6 groups of garlic ranged from 7.45 µg/kg (WPRO) to 77 µg/kg (SEARO); the lowest is the lowest observed in that study, not an established sourcing preference.[1] In another study, chromium across 4 groups of garlic ranged from 300 µg/kg (Kawran Bazar market, Dhaka, sampling phase 1) to 1,600 µg/kg (Kawran Bazar market, Dhaka, sampling phase 3); the lowest is the lowest observed in that study, not an established sourcing preference.[10]

5 | Processing, cooking and preparation

Processed or prepared forms were compared only with unprocessed garlic in the same study and group. Cooked garlic (EURO) had cadmium lower at 18 µg/kg, against 80 µg/kg for the unprocessed form in the same group (garlic as sold).[1]

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

6 | Mitigation for garlic

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 garlic for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 0.3 µg/kg (WHO GEMS/Food) to 1,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1] Reporting limits for cadmium ranged from 1 µg/kg (FDA Total Diet Study) to 400 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 0.3

µg/kg (WHO GEMS/Food) to 500 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 garlic

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

10 | Exposure from garlic

No source in the library converted garlic 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 garlic was decided on its content: 23 occurrence extracted, 23 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 | Garlic 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 and As in garlic, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in garlic as sold from 1,092 results in 5 reporting regions, with subgroup medians from 7.45 to 330 µg/kg.[1]

Among GEMS/Food reporting regions, garlic as sold had the lowest lead subgroup median in WPRO (7.45 µg/kg) and the highest in EMRO (330 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in EURO (9 µg/kg) and the highest in EURO (80 µg/kg).[1]

Only comparisons between forms in the same study are available, not before-and-after measurements of the same garlic.[1] cooked garlic (EURO) had cadmium lower at 18 µg/kg, against 80 µg/kg for the unprocessed form in the same group (garlic as sold).[1]

Inorganic arsenic, the more toxic form, was measured in 7 results from 3 sources, far fewer than total arsenic.[1,6,11] Marín et al. 2018 reported inorganic arsenic at 3.1 µg/kg (mean) in garlic as sold from Vegetables and fruits group, Region of Valencia TDS 2010-2011.[6]

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STATUS AND LICENCE

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DATA AVAILABILITY

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.

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