Mustard

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Abstract

Mustard in the HMI library has 269 reported results for lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn and V from 18 sources. WHO gems/food submissions reported lead in mustard as sold from 512 results in 4 reporting regions, with subgroup medians from 15.5 to 500 µg/kg. In the US Total Diet Study, mustard as sold had a median lead result of 6 µg/kg across 3 composites from 2018-2020.

1 | Mustard overview

Across 2 other studies of ordinary farms and markets, reported lead means and medians with the basis not stated ranged from 10.8 µg/kg (Wang et al. 2020) to 48.4 µg/kg (Wang et al. 2020).[7] For cadmium, 2 studies on an as-sold or fresh-weight basis reported means and medians from 7.22 µg/kg (EMRKB et al. 2019) to 35 µg/kg (Spungen et al. 2024).[3,8] Higher results came from contaminated or exposed settings rather than ordinary supply. Mustard as sold from local vendors, Dehradun City (wastewater-irrigated fields) had chromium higher at 2,570 µg/kg, against 1,060 µg/kg for walled garden control in the same study.[4]

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

2 | What counts as mustard

This page covers mustard in 2 forms kept separate in every comparison: mustard as sold (197 results) and mustard oil (72 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 mustard

The evidence on how metals reach mustard comes from studies that compared exposed and ordinary settings. Mustard as sold from local vendors, Dehradun City (wastewater-irrigated fields) had chromium higher at 2,570 µg/kg, against 1,060 µg/kg for walled garden control in the same study.[4]

A within-study comparison in Saharanpur district, India found that *Brassica juncea* grown with clean borewell water had cadmium in leaves of 40 µg/kg DW (0.04 mg/kg), well below the FAO/WHO permissible limit of 100 µg/kg, while the same crop grown with paper mill effluent had cadmium in leaves of 150 µg/kg DW, above the limit; chromium health risk index (HRI) for children exceeded 1 under effluent irrigation but remained below 1 under borewell irrigation.[14] A field study in Brunei Darussalam found cadmium in *B. Juncea* leaves of 4,100 µg/kg DW (41-fold above FAO/WHO limit) and lead at 4,800 µg/kg DW (16-fold above limit), both from soil with moderate cadmium elevation (1.3 mg/kg pre-harvest soil Cd, near the Canadian Council of Ministers of the Environment guideline of 1.4 mg/kg); HRI for cadmium exceeded 1 for both adults (3.3) and children (5.2).[15]

These are observational comparisons from single studies; the size of the difference depends on the site, metal and distance. Irrigation water quality is the primary within-study driver in the Indian comparison; soil cadmium background is the driver in Brunei.

4 | Which forms and regions measured lower

The hmi reference for lead in mustard as sold pools 64 subgroup units from 2 sampling families, with a median of between 6 and 6.4 µg/kg and a middle half spanning below 6 (lower quartile) and between 6.4 and 50 µg/kg (upper quartile).[1,2] for lead in mustard as sold, the reference median was below 5,000 µg/kg, with a middle half from below 5 to below 10,000 µg/kg across 5 units.[1,9] for cadmium in mustard as sold, the reference median was 28 µg/kg, with a middle half from 7.22 to 38 µg/kg across 47 units.[1,2,8]

Among GEMS/Food reporting regions, mustard as sold had the lowest lead subgroup median in WPRO (15.5 µg/kg) and the highest in WPRO (500 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in EURO (14 µg/kg) and the highest in PAHO (236 µg/kg).[1]

Targeted mustard as sold samples in EURO had cadmium lower at 10 µg/kg, against 141 µg/kg for EURO in the same study.[1] In another study, targeted mustard as sold samples in EURO had cadmium lower at 87 µg/kg, against 141 µg/kg for EURO in the same study.[1]

In one study, nickel across 10 groups of mustard ranged from 550 µg/kg (sample M3, Dhaka/Chattogram/-Cumilla/Feni retail markets) to 11,300 µg/kg (sample M6, Dhaka/Chattogram/Cumilla/Feni retail markets); the lowest is the lowest observed in that study, not an established sourcing preference.[11] In another study, nickel across 4 groups of mustard ranged from 1,500 µg/kg (2nd phase (mid)) to 6,500 µg/kg (3rd phase (mid)); the lowest is the lowest observed in that study, not an established sourcing preference.[9]

Under clean (borewell) irrigation in a field trial in Saharanpur district, India, cadmium in *B. Juncea* leaves was 40 µg/kg DW, below the FAO/WHO permissible limit; under paper mill effluent irrigation in the same study, leaf cadmium rose to 150 µg/kg DW.[14] mustard honey (*Brassica juncea* floral honey) sampled from three regions of Bangladesh had cadmium below the detection limit and lead at a mean of 100 µg/kg (range below detection to 190 µg/kg), within the EU maximum admissible level of 1,000 µg/kg for honey.[16] Lead in mustard honey is not transferable to condiment mustard or mustard seeds because the bee-honey accumulation pathway differs from direct plant uptake.

5 | Processing, cooking and preparation

No study measuring metals before and after a defined processing step for condiment mustard or mustard seeds is in the library. For fermented mustard products, one migration study found that unglazed ceramic food containers with elevated cadmium and lead content (Cd 422-571 mg/kg, Pb 570-758 mg/kg in ceramic body) can leach measurable cadmium and lead into acidic pickled mustard greens juice over storage time, with cadmium reaching approximately 150 µg/L in the leachate at later time points; the paper is primarily in Vietnamese and the full numerical series is not fully extractable.[17] This is a food contact material pathway, not a primary agricultural contamination pathway.

6 | Mitigation for mustard

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.[4] 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 mustard for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 2 µg/kg (WHO GEMS/Food) to 10,000 µg/kg (Sultana et al. 2022), so a non-detect from a less sensitive method says much less.[1,9] Reporting limits for cadmium ranged from 0.4 µg/kg (WHO GEMS/Food) to 50.8 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 3 µg/kg (WHO GEMS/Food) to 200 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 mustard

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

10 | Exposure from mustard

No source in the library converted mustard 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 mustard was decided on its content: 27 records in all. The occurrence table renders every extracted result; held values remain visible with their reason. The 9 sources added in the November 7, 2026 evidence fill (HMI-TOPIC-0297) are field and laboratory studies of *Brassica juncea* tissue: they contribute pathways and variation evidence but are not retail or market occurrence surveys; their concentrations reflect specific soil conditions and are not transferable to the market-occurrence distribution.

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 | Mustard FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn and V in mustard, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in mustard as sold from 512 results in 4 reporting regions, with subgroup medians from 15.5 to 500 µg/kg.[1]

In the studies available, mustard from contaminated or exposed settings carried more metal than mustard from the same study's control.[4] mustard as sold from local vendors, Dehradun City (wastewater-irrigated fields) had cadmium higher at 460 µg/kg, against 240 µg/kg for walled garden control in the same study.[4]

Among GEMS/Food reporting regions, mustard as sold had the lowest lead subgroup median in WPRO (15.5 µg/kg) and the highest in WPRO (500 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in EURO (14 µg/kg) and the highest in PAHO (236 µg/kg).[1]

Inorganic arsenic, the more toxic form, was measured in 3 results from 3 sources, far fewer than total arsenic.[1-,12,13] Across 2 other studies of ordinary farms and markets, reported inorganic arsenic means and medians with the basis not stated ranged from 8 µg/kg (Centre for Food Safety FEHD HKSAR 2012) to 33.7 µg/kg (European Food Safety Authority (EFSA) 2014).[12,13]

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STATUS AND LICENCE

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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/mustard#sources.

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