Herbal botanicals

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Abstract

Herbal botanicals in the HMI library has 502 reported results for lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, nickel, chromium, aluminum, tin, Co, Cu, Fe, Mn, Zn, V, Ba, Mo, Sr and Tl from 28 sources. WHO GEMS/Food submissions reported lead in herbal botanicals as sold from 1,791 results in 5 reporting regions, with subgroup medians from 2.2 to 1,690 µg/kg. For cadmium, GEMS/Food gave subgroup medians from 9 to 400 µg/kg from 1,056 results.

1 | Herbal botanicals 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 60 µg/kg (Shchukin et al. 2022) to 2,570 µg/kg (Shchukin et al. 2022).[4] For cadmium, 6 studies on a dry-weight basis reported means and medians from 30 µg/kg (Falahati et al. 2025) to 430 µg/kg (Özden 2021).[8,9] Higher results came from contaminated or exposed settings rather than ordinary supply. Herbal botanicals as sold from grown independently had total mercury higher at 14.2 µg/kg, against 9.39 µg/kg for all samples in the same study.[7]

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

2 | What counts as herbal botanicals

This page covers herbal botanicals in 5 forms kept separate in every comparison: herbal botanicals as sold (425 results), herbal botanicals oil (49 results), herbal botanicals powder or ground (15 results), dried herbal botanicals (7 results) and herbal botanicals flour or meal (6 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 herbal botanicals

The evidence on how metals reach herbal botanicals comes from studies that compared exposed and ordinary settings. Herbal botanicals as sold from grown independently had total mercury higher at 14.2 µg/kg, against 9.39 µg/kg for all samples 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 lead, the HMI reference median was lowest for herbal botanicals flour or meal (276 µg/kg) and highest for herbal botanicals as sold (7,800 µg/kg); forms differ in water content, so this compares foods as sold or eaten, not uptake.[1,5,12,13] The HMI reference for lead in herbal botanicals as sold pools 18 subgroup units from 4 sampling families, with a median of 7,800 µg/kg and a middle half spanning 1,000 (lower quartile) and 20,500 µg/kg (upper quartile).[1,5,12,13] for lead in herbal botanicals as sold, the reference median was between 101 and 139 µg/kg, with a middle half from between 12.4 and 18.3 to between 350 and 355 µg/kg across 78 units.[1] for lead in herbal botanicals flour or meal, the reference median was 276 µg/kg, with a middle half from 133 to 302 µg/kg across 12 units.[1]

Among GEMS/Food reporting regions, herbal botanicals as sold had the lowest lead subgroup median in PAHO (2.2 µg/kg) and the highest in SEARO (1,690 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in PAHO (13.5 µg/kg) and the highest in PAHO (250 µg/kg).[1]

Targeted herbal botanicals as sold samples in SEARO had lead higher at 420 µg/kg, against 374 µg/kg for SEARO in the same study.[1] In another study, targeted herbal botanicals as sold samples in EURO had cadmium higher at 400 µg/kg, against 57 µg/kg for EURO in the same study.[1]

In one study, lead across 12 groups of herbal botanicals ranged from 2.2 µg/kg (PAHO) to 800 µg/kg (SEARO); the lowest is the lowest observed in that study, not an established sourcing preference.[1] In another study, lead across 8 groups of herbal botanicals ranged from 80 µg/kg (peppermint tincture 1) to 2,570 µg/kg (commercial herbal drug 3, 2020 lot); the lowest is the lowest observed in that study, not an established sourcing preference.[4]

5 | Processing, cooking and preparation

Processed or prepared forms were compared only with unprocessed herbal botanicals in the same study and group. Herbal botanicals flour or meal (EURO) had lead lower at 233 µg/kg, against 338 µg/kg for the unprocessed form in the same group (herbal botanicals 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 herbal botanicals

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.[7] 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 herbal botanicals for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 1 µg/kg (WHO GEMS/Food) to 1,300 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1] Reporting limits for cadmium ranged from 1.2 µg/kg (WHO GEMS/Food) to 100 µg/kg (Dghaim et al. 2015), so a non-detect from a less sensitive method says much less.[1,14] Reporting limits for total arsenic ranged from 25 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]

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

9 | Buying and verifying herbal botanicals

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

10 | Exposure from herbal botanicals

No source in the library converted herbal botanicals 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 herbal botanicals was decided on its content: 28 occurrence extracted, 28 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 | Herbal botanicals FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, nickel, chromium, aluminum, tin, Co, Cu, Fe, Mn, Zn, V, Ba, Mo, Sr and Tl in herbal botanicals, most often lead, cadmium and total arsenic.[1,2,3,4] WHO GEMS/Food submissions reported lead in herbal botanicals as sold from 1,791 results in 5 reporting regions, with subgroup medians from 2.2 to 1,690 µg/kg.[1]

In the studies available, herbal botanicals from contaminated or exposed settings carried more metal than herbal botanicals from the same study's control.[7] herbal botanicals as sold from grown independently had total mercury higher at 14.2 µg/kg, against 9.39 µg/kg for all samples in the same study.[7]

For lead, the HMI reference median was lowest for herbal botanicals flour or meal (276 µg/kg) and highest for herbal botanicals as sold (7,800 µg/kg); forms differ in water content, so this compares foods as sold or eaten, not uptake.[1,5,12,13]

Among GEMS/Food reporting regions, herbal botanicals as sold had the lowest lead subgroup median in PAHO (2.2 µg/kg) and the highest in SEARO (1,690 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in PAHO (13.5 µg/kg) and the highest in PAHO (250 µg/kg).[1]

Only comparisons between forms in the same study are available, not before-and-after measurements of the same herbal botanicals.[1] herbal botanicals flour or meal (EURO) had lead lower at 233 µg/kg, against 338 µg/kg for the unprocessed form in the same group (herbal botanicals as sold).[1]

Inorganic arsenic, the more toxic form, was measured in 7 results from 2 sources, far fewer than total arsenic.[1,15] European Food Safety Authority (EFSA) 2014 reported inorganic arsenic at 260 µg/kg (mean) in herbal botanicals as sold from European dietary-survey occurrence data.[15]

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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/herbal-botanicals#sources.

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