Almond

Karen Pendergrass · Heavy Metal Index, Institute of Contaminant Standards

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Abstract

Almond in the HMI library has 190 reported results for lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, uranium, Co, Cu, Fe, Mn, Zn, V, Se, Ca, CrIII, Hg, K, Mg, Mo, Na, P and Sr from 19 sources. WHO gems/food submissions reported lead in almond as sold from 366 results in 3 reporting regions, with subgroup medians from 2.2 to 352 µg/kg. In the US Total Diet Study, almond as sold had a median lead result below 4 µg/kg across 3 composites from 2018-2020.

1 | Almond 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 25.8 µg/kg (Begday et al. 2026) to 80 µg/kg (Caridi et al. 2021).[3,7] For cadmium, 4 studies on an as-sold or fresh-weight basis reported means and medians from 0.3 µg/kg (Pehlivan et al. 2008) to 15 µg/kg (Spungen et al. 2024).[8,9]

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

2 | What counts as almond

This page covers almond in 4 forms kept separate in every comparison: almond as sold (163 results), almond flour or meal (11 results), almond oil (9 results) cooked and almond (7 results).[1,2,3,4,5,6] Foods made from almond that have their own pages, such as almond beverage, 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 almond

No study in the library compared almond 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 almond as sold pools 53 subgroup units from 5 sampling families, with a median of below 18.5 µg/kg and a middle half spanning below 4 (lower quartile) and below 52 µg/kg (upper quartile).[1,2,5,6,9] for cadmium in almond as sold, the reference median was between 5 and 21 µg/kg, with a middle half from below 12 to between 18 and 30 µg/kg across 41 units.[1,2,5] for total arsenic in almond as sold, the reference median was between 4.1 and 12 µg/kg, with a middle half from below 10 to between 12 and 42.5 µg/kg across 34 units.[1,2]

Among GEMS/Food reporting regions, almond as sold had the lowest lead subgroup median in PAHO (2.2 µg/kg) and the highest in WPRO (352 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in PAHO (11.6 µg/kg) and the highest in EMRO (15 µg/kg).[1]

Targeted almond as sold samples in EURO had cadmium lower at 6 µg/kg, against 13 µg/kg for EURO in the same study.[1] In another study, targeted almond as sold samples in EURO had cadmium lower at 7 µg/kg, against 13 µg/kg for EURO in the same study.[1]

5 | Processing, cooking and preparation

Processed or prepared forms were compared only with unprocessed almond in the same study and group. Cooked almond (market samples, Konya Province, turkey (2021 products)) had lead higher at 73 µg/kg, against 55.2 µg/kg for the unprocessed form in the same group (almond as sold).[10]

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

6 | Mitigation for almond

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 almond for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 1 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] Reporting limits for cadmium ranged from 0.4 µg/kg (WHO GEMS/Food) to 50 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 (FDA Total Diet Study) to 700 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,2]

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

9 | Buying and verifying almond

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

10 | Exposure from almond

No source in the library converted almond 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 almond was decided on its content: 19 occurrence extracted, 19 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 | Almond FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, uranium, Co, Cu, Fe, Mn, Zn, V, Se, Ca, CrIII, Hg, K, Mg, Mo, Na, P and Sr in almond, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in almond as sold from 366 results in 3 reporting regions, with subgroup medians from 2.2 to 352 µg/kg.[1]

Among GEMS/Food reporting regions, almond as sold had the lowest lead subgroup median in PAHO (2.2 µg/kg) and the highest in WPRO (352 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in PAHO (11.6 µg/kg) and the highest in EMRO (15 µg/kg).[1]

Only comparisons between forms in the same study are available, not before-and-after measurements of the same almond.[10] cooked almond (market samples, Konya Province, turkey (2021 products)) had lead higher at 73 µg/kg, against 55.2 µg/kg for the unprocessed form in the same group (almond as sold).[10]

Inorganic arsenic, the more toxic form, was measured in 4 results from 2 sources, far fewer than total arsenic.[1,11] European Food Safety Authority (EFSA) 2014 reported inorganic arsenic at 10.8 µg/kg (mean) in almond as sold from European dietary-survey occurrence data.[11]

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GOVERNMENT

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/almond#sources.

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