Eggs

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Abstract

Eggs in the HMI library has 941 reported results for lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, methylmercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, As, B, Ba, F, Hg, I, Mg, Mo, S, Sr and Tl from 50 sources. WHO gems/food submissions reported lead in eggs as sold from 6,699 results in 5 reporting regions, with subgroup medians from 0.569 to 340 µg/kg. In the US Total Diet Study, cooked eggs had a median lead result below 4 µg/kg across 27 composites from 2017-2020.

1 | Eggs overview

Across 6 other studies of ordinary farms and markets, reported lead means and medians on an as-sold or fresh-weight basis ranged from 4.2 µg/kg (Marín et al. 2018) to 5,600 µg/kg (Chowdhury et al. 2024).[4,8] For cadmium, 5 studies on an as-sold or fresh-weight basis reported means and medians from 0.6 µg/kg (EFSA Panel on Contaminants in the Food Chain (CONTAM) 2009) to 625 µg/kg (Chowdhury et al. 2024).[4,9] Higher results came from contaminated or exposed settings rather than ordinary supply. Eggs as sold from Hg mining area (Wuchuan) (mining-affected area) had Zn higher at 61,800 µg/kg, against 310 µg/kg for background area (Anshun) in the same study.[10]

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

2 | What counts as eggs

This page covers eggs in 5 forms kept separate in every comparison: eggs as sold (914 results), dried eggs (10 results), cooked eggs (9 results), canned eggs (4 results) and eggs powder or ground (4 results).[1,2,3,4,5,6] Foods made from eggs that have their own pages, such as egg noodles, 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 eggs

The evidence on how metals reach eggs comes from studies that compared exposed and ordinary settings. Eggs as sold from Hg mining area (Wuchuan) (mining-affected area) had Zn higher at 61,800 µg/kg, against 310 µg/kg for background area (Anshun) in the same study.[10] In another study, eggs as sold from HEM diet + 0.4 mg Se/kg as selenized yeast (HEM+Se) (experiment) had Se higher at 1,640 µg/kg, against 610 µg/kg for hens fed corn-soybean meal basal diet (control, CON) in the same study.[7] a third study found that eggs as sold from 100% of soybean oil replaced by black soldier fly larvae oil (experiment) had aluminum higher at 3,660 µg/kg, against 2,210 µg/kg for control diet, corn-soybean meal with soybean oil (CON) in the same study.[12]

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

The hmi reference for lead in eggs as sold pools 165 subgroup units from 2 sampling families, with a median of 183 µg/kg and a middle half spanning below 10 (lower quartile) and 183 µg/kg (upper quartile).[1,11] cooked for lead in eggs, the reference median was below 4 µg/kg, with a middle half from below 4 to below 4 µg/kg across 28 units.[2,14] for lead in eggs as sold, the reference median was between 230 and 230 µg/kg, with a middle half from below 0.12 to 6,460 µg/kg across 18 units.[15,16]

Among GEMS/Food reporting regions, eggs as sold had the lowest lead subgroup median in PAHO (0.569 µg/kg) and the highest in SEARO (340 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in PAHO (0.4 µg/kg) and the highest in EURO (20.8 µg/kg).[1] For inorganic arsenic, the lowest regional median was in WPRO (8.5 µg/kg) and the highest in WPRO (90 µg/kg).[1]

In one study, lead across 30 groups of eggs ranged from 10 µg/kg (Leghorn hens, rural farm (R2, white shell)) to 1,500 µg/kg (organic eggs, supermarket 1 (S1)); the lowest is the lowest observed in that study, not an established sourcing preference.[17] In another study, lead across 15 groups of eggs ranged from 460 µg/kg (Farm B) to 15,000 µg/kg (Farm F); the lowest is the lowest observed in that study, not an established sourcing preference.[16]

5 | Processing, cooking and preparation

Processed or prepared forms were compared only with unprocessed eggs in the same study and group. Canned eggs (all samples (Guangzhou, 2014-2017)) had lead lower at 4 µg/kg, against 6 µg/kg for the unprocessed form in the same group (eggs as sold).[18] In another study, canned eggs (China, 31 provinces, all samples) had cadmium higher at 8 µg/kg, against 7 µg/kg for the unprocessed form in the same group (eggs as sold).[19] a third study found that eggs powder or ground (all samples (EU Member State submissions)) had cadmium higher at 10.4 µg/kg, against 3.33 µg/kg for the unprocessed form in the same group (eggs as sold).[20]

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

6 | Mitigation for eggs

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.[10] 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 eggs for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 0.08 µg/kg (Iyu 2022) to 3,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,21] Reporting limits for cadmium ranged from 0.05 µg/kg (Iyu 2022) to 1,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,21] Reporting limits for total arsenic ranged from 1 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 eggs

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

10 | Exposure from eggs

No source in the library converted eggs 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 eggs was decided on its content: 50 occurrence extracted, 50 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 | Eggs FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, methylmercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, As, B, Ba, F, Hg, I, Mg, Mo, S, Sr and Tl in eggs, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in eggs as sold from 6,699 results in 5 reporting regions, with subgroup medians from 0.569 to 340 µg/kg.[1]

In the studies available, eggs from contaminated or exposed settings carried more metal than eggs from the same study's control.[7] eggs as sold from basal diet + 5 mg Cd, 50 mg Pb, 3 mg Hg, 5 mg Cr per kg (HEM) (experiment) had lead higher at 1,000 µg/kg, against 920 µg/kg for hens fed corn-soybean meal basal diet (control, CON) in the same study.[7]

Among GEMS/Food reporting regions, eggs as sold had the lowest lead subgroup median in PAHO (0.569 µg/kg) and the highest in SEARO (340 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in PAHO (0.4 µg/kg) and the highest in EURO (20.8 µg/kg).[1]

Only comparisons between forms in the same study are available, not before-and-after measurements of the same eggs.[18] canned eggs (all samples (Guangzhou, 2014-2017)) had lead lower at 4 µg/kg, against 6 µg/kg for the unprocessed form in the same group (eggs as sold).[18]

Inorganic arsenic, the more toxic form, was measured in 16 results from 6 sources, far fewer than total arsenic.[1,6,8,22,23,24] Across 2 other studies of ordinary farms and markets, reported inorganic arsenic means and medians with the basis not stated ranged from 26.8 µg/kg (European Food Safety Authority (EFSA) 2014) to 58 µg/kg (Centre for Food Safety FEHD HKSAR 2012).[23,24]

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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/eggs#sources.

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