Oranges

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Abstract

Oranges in the HMI library has 420 reported results for lead, cadmium, total arsenic, inorganic arsenic, total mercury, methylmercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, As, Ba, Hg, Mo and Tl from 37 sources. WHO gems/food submissions reported lead in oranges as sold from 1,964 results in 5 reporting regions, with subgroup medians from 10.4 to 880 µg/kg. In the US Total Diet Study, oranges as sold had a median lead result below 4 µg/kg across 27 composites from 2017-2020.

1 | Oranges overview

Across 5 other studies of ordinary farms and markets, reported lead means and medians on an as-sold or fresh-weight basis ranged from 1.6 µg/kg (Marín et al. 2018) to 1,100 µg/kg (Guerra et al. 2012).[3,8] For cadmium, 4 studies on an as-sold or fresh-weight basis reported means and medians from 0.1 µg/kg (Lee et al. 2011) to 60 µg/kg (Guerra et al. 2012).[3,5] Higher results came from contaminated or exposed settings rather than ordinary supply. Oranges as sold from migratable fraction in 0.07 M HCl had Ba higher at 7,900 µg/kg, against 1,200 µg/kg for migratable fraction in 0.07 M HCl in the same study.[7]

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

2 | What counts as oranges

This page covers oranges in 5 forms kept separate in every comparison: oranges as sold (398 results), oranges juice (7 results), dried oranges (6 results), peeled or flesh oranges (6 results) cooked and oranges (3 results).[1,2,3,4,5,6] Foods made from oranges that have their own pages, such as orange juice, 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 oranges

The evidence on how metals reach oranges comes from studies that compared exposed and ordinary settings. Oranges as sold from migratable fraction in 0.07 M HCl had Ba higher at 7,900 µg/kg, against 1,200 µg/kg for migratable fraction in 0.07 M HCl 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

The hmi reference for lead in oranges as sold pools 115 subgroup units from 6 sampling families, with a median of between 147 and 200 µg/kg and a middle half spanning below 4 (lower quartile) and 1,300 µg/kg (upper quartile).[1,2,4,16,17,18] for lead in oranges as sold, the reference median was 110 µg/kg, with a middle half from 80 to 220 µg/kg across 7 units.[1] for cadmium in oranges as sold, the reference median was 400 µg/kg, with a middle half from below 1.6 to 500 µg/kg across 93 units.[1,2,4,7,17]

Among GEMS/Food reporting regions, oranges as sold had the lowest lead subgroup median in PAHO (10.4 µg/kg) and the highest in EURO (215 µg/kg); reporting regions are markets, not growing areas.[1] For total arsenic, the lowest regional median was in EURO (0.307 µg/kg) and the highest in EURO (22 µg/kg).[1] For total mercury, the lowest regional median was in WPRO (1.5 µg/kg) and the highest in PAHO (490 µg/kg).[1]

In one study, lead across 5 groups of oranges ranged from 20 µg/kg (Retail shop 2 (super market, Dhanmondi), Dhaka) to 60 µg/kg (Retail shop 1 (super shop, Mirpur-10), Dhaka); the lowest is the lowest observed in that study, not an established sourcing preference.[14] In another study, lead across 5 groups of oranges ranged from 40 µg/kg (Oyingbo market (Lagos Mainland)) to 217 µg/kg (Ketu market (Ikosi/Isheri)); the lowest is the lowest observed in that study, not an established sourcing preference.[19]

5 | Processing, cooking and preparation

No processing study for metals in this food is in the library yet.

6 | Mitigation for oranges

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 oranges for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 0.333 µg/kg (WHO GEMS/Food) to 4,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1] Reporting limits for cadmium ranged from 0.001 µg/kg (Lee et al. 2011) to 1,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,5] Reporting limits for total arsenic ranged from 0.03 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 oranges

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

10 | Exposure from oranges

No source in the library converted oranges 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 oranges was decided on its content: 37 occurrence extracted, 37 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 | Oranges FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, total mercury, methylmercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, As, Ba, Hg, Mo and Tl in oranges, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in oranges as sold from 1,964 results in 5 reporting regions, with subgroup medians from 10.4 to 880 µg/kg.[1]

In the studies available, oranges from contaminated or exposed settings carried more metal than oranges from the same study's control.[7] oranges as sold from migratable fraction in 0.07 M HCl had Ba higher at 7,900 µg/kg, against 1,200 µg/kg for migratable fraction in 0.07 M HCl in the same study.[7]

Among GEMS/Food reporting regions, oranges as sold had the lowest lead subgroup median in PAHO (10.4 µg/kg) and the highest in EURO (215 µg/kg); reporting regions are markets, not growing areas.[1] For total arsenic, the lowest regional median was in EURO (0.307 µg/kg) and the highest in EURO (22 µg/kg).[1]

Inorganic arsenic, the more toxic form, was measured in 9 results from 5 sources, far fewer than total arsenic.-[1,8,20,21,22] Marín et al. 2018 reported inorganic arsenic at 0.8 µg/kg (mean) in oranges as sold from Vegetables and fruits group, Region of Valencia TDS 2010-2011.[8]

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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/oranges#sources.

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