# Vegetable Oils

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## Abstract

Vegetable oils in the HMI library has 877 reported results for lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, Ba, K, Na and Tl from 23 sources. WHO GEMS/Food submissions reported lead in vegetable oils from 37 results in 2 reporting regions, with subgroup medians below 10 µg/kg, mostly non-detects. In the US Total Diet Study, vegetable oils had a median lead result below 5 µg/kg across 3 composites from 2018-2020.

## 1 | Vegetable oils overview

Across 4 other studies of ordinary farms and markets, reported lead means and medians on an as-sold or fresh-weight basis ranged from 2.58 µg/kg (S-T et al. 2024) to 27 µg/kg (Mehri et al. 2024).[4,6] For cadmium, 3 studies on an as-sold or fresh-weight basis reported means and medians from 0.079 µg/kg (S-T et al. 2024) to 11 µg/kg (Mehri et al. 2024).[4,6] Higher results came from contaminated or exposed settings rather than ordinary supply. Vegetable oils oil from industrial had Fe higher at 23,700 µg/kg, against 11,300 µg/kg for industrial in the same study.[4]

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

## 2 | What counts as vegetable oils

This page covers vegetable oils in 2 forms kept separate in every comparison: vegetable oils (761 results) and vegetable oils as sold (116 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 vegetable oils

The evidence on how metals reach vegetable oils comes from studies that compared exposed and ordinary settings. Vegetable oils oil from industrial had Fe higher at 23,700 µg/kg, against 11,300 µg/kg for industrial in the same study.[4]

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 vegetable oils pools 44 subgroup units from 5 sampling families, with a median of below 8 µg/kg and a middle half spanning below 5 (lower quartile) and 17 µg/kg (upper quartile).[1,2,3,5,8] for lead in vegetable oils as sold, the reference median was below 4 µg/kg, with a middle half from below 4 to below 14 µg/kg across 111 units.[1,2,8] for cadmium in vegetable oils, the reference median was below 2 µg/kg, with a middle half from below 2 to below 10 µg/kg across 59 units.[1,2,3,8]

Among GEMS/Food reporting regions, vegetable oils as sold had the lowest lead subgroup median in SEARO (30 µg/kg) and the highest in SEARO (40 µg/kg); reporting regions are markets, not growing areas.[1]

In one study, lead across 37 groups of vegetable oils ranged from 4 µg/kg (edible oil sample 2, Riyadh supermarket) to 87 µg/kg (edible oil sample 39, Riyadh supermarket); the lowest is the lowest observed in that study, not an established sourcing preference.[3] In another study, nickel across 5 groups of vegetable oils ranged from 1,070 µg/kg (sample D5, Dhaka/Chattogram/Cumilla/Feni retail markets) to 27,100 µg/kg (sample D4, Dhaka/Chattogram/Cumilla/Feni retail markets); the lowest is the lowest observed in that study, not an established sourcing preference.[5]

## 5 | Processing, cooking and preparation

Processed or prepared forms were compared only with unprocessed vegetable oils in the same study and group. Vegetable oils (GEMS/Food contaminants database) had cadmium lower at 2.5 µg/kg, against 4.4 µg/kg for the unprocessed form in the same group (vegetable oils as sold).[9] In another study, vegetable oils (European dietary-survey occurrence data) had inorganic arsenic higher at 16.9 µg/kg, against 8.2 µg/kg for the unprocessed form in the same group (vegetable oils as sold).[10] A third study found that vegetable oils (EU occurrence data) had total mercury higher at 0.5 µg/kg, against 0.2 µg/kg for the unprocessed form in the same group (vegetable oils as sold).[11]

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

## 6 | Mitigation for vegetable oils

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 vegetable oils for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 2 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 0.1 µg/kg (Alrajhi et al. 2020) to 1,200 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,3] Reporting limits for total arsenic ranged from 2 µg/kg (WHO GEMS/Food) to 160 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 vegetable oils

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

## 10 | Exposure from vegetable oils

No source in the library converted vegetable oils 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 vegetable oils was decided on its content: 23 occurrence extracted, 23 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 | Vegetable oils FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, Ba, K, Na and Tl in vegetable oils, most often lead, cadmium and total arsenic.[1,2,3,4] WHO GEMS/Food submissions reported lead in vegetable oils from 37 results in 2 reporting regions, with subgroup medians below 10 µg/kg, mostly non-detects.[1]

In the studies available, vegetable oils from contaminated or exposed settings carried more metal than vegetable oils from the same study's control.[4] vegetable oils oil from industrial had lead higher at 27 µg/kg, against 13 µg/kg for industrial in the same study.[4]

Among GEMS/Food reporting regions, vegetable oils as sold had the lowest lead subgroup median in SEARO (30 µg/kg) and the highest in SEARO (40 µg/kg); reporting regions are markets, not growing areas.[1]

Only comparisons between forms in the same study are available, not before-and-after measurements of the same vegetable oils.[9] vegetable oils (GEMS/Food contaminants database) had cadmium lower at 2.5 µg/kg, against 4.4 µg/kg for the unprocessed form in the same group (vegetable oils as sold).[9]

Inorganic arsenic, the more toxic form, was measured in 8 results from 5 sources, far fewer than total arsenic.[1,12,10,13,14] European Food Safety Authority (EFSA) 2014 reported inorganic arsenic at 16.9 µg/kg (mean) in vegetable oils oil from european dietary-survey occurrence data.[10]

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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/vegetable-oils#sources.

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