# Popcorn

Karen Pendergrass · Heavy Metal Index, Institute of Contaminant Standards

HEAVY METAL INDEX · INGREDIENT PROFILE October 2026

DOI 10.83376/hmi.ingredient.popcorn

CITE AS

Pendergrass, K. (2026). Popcorn. Heavy Metal Index. https://doi.org/10.83376/hmi.ingredient.popcorn

CORRESPONDENCE

Corrections are logged publicly on the article page, each with its date, the affected value, and the source that resolved it.

KEYWORDS

heavy metals, food safety, dietary exposure

PUBLICATION HISTORY

This revision 2026-10-22.

## Abstract

Popcorn in the HMI library has 83 reported results for lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, uranium, Co, Cu, Mn, Zn, V, Se, Ba, Mo, Si and Sr from 10 sources. WHO gems/food submissions reported lead in popcorn as sold from 65 results in 3 reporting regions, with subgroup medians from 3.4 to 50 µg/kg. In the US Total Diet Study, popcorn as sold had a median lead result below 5 µg/kg across 3 composites from 2018-2020.

## 1 | Popcorn 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 3.8 µg/kg (Spungen et al. 2024) to 107 µg/kg (Bielecka et al. 2022).[3,5] For cadmium, 2 studies on an as-sold or fresh-weight basis reported means and medians from 3.68 µg/kg (Bielecka et al. 2022) to 6 µg/kg (Spungen et al. 2024).[3,5]

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

## 2 | What counts as popcorn

This page covers popcorn as sold (83 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 popcorn

No study in the library compared popcorn 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 popcorn as sold pools 32 subgroup units from 3 sampling families, with a median of between 6.5 and 23 µg/kg and a middle half spanning below 5 (lower quartile) and 107 µg/kg (upper quartile).[1,2,3] for cadmium in popcorn as sold, the reference median was between 4.03 and 5.1 µg/kg, with a middle half from below 4.03 to between 6.1 and 6.2 µg/kg across 49 units.[1,2,3,4] for total arsenic in popcorn as sold, the reference median was below 5.4 µg/kg, with a middle half from below 4 to between 3.82 and 12 µg/kg across 15 units.[1,2,3,4,7]

Among GEMS/Food reporting regions, popcorn as sold had the lowest lead subgroup median in PAHO (3.4 µg/kg) and the highest in EURO (50 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in EURO (4.5 µg/kg) and the highest in EMRO (14 µg/kg).[1] For total arsenic, the lowest regional median was in EURO (7 µg/kg) and the highest in EURO (245 µg/kg).[1]

## 5 | Processing, cooking and preparation

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

## 6 | Mitigation for popcorn

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 popcorn for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 0.2 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 0.017 µg/kg (Bielecka et al. 2022) 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 0.019 µg/kg (Bielecka et al. 2022) to 50 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,3]

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

## 9 | Buying and verifying popcorn

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

## 10 | Exposure from popcorn

No source in the library converted popcorn 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 popcorn was decided on its content: 10 occurrence extracted, 10 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 | Popcorn FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, total mercury, nickel, chromium, aluminum, tin, uranium, Co, Cu, Mn, Zn, V, Se, Ba, Mo, Si and Sr in popcorn, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in popcorn as sold from 65 results in 3 reporting regions, with subgroup medians from 3.4 to 50 µg/kg.[1]

Among GEMS/Food reporting regions, popcorn as sold had the lowest lead subgroup median in PAHO (3.4 µg/kg) and the highest in EURO (50 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in EURO (4.5 µg/kg) and the highest in EMRO (14 µg/kg).[1]

Inorganic arsenic, the more toxic form, was measured in 1 result from 1 source, far fewer than total arsenic.[1] WHO GEMS/Food submissions reported inorganic arsenic in popcorn as sold from 4 results in 1 reporting region, with subgroup medians below 15.8 µg/kg, mostly non-detects.[1]

## References


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## STATUS AND LICENCE

Editorially reviewed in-house; no external peer review has been completed on this ingredient profile. Published as an institutional technical report with its review state tracked on the article page. Released under CC BY 4.0.

## DATA AVAILABILITY

Every source behind this ingredient profile is listed with its own source record at https://heavymetalindex.com/ingredients/popcorn#sources.

## COMPETING INTERESTS

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## PUBLICATION HISTORY

This revision 2026-10-22. The full dated record is maintained at https://heavymetalindex.com/ingredients/popcorn.