Corn

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Abstract

Most corn sold as maize grain or sweet corn carries lead, cadmium, arsenic and mercury below or near the limits laboratories can measure. In WHO GEMS/Food, European maize grain had a median lead result below 20 µg/kg across 890 results from 2001 to 2020, and 8 exceeded the EU and Codex cereal limit of 200 µg/kg; cadmium had a median below 3.2 µg/kg, with 3 of 1,238 results above the 100 µg/kg limit. Frozen corn boiled as eaten in the US Total Diet Study had lead, arsenic and mercury below detection in all 27 national composites, and a median cadmium of 2.6 µg/kg.

1 | Corn overview

The exceptions come from where the corn grew. Maize from farms downwind of a Nigerian cement plant averaged 230-380 µg/kg lead against 20 µg/kg at a control farm, maize irrigated with wastewater in Egypt carried 260-550 µg/kg lead against 30-40 µg/kg or less with fresh or ground water, and maize within 1 km of Chinese coal-fired power plants held about 21 µg/kg mercury against about 1 µg/kg at 5 km and 0.72 µg/kg in maize from a distant grocery store.[3,4,5] Field surveys in China, Bangladesh and Burkina Faso also report cadmium or lead in ordinary maize at or above the cereal limits, though several use dry-weight or unstated bases that cannot be set directly beside monitoring results.[6,7,11,12]

For a buyer the practical points are the growing area, the form bought and the laboratory's quantification limit. M aize grain and sweet corn have different legal limits: the EU allows 200 µg/kg lead and 100 µg/kg cadmium i n cereals but 100 µg/kg lead and 20 µg/kg cadmium in sweet corn, on a wet-weight basis.[9] Lot results with a quantification limit well below those values are the supported check; testing finds contamination but does not remove it.[1,9]

2 | What counts as corn

This page covers corn (Zea mays) in two forms that are measured and regulated differently: mature maize grain, the dry kernels sold as a cereal, and fresh corn, meaning sweet corn or green frozen ears eaten as a vegetable raw or cooked, together with baby corn.[1,2,9] Each form is kept separate because sweet corn is mostly water and grain is dry, so the same amount of metal gives a much lower concentration per kilogram of sweet corn.[9,10]

Foods made from corn have their own pages and their results are not used here: canned corn, corn flour and meal, grits, polenta, corn flakes, popcorn, tortillas, cornbread, corn oil and corn syrup.[1,2] Animal feed, maize silage, infant cereals that contain corn and corn salad, a leafy vegetable that is not corn at all, are also outside this page.[1]

Results are kept on the basis each source reports. Monitoring programs report corn as sold or as eaten, field studies often report dried grain, and several papers do not say which, so dry-weight, as-sold and unstated results are never pooled.[1,3,11,13]

3 | How metals reach corn

Corn takes up cadmium and nickel from soil into the grain, while lead and mercury reach the grain more from air and dust deposited on the plant.[3,5,8] In Guangxi, maize grain cadmium and lead uptake fell as soil organic carbon and manganese rose, and cadmium uptake also fell with higher soil pH, across 65 paired grain and soil samples.[8] In Bangladesh, soil-to-grain transfer factors for maize were 0.054 for cadmium and 0.014 for lead, so grain carried a small fraction of soil levels.[7]

Industrial emissions raise the metals in corn grown nearby. At five farms around a cement plant at Obajana, Kogi State, Nigeria, maize harvested in 2017 averaged 230-380 µg/kg lead on a dry-weight basis at the three downwind farms against 20 µg/kg at a control farm 18 km upwind.[3] Near two Chinese coal-fired power plants, maize mercury fell from about 21 µg/kg at 1 km to 4.7-6.7 µg/kg at 3 km and 1.06 µg/kg at 5 km, on a fresh-weight basis, against 0.72 µg/kg in maize from a grocery store more than 55 km away.[5] Maize from a village 2.5 km from a battery plant in Henan averaged 140 µg/kg lead and 70 µg/kg mercury, with the basis not stated.[16]

Irrigation water and mining waste are the other routes in the evidence. In Egypt, maize irrigated with sewage or industrial wastewater carried 260-550 µg/kg lead and 38-112 µg/kg cadmium, against 30-40 µg/kg lead and 9-10 µg/kg cadmium or less with Nile or ground water, basis not stated.[4] In a high-arsenic coal-burning area of Shaanxi, China, corn dried before analysis held 4,240 µg/kg arsenic, and a corn sample from a gold-mining orchard in Ecuador held 740 µg/kg arsenic and 1,620 µg/kg nickel.[14,26]

In the studies available, yes: maize downwind of a cement plant averaged 230-380 µg/kg lead against 20 µg/kg at a control farm, and maize within 1 km of coal-fired power plants held about 21 µg/kg mercury against about 1 µg/kg at 5 km.[3,5] These are single observational studies, so the size of the effect elsewhere depends on emissions, wind and distance.[3,5]

4 | Which forms and regions measured lower

For lead, fresh and cooked sweet corn measured lowest in the evidence. Frozen corn boiled as eaten had lead below 4 µg/kg in all 27 US Total Diet Study composites from 2017 to 2020, and only 1 of 65 cooked sweet corn results submitted to GEMS/Food from the Americas in 2000-2017 was detected.[1,2] Raw sweet corn had median lead below 10 µg/kg in European and South-East Asian submissions and below 1.4 µg/kg in 65 results from the Americas in 2014-2016, while maize grain had a median below 20 µg/kg in Europe.[1] Sweet corn is mostly water, so these per-kilogram differences do not show that sweet corn plants take up less lead than grain maize.

Among regions reporting maize grain, European results were lowest for lead and Western Pacific results highest.[1] Western Pacific submissions from 2001 to 2010, almost all labeled domestic, had a median of 29-50 µg/kg and 24 of 327 above 200 µg/kg, against 8 of 890 in Europe.[1] Within Europe, maize labeled imported had a median below 17 µg/kg and a highest detected value of 155 µg/kg, against a median below 20 µg/kg and a highest value of 790 µg/kg for domestic maize, a tentative difference from 48 imported results.[1] WHO regions are reporting regions, not growing areas, so this does not identify producing countries with lower lead.

European maize lead also fell over time.[1] 4 of 233 grain results from 2001-2007 and 4 of 257 from 2008-2013 exceeded 200 µg/kg, against none of 400 from 2014-2020.[1]

For cadmium, monitored maize grain and sweet corn were both low, and imported sweet corn measured lower than domestic sweet corn in Europe.[1] European grain had a median below 3.2 µg/kg, and European sweet corn a median of 1-4 µg/kg; sweet corn labeled imported had a median below 2.4 µg/kg against 2.6-4 µg/kg for domestic, from 138 and 129 results.[1] Field surveys in China were higher: maize from Guizhou karst fields averaged 43 µg/kg with 13.5% above 100 µg/kg, and maize from an industrial area near Chengdu averaged 260 µg/kg, both on a dry-weight basis.[6,12] Maize from Nanyang Basin fields in Henan averaged 18 µg/kg cadmium on an air-dried basis, showing that ordinary Chinese fields are not uniformly high.[18]

For arsenic, maize grain is generally low but has a wider upper tail than sweet corn.[1] European total arsenic medians were below 12-15 µg/kg for grain and below 10 µg/kg for sweet corn, but 7 of 721 grain results exceeded 300 µg/kg, the Mercosur cereal limit, against a highest sweet corn value of 27 µg/kg in Europe.[1,27] Only 12 maize results were speciated for inorganic arsenic, and 2 were detected, at 8 and 310 µg/kg.[1] Maize from Bangladesh fields averaged 640 µg/kg total arsenic on a dry-weight basis, and Sri Lankan farm maize averaged 91 µg/kg wet weight with most results below detection, so arsenic depends strongly on local soil and water.[7,19]

Per kilogram, yes, for lead in the monitoring evidence: raw sweet corn medians were below 1.4-10 µg/kg and cooked US sweet corn was below 4 µg/kg in every composite, against a European grain median below 20 µg/kg.[1,2] Sweet corn is mostly water and grain is dry, so this reflects the food as eaten rather than lower uptake, and the EU sets a lower lead limit for sweet corn (100 µg/kg) than for cereals (200 µg/kg).[9]

European submissions, with a median below 20 µg/kg and 8 of 890 results above 200 µg/kg, against 24 of 327 above 200 µg/kg in Western Pacific submissions from 2001-2010.[1] These are reporting markets, mostly of domestic grain, so they show where testing found lower lead rather than which countries grow cleaner maize.[1]

5 | Drying, cooking and processing

No study in the library measured the same corn before and after washing, husking, milling, soaking or cooking for metals. Cooking was compared only across different samples: cooked sweet corn submitted to GEMS/Food had lead and cadmium medians similar to raw sweet corn from the same region, with overlapping reporting limits.[1] Heat does not destroy metals, so cooking can lower a concentration only by moving metal into water or adding water to the food.

Drying works the other way. Field studies report dried grain, and drying raises the concentration per kilogram because water is removed, so dry-weight results cannot be set against sweet corn as eaten.[3,15,12] Fresh sweet corn from a North Dakota farmers' market, measured after oven drying, had 7 µg/kg lead and 6 µg/kg cadmium o n a dry-weight basis.[15]

Milled and processed maize foods are outside this page, but one comparison shows why corn matters to their contamination. European infant porridges and cakes that mixed rice with maize and other grains had median

inorganic arsenic of 10 and 8 µg/kg against 66 and 60 µg/kg for pure rice products, although maize's own c ontribution was not separated.[28]

6 | Mitigation from field to lot

Measured or observed controls for metals in corn act at the field and at lot release. Field siting has the clearest evidence: grain from farms downwind of a cement plant, irrigated with wastewater, or within 3 km of coal-fired power plants carried several to many times more lead or mercury than grain from control sites in the same studies.[3,4,5] These are observational comparisons, not tested interventions, and they come from single studies in Nigeria, Egypt and China.[3,4,5]

Crop choice changes exposure on contaminated land. Near the Chinese power plants, maize held about a third of the mercury of rice at the same locations (21 against 63 µg/kg at 1 km), and in the Chengdu industrial area maize averaged 260 µg/kg cadmium against 460 µg/kg for rice.[5,6] In Guangxi, soils richer in organic carbon and manganese, and with higher pH, gave lower cadmium uptake into maize grain, which supports liming and organic amendments as plausible levers, although no amendment was tested on maize grain in the library.[8]

At release, the supported control is lot testing against the destination limit with an adequate method.[9,10] A portable screening method recovered 95-110% of cadmium and lead added to corn, which supports rapid screening, while laboratory confirmation remains necessary.[29]

7 | Trade-offs and limits of controls

Choosing corn instead of rice on contaminated land lowers mercury and cadmium in the grain but does not remove the source.[5,6] The same Chengdu maize still averaged 290 µg/kg lead, above the 200 µg/kg cereal limit, so a crop switch can trade one problem for another.[6,9]

Metals do not move together. In Burkina Faso markets, maize from Ouagadougou and Cinkassé had the same median lead (230 µg/kg) but nickel of 670 against 1,090 µg/kg, and maize from Bangladesh fields carried 1,900 µg/kg chromium and 1,400 µg/kg nickel alongside 310 µg/kg lead on a dry-weight basis.[7,11] A lot that passes a lead limit therefore says little about cadmium, arsenic or nickel unless those are tested as well.[9]

Grain and sweet corn are judged against different limits. A sweet corn lot at 50 µg/kg lead is within the EU sweet corn limit of 100 µg/kg, while the same value in grain would be a quarter of the cereal limit; comparing them per kilogram without moisture mixes two different foods.[9]

8 | Testing corn for metals

A useful corn test reports total lead, cadmium and arsenic with quantification limits well below the limits that apply.[9,10] Many GEMS/Food maize non-detects carried limits of 20-40 µg/kg for lead and 10-25 µg/kg for arsenic, adequate for grain but coarse for sweet corn, where the EU cadmium limit is 20 µg/kg.[1,9] The FDA reported cooked corn with limits of 4 µg/kg for lead, 3 µg/kg for arsenic and 1 µg/kg for mercury.[2]

Several field studies lacked basic quality checks. A Nigerian seasonal survey measured mercury after dry ashing at 550 °C, which drives mercury off, and an Ethiopian market composite was read below the lowest calibration standard; these values are shown but held.[13,22] Arsenic in maize should be read as total arsenic unless the laboratory speciated it, because only 12 inorganic arsenic results exist for maize in the evidence.[1]

State the form and basis on every result. A dried-grain result, an as-sold grain result and a sweet corn result as eaten are not interchangeable, and the EU and Codex limits for sweet corn apply to kernels and cob without husk on a wet-weight basis.[9,10]

9 | Buying and verifying corn

Ask for lot-specific lead and cadmium results on the form being bought, with the quantification limit, compared with the destination-market limit.[9,10] For maize grain the EU, Codex, China, Hong Kong, Korea and India set 200 µg/kg lead and 100 µg/kg cadmium; China and Hong Kong add 20 µg/kg total mercury for maize and 500 µg/kg total arsenic for cereals other than rice, and Mercosur sets 300 µg/kg arsenic.[9,10,30,31,32,33,27] For sweet corn the EU sets 100 µg/kg lead and 20 µg/kg cadmium and Codex 50 µg/kg for both, and the EU adds nickel limits of 400 µg/kg for fruiting vegetables including sweet corn, applied since July 2025, and 800 µg/kg for cereals from July 2026.[9,10]

Record where the corn was grown, not only where it was packed.[1] The evidence supports avoiding grain from fields downwind of cement or battery plants, near coal-fired power plants, irrigated with wastewater or on mining land unless lot testing shows otherwise.[3,4,5,14,16,17]

Within the monitoring evidence, the lowest-lead options were sweet corn and European-reported maize grain, and recent European grain had no lead results above the cereal limit in 2014-2020.[1,2] These are descriptive patterns from reporting markets; they support asking for origin and test data, not a preference for any producing country.[1]

10 | Exposure from corn

Corn is a staple in Africa and Latin America and a common vegetable elsewhere, so its share of metal intake depends heavily on how much is eaten. No source in the ledger gives a verified population estimate of lead or cadmium intake from maize grain or sweet corn. A Henan village study estimated that adults ate 13.5 g of corn a day, and several field studies report intake indices, but most rest on dry-weight values applied to as-eaten intake or on concentrations held for integrity problems.[4,7,16]

Monitoring results bound the contribution for typical retail corn. With cooked US sweet corn below 4 µg/kg lead and 1 µg/kg mercury in every composite, and median cadmium of 2.6 µg/kg, ordinary retail sweet corn adds little per serving compared with the limits.[2] Where maize is eaten daily as a staple, the field results above 200 µg/kg lead in Burkina Faso, Bangladesh and contaminated areas are the cases that would matter for intake, but none was turned into a verified exposure estimate.[3,4,7,11]

11 | Evidence review and remaining gaps

This assessment covers every source record in the HMI library that names corn or maize, every corn row in the WHO GEMS/Food exports and every corn food in the FDA Total Diet Study; each has a recorded decision based on its content.[1,2] Thirty literature sources contribute results for maize grain or fresh corn, and values from 13 are held in part because they could not be reconciled with their own methods or tables.[13,20,21,22,23,24,25,34,35]

The main gaps are origin-linked monitoring of maize grain outside Europe and the Western Pacific, inorganic arsenic in maize, and any study that measures the same corn before and after cleaning, milling or cooking.[1] Two records about Health Canada diaper-rash monographs matched the search but have no readable file; they are unrelated to corn.

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 | Corn FAQs

Lead, cadmium, arsenic and mercury are measured most often, and in monitored maize grain and sweet corn most results are below reporting limits.[1,2] Field studies also report nickel and chromium, which reached about 1,400-1,900 µg/kg in dried maize from Bangladesh fields.[7]

Corn takes up cadmium and nickel from soil, and lead and mercury also reach it from dust and emissions settling on the plant.[3,5,8] Wastewater irrigation and mining or industrial land raised lead, cadmium, mercury or arsenic in the studies available.[4,14,26]

For lead, sweet corn measured lowest per kilogram: cooked US sweet corn was below 4 µg/kg in all 27 composites and raw sweet corn medians were below 1.4-10 µg/kg.[1,2] Maize grain had a European median below 20 µg/kg, and the higher figure largely reflects that grain is dry.[1]

Among reporting regions, European maize grain had the fewest results above the 200 µg/kg cereal limit (8 of 890), against 24 of 327 in Western Pacific submissions.[1] GEMS/Food does not name the country where corn was grown, so the evidence cannot rank producing countries; growing near industry, wastewater or mines matters more in the field studies.[1,3,4]

Corn flour, flakes, canned popcorn corn and other corn foods are measured separately and have their own pages, so their results are not repeated here.[1,2] One European study found that infant porridges mixing rice with maize and other grains had lower inorganic arsenic than pure rice porridges (median 10 against 66 µg/kg).[28]

No source in the ledger turned corn concentrations into a verified estimate of population intake, so the evidence cannot say how much corn contributes to lead or cadmium exposure overall. Typical retail sweet corn is low per serving, while maize eaten daily as a staple from contaminated fields is the case where intake could matter.[2,7,11]

Yes: for maize grain the EU, Codex, China, Hong Kong, Korea and India set 200 µg/kg lead and 100 µg/kg cadmium, and China and Hong Kong set 20 µg/kg total mercury for maize.[9,10,30,31,32,33] For sweet corn the EU sets 100 µg/kg lead and 20 µg/kg cadmium on a wet-weight basis, and Codex sets 50 µg/kg for each.[9,10]

No study in the library measured the same corn before and after cleaning, husking, milling or cooking, so no reduction can be stated. Drying raises the concentration per kilogram because water is removed, which is why dried-grain results look higher than sweet corn as eaten.[3,15]

Heat does not destroy metals, and no study measured the same corn before and after cooking. Cooked sweet corn in monitoring had lead and cadmium similar to raw sweet corn from the same regions, mostly below reporting limits.[1,2]

Much less is known: only 12 maize results were speciated for inorganic arsenic, and 2 were detected, at 8 and 310 µg/kg.[1] Total arsenic in monitored maize grain had a median below 12-15 µg/kg, but field maize from Bangladesh and arsenic-affected areas of China and Ecuador was far higher.[1,7,14,26]

In the same contaminated areas, maize carried less than rice: about a third of the mercury near Chinese coal-fired power plants and 260 against 460 µg/kg cadmium near Chengdu.[5,6] Maize lead was similar to rice in Chengdu (290 against 300 µg/kg), so the advantage is not universal.[6]

Infant cereals and baby foods containing corn are covered on their own pages; on this page, retail sweet corn was low in lead, with every cooked US composite below 4 µg/kg.[2] Maize from contaminated fields would matter most where it is a daily staple for children, and the evidence has no child-specific exposure estimate.[3,4]

Sweet corn had lower lead per kilogram in monitoring, but it is mostly water and is judged against a lower lead limit (100 against 200 µg/kg in the EU).[1,2,9] Both forms grown near industry, wastewater or mines can carry more metal, so where the corn grew matters more than the type.[3,4,5]

In European maize grain submitted to GEMS/Food, 4 of 233 results from 2001-2007 and 4 of 257 from 2008-2013 exceeded 200 µg/kg lead, against none of 400 from 2014-2020.[1] Coverage changed over the years, so this is a monitoring pattern rather than a fixed panel of farms.[1]

In European submissions, imported maize grain had lead and cadmium similar to domestic grain, and imported sweet corn had lower cadmium (median below 2.4 against 2.6-4 µg/kg).[1] The export does not name the producing country, so this cannot identify which origins are higher.[1]

Yes, in every such study available: downwind of a cement plant, beside coal-fired power plants, near a battery plant, on wastewater-irrigated fields and in mining areas, corn carried more lead, mercury, cadmium or arsenic than control or market corn.[3,4,5,14,16,17] The size of the increase varied widely between sites and metals.[3,4,5]

Check that the quantification limit sits well below the limit for the form tested, for example below 20 µg/kg cadmium for sweet corn in the EU, and that the result states the form and basis.[9] The FDA reported cooked corn with limits of 4 µg/kg lead, 3 µg/kg arsenic and 1 µg/kg mercury, a useful benchmark for sensitivity.[2]

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Masite NS, Ncube S, Madikizela LM, Mtunzi FM, and Pakade VE · International Journal of Food Science · 2022 · doi.org/10.1155/2022/1509569
PEER-REVIEWED

[35] Essential and toxic heavy metals in cereals and agricultural products marketed in Kermanshah, Iran, and human health risk assessment
Meghdad Pirsaheb, Nazir Fattahi, Kiomars Sharafi, Razieh Khamotian, and Zahra Atafar · Food Additives & Contaminants: Part B, Surveillance · 2015 · doi.org/10.1080/19393210.2015.1099570
PEER-REVIEWED

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.

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/corn#sources.

PUBLICATION HISTORY

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