Carrot

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Abstract

Carrot in the HMI library has 1,288 reported results for lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, monomethylarsonic acid, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, Ag, As, Ba, Ca, Ce, I, K, La, Mg, Mo, P, Rb, Sr, Ti and Tl from 83 sources. WHO gems/food submissions reported lead in carrot as sold from 4,856 results in 4 reporting regions, with subgroup medians from 3.65 to 60 µg/kg. In the US Total Diet Study, carrot as sold had a median lead result below 4 µg/kg across 27 composites from 2017-2020.

1 | Carrot overview

Across 13 other studies of ordinary farms and markets, reported lead means and medians on an as-sold or fresh-weight basis ranged from 6 µg/kg (Antoine et al. 2017) to 1,790 µg/kg (Chowdhury et al. 2024).[4,6] For cadmium, 13 studies on an as-sold or fresh-weight basis reported means and medians from 3 µg/kg (Alimohammadi et al. 2018) to 254 µg/kg (Chowdhury et al. 2024).[3,6] Higher results came from contaminated or exposed settings rather than ordinary supply. Carrot as sold from Ruschita old mining area (R) (mining-affected area) had lead higher at 2,110 µg/kg, against 30 µg/kg for Borlova reference area (Ref) in the same study.[8]

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

2 | What counts as carrot

This page covers carrot in 5 forms kept separate in every comparison: carrot as sold (1,206 results), carrot powder or ground (60 results), cooked carrot (11 results), peeled or flesh carrot (8 results) canned and carrot (3 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 carrot

The evidence on how metals reach carrot comes from studies that compared exposed and ordinary settings. Carrot as sold from Ruschita old mining area (R) (mining-affected area) had lead higher at 2,110 µg/kg, against 30 µg/kg for Borlova reference area (Ref) in the same study.[8] In another study, carrot as sold from Wastewater irrigation (WW) (experiment) had Co higher at 288 µg/kg, against 7 µg/kg for Control (freshwater irrigation) (Control (Fw)) in the same study.[23] a third study found that carrot as sold from Ruschita (mining area R) (mining-affected area) had lead higher at 2,110 µg/kg, against 60 µg/kg for Borlova (reference area) 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 carrot as sold pools 162 subgroup units from 8 sampling families, with a median of between 10.8 and 12 µg/kg and a middle half spanning below 4 (lower quartile) and 120 µg/kg (upper quartile).[1,2,18,24,25,26,27,28] for lead in carrot as sold, the reference median was between 50 and 1,450 µg/kg, with a middle half from below 50 to between 1,840 and 4,050 µg/kg across 15 units.[1,10,13,29,30] for cadmium in carrot as sold, the reference median was 18 µg/kg, with a middle half from between 11 and 11.2 to 34 µg/kg across 143 units.[1,2,18,24,25,28]

Among GEMS/Food reporting regions, carrot as sold had the lowest lead subgroup median in PAHO (3.65 µg/kg) and the highest in SEARO (60 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in WPRO (9.54 µg/kg) and the highest in EURO (300 µg/kg).[1] For total arsenic, the lowest regional median was in EURO (3.96 µg/kg) and the highest in EURO (54 µg/kg).[1]

Targeted carrot as sold samples in EURO had lead higher at 13.5 µg/kg, against 10.7 µg/kg for EURO in the same study.[1] In another study, targeted carrot as sold samples in WPRO had cadmium lower at 10.4 µg/kg, against 20 µg/kg for WPRO in the same study.[1]

In one study, lead across 36 groups of carrot ranged from 0.8 µg/kg (Vegetables, FY2017) to 24.1 µg/kg (Vegetables, FY2017); the lowest is the lowest observed in that study, not an established sourcing preference.[28] In another study, lead across 7 groups of carrot ranged from 1.3 µg/kg (Vegetable) to 27.2 µg/kg (Vegetable); the lowest is the lowest observed in that study, not an established sourcing preference.[24]

5 | Processing, cooking and preparation

Processed or prepared forms were compared only with unprocessed carrot in the same study and group. Cooked carrot (5 city composites) had lead lower at 7 µg/kg, against 14.5 µg/kg for the unprocessed form in the same group (carrot as sold).[31] In another study, canned carrot (Vegetables, Riyadh city markets, May 2009) had lead lower at 25 µg/kg, against 27 µg/kg for the unprocessed form in the same group (carrot as sold).[32] cooked a third study found that carrot (PAHO) had cadmium lower at 10.8 µg/kg, against 15 µg/kg for the unprocessed form in the same group (carrot as sold).[1]

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

6 | Mitigation for carrot

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.[8] 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 carrot for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 0.35 µg/kg (Heshmati et al. 2020) to 10,000 µg/kg (Sultana et al. 2022), so a non-detect from a less sensitive method says much less.[13,33] Reporting limits for cadmium ranged from 0.1 µg/kg (Al-Salimi et al. 2026) to 89,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,22] Reporting limits for total arsenic ranged from 0.03 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 carrot

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

10 | Exposure from carrot

No source in the library converted carrot 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 carrot was decided on its content: 83 occurrence extracted, 83 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 | Carrot FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, monomethylarsonic acid, total mercury, nickel, chromium, aluminum, tin, antimony, uranium, Co, Cu, Fe, Mn, Zn, V, Se, Ag, As, Ba, Ca, Ce, I, K, La, Mg, Mo, P, Rb, Sr, Ti and Tl in carrot, most often lead, cadmium and total arsenic.[1,2,3,4] WHO

gems/food submissions reported lead in carrot as sold from 4,856 results in 4 reporting regions, with subgroup medians from 3.65 to 60 µg/kg.[1]

In the studies available, carrot from contaminated or exposed settings carried more metal than carrot from the same study's control.[7] carrot as sold from Moldova Noua (mining area M) (mining-affected area) had lead higher at 120 µg/kg, against 60 µg/kg for Borlova (reference area) in the same study.[7]

Among GEMS/Food reporting regions, carrot as sold had the lowest lead subgroup median in PAHO (3.65 µg/kg) and the highest in SEARO (60 µg/kg); reporting regions are markets, not growing areas.[1] For cadmium, the lowest regional median was in WPRO (9.54 µg/kg) and the highest in EURO (300 µg/kg).[1]

Only comparisons between forms in the same study are available, not before-and-after measurements of the same carrot.[31] cooked carrot (5 city composites) had lead lower at 7 µg/kg, against 14.5 µg/kg for the unprocessed form in the same group (carrot as sold).[31]

Inorganic arsenic, the more toxic form, was measured in 8 results from 4 sources, far fewer than total arsenic.-[1,34,35,36] Laizu 2007 reported inorganic arsenic at 900 µg/kg (mean ± 1,000 SD) in carrot as sold from root and tuber vegetables, local market, Dhaka.[34]

References

[1] GEMS/Food Contaminants database heavy-metal exports
World Health Organization · GEMS/Food Contamination Monitoring and Assessment Programme · 2026 · extranet.who.int
DATASET

[2] FY2018-FY2020 TDS Elements Analytical Results
U.S. Food and Drug Administration · FDA Total Diet Study · 2022 · www.fda.gov
DATASET

[3] Heavy metal(oid)s concentration in Tehran supermarket vegetables: carcinogenic and non-carcinogenic health risk assessment
Alimohammadi M, Younesian M, Madihi-Bidgoli S, Nabizadeh Nodehi R, Jahed Khaniki GR, Hadi M, et al. · Toxin Reviews · 2018 · doi.org/10.1080/15569543.2018.1522644
PEER-REVIEWED

[4] Assessment of the potential health risks associated with the aluminium, arsenic, cadmium and lead content in selected fruits and vegetables grown in Jamaica
Antoine JMR, Hoo Fung LA, and Grant CN · Toxicology Reports 4 (2017) 181-187 · 2017 · doi.org/10.1016/j.toxrep.2017.03.006
PEER-REVIEWED

[5] Quantification and Reduction in Heavy Metal Residues in Some Fruits and Vegetables: A Case Study Galați County, Romania
Bora FD, Bunea A, Pop SR, Banita SI, Dusa DS, Chira A, et al. · Horticulturae · 2022 · doi.org/10.3390/horticulturae8111034
PEER-REVIEWED

[6] Human health risk assessment of heavy metals in vegetables of Bangladesh
Chowdhury AI, Shill LC, Raihan MM, Rashid R, Bhuiyan MNH, Reza S, et al. · Scientific Reports 2024, 14: 15616 · 2024 · doi.org/10.1038/s41598-024-65734-6
PEER-REVIEWED

[7] Application of principal component analysis in the pollution assessment with heavy metals of vegetable food chain in the old mining areas
Iosif Gergen and Monica Harmanescu · Chemistry Central Journal6:156 · 2012 · doi.org/10.1186/1752-153x-6-156
PEER-REVIEWED

[8] Heavy metals health risk assessment for population via consumption of vegetables grown in old mining area; a case study: Banat County, Romania
Harmanescu M, Alda LM, Bordean DM, Gogoasa I, and Gergen I · Chemistry Central Journal 2011, 5:64 · 2011 · doi.org/10.1186/1752-153X-5-64
PEER-REVIEWED

[9] Health Risks from Heavy Metals via Consumption of Cereals and Vegetables in Isfahan Province, Iran
Mitra Salehipour, Hadi Ghorbani, Hossein Kheirabadi, and Majid Afyuni · Human and Ecological Risk Assessment: An International Journal · 2015 · doi.org/10.1080/10807039.2014.1002292
PEER-REVIEWED

[10] Determination of heavy metals in selected vegetables from markets in Tamale Metropolis, Ghana
Ametepey ST, Cobbina SJ, Akpabey FJ, Duwiejua AB, and Atule AA · International Journal of Food Contamination · 2018 · doi.org/10.1186/s40550-018-0067-0
PEER-REVIEWED

[11] Heavy metals in soils and selected root
Unknown authors · Peer-reviewed article · 2025 · doi.org/10.26444/aaem/205856
PEER-REVIEWED

[12] Food survey: Levels and potential health risks of chromium, lead, zinc and copper content in fruits and vegetables consumed in Algeria
Cherfi A, Abdoun S, and Gaci O · Food and Chemical Toxicology · 2014 · doi.org/10.1016/j.fct.2014.04.044
PEER-REVIEWED

[13] Heavy Metals in Commonly Consumed Root and Leafy Vegetables in Dhaka City, Bangladesh, and Assessment of Associated Public Health Risks
Sultana R, Tanvir RU, Hussain KA, Chamon AS, and Mondol MN · Environmental Systems Research · 2022 · doi.org/10.1186/s40068-022-00261-9
PEER-REVIEWED

[14] Health risk assessment of cadmium and lead in root vegetables from retail and private cultivation in the Silesian Province, south-west Poland
Osmala-Kurpiewska W, Niesler A, and Piekut AK · Medycyna Ogólna i Nauki o Zdrowiu 2026, Tom 32, Nr 3, 220-226 · 2026 · doi.org/10.26444/monz/225643
PEER-REVIEWED

[15] ASSESSMENT OF HEAVY METAL CONTAMINATION IN SOILS AND VEGETABLE CROPS FROM
Unknown authors · Peer-reviewed article · 2025 · doi.org/10.33003/fjs-2025-0908-3900
PEER-REVIEWED

[16] Assessment of the Concentrations of some Heavy Metals in some Vegetables Traded in the Local Market in Sebha City - Libya
Iessa KR and Hamdan M · JATAED: Journal of Appropriate Technology for Agriculture, Environment, and Development, Volume 1, Number 2 · 2024 · doi.org/10.62671/jataed.v1i2.32
PEER-REVIEWED

[17] Uptake of Arsenic by Irrigated Vegetables and Cooked Food Products in Burkina Faso
Clair-Caliot G, Marks SJ, Hug SJ, Bretzler A, N'guessan ND, Tihe SFK, et al. · Frontiers in Water · 2021 · doi.org/10.3389/frwa.2021.667308
PEER-REVIEWED

[18] Determination of Heavy Metals in Some Fruits, Vegetables and Fish by ICP-MS
Islamoglu AH, Kahvecioglu T, Bonce G, Gedik E, and Gunes FE · Eurasian Journal of Food Science and Technology 5(1):67-76 · 2021 · dergipark.org.tr
PEER-REVIEWED

[19] Determination of some heavy metals and their potential risk in selected vegetables on sale within Kaduna Metropolis, Kaduna State, Nigeria
Imongben CO, Tomori WB, Umoru PE, and Oyerinde WA · World Nutrition · 2026 · doi.org/10.26596/wn.20261718-18
PEER-REVIEWED

[20] Analysis and exposure assessment of some heavy metals in foodstuffs from Ismailia city, Egypt
Loutfy N, Mentler A, Shoeab M, Ahmed MT, and Fuerhacker M · Toxicological & Environmental Chemistry · 2012 · doi.org/10.1080/02772248.2011.638445
PEER-REVIEWED

[21] Heavy Metals in Soil and Vegetables and their Effect on Health
Pal Jitender, Bishnoi Mukal, and Kaur Mandeep · International Journal of Engineering Science Technologies · 2017 · doi.org/10.29121/IJOEST.v2.i1.2017.03
PEER-REVIEWED

[22] Lead and trace element contamination in market vegetables of Aden, Yemen: a human health risk assessment
Al-Salimi MSS, Saeed AAM, and Bin Yahia AA · Discover Chemistry (2026) 3:83 · 2026 · doi.org/10.1007/s44371-026-00553-4
PEER-REVIEWED

[23] Effect of selenium nanoparticles on heavy metal accumulation in carrot (Daucus carota) irrigated with wastewater
El-Batal AI, El-Sayyad GS, El-Ghamry A, and Abdel-Megeed A · Biologia · 2023 · doi.org/10.1007/s11756-023-01401-x
PEER-REVIEWED

[24] What's in My Baby's Food? A National Investigation Finds 95 Percent of Baby Foods Tested Contain Toxic Chemicals That Lower Babies' IQ, Including Arsenic and Lead
Jane Houlihan and Charlotte Brody · Healthy Babies Bright Futures · 2019 · www.hbbf.org
NGO

[25] Cadmium and lead in vegetable and fruit produce selected from specific regional areas of the UK
Norton GJ, Deacon CM, Mestrot A, Feldmann J, Jenkins P, Baskaran C, et al. · The Science of the Total Environment 533, 520-527 (2015); accepted author manuscript · 2015 · doi.org/10.1016/j.scitotenv.2015.06.130
PEER-REVIEWED

[26] Infants' and young children's dietary exposures to lead and cadmium: FDA total diet study 2018-2020
Spungen JH and et al. · Food Additives & Contaminants: Part A · 2024 · doi.org/10.1080/19440049.2024.2396910
PEER-REVIEWED

[27] Detection of heavy metals in common vegetables at Varaždin City Market, Croatia
Stančić Z, Vujević D, Gomaz A, Bogdan S, and Vincek D · Arhiv za higijenu rada i toksikologiju (Archives of Industrial Hygiene and Toxicology) 2016;67:340-350 · 2016 · doi.org/10.1515/aiht-2016-67-2823
PEER-REVIEWED

[28] Analytical Results for Arsenic, Lead, Cadmium, and Mercury in Food Intended for Babies and Young Children - TEP (FY2009-FY2024)
U.S. Food and Drug Administration · FDA analytical results table · 2024 · www.fda.gov
DATASET

[29] Determination of cadmium and lead in vegetables marketed in Quito, Ecuador
Vela Doris, Simbana-Farinango Karina, Navarrete Hugo, and Romero-Estevez David · Revista Internacional de Contaminacion Ambiental · 2023 · doi.org/10.20937/rica.54656
PEER-REVIEWED

[30] Heavy Metal Contaminations and Health Risk Assessment from Fruits and Vegetables in Bangalore Rural Markets, Karnataka, India
Shivakumar L, Reddy KR, and Kalshetty BM · Rasayan Journal of Chemistry, Vol. 13, No. 4, 2498-2507 · 2020 · doi.org/10.31788/rjc.2020.1346039
PEER-REVIEWED

[31] Survey of Lead, Cadmium, Fluoride, Nickel, and Cobalt in Food Composites and Estimation of Dietary Intakes of These Elements by Canadians in 1986-1988
Dabeka RW and McKenzie AD · Journal of AOAC International · 1995 · academic.oup.com
PEER-REVIEWED

[32] Lead Contamination in Selected Foods from Riyadh City Market and Estimation of the Daily Intake
Al Othman ZA · Molecules 2010, 15, 7482-7497 · 2010 · doi.org/10.3390/molecules15107482
PEER-REVIEWED

[33] Concentration and Risk Assessment of Potentially Toxic Elements, Lead and Cadmium, in Vegetables and Cereals Consumed in Western Iran
Ali Heshmati, Fereshteh Mehri, Javad Karami-Momtaz, and Amin Mousavi Khaneghah · Journal of Food Protection 83(1):101-107 · 2020 · doi.org/10.4315/0362-028X.JFP-19-312
PEER-REVIEWED

[34] Speciation of arsenic in vegetables and their correlation with inorganic phosphate level
Laizu J · Bangladesh Journal of Pharmacology 2007; 2: 88-94 · 2007 · doi.org/10.3329/bjp.v2i2.576
PEER-REVIEWED

[35] Total Diet Study of metals and other elements in food
Baxter M and Brereton N · Food and Environment Research Agency report for the UK Food Standards Agency, Fera report 15/06, project FS102081 · 2015 · www.food.gov.uk
GOVERNMENT

[36] Dietary exposure to inorganic arsenic in the European population
European Food Safety Authority (EFSA) · EFSA Journal 2014;12(3):3597 · 2014 · doi.org/10.2903/j.efsa.2014.3597
GOVERNMENT

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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

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