Honey

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Abstract

Large monitoring datasets find most honey lead, cadmium and mercury results at or below their reporting limits. In WHO GEMS/Food, about one third of 4,901 European lead results and about a quarter of 1,000 results from the Americas were above detection, and the most recent European period had the fewest results definitely above the EU limit. All three FDA Total Diet Study honey composites from 2018-2020 were below every reporting limit, including 4 µg/kg for lead.

1 | Honey overview

Lead is still the metal that decides most honey questions. The EU sets a binding maximum of 0.10 mg/kg (100 µg/kg) for lead in honey and no honey limit for the other metals.[2] Australia's total diet studies found lead in honey a t a median of 40 µg/kg and later a mean of 24 µg/kg, placing honey among the highest-lead foods tested, though h oney contributed little to most people's lead intake.[7,8]

Small apiary surveys tell a different and less consistent story. Means of 90-190 µg/kg in eastern Morocco and 205-935 µg/kg across four Iranian regions sit above the pooled honey reference, while Balkan and Turkish surveys and most Polish surveys sit within it.[3,5,9,10,11,12] One small Polish study of 15 honeys (12 organic, 3 conventional) reported a mean of 147 µg/kg lead and up to 644 µg/kg, and said 7 of the 12 organic honeys exceeded the EU limit; it states no detection limit, reference material or recovery, so its rows are shown as printed and not used to rate honey.[12] Several of the highest reported values fail checks against their own papers, so the page shows them but does not compare them.[13,14,15] For a buyer, the supported priority is a lot-specific lead result measured with a method able to see well below 100 µg/kg; country of origin alone does not settle it.[2,16]

2 | What counts as honey

This page covers honey as sold or collected from the hive: blossom honeys named by floral source, honeydew honey, and multifloral blends, measured as they are eaten without moisture conversion.[1,5,17] Bee-fed sugar syrup,

a Libyan “black honey” made from sugar cane, and foods that contain honey are outside this scope, as is the “honey mushroom”, a fungus that shares the name in Hong Kong’s contaminant schedule.[18,19,20,21]

Honey’s identity matters because studies use different words for different things. A “region” in GEMS/Food is a WHO reporting region, not where bees foraged, and several surveys report the place of purchase rather than the apiary.[1,9]

3 | How metals reach honey

Metals reach honey mainly through what bees collect: nectar and honeydew from plants rooted in local soil, and particles deposited from the air.[5,6,23] The best measured chain in the ledger, from Podkarpackie in Poland, found lead falling at every step from soil (21.3 mg/kg) to plants (0.52), bees (0.13) and honey (0.05 mg/kg).[5] Cadmium followed the same pattern, with honey at about a thirtieth of the level in bee bodies (0.02 against 0.63 mg/kg), and its movement along the chain was faster on acidic soils.[5]

Location effects are real but uneven. In north-west Iran, honey from the most industrialised district averaged 935 µg/kg lead against 205-595 µg/kg elsewhere, the only metal with a significant regional difference.[3] In Poland, by contrast, honeys from urbanised and ecologically clean areas were comparable for cadmium, lead, aluminum and nickel.[5] A review of bee studies also reports substantial cadmium in bees from farmland and apparently unpolluted rural areas, sometimes above industrial sites.[24]

Contact after harvest is a plausible second route. Honey is acidic, and reviews and survey authors warn that bare metal, soldered or galvanised containers can add lead, tin, chromium or zinc; none of the sources measured this directly in honey.[3,6,14]

4 | Which honeys and origins measured lower

For lead, the lowest results come from routinely monitored retail honey.[1,4,7] FDA’s US composites were below 4 µg/kg, most European GEMS/Food results were below detection, and Australian honey averaged 24 µg/kg.[1,4,7] Among apiary surveys, five Balkan samples (33-55 µg/kg), Turkish chestnut honey (21 µg/kg mean) and Polish honeys (20-90 µg/kg means by habitat and variety) were lowest, while Iranian, Moroccan and Libyan honeys were highest.[3,5,9,10,18,11] These are lowest observed values in different studies with different methods, not a ranking of countries.

Within single studies, comparisons are more reliable. In Calabria, chestnut honey had the lowest lead mean (79 µg/kg) and wildflower the highest (125 µg/kg), with 80% of wildflower samples above 100 µg/kg against 25% of chestnut and heather honeys.[17] In Iran the less industrial south was lowest (205 µg/kg mean).[3] These are tentative patterns from one region each, not a supported preference for a floral type everywhere.

Cadmium, mercury and arsenic are usually low, so their comparisons rarely change a decision.[1,4] The exception in the library is the same small Polish study, which reported arsenic up to 287.72 µg/kg in one organic honey in its Table 4 but a maximum of 387 µg/kg in its Table 6; both are shown as printed.[12] European GEMS/Food cadmium results above detection had a median of 7.5 µg/kg, and US composites were below 1 µg/kg.[1,4] Aluminum is the exception that moves with type: Polish honeydew honey carried far more aluminum than the blossom honeys from the same apiaries.[5]

In the one study comparing floral types side by side, Calabrian chestnut honey averaged 79 µg/kg lead, below citrus (124), honeydew (109), heather (104) and wildflower (125 µg/kg).[17] In Morocco, thyme honey averaged 90 µg/kg and multifloral 190 µg/kg.[10] Each pattern comes from one region and a handful of samples per type.

Not consistently. In Poland, honeys from urbanised and ecologically clean areas were comparable for all four measured metals.[5] In north-west Iran, the most industrialised district had the highest lead, and in Prayagraj, India, lead was detected in only four of fourteen hives, in both urban and rural sites.[3,22]

5 | Processing, storage and packaging

No source in the ledger measured a processing step, filtration or storage time against a control for metals in honey. The processing evidence is guidance: avoid soldered, uncoated or galvanised metal containers for acidic honey, and be aware that aluminum equipment may add aluminum.[3,6,17] One review notes comb (waxed) honey carrying more lead than other samples and attributes it to metal storage and wax; that is an observation from cited studies, not a tested effect.[6]

6 | Mitigation from apiary to jar

Controls for honey act at the apiary, at extraction and storage, and at the release test. The only measured comparisons are observational: siting away from industrial districts coincided with lower lead in Iran, while urban and clean habitats did not differ in Poland.[3,5] Container and equipment controls are guidance without measured effects, and testing detects lead without removing it.[3,6,16]

7 | Trade-offs and limits of controls

Moving hives toward “clean” countryside is not a guaranteed fix.[5,24] Farmland can carry cadmium from phosphate fertilizer and soil, and the Polish clean-area honeys were not measurably lower than urban ones.[5,24]

Choosing floral type for lower lead can raise another metal. Honeydew honey in Poland was higher in aluminum and manganese, while Calabrian honeydew sat in the middle for lead.[5,17] Cheaper screening tools carry their own trade-off: a published lead sensor’s detection limit, once its 20-fold dilution is counted, is about 378 µg/kg, t oo high to check the EU limit.[16]

8 | Testing honey for metals

A useful honey lead test must be able to see well below 100 µg/kg.[2] FDA's reporting limit was 4 µg/kg and many European laboratories reported limits of a few µg/kg, but some GEMS/Food submissions carried limits of 200 µg/kg or more, which cannot show whether honey meets the EU limit.[1,4] Several surveys reported no detection limit, reference material or recovery at all.[9,13,15,25]

Report non-detects with their limit, keep the method and laboratory, and treat a single composite or a supplier's average as different from a lot result.[1,4] Arsenic and mercury in honey should be read as totals; no source here measured their species.[13,11,22]

Some very high values do not survive a check against their own papers. One Ethiopian study reports about 20 mg/kg lead, a level its own detection limits could not have measured after its stated dilution, and a Libyan survey reports 2.4-11 mg/kg means with no quality control.[14,15] Other high results, such as 1.55 mg/kg in a Libyan market honey, are single values without replicate or method detail.[18]

9 | Buying and verifying honey

Ask for lot-specific lead results with the laboratory's quantification limit, compared with the EU 100 µg/kg maximum or the limit in the destination market.[2,26,27] Limits differ: MERCOSUR sets 300 µg/kg for lead, China 500 µg/kg, and Hong Kong 100 µg/kg for honey and sugar-based candies.[21,26,27]

Record where the bees foraged as well as where the honey was packed or bought, because most datasets identify only the market.[1,9] Blends from several origins can hide a high-lead component that a single average will not reveal.

10 | Exposure from honey

Honey is eaten in small amounts, so even its relatively high lead median adds little to most diets.[7] Australia's 25th Total Diet Study found honey was a minor contributor to lead exposure for every age group except children aged 2-5, where it contributed 6%.[7]

One US paper reports that honey intakes exceed tolerable weekly limits, but its intake table is mislabelled by a factor of 1,000.[13] Recomputing with the paper's own formula puts its lead intake at about 1.5% of the reference value it cites, so the paper does not show an exceedance.[13] No source in the ledger measured metals in honey-containing foods together with the honey that went into them.[19,20]

11 | Evidence review and remaining gaps

This assessment covers every source record in the HMI library that is tagged to honey or mentions it, plus every honey row in the WHO GEMS/Food, FDA and other indexed datasets; each has a recorded decision based on its content. Three sources are held in part because their values could not be reconciled with their own methods or figures.[13,14,15] Two gaps remain: the Australian total diet studies' appendices with honey cadmium, arsenic and mercury, and the German MEAL study's per-food supplement.[7,8]

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.

Lead is the metal most often found at levels that matter; cadmium, mercury and arsenic are usually low or below detection.[1,4] honey can also contain aluminum, nickel and chromium, which vary with honey type and processing.[5,17,9]

Bees carry metals from nectar, honeydew and airborne dust into the hive, but much is filtered out along the way.[5,6] In Poland, lead fell from 21.3 mg/kg in soil to 0.05 mg/kg in honey.[5]

No source in the HMI ledger compares organic-certified and conventional honey for metals, so there is no evidence either way. Raw honey from beekeepers is not automatically lower: five Balkan samples, four from beekeepers and one from a shop, all had lead between 33 and 55 µg/kg.[9]

Within one Italian study, chestnut honey had the lowest lead and wildflower the highest, but no study shows a floral type that is reliably lower everywhere.[17] Honeydew honey tends to carry more aluminum.[5]

Monitored retail honey in the US, Europe and Australia shows the lowest lead in the evidence, with US composites below 4 µg/kg and most European results below detection.[1,4,7] Surveys from Iran, Morocco and Libya report higher values, but they used different methods and sampling, so they cannot rank countries.[3,10,18]

No study in the ledger measured both a honey and the food made with it. Honey-sweetened cereal bars and infant cereals have been tested, but their lead cannot be attributed to the honey.[19,20]

Because honey is eaten in small amounts, it contributes little lead to most diets: in Australia it was a minor source for all ages except children aged 2-5, where it supplied 6%.[7] A widely cited US claim that honey exceeds tolerable intakes rests on a unit error in that paper.[13]

Yes, mostly for lead: the EU allows 0.10 mg/kg, Hong Kong 0.1 mg/kg, MERCOSUR 0.30 mg/kg and China 0.5 mg/kg.[2,21,26,27] MERCOSUR also sets cadmium (0.10) and total arsenic (0.30 mg/kg) limits for honey.[26]

No study in the ledger measured metal removal by filtering or processing honey. The supported advice is preventive: keep honey out of soldered, uncoated or galvanised metal containers.[3,6]

Yes for aluminum: Polish honeydew honey carried far more aluminum than blossom honeys from the same apiaries.[5] For lead it was neither lowest nor highest in the Calabrian study.[17]

Survey authors and reviews advise against soldered, uncoated or galvanised metal, because acidic honey can corrode it and pick up lead, tin or zinc.[3,6,14] This is guidance; no source measured the effect.

Check that the laboratory's quantification limit is far below 100 µg/kg; FDA reported down to 4 µg/kg.[2,4] A published low-cost lead sensor could only see about 378 µg/kg in honey, too high to check the EU limit.[16]

In European GEMS/Food submissions, the share of results definitely above 100 µg/kg fell from 6.7% in 2003-2007 to 1.3% in 2013-2019.[1] These are national monitoring submissions, not a fixed panel of producers.

Usually very little: about four in five European mercury results were below detection, and US composites were below 1 µg/kg mercury and 3 µg/kg arsenic.[1,4] A US paper reporting mercury in the mg/kg range used an unverified method and is not used here.[13]

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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/honey#sources.

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