

10. REDUCING EXPOSURE TO METALS IN FOOD: PREVENTION AND INFORMED CHOICES

The preceding chapters have examined the origins, occurrence and health implications of the main metals and metalloids found in food. This concluding chapter considers what can actually be done to reduce avoidable exposure, from prevention throughout the food supply chain to purchasing and consumption choices. The aim is not to propose a diet free of every measurable trace—which would be difficult to achieve—but to understand which actions are supported by evidence and which reassurances, or warnings, go too far.



THE STARTING POINT: WHERE EXPOSURE ORIGINATES

Metals and metalloids may occur naturally in rocks, soils and water; mining, industrial and agricultural activities, atmospheric emissions and historical residues can increase their local availability. Plants may absorb certain elements from soil or water; in aquatic animals, some contaminants become concentrated along the food web. Further inputs

may arise during processing and storage and, in specific circumstances, from food-contact materials.

Dietary exposure for an individual is not equivalent to the concentration of one substance in one product. It depends on the amount eaten, consumption frequency, the various dietary sources, body weight and sometimes the chemical form of the contaminant. For these reasons, risk can be reduced effectively by acting on sources and assessing dietary habits as a whole, rather than broadly labelling a food as “good” or “bad”.

PREVENTING CONTAMINATION THROUGHOUT THE SUPPLY CHAIN

Where possible, the most effective measure is to prevent contaminants from entering the food system. This requires knowledge of local geochemical conditions, monitoring of irrigation water and soils, identification of emissions and historical deposits, selection of raw materials and oversight of production processes. Soil naturally rich in an element does not necessarily produce food with equally high levels: uptake also depends on the crop species, pH, redox conditions and other soil properties.

Agronomic management can sometimes reduce a metal's bioavailability, but a technique that works in one setting cannot automatically be transferred to another. For example, water management in rice fields affects the processes governing arsenic and cadmium mobility, potentially with opposing effects. Interventions must therefore be assessed in the actual matrix, monitoring several contaminants rather than assuming that a single adjustment solves every problem.

DIETARY VARIETY: USEFUL, BUT NOT SUFFICIENT ON ITS OWN

A varied diet reduces continued reliance on a small number of raw materials or origins and may lessen repeated exposure to a contaminant prevalent in particular categories. It does not, however, guarantee low overall exposure: different foods can contain the same element, and habits involving large portions may matter more than an occasional relatively high concentration.

For cereals, vegetables, pulses and derived products, it is reasonable to diversify choices without excluding whole categories in the absence of documented reasons. Origin can guide an investigation, but a country or region does not, in itself, constitute an analytical measurement of an individual batch. The production site, raw material, controls and representativeness of sampling all matter.

FISH AND METHYLMERCURY: BALANCING BENEFITS AND RISKS

Fish provides important nutrients, but certain long-lived predatory species tend to accumulate more methylmercury. The useful choice is not to avoid fish indiscriminately: it is to alternate species and avoid concentrating frequent consumption on large predators. Pregnant women, those planning pregnancy and children should pay particular attention to advice issued by national health authorities, taking account of species and consumption frequency.

In 2026, EFSA reiterated the importance of national fish-consumption guidance: recommendations may vary by country and population group. Compliance with the maximum mercury level set for a species must not be interpreted as permission to consume it without limits on frequency. The maximum level governs marketing of the product; dietary advice considers total exposure and the balance between risks and benefits.

WATER, COOKING AND PREPARATION: WHAT REALLY CHANGES

Washing fruit and vegetables can remove soil and surface particles, helping reduce certain external contamination. It does not, however, reliably eliminate metals already absorbed into plant tissues. Peeling or discarding particular parts may alter their content, but effects depend on the food and may also involve nutritional losses. There is no universal rule for “detoxification” by washing.

Boiling, soaking and discarding cooking water can, under certain conditions, reduce the content of particular chemical species or their concentration in a serving; effects depend on the substance, the food matrix and the quality of the water used. In rice, for example, cooking with plenty of water can reduce some inorganic arsenic, but may also change nutrient content. Cooking does not destroy chemical elements: it may instead transfer them between the food and liquid, or concentrate what remains as water is lost.

If household water has documented contamination, cooking or diluting food with that same water does not necessarily solve the problem. Measures and instructions from the competent authority should be followed. Treatment devices, too, must be chosen according to the contaminant concerned and verified effectiveness, rather than generic promises.

FOOD-CONTACT MATERIALS AND PROCESS-RELATED CONTAMINATION

Utensils, containers, coatings and equipment intended to come into contact with food must meet applicable requirements. Unwanted migration may depend on composition, wear, food acidity, temperature and contact time. A metal surface does not automatically imply hazardous release, whereas unsuitable or deteriorated materials deserve attention. Process control is also important for canned and processed foods.

For consumers, the soundest measure is to use products suitable for food contact in accordance with the manufacturer's instructions and avoid containers of uncertain origin. Monitoring contact materials complements—but does not replace—monitoring raw materials: these are separate potential contributions.

MORE SENSITIVE GROUPS AND RISK COMMUNICATION

Age and physiological circumstances affect priorities. Neurological development makes exposure to lead and methylmercury particularly relevant early in life; for cadmium, repeated exposure and accumulation over time are especially important. Advice specifically intended for children or pregnant women cannot automatically be extended to the entire population without considering the nutritional benefits of different foods.

Responsible communication must distinguish three messages: “a substance is present”, “estimated intake reaches a particular level”, and “based on current knowledge, that exposure raises concern”. These statements are not equivalent. A result below the limit of quantification (LOQ) also depends on the method's LOQ: it does not prove that the concentration is exactly zero.

THE ROLE OF OFFICIAL CONTROLS AND VOLUNTARY TESTING

Within the European Union, Regulation (EU) 2023/915 sets maximum levels for specified contaminants in defined food categories; Regulation (EC) No 333/2007 lays down sampling and analytical requirements for several substances. Official controls are essential for enforcing legislation, identifying recurring problems and informing risk assessments. Because they are based on sampling plans, they do not physically test every unit placed on the market.

Additional tests on individual batches can improve the information available, especially when accompanied by clear sample identification, methods with adequate performance, LOQs, units of measurement and accessible results. Nevertheless, extra testing does not replace legal requirements, appropriately representative sampling or scientific exposure assessment. “Not quantified” and “absent” are different claims.

HOW TO READ A RESULT WITHOUT JUMPING TO CONCLUSIONS

A number must be interpreted in light of the food matrix, edible portion, chemical form where relevant, reporting basis (fresh or dry weight), analytical method and LOQ. Comparing concentrations across different foods, or adding values for different elements without a suitable toxicological assessment, can be misleading. Even levels below legal limits can contribute to chronic exposure: legal compliance and absence of exposure are not synonymous.

To make informed choices, it is better to ask whether the result relates to an identifiable batch, whether the measurement is reliable and how the product fits into the diet. Transparency is valuable when it helps people ask better questions, not when it turns one result into a general guarantee of health.

CONCLUSIONS: REDUCING EXPOSURE, NOT CHASING AN ABSTRACT ZERO

The most robust prevention strategy combines reduction of environmental sources, supply-chain controls, a varied diet, targeted guidance for sensitive groups and access to understandable analytical data. Not all metals have the same toxicity, not all chemical forms have the same significance, and not every measured trace represents an appreciable risk. At the same time, meeting a legal limit is not a certificate that contamination is entirely absent.

The methodological conclusion of the Overorganic Library on metals is therefore to understand the data, acknowledge their uncertainty and distinguish presence, exposure and risk. In this space between public controls and better information about individual products, more informed food choices can be built, without alarmism or oversimplification.

SCIENTIFIC AND REGULATORY REFERENCES

- [1. EFSA – Metals as contaminants in food: assessments and updates \(2026\).](#)
- [2. EFSA – Fish and seafood consumption in the EU: awareness of dietary advice on mercury \(2026\).](#)
- [3. EFSA – Fish: scenarios indicate benefits versus risks \(2015\).](#)
- [4. European Commission – Regulation \(EU\) 2023/915, maximum levels for contaminants in food, consolidated text as of 19 August 2026.](#)
- [5. European Commission – Regulation \(EC\) No 333/2007, sampling and analysis, consolidated text as of 30 April 2024.](#)
- [6. European Parliament and Council – Regulation \(EU\) 2017/625, official controls.](#)
- [7. EFSA – Metals in food and health risks: topic resources and scientific opinions.](#)