

## HEAVY METALS IN FOOD



### WHAT THEY ARE AND WHY WE HEAR SO MUCH ABOUT THEM

When we hear about “heavy metals in food”, we often think of something foreign and necessarily dangerous. In fact, the presence of metallic elements in food is more complex: some are essential for life, others may pose health concerns and, above all, their presence does not automatically mean that a food is unsafe.

The useful question is not simply “are there metals in what we eat?”, but rather “which elements are present, in what chemical form, at what concentration and how often do we consume them?”. This information is what allows us to make a meaningful assessment.

### WHAT DO WE MEAN BY “HEAVY METALS”?

The expression “heavy metals” is widely used in everyday language, in newspapers and even in some technical communications. However, it does not identify a group of substances defined unambiguously in chemical or toxicological terms. Depending on the context, the term may refer to very different elements. Even arsenic, often included in lists of so-called heavy metals, is actually a metalloid.

This distinction is not mere chemical pedantry. Speaking generically about “heavy metals” can suggest that all these elements behave in the same way and have the same toxicity. They do not. To understand the risk, we need to identify the element and, where necessary, its chemical form.

## ARE METALS ALWAYS UNWANTED SUBSTANCES?

No. Iron, zinc and copper, for example, are essential nutrients: our bodies need them to perform fundamental physiological functions. An insufficient intake can affect health, while excessive amounts can be harmful. Here too, the dose matters.

The situation is different for elements such as lead and cadmium, which have no recognised nutritional function in the human body and are studied as food contaminants. Mercury deserves particular attention in some of its forms, while for arsenic the distinction between inorganic and organic forms is essential.

|  <b>ESSENTIAL ELEMENTS</b>                  |                                                                                     |                                                                                     |  <b>METALS OF TOXICOLOGICAL INTEREST</b>                                                     |                                                                                       |                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Iron                                                                                                                         | Zinc                                                                                | Copper                                                                              | Lead                                                                                                                                                                          | Cadmium                                                                               | Mercury                                                                               |
| <b>Fe</b>                                                                                                                    | <b>Zn</b>                                                                           | <b>Cu</b>                                                                           | <b>Pb</b>                                                                                                                                                                     | <b>Cd</b>                                                                             | <b>Hg</b>                                                                             |
|                                           |  |  |                                                                                           |  |  |
| Found in leafy green vegetables, legumes, seeds and whole grains.                                                            |                                                                                     |                                                                                     | May be present in cereals, rice, vegetables and other foods due to environmental contamination.                                                                               |                                                                                       |                                                                                       |
| Found in legumes, nuts, seeds and whole grains.                                                                              |                                                                                     |                                                                                     | May be present in cereals, rice, vegetables and other foods due to environmental contamination.                                                                               |                                                                                       |                                                                                       |
| Found in shellfish, nuts, seeds and whole grains.                                                                            |                                                                                     |                                                                                     | May be present in fish and seafood due to environmental contamination.                                                                                                        |                                                                                       |                                                                                       |
|  Useful for the body in adequate amounts. |                                                                                     |                                                                                     |  They may pose a risk if present in foods above certain levels or with prolonged exposure. |                                                                                       |                                                                                       |



Essential elements can also become problematic if consumed in excess.

This is the first point to remember: the word “metal” does not mean “poison”. Nor do all metallic contaminants pose the same risk.

## **WHY CAN THESE ELEMENTS BE PRESENT IN FOOD?**

Because they are part of the environment in which food is produced. Rocks and soils naturally contain numerous elements; water can carry some of them, and plants may absorb certain amounts. Natural sources are accompanied by sources associated with human activities, such as particular industrial emissions, agricultural practices and other forms of environmental contamination.

Under certain conditions, elements present in soil become more readily available to plants and can thus enter the food chain. Processing and storage may also contribute to the contamination of some products. We do not need to delve into soil chemistry to understand the basic mechanism: what is present in the environment can, under certain conditions, end up on our plates.

This does not mean, however, that every soil or every crop transfers the same quantities. Levels in food vary according to the element, the geographical area, the plant or animal species and production conditions.

## **WHICH NAMES SHOULD WE KNOW?**

When discussing inorganic contaminants in food, four names come up particularly often:

Arsenic — Among other things, it is known for the attention paid to inorganic arsenic in rice and certain rice-based products.

Cadmium — It can enter a range of foods from the environment; it is of particular concern because of the effects of long-term exposure.

Lead — This is a contaminant for which protecting children and pregnant women is particularly important.

Mercury — Methylmercury can accumulate in aquatic food chains and calls for attention when choosing particular fish species and deciding how often to eat them.

These elements will be examined individually in the following chapters, with practical examples of foods, exposure and controls.

## **THE AMOUNT MATTERS. BUT IT IS NOT THE ONLY THING THAT MATTERS.**

A laboratory result expressed in milligrams or micrograms per kilogram tells us how much of a given substance is present in a food. On its own, however, it does not tell the whole story. To estimate exposure, we need to consider how much of that food is eaten, how frequently, what other sources contribute to intake and who is exposed.

Chemical form also matters. Two substances containing the same element can behave differently and have different toxicities: for example, it is incorrect to automatically treat

total arsenic as though it were all inorganic arsenic, or to consider every form of mercury equivalent to methylmercury.

The effects of occasional exposure are not necessarily comparable with those of repeated exposure over many years. This is why food safety assessments often examine long-term exposure as well.

### **IF A FOOD COMPLIES WITH THE LAW, IS IT SAFE?**

The European Union sets maximum levels for certain contaminants, including specific metals and metalloids, in designated categories of food. These limits are based on scientific assessments and the aim of protecting public health. EU legislation also requires contaminant levels to be kept as low as reasonably achievable within the framework of good practices.

It is important, however, to distinguish two concepts: regulatory compliance and the absolute absence of risk. Compliance with a limit means that the product meets the applicable legal requirement; it does not mean that the contaminant is present at zero concentration, nor that a risk assessment can disregard the overall diet and the duration of exposure.

At the same time, detecting a measurable quantity of an element is not enough to conclude that a food is dangerous. Context, chemical form, concentration and correct interpretation of the data are all needed. Avoiding both absolute reassurances and alarmism is part of sound scientific communication.

### **CAN WE RECOGNISE CONTAMINATED FOOD?**

In most cases, no: a food containing residues of metals or metalloids does not necessarily have distinctive visible characteristics, smells or tastes. Freshness, an appealing appearance and even origin cannot, on their own, tell us the concentration of a contaminant.

When it is necessary to establish the presence and amount of these elements, the answer comes from laboratory analyses using appropriate methods, the interpretation of their results and controls throughout the food supply chain. But understanding analytical data also means knowing exactly what was measured and at what detection or quantification limit.

### **THE QUESTION THAT WILL GUIDE US**

Metals and metalloids in food are not a single, uniform problem: they are different substances, with different origins, behaviours and possible effects. Science and regulatory

authorities have developed important tools to assess them, but understanding what a particular food actually contains requires moving from general considerations to measured data.

In the following chapters we will explore how some of these elements reach food, which products deserve greater attention, what we know about possible health effects, and how to correctly interpret legal limits and analytical results.

## **SCIENTIFIC AND REGULATORY REFERENCES**

1. EFSA (2026). Metals as contaminants in food. [View source](#)
2. Duffus, J. H. (2002). “Heavy metals”—a meaningless term? IUPAC Technical Report. Pure and Applied Chemistry, 74(5), 793–807. [View source](#)
3. European Commission. Regulation (EU) 2023/915 on maximum levels for certain contaminants in food (current text and subsequent amendments). [View source](#)
4. European Commission. Food contaminants — Legislation: regulatory principles and reduction of contamination levels. [View source](#)