

WHICH FOODS MAY CONTAIN MORE PAHS?

Polycyclic aromatic hydrocarbons (PAHs) are not confined to a single type of food. They may occur in smoked foods or products subjected to intensive heat treatment, but also in raw materials exposed to contaminants in the environment, during drying or during processing. To understand where to look for them, two questions must be distinguished: which foods may have relatively high concentrations, and which foods contribute most to the population's habitual exposure? The answers do not necessarily coincide.

SMOKED FOODS: MEAT, FISH AND SHELLFISH

Smoked meat and fish products are among the foods deserving particular attention. When smoke from the combustion or thermal degradation of wood directly contacts a product's surface, it can carry PAHs that are deposited there. Concentrations depend on the process: fuel, temperature, oxygen availability, distance from the source, duration and smoking technique. Not all smoked foods therefore have the same concentrations; well-controlled technologies can substantially reduce contamination.

Bivalve molluscs also deserve attention, but for a different reason: because they filter water and live in environments influenced by sediments, they may reflect contamination at the harvesting site. Smoking may introduce an additional PAH source. Environmental contamination of the fresh product should not be confused with contamination introduced by processing.



MEAT AND FISH COOKED OVER DIRECT FLAMES

During grilling and barbecuing, PAHs may form when fats and juices drip onto embers or very hot surfaces, producing smoke that reaches the food. Contact with flames and charred areas can also increase contamination. Results vary markedly between preparations: the description 'grilled' alone cannot predict an analytical concentration. Conditions that promote PAH formation and practices that reduce it are examined in the chapter on cooking.



VEGETABLE OILS AND OTHER FATS

PAHs generally have low water solubility, and several members of the family have an affinity for lipid fractions. In vegetable oils, contamination may arise, among other sources, from exposure of raw materials to atmospheric deposition or from drying with hot gases or combustion fumes. Appropriate refining can also help reduce certain contaminants, although effectiveness depends on the substances and treatment used.

This does not mean that all oils are heavily contaminated. Rather, oils are an important matrix for PAH monitoring, and production processes can affect the quality of the finished product.

COCOA, COFFEE, SPICES AND DRIED HERBS

In cocoa, spices and dried herbs, contamination issues may arise mainly during drying and heat treatment, particularly when the material contacts smoke or combustion gases. In cocoa, the distribution of PAHs between different parts of the bean and the fractions produced during subsequent processing is also relevant. Coffee may contain PAHs associated with roasting and other production stages, but concentrations vary widely and it would be wrong to regard every roasted product as heavily contaminated.

The fact that legislation specifies maximum levels for certain categories — including dried spices, dried herbs, cocoa products and oils — is not a ranking of the most dangerous foods. It identifies categories requiring specific management of the contaminant.

CEREALS, VEGETABLES AND EVERYDAY FOODS

Cereals, cereal products and vegetables may acquire PAHs through deposition of airborne particles, contact with contaminated environmental media and certain processing operations. Concentrations may often be modest compared with those in some smoked or intensely heat-treated products. However, these foods are frequently eaten and may be consumed in greater quantities.

This reveals an essential distinction: a food containing only a few micrograms of contaminant per kilogram but eaten daily may contribute more to total exposure than a food with a higher concentration eaten only occasionally. Historical dietary exposure estimates have indeed shown important contributions from common categories, including cereals and cereal products. These contributions depend on dietary habits and the population studied and must not be turned into a universal ranking.

CONCENTRATION AND EXPOSURE ARE NOT THE SAME

Concentration describes the amount of PAHs in a given quantity of food, often expressed as micrograms per kilogram ($\mu\text{g/kg}$). Dietary exposure also depends on the amount eaten, consumption frequency and, when assessing an individual, body weight. Comparisons between products also require knowing whether the measurement covers benzo[a]pyrene alone, the sum of four indicator PAHs (PAH4), or a wider group of compounds.

It is therefore scientifically inappropriate to describe a food as ‘the most contaminated’ without specifying the PAHs analysed, the number of samples, the methods and production conditions. Similarly, one positive sample cannot justify generalising the result to every product in that category.

HOW TO INTERPRET CATEGORIES SUBJECT TO CONTROL

Regulation (EU) 2023/915, as amended, establishes maximum levels for benzo[a]pyrene and the sum of four PAHs in many categories, including smoked foods, bivalve molluscs, cocoa products, oils and fats, dried spices and herbs, and certain foods for children. Levels vary by food matrix. Their existence does not imply that each product reaches or exceeds them: a legal limit is a compliance threshold, not a measure of the concentration normally found.

Health-risk assessment requires further information: the identity and quantity of PAHs, dietary consumption over time and toxicological data. Later chapters examine health effects, analytical indicators and official controls separately.

IN SUMMARY

Foods deserving attention do not belong to just one category. Smoking, intensive cooking, drying, properties of fatty matrices and environmental contamination can all contribute to PAH occurrence to differing extents. For consumers, the most useful question is not only 'which food contains the most?' but also 'how much of my exposure comes from what I eat regularly?' This distinction allows control results to be interpreted accurately without alarmism.

SCIENTIFIC AND REGULATORY REFERENCES

[EFSA CONTAM Panel \(2008\). Polycyclic Aromatic Hydrocarbons in Food. EFSA Journal 6\(8\), 724.](#)

[EFSA \(2008\). Opinion on indicators of PAH occurrence and toxicity in food.](#)

[European Commission. Regulation \(EU\) 2023/915, consolidated text, Annex I, Section 5.1.](#)

[UK Food Standards Agency. Polycyclic Aromatic Hydrocarbons in cereals, vegetables and traditionally smoked foods.](#)