VOLUME
34
August
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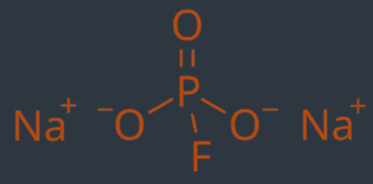
GT
GERMAN SOCIETY OF
TOXICOLOGY

Poison of the month



sodium monofluorophosphate

The proposal to select fluoride as the "Toxin of the Month" for August 2025 was put forward by the Advisory Commission of the GT

The aim was to draw attention to its newly published consumer-friendly method for calculating daily fluoride intake. This method was developed in the context of EFSA's re-evaluation of safe intake levels and enables individuals—especially pregnant women, in view of the special protection of the unborn child—to record and assess their personal daily fluoride intake in a practical manner.

Toxicity

The solubility and acute toxicity of fluoride vary depending on the salt. Different compounds are used in consumer products (e.g., sodium fluoride, stannous fluoride, amine fluorides, sodium monofluorophosphate). A very high acute oral intake of fluoride may cause nausea, vomiting, abdominal pain, and diarrhea, as well as dizziness, headache, seizures, coma, and cardiac arrest. The minimum acute dose at which gastrointestinal effects occur is reported as 0.4–5 mg fluoride per kg body weight.

Chronically elevated fluoride intake up to about the age of 8 years may result in dental fluorosis, since excessive fluoride is incorporated into enamel prior to tooth eruption, leading to hypomineralization. As a preventive measure, EFSA has established age-dependent ULs (upper intake levels): 1 mg/day for infants, 1.6 mg/day for children aged 1–3 years, and 2 mg/day for children aged 4–8 years.

Fluoride – EFSA Re-Evaluation of the Safe Intake Level and Calculation of Individual Intake Using the Advisory Commission's Calculator

Fluoride (F^-) is the anion of the element fluorine and not, strictly speaking, a poison. In the environment, fluorides – the salts of hydrofluoric acid (HF) – are leached during the weathering of F^--containing rocks and thereby enter groundwater and drinking water. Plants absorb F^- from the soil and may accumulate it. We ingest small amounts daily through beverages and foods, drinking water, and in some cases through natural mineral water. Additional sources are fluoridated table salt, black or green tea, and, if swallowed, fluoride-containing dental care products.

Part of the ingested fluoride is incorporated into bone and dental hard tissues. In the oral cavity, F^- promotes remineralization of enamel and reduces the susceptibility of teeth to acid attacks by caries bacteria. There is no classical deficiency syndrome; hence F^- is not considered an essential element, and a dietary supply is not deemed strictly necessary. Nevertheless, the caries-preventive effect is undisputed, which is why topical use via dental care products and/or fluoride applications in dental practice is generally recommended.

On 22 July 2025, EFSA updated its assessment of fluoride intake and derived a precautionary safe intake level of 3.3 mg F^-/day. This refers to the total cumulative intake from water, foods, fluoridated table salt, and dental care products. The rationale for establishing a safe intake level, with particular regard to the protection of the unborn child in pregnant women, is based on findings from several prospective cohort studies. These studies investigated associations between maternal F^- intake during pregnancy and subsequent IQ test results in their children at preschool or school age. Some reported small but statistically robust

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differences in cognitive testing, prompting discussion of possible effects of elevated F^- exposure on brain development.

To enable rapid individual estimation of daily total intake according to the new EFSA guidance, the Advisory Commission (AC) compiled data on the most relevant F^- sources and identified fluoridated table salt as well as black/green tea as major contributors. Intake from other foods and from toothpaste was conservatively set at fixed values in the model, due to a lack of reliable, individualized usage data. Based on this, the AC developed a simple, practice-oriented calculation method to estimate individual daily intake. Interested individuals can estimate their intake using an Excel-based calculator made publicly available.

Scenario calculations presented in the publication demonstrate that herbal teas contribute negligibly to daily intake, whereas black and green tea, depending on variety and preparation, can show substantially higher F^- levels. Four to eight large cups per day may already lead to exceedance of the safe range. By contrast, intake profiles such as “two cups of black/green tea plus moderate use of fluoridated table salt and 2 L of water” usually remain below 3.3 mg/day. Higher tea consumption or a greater proportion of fluoridated salt can, however, raise the sum above the safe threshold.

The AC therefore advises pregnant women to consider reducing their consumption of black/green tea as well as fluoridated household salt. Toothpaste should be used as intended (pea-sized amount, not swallowed). However, the AC also notes that not every exceedance of the EFSA-derived intake value is necessarily equivalent to a health risk.

For fluoridated table salt, the F^- content is regulated (maximum in Germany: 31 mg/100 g) and must be declared on the packaging. By contrast, no such labelling requirement exists for black or green tea, even though these can contribute substantially to F^- intake and may contain very high levels. The AC therefore recommends that labelling should also be introduced for these types of tea, in order to improve transparency and enable more informed product choices, particularly for vulnerable groups such as pregnant women.

By Ute Haßmann

Authorization

With long-term high intake, the risk of skeletal fluorosis increases. This condition is characterized by higher bone density but reduced elasticity, which can result in an elevated risk of fractures, joint pain, and stiffness. In advanced stages, skeletal deformities and ligament calcification may occur.

Reliability of the New Study Data

A clear causal relationship between fluoride exposure and reduced IQ however, cannot, be derived from the available data, since epidemiological studies do not have the methodological rigor of randomized controlled trials.

Animal studies have demonstrated learning and memory impairments, but only at significantly higher doses. Overall, there appears to be a possible risk, which EFSA has addressed by introducing a precautionary intake threshold. Further studies are needed to better quantify this risk with reduced uncertainty.

Literature and links:

- Fluoride intake during pregnancy: calculation of realistic exposure scenarios for individual risk assessment | Archives of Toxicology, https://doi.org/10.1007/s00204-025-04143-8
- Individueller Florid-Aufnahme-Rechner (Excel-Datei)
- Updated consumer risk assessment of fluoride in food and drinking water including the contribution from other sources of oral exposure | EFSA https://doi.org/10.2903/j.efsa.2025.9478
- Microsoft Word - 45EAU-02.12.03-Rapport-2001-SA-0257.doc
- Fluorid – Ein wichtiger Baustoff für die Zähne - BfR
- Foto von Alan Emery auf Unsplash