

Nitrosamines in food: EFSA publishes new opinion on health risks

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The European Food Safety Authority ([EFSA](#)) [has assessed the health risks related to the human exposure to nitrosamines in food](#). Nitrosamines are chemical compounds that can form in the presence of substances such as nitrite and nitrogen oxides as well as certain secondary and tertiary amines. Therefore, they are found in cured meat products, processed fish, beer and other alcoholic and non-alcoholic drinks among others. However, they have also been detected in cheese, grains, processed vegetables, soy sauces and various oils. Most of these compounds have proven to be carcinogenic in animal experiments. Whether this also applies to humans has not yet been clearly proven. Nitrosamines can also form in the human body. The extent to which the intake of nitrite or nitrate from food leads to the endogenous formation of nitrosamines is still not sufficiently clear.

In a recent opinion, EFSA assessed health risks from nitrosamines in food. This was done based on a total intake estimate, using available data on nitrosamine levels. It was also taken into consideration that most of the nitrosamines are converted in the body by cytochrome P450 enzyme systems into mutagenic and carcinogenic (genotoxic and carcinogenic) compounds (bioactivation). For its risk assessment, EFSA used the *margin of exposure* (MOE) concept, as is standard in the EU for genotoxic and carcinogenic substances in food. According to this, dietary exposure to nitrosamines, especially in the case of high consumption of certain foods, can lead to MOE values significantly lower than 10,000. Overall, EFSA concludes that dietary exposure to nitrosamines (P95; high consumption of foods containing nitrosamines) is very likely to indicate a health risk for all age groups, even taking into consideration existing uncertainties.

The German Federal Institute for Risk Assessment (BfR) shares the views of EFSA also with regard to the existing scientific uncertainties.

A total of 32 different nitrosamine compounds have been analysed, but so far only some of them could be detected in food. In the case of rodents, the intake of certain nitrosamines causes tumours mainly in the liver, upper gastrointestinal tract and respiratory tract were observed. Epidemiological studies in humans report links between the intake of nitrosamines and cancer in various organs. However, because of limitations in the study design, these epidemiological studies could not be used to assess the risk to human health. Therefore, EFSA considered the incidence of liver tumours in rodents as the major adverse effect of nitrosamine exposure for its risk assessment.

The *margin of exposure* (MOE) concept was used for the risk assessment, as is standard in the EU for genotoxic and carcinogenic substances. The MOE is the ratio calculated from a suitable toxicological reference point and the estimate of the exposure level to the substance in humans. EFSA identified a reference point (liver tumours, BMDL₁₀) of 10 micrograms per kilogram of body weight per day for N-nitrosodiethylamine (NDEA) from animal experiment data. This value was used as a substitute reference point for all nitrosamines assessed. A MOE of 10,000 or more is viewed as less harmful – certainly not harmless – with regard to public health, and therefore considered as low priority for risk management measures. The MOE concept is exclusively used for prioritising, i.e. estimating the urgency of risk management measures. No health-based guidance values are derived for substances with genotoxic and carcinogenic effects. EFSA concludes that the MOE for carcinogenic nitrosamines at P95 exposure (high consumption of foods containing nitrosamines) is probably below 10,000 for all age groups. Overall, EFSA concludes that dietary exposure (P95; high consumption of

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foods containing nitrosamines) to nitrosamines is very likely to indicate a health risk for all age groups, even taking into consideration existing uncertainties.

Highest intake of nitrosamines from meat and meat products

EFSA analysed a large number of data from food samples as well as analytical data from publications and was able to estimate the dietary exposure for the following five food categories: “alcoholic beverages”, “coffee, cocoa, tea and infusions”, “fish, seafood, amphibians, reptiles and invertebrates”, “meat and meat products” and “spices, sauces and seasoning”.

According to the EFSA opinion, the category “meat and meat products” contributes most to the intake of carcinogenic nitrosamines. However, there are still scientific uncertainties with regard to the assessment of the health risk of exposure to nitrosamines since important food categories, such as vegetables, grains and milk and dairy products, could not be included due to missing data.

Finding missing data

To assess the risk to human health even better, more data on the toxicology (mechanism of action, mutagenic and carcinogenic potency) of additional nitrosamines should be included in the assessment in future. EFSA indicates the need for epidemiological studies, which should be supplemented by modern molecular approaches to be able to establish the relation between nitrosamines and the development of tumours in humans, also taking into consideration other external factors. Further uncertainties result from missing data on nitrosamine levels in other important food categories, in particular vegetables, grains, milk and dairy products, but also fermented foods, pickled products, seasoned foods and cooked products. This requires standardised and sufficiently sensitive analytical detection methods for the quantification of volatile and non-volatile nitrosamines in various foods.

Further information on the subject of nitrosamines from the BfR website:

Questions and answers on nitrate and nitrite in food: <https://www.bfr.bund.de/en/frequently-asked-questions-on-nitrate-and-nitrite-in-food-241910.html>



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