



## Nitrites and nitrates added to food

- What are nitrites/nitrates? Why are they present in food?
  - What happens to nitrites/nitrates in the body?
  - Why did EFSA re-evaluate nitrites/nitrates added to food?
  - How did EFSA re-assess the safety of nitrites and nitrates?
- What were EFSA's findings on nitrosamines?
  - What were the main conclusions?
  - What did the panel recommend?
  - What other work has been done in this area?
  - What happens next?
  - Glossary

In June 2017 EFSA published two scientific opinions on its re-evaluation of nitrites and nitrates added to food. This summary explains why nitrites and nitrates are present in food, and what EFSA's experts concluded on their safety.

### What are nitrites/nitrates? Why are they present in food?

The salts of nitrite and nitrate are commonly used for curing meat and other perishable produce. They are added to food to preserve it and also help hinder the growth of harmful microorganisms, in particular *Clostridium botulinum*, the bacterium responsible for life-threatening botulism. Nitrites, together with nitrates, are also added to meat to keep it red and give flavour, while nitrates are used to prevent certain cheeses from bloating during fermentation. Nitrate is found naturally in vegetables, with the highest concentrations occurring in leafy vegetables like spinach and lettuce. It can also enter the food chain as an environmental contaminant in water, due to its use in intensive farming methods, livestock production and sewage discharge.

### What happens to nitrites/nitrates in the body?

In humans, nitrite and nitrate from food are rapidly absorbed by the body and, for the most part, excreted as nitrate. Some of the nitrate absorbed by the body is recirculated through salivary glands and part of it is converted by mouth bacteria into nitrite. Absorbed nitrite can oxidise haemoglobin to methaemoglobin, an excess of which reduces the ability of red blood cells to bind and transport oxygen through the body. Nitrite in food (and nitrate converted to nitrite in the body) may also contribute to the formation of a group of compounds known as nitrosamines, some of which are carcinogenic.

### Why did EFSA re-evaluate nitrites/nitrates added to food?

The European Commission has asked EFSA to re-evaluate by 2020 all additives authorised before 20 January 2009. As part of this programme, EFSA has re-assessed the safety of sodium and potassium salts of nitrite (E 249-250) and nitrate (E 251-252) in two scientific opinions published in June 2017.

The current acceptable daily intakes (ADIs) for nitrite, set by the European Commission's former Scientific Committee for Food (SCF) in 1997 and the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in 2002, are 0.06 and 0.07 milligrams per kilogram of body weight per day (mg/kg bw/day), respectively. For nitrate both bodies set the ADI at 3.7 mg/kg bw/day.



## How did EFSA re-assess the safety of nitrites and nitrates?

EFSA's Panel on Food Additives and Nutrient Sources Added to Food (ANS) based its assessment on previous evaluations, new scientific literature, and information provided following public calls for data.

### **Nitrate**

The experts were able to derive an ADI for nitrate as they did not consider it to be genotoxic or carcinogenic (for substances that are potentially damaging to DNA or may cause cancer no safe level can be established). The panel considered the most relevant effect for setting a safe level was elevated blood concentrations of methaemoglobin, caused by nitrite converted from nitrate in saliva (see above). Based on this effect, the panel concluded that the ADI set by the SCF (1997) was sufficiently protective of public health.

### **Nitrite**

The panel calculated an ADI of 0.07 mg/kg bw/day, corresponding to the safe level established by JECFA and close to the slightly more conservative current ADI of 0.06 mg/kg/bw/day derived by the SCF. As for nitrate, this is based on increased methaemoglobin levels in the blood following consumption as a food additive.

## What were EFSA's findings on nitrosamines?

Nitrites – including when used as food additives – contribute to the formation of a group of compounds known as nitrosamines, some of which are carcinogenic.

Applying a number of conservative (i.e. worst-case scenario) assumptions, the panel concluded that the formation of nitrosamines in the body from nitrites added at approved levels to meat products was of low concern for human health.

The panel further noted that nitrite unintentionally present in meat products from other sources such as environmental contamination can also contribute to the formation of nitrosamines. EFSA's experts concluded that these levels of nitrosamines might give rise to potential health concerns but that more research was needed to address uncertainties and knowledge gaps in this complex area.



## What were the main conclusions?

Based on the available evidence, EFSA's experts concluded that existing safe levels for nitrites and nitrates added to meat and other foods are sufficiently protective for consumers. Using more realistic data (i.e. actual concentration levels in food), the experts estimated that consumer exposure to nitrate solely from its use as a food additive was less than 5% of the overall exposure to nitrate in food, and did not exceed the ADI. For nitrites used as food additives, experts estimated exposure to be within safe levels for all population groups, except for a slight exceedance in children whose diet is high in foods containing these additives.

If all sources of dietary nitrate are considered (food additives, natural presence in food and environmental contaminants), the ADI may be exceeded for individuals of all age groups with medium to high exposure. Nitrite exposure from all dietary sources may exceed the ADI for infants, toddlers and children with average exposure, and for highly exposed individuals of all age groups.

## What did the panel recommend?

To reduce uncertainties, the panel made several recommendations, including:

- additional studies to measure the excretion of nitrate into human saliva, its conversion to nitrites, and the resulting methaemoglobin formation;
- further studies on the levels of nitrosamines formed in different meat products based on known amounts of added nitrites/nitrates;
- large-scale epidemiological studies on nitrite, nitrate and nitrosamine intake and risk of certain cancer types.

## What other work has been done in this area?

The SCF and JECFA have reviewed nitrite and nitrate added to food on several occasions, which led to the setting of the current ADIs. In 2010, EFSA's ANS Panel issued a statement on nitrites in meat products considering data from Denmark, which did not lead EFSA to revise the existing ADI. EFSA's Panel on Contaminants in the Food Chain (CONTAM) has produced three opinions relevant to nitrites and nitrates, none of which proposed a revision of the ADIs previously set by the SCF and JECFA:

- In 2008, the CONTAM Panel assessed the risks and benefits to consumers from nitrates in vegetables. It concluded that the beneficial effects outweighed potential health risks from exposure to nitrate through vegetables, and that the average consumer would not exceed the ADI.



- In its 2009 opinion on nitrites as undesirable substances in animal feed, the panel concluded that the low nitrite levels in fresh animal products did not raise any concern for human health.
- In 2010, a further opinion was delivered on the potential health risks for infants and young children from naturally occurring nitrate in leafy vegetables, in which the panel concluded that levels of nitrate in these vegetables are not of health concern for most children.

The International Agency for Research on Cancer (IARC) re-evaluated data available on nitrite and nitrate in 2010, but did not comment on the ADIs set previously by other organisations. The IARC evaluation includes a review of the effects of ingested nitrate in experimental animals and in humans arising from epidemiological studies.

In 2015, IARC classified processed meat as a carcinogenic hazard to humans (Group 1), with the formation of carcinogenic nitrosamines as one contributing factor. While IARC assesses the carcinogenic properties of substances, i.e. the potential hazard they pose, EFSA also evaluates the likelihood and level of exposure for different population groups in its risk assessments.

## What happens next?

EFSA's scientific advice will inform risk managers in the European Commission and Member States who regulate the safe use of nitrites and nitrates as food additives as well as their overall levels in food in the EU.

### Glossary

**Acceptable daily intake** – an estimate of the amount of a substance in food or drinking water that can be consumed over a lifetime without presenting an appreciable risk to health. It is usually expressed as milligrams of the substance per kilogram of body weight and applies to chemical substances such as food additives, pesticide residues and veterinary drugs.

**Exposure** – concentration or amount of a particular substance that is taken in by an individual, population or ecosystem in a specific frequency over a certain amount of time. When experts assess consumers' dietary exposure to a chemical substance, they combine data on its concentrations in food with the quantity of those foods consumed. Children are often more exposed to substances because of their higher food consumption levels relative to their body weight.