

## Frequently asked questions on ergot alkaloids in cereal products

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Ergot alkaloids are metabolites of certain fungi, for example *Claviceps purpurea*. Depending on the dose, these alkaloids can cause moderate to serious health problems. Studies conducted in Germany and the European Union have shown that rye products in particular but also cereal products made from other types of cereals can contain high amounts of ergot alkaloids: Depending on the cultivation and climate conditions of a given harvest year, the cereal can be infested to an increasing degree with the permanent form of the fungus, i.e. the dark solid-walled sclerotia (secale cornutum). Under inappropriate situations, this can lead to increase levels of ergot alkaloids in cereal products. The BfR has compiled questions and answers on the health risk of ergot alkaloids in cereal products.

### What are ergot alkaloids?

Ergot alkaloids or secale cornutum alkaloids are predominantly contained in the ergot. The term ergot denotes structures which are developed by phytopathogenic fungi such as ergot fungus (*Claviceps purpurea*). Called sclerotia in scientific terms, these permanent states of the fungus protrude from the husk of the grain ear of infected wild grass types and cereals as the "ergot". Due to its darker colour, they are usually easy to see. Of agriculturally cultivated cereal types, rye in particular is affected. However, other cereals such as wheat too can be infected with the fungus.

### What health risks do ergot alkaloids pose for humans?

Following oral ingestion of small quantities of ergot alkaloids, acute symptoms such as vomiting, spasms, headaches, cardiovascular problems (e.g. hypertension or cardiac arrhythmia) and dysfunctions of the central nervous system can occur. Human data show that uterus contractions can be caused even by small intake quantities. These can in turn lead to uterus bleeding and miscarriage. Following consumption of high ergot alkaloid quantities, acute toxic effects such as circulatory disorders due to the vaso-constrictive effects on blood vessels, especially to the cardiac muscle but also to the kidneys and the extremities, have been described. The symptoms can be accompanied by hallucinations, spasms and impaired sensations and paralysis and can, following respiratory or cardiac arrest, lead to death.

Chronic intake of moderate quantities of ergot alkaloid, effects can have a negative impact on reproduction (e.g. trigger miscarriage, lower birth weight, deficient lactation). Chronic oral ingestion of large quantities of ergot alkaloids result in symptoms which correspond to acute ingestion of high quantities of ergot alkaloids. This is known from observations of unwanted effects where certain ergot alkaloids were used as active ingredients in medicines or where, following ingestion of cereal products containing high levels of ergot, people became ill.

### Are there any legal regulations on the quantity of ergot alkaloids in cereals and cereal products?

In contrast to other mycotoxins (e.g. deoxynivalenol and zearalenone) a maximum level has been established for cereal-based foods neither at the national nor at the European level. However, this aspect is taken into account in Regulation (EU) No. 1272/2009 which regulates the joint implementation directives on Regulation (EG) No. 1234/2007 of the Council with regard to the purchase and sale of agricultural produce within the framework of public intervention \*. Even though the regulation currently exclusively refers to ergot levels in soft wheat or hard wheat with a maximum content of 0.05 % ergot as the minimum quality criterion, rye is, for surveillance purposes, also assessed on the basis of this quality criterion.

*\* At the European level, the quality of cereals is determined by means of intervention regulations. As part of these regulations, quality criteria on the purchase of cereals that cannot be sold in the market are defined. If these quality criteria are not complied with, the cereals are not purchased by the intervention authority. The supervisor authorities of the federal states use these quality criteria to decide whether the cereals they have tested are fit to be traded and whether they may be used in food production.*

### **Why is the subject "ergot alkaloids in rye products" so topical again at the moment?**

In the year 2012, the European Food Safety Authority (EFSA) for the first time inferred health-based guidance values for tolerable intake quantities of ergot alkaloids for acute and chronic exposure and contrasted them with pharmacological insights from drug treatment. A study conducted by the Supervisory Authority in Baden-Württemberg levels of ergot alkaloids were found in rye bread rolls and rye flour, which, in dependence of the intake quantities, can mean that these guidance values are significantly exceeded. Currently additional data from the federal states are analysed in order to define risk assessment in more detail. Furthermore, as part of the current food monitoring programme, the competent authorities of the federal states are currently taking and analysing additional samples for monitoring purposes. With these results, the authorities are determining what further measures are necessary to reduce the ergot alkaloid contents in cereals. This type of monitoring focuses on rye products, since comparatively large amounts of rye products are consumed in Germany and rye is also a central concern in terms of *Claviceps purpurea* fungal infection.

### **Which foods can lead to ergot alkaloid intake in consumers?**

The main source of intake of ergot alkaloids are cereal products such as flour, bread and baked goods. In Germany, depending on harvest conditions it is notably products made from rye (rye flour, rye wholemeal bread, rye bread and bread rolls) but also other types of cereals that may, contain higher ergot alkaloid levels.

### **How do ergot alkaloids get into cereal products?**

Apart from the climatic conditions agricultural and technical measures of the economic stakeholders along the entire value-added chain from the selection of seeds to cultivation, selection of the raw materials and down to technological processing of the cereals influence ergot alkaloid levels. For example, insufficient removal of ergot before processing of the cereal can lead to a situation where ergot alkaloids get into the cereal products during the milling processes. Contamination with ergot alkaloids can, however, also occur after the cereals have been cleaned. This can happen, for example through fragments or through ergot alkaloid-contaminated dusts from the ergot.

### **How can consumers see that cereal products are contaminated with ergot alkaloids?**

It is not possible for consumers to see whether cereal products are contaminated with ergot alkaloids. It can only be detected in the cereal products by means of chemical and analytical methods. For this reason, ergot alkaloid contents are, paying special attention to rye products, measured in cereal products, both as part of regular food control measures and as part of food monitoring and also through self-control processes of the food industry.

### **What consumer groups are especially at risk from ergot alkaloids contained in foods?**

Due to their low body weight relative to the consumption quantity, children are regarded as a particularly sensitive consumer group. In addition, pregnant women, unborn children and infants too are considered to be particularly sensitive consumer groups.

### **What measures are used to prevent ergot alkaloid contamination?**

In the mills, ergot is removed by means of different technical measures. However, under certain circumstances, for example climatic conditions such as droughts, the shape and / or colour of the ergot can undergo changes. Due to these changes, it is possible that routinely

used cleaning techniques fail to remove the ergot. This can result in increased concentrations of ergot alkaloids in cereal products. For this reason, the Federal Institute for Risk Assessment recommends systematic application of agricultural and technological good manufacturing practice (GMP) with the aim of minimising the ergot alkaloid concentrations in rye products. The focus should be on the efforts of all actors in the industry along the entire value added chain in the choice of seeds, the cultivation technique and the selection of raw materials through to the technological processing of the rye.

**How can consumers avoid ingestion of ergot alkaloids?**

Consumers and especially sensitive groups such as pregnant women and children can reduce their intake of ergot alkaloids via bread and other rye products by ensuring that they eat a wide variety of different types of bread.