Bundesinstitut für Risikobewertung

FAQs on anthrax and possible contamination of foods with *Bacillus anthracis*

BfR FAQ, 22 October 2014

Cattle from a Slovakian cattle population were recently slaughtered in Poland. A few days later, some animals of the same herd became ill with and died of anthrax. Subsequently subjected to veterinary examinations, the animals slaughtered in Poland did not show any symptoms of illness. Nor did the meat inspection indicate that the cattle had contracted anthrax. Following clearance, the meat of the animals was delivered, via the Netherlands, to several meat processing plants in some member states of the European Union. This happened before the anthrax cases in the Slovakian herd became known. Some of those processing plants are in Germany. Having received the information that meat from a herd potentially infected with anthrax has entered the food chain, the Federal Institute for Risk Assessment (BfR) has compiled a list of FAQ on the subject.

What is *Bacillus anthracis*?

Bacillus anthracis belongs to the genus Bacillus. It is a gram-positive and spore-forming rod-shaped bacterium characterised by aerobic growth (in the presence of oxygen) or facultative anaerobic growth (in the absence of oxygen). *Bacillus anthracis* is found in the soil. As such, it causes illness predominantly in grazing animals. Vegetative forms of *Bacillus anthracis* (i.e. live, replication-competent bacteria) lose their virulence (their ability to cause illness) and have low chances of survival outside of human or animal tissue. When an infected animal dies and through drying of bodily fluids, persistent variants, so-called anthrax spores, are formed.

What is anthrax?

Anthrax or splenic fever denotes illnesses resulting from infection with *Bacillus anthracis*.

Where is *Bacillus anthracis* found?

Bacillus anthracis is endemic (this means that the bacterium is found in animal populations) in Latin America, Asia and Africa, especially in warm areas. The bacteria are also common in European countries, although they are not as prevalent there as on other continents. Herbivorous farm and wild animals are believed to be the bacteria's main reservoir.

What animals are affected?

Domestic and wild ruminants are highly susceptible to illness caused by the anthrax pathogen. In contrast, pigs, carnivores and birds (with the exception of ostriches) are considered to be almost resistant. The disease is not transmitted directly from animal to animals but via feed contaminated with anthrax spores originating in the soil. In the last three decades, anthrax outbreaks have sporadically erupted in Germany too, especially in cattle.

How do humans become infected with *Bacillus anthracis*?

There are three different types of anthrax in humans. Cutaneous (skin) anthrax is caused by direct contact of the skin with animal materials containing pathogens, for example skins, organs, coats, wool, bones or bone meal. In its pulmonary form (pulmonary anthrax), the illness is contracted when spores enter the body through inhalation of dust or aerosols. Intestinal anthrax has been observed following consumption of highly contaminated meat as well as offal or water. In addition, intravenous use of contaminated heroin can cause anthrax.

How long is the incubation period in humans?

The incubation period, i.e. the time from the infection to the first symptoms of illness, depends on the way the disease was contracted and on the number of pathogens entering the body. It is between several hours to several days but may be even longer.

How does infection with *Bacillus anthracis* manifest itself?

In all its forms, anthrax can cause severe general symptoms, high fever, drowsiness, and cardiovascular disorders including shock. Cutaneous anthrax can manifest in the form of papules with redness and swelling, followed by fluid-filled blisters which then become scabby necrotic ulcers (“anthrax carbuncles”). The very rare pulmonary type (pulmonary anthrax) is characterised by an unspecific initial stage with fever, headache and pain in the limbs. Within 1 to 3 days, patients then develop severe symptoms which may include sepsis as well as pulmonary and cardiovascular failure.

For intestinal anthrax, there are two distinct disease patterns. The oropharyngeal type (affecting the mouth and throat) starts with a sore throat, difficulty swallowing, and ulcer formation in the mouth or the oesophagus. This is followed by severe lymph node affliction, oedemas and sepsis. The abdominal form is characterised by fever, fatigue and indisposition, later with severe abdominal pain, bloody diarrhoea, peritonitis and sepsis, in some cases leading to cardiovascular failure.

Can food be contaminated with *Bacillus anthracis*?

When animals from infected herds are slaughtered, *Bacillus anthracis* and anthrax spores can be transferred to the meat and meat products. When clinically healthy animals are slaughtered, the transferrable pathogen quantities are, in line with expectations, very low. Massive pathogen quantities are only released in the bacteraemic stage, i.e. when the bacteria are spread via the circulatory system of infected animals. This occurs during the acute or hyperacute (these terms denote a very quick and severe progression) stage of the illness. In addition, the various steps of processing the meat into meat products can lead to a reduction in the number of pathogens present, for example through heating or acidification. Moreover, based on the current state of knowledge, the quantity of *Bacillus anthracis* required for transmission to humans through food is very high.

In Germany, there have been no cases of intestinal anthrax in humans in the last two decades. Reports about anthrax outbreaks among ruminants are rare. For all these reasons, the BfR currently regards the probability of becoming ill with anthrax following consumption of food produced in Germany as very low.

How can *Bacillus anthracis* be killed?

Vegetative forms of *Bacillus anthracis* are easily killed during normal cooking procedures and common disinfection methods. Anthrax spores, on the other hand, are highly resistant to heat, dryness, deep freezing and common drinking water chlorination. Additionally, they are extremely resistant to disinfectants. The spores are inactivated only when heated to 100°C for 15 minutes or through sterilisation. However, with acids (pH level under 5), high solar irradiation or strong disinfectants (10% formaldehyde, 3% hydrogen peroxide, 1% peracetic acid) and an application time of 2 hours, even anthrax spores are killed.

What are the conditions under which *Bacillus anthracis* can multiply?

In a nutrient-rich environment such as the blood or lymph fluid of an infected grazing animal, the spores germinate at 8 - 45 °C and in a pH range of 5 - 9, so that the vegetative form of the bacteria can multiply in a temperature range between 22 - 42°C. Under certain conditions (optimal temperature and pH levels and minimal accompanying flora), multiplication in food is possible.

Which groups of persons are especially at risk of becoming ill with anthrax?

Persons working in slaughter houses who come into contact with animals from herds infected with *Bacillus anthracis* have an increased risk compared to other groups of persons. However, cases of anthrax infection in humans are very rare in most industrialised nations. Infection via the skin though contact with animals for slaughter or the coat, meat, blood, bones or other by-products of such animals is conceivable. This form of infection could also occur in persons involved in the cutting up or processing of meat, since these activities are associated with a higher risk of injury and hence with skin lesions (injured skin). Infections via the respiratory system, for example during processing of contaminated wool or coats in closed rooms, usually occur even more rare.
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