



# The meatball case

**Ubiquitous, persistent and sometimes deadly: listeria can lead to food-borne disease. It was previously almost impossible to ascertain the source of the disease cases – until now.**

**I**n Germany's second largest listeriosis outbreak, which began in 2013, 83 people fell ill. Five of them died. The disease cases were spread over twelve German federal states. "This outbreak lasted a long time and spanned a total of six years," says Dr. Sylvia Kleta. As head of the National Reference Laboratory (NRL) for Listeria at the BfR, she routinely deals with the bacteria,

which can be found in a variety of foods. Listeriosis outbreaks occur again and again, with illnesses appearing and spreading nationwide over many months or years. The outbreaks are often only detected when the listeria found in the patients is compared using whole genome sequencing. Then the search for the origin of the outbreak begins.

## Contaminated food

Listeria are widespread in the environment – in the soil, on plants, in animals as well as in faeces and sewage. The route to food is often short, especially when it comes to raw meat, minced meat, raw sausages and raw milk. Plant-based foods, such as vegetables, can also be contaminated in the field if the soil was previously fertilised with manure containing listeria.

The pathogens are a common problem in food production. They survive in cracks and crevices, among other places, in mostly humid rooms. There, the comparatively stubborn listeria get by with few nutrients. And they are able to withstand the lack of oxygen in food packaging just as well as frost in the freezer. They even cope better with salt and acid than their conspecifics.

Food manufacturers have to go to great efforts when it comes to cleaning and disinfection to keep the bacteria at bay. One infected spot on the production line is enough to contaminate a number of foodstuffs. As a result, listeria is often found in processed foods, for example, smoked fish, such as smoked salmon, and in seafood, such as sushi or oysters. Cheese, pre-cut salads or cold cuts can also be affected.

## Life-threatening danger for risk groups

Of the 21 known species of listeria, only *Listeria monocytogenes* can infect humans. When a healthy person falls ill with listeriosis, this leads to a feverish reaction or gastrointestinal inflammation with a mostly mild progression. It can be life-threatening for senior citizens, people with weakened immune defences (for example transplant patients, cancer patients) and newborn babies. Infected pregnant women can also suffer miscarriage or stillbirth. The Robert Koch Institute (RKI) registered 591 disease cases in Germany in 2019; seven percent of the patients died.

Federal and state authorities work together to uncover the origin of listeriosis cases. Whole genome sequencing has provided the authorities with a powerful tool for several years now. Experts can use it to decode the genetic make-up of individual listeria isolates. Isolates are bacteria that have been taken from a food sample or a patient. The decoded sequences can be used like fingerprints. If identical fingerprints are found at different locations, clues can be derived as to the common origin.

“Whole genome sequencing has revolutionised our work,” says BfR scientist Dr. Stefanie Lüth, who also works at the NRL. In the past, it was almost impossible to identify the food to which an outbreak could be traced. The technique can be used to establish links between infections and food. “We are incredibly successful in outbreak clarification.” The method has been used to trace around 40 listeriosis outbreaks since 2016, more than ever before.



Experts take listeria isolates from various food samples. The National Reference Laboratory (NRL) for Listeria sequences isolates obtained by the German federal states during food monitoring.

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Listeria in food: one contaminated spot on the production line is enough.

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### Successful cooperation

The BfR has an important task in solving listeriosis outbreaks. Located at the BfR, the NRL sequences isolates obtained by the German federal states during food monitoring. The sequences of these isolates, which are permanently stored in a database, are regularly compared with sequences obtained from isolates of listeriosis diseases. The latter fingerprints come from the RKI, which is responsible for this area. If scientists at the RKI become aware of several identical isolates – also known as cluster – this indicates an outbreak. The BfR then receives the cluster sequence and compares it to its own entries. The federal and state food monitoring authorities are informed if any matches are found. They can then actively follow up on the suspicion and eliminate the cause of infection.

The BfR's matching initially remained unsuccessful for a long time in the case of Germany's second-largest listeriosis outbreak. A match was only found in 2017, four and a half years after the first reported illness case. An isolate from a ready-to-eat meatball, which was sequenced as part of a research project, matched the outbreak cluster. This information led authorities to inspect the manufacturer. They found the outbreak strain at the manufacturer's facilities. 18 other listeria strains were detected in addition to this one. One of them was responsible for a second listeria cluster. The food processing facility was closed and the Germany-wide listeriosis outbreak stopped. ■

**More information:**

[www.bfr.bund.de/en](http://www.bfr.bund.de/en) > A-Z-Index: *Listeria monocytogenes*