

## Communication 48/2024

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### Climate change and foodborne diseases

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Climate change can have many different effects on human health and may also increase the risk of foodborne diseases in the form of infections caused by bacteria and parasites as well as intoxication due to marine biotoxins. The German Federal Institute for Risk Assessment (BfR) provides information on these topics in connection with enquiries from the public.

Scientific studies have demonstrated that there is a direct link between climate change and more frequent occurrences of certain foodborne diseases. This is a verifiable trend despite the fact that in the case of bacteria, such as salmonella and *Campylobacter*, and parasites, such as cryptosporidia, infections can mostly be avoided with good kitchen hygiene and appropriate handling of food during transport, storage, and preparation. Given the warming of bodies of water, it can also be assumed that gastrointestinal diseases caused by *Vibrio* bacteria as well as *Vibrio* contact infections from swimming will increase.

Overall, it can be assumed that pathogens will adapt well to the changing climate conditions over time. Additionally, weather extremes such as heavy rainfall and flooding lead to increased spreading of pathogens in the environment. The BfR is conducting several studies to improve data. For instance, a long-term project is examining the prevalence of various pathogens in relation to environmental factors such as temperature, humidity, and geographical location.

Climate change can also alter the geographical distribution of certain harmful algae that produce toxins known as marine biotoxins. They can accumulate in shellfish or fish that eat these algae. Consuming contaminated shellfish or fish (seafood) can cause various illnesses in humans.

Climate change can also affect the occurrence of mould and thus also the geographical distribution and prevalence (frequency) of mould toxins, so-called mycotoxins. These are natural secondary metabolites produced by mould that can cause health impairments in animals and humans.

Based on climate data collected over the past decades, it is to be expected that factors such as temperature, precipitation, and humidity will directly impact the entire ecosystem,

including the microorganisms therein. Through increased survival in the environment and easier transmission via insects and rodents, the probability that livestock intended for food production will be colonised with zoonotic pathogens increases with higher outside temperatures.

Furthermore, pathogens may grow faster in perishable foods, especially if stored improperly outdoors (e.g. at barbecues or picnics) or in warm kitchens. In Germany, for example, most human cases of salmonellosis and Campylobacteriosis are reported during the summer months.

### **Hygiene and heat protect against foodborne diseases from bacteria and parasites**

A study published in 2010 predicted that the weekly cases of foodborne salmonellosis might increase by approximately 10% if the average maximum temperature increases by 1°C (Zhang et al., 2010)<sup>1</sup>. This is less due to a direct impact of higher temperatures on bacteria than to an increased number of hot days, on which the risk of infection increases due to recreational activities and lack of compliance with cold chains, for example.

Foodborne diseases are usually self-limiting. For people with impaired or not fully developed immune systems (young children, pregnant women, people with pre-existing medical conditions), however, these diseases can be more severe and in individual cases may even be life-threatening. In order to avoid illnesses such as, for example, gastrointestinal diseases caused by salmonella or *Campylobacter*, good kitchen hygiene should be ensured when storing and preparing food. This includes thorough handwashing, using clean kitchen utensils, avoiding cross contamination – i.e. direct or indirect transfer of pathogens from one food to another – and maintaining the cold chain. Fresh fruit and vegetables should be thoroughly washed before consumption. Heating foods to at least 70°C core temperature for two minutes before consumption kills these bacteria and most other pathogens.

Climate change can also create more favourable conditions for parasitic infections. This is particularly the case for unicellular parasites, called protozoa, as they are already very stable in the environment. Protozoa include *Cryptosporidium* and *Giardia*. Infections can be asymptomatic, accompanied by gastrointestinal symptoms, but can also be severe and sometimes fatal. It can be assumed that the changed climate conditions have a direct effect on the spread and frequency of infections and diseases due to parasites. Transmission to humans can occur via contaminated foods which are consumed raw or after insufficient heating as well as through cross contamination due to poor kitchen hygiene.

### **Vibrio: risk of infection through consumption of food and contact**

Additionally, increasing water temperatures have been recorded, particularly the near shore coasts of the North and Baltic Seas. This impacts the entire ecosystem and provides favourable conditions for growth of certain pathogens such as *Vibrio* bacteria. *Vibrio* bacteria occur naturally in the environment, especially in water, and can cause mild to severe gastrointestinal infections in humans if they are ingested with food. They can accumulate in seafood, such as mussels and shrimps, and multiply particularly well in higher water temperatures (>18°C). Immunocompromised people with unnoticed small wounds can also become infected with *Vibrio* bacteria through direct contact with water, for example

<sup>1</sup> Zhang Y, Bi P, Hiller JE. Climate variations and salmonella infection in Australian subtropical and tropical regions. *Sci Total Environ.* 2010 Jan 1;408(3):524-30

while swimming. Severe cases can lead to fatal sepsis. To date, very few *Vibrio* infections in humans have been reported in Germany. However, with warming of bodies of water the importance of these pathogens is expected to increase in Europe and Germany.

### **Toxins in fish and mussels**

Certain types of algae produce harmful substances such as marine biotoxins. If marine biotoxins are consumed by mussels or fish, these toxins can accumulate in their tissue. The consumption of contaminated mussels or fish can lead to various diseases in humans, depending on the type of toxin and concentration. Symptoms vary and may include diarrhoea, nausea, vomiting, and headache or amnesia and neurological disorders such as slight numbness or even paralysis which can, in rare cases, be fatal.

Fast algae growth is called an algal bloom. If these blooms have a negative effect, for instance if they produce toxins, they are called harmful algal blooms. Climate change can alter the geographical distribution of harmful algal bloom forming algae. For example, warm-water species can spread in the direction of the poles and occur in new areas. In order to protect consumers, the European Commission has set limits for seafood containing marine biotoxins (Regulation (EC) No 853/2004).

### **Toxins from moulds (mycotoxins)**

In addition to the risks discussed in more detail in the publication mentioned below, it is assumed that climate change also affects the occurrence of mould and mould toxins, so-called mycotoxins. These are natural secondary metabolites produced by mould that can lead to health impairments in animals and humans. The toxic effect depends on the specific toxin, the duration of exposure (acute or chronic), the amount of intake and the health condition of the individual consumer. Possible symptoms of acute mycotoxin poisoning in animals and humans include liver and kidney damage, impairment of the immune system or the central nervous system, hormone-like effects, nausea, vomiting and diarrhoea. In addition, some mycotoxins can also have carcinogenic and mutagenic effects after chronic exposure. Therefore, the European Commission has set maximum levels for certain mycotoxins in various foods (Regulation (EU) 2023/915).

The occurrence of moulds and the production of mycotoxins depend on various factors such as temperature, precipitation and humidity, so that their geographical distribution and prevalence (frequency) can also be influenced by climate change.

Further information is included in the German-language article *Auswirkungen des Klimawandels auf lebensmittelassoziierte Infektionen und Intoxikationen* ("Effects of climate change on foodborne infections and intoxications"), which was published as part of the series *Sachstandsbericht Klimawandel und Gesundheit 2023* ("2023 climate change and health status report"):

[https://www.rki.de/DE/Content/Gesundheitsmonitoring/Gesundheitsberichterstattung/GBE/Downloads/J/Focus/JHealthMonit\\_2023\\_S3\\_Lebensmittelassoziierte\\_Infektionen\\_Intoxikationen\\_Sachstandsbericht\\_Klimawandel\\_Gesundheit.pdf?\\_blob=publicationFile](https://www.rki.de/DE/Content/Gesundheitsmonitoring/Gesundheitsberichterstattung/GBE/Downloads/J/Focus/JHealthMonit_2023_S3_Lebensmittelassoziierte_Infektionen_Intoxikationen_Sachstandsbericht_Klimawandel_Gesundheit.pdf?_blob=publicationFile)

**Further information on the BfR website**

Food hygiene – general information

[https://www.bfr.bund.de/en/food\\_hygiene-54339.html](https://www.bfr.bund.de/en/food_hygiene-54339.html)

Assessment of marine biotoxins in food – general information

<https://www.bfr.bund.de/en/search.html?search%5Bquery%5D=biotoxins>

FAQs Mould in foods - health risks and how to avoid them

## About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. The BfR advises the Federal Government and the States ('Laender') on questions of food, chemicals and product safety. The BfR conducts independent research on topics that are closely linked to its assessment tasks.

*This text version is a translation of the original German text which is the only legally binding version.*

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