

FAQ

15 January 2024

***Escherichia coli* in flour and dough - What is important for enjoyment without remorse?**

Escherichia (E.) coli are bacteria that occur naturally in the intestines of animals and humans. If *E. coli* are detected in food, they are considered an important indicator of faecal contamination. Certain *E. coli* can cause serious illnesses in animals and humans as they produce toxins. The bacteria can enter the environment and various animal and plant foods via faeces. Direct transmission between animals and humans and from human to human is also possible.

Of particular importance for humans are *E. coli* that produce shiga toxins. These are abbreviated as STEC. STEC that cause serious illness in humans are known as enterohaemorrhagic *E. coli* (EHEC).

In recent years, official food monitoring in Germany has repeatedly detected STEC in flour, baking mixes and dough samples. Since 2009, several infections have occurred in the USA and Canada that could be traced back to dough or flour contaminated with these bacteria. In some cases, serious illnesses occurred. In France, food-borne EHEC illnesses and two deaths were linked to frozen pizza dough.

Consumers can protect themselves from infection with STEC/EHEC by observing the rules of kitchen hygiene and not consuming unbaked bread, cake, pizza and biscuit dough.

What is STEC/EHEC?

STEC/EHEC are *Escherichia (E.) coli* bacteria that produce toxins (shiga toxins). These toxins can cause serious illness in humans. The symptoms are initially gastrointestinal complaints. The possible degrees of severity range from watery to bloody diarrhoea. In adults, an infection can also be asymptomatic. A particularly serious complication of an infection is haemolytic uraemic syndrome (HUS). This is a disease that manifests itself in acute kidney failure, blood clotting disorders and destruction of the red blood cells and can even lead to death. This form of the disease affects particularly vulnerable groups of people such as young children.

STEC/EHEC usually occur naturally in the intestines of ruminants such as cattle, deer, goats or sheep and are excreted in the animals' faeces. They can be transmitted directly or indirectly from animals to humans and cause illness.

Why can flour be contaminated with STEC/EHEC?

Plant-based raw materials such as grain can be contaminated with STEC/EHEC bacteria through contaminated water, natural fertilisers or wild animal faeces. During further processing from grain to flour in the mills, germs that have been introduced can be distributed in the end product and possibly multiply during certain process steps. Flour as an end product is a dry foodstuff in which STEC can multiply poorly but survive well.

How can humans become infected with STEC/EHEC through flour?

People usually become infected with STEC/EHEC through the oral route. The pathogen is often ingested when eating contaminated food. This includes undercooked dough. Poor kitchen hygiene can also lead to infections. The STEC/EHEC bacteria can survive well in flour. As the infectious dose - the minimum number required for an infection - is very low (less than 100 bacteria), it is quickly reached. This is especially true for (liquid) doughs that are left at room temperature for a long time, as this can lead to a proliferation of bacteria. For comparison: in the case of salmonella, the infection dose for adults is in the region of 10,000 bacteria.

How long can the incubation period last?

It takes an average of three to four days from eating food contaminated with STEC/EHEC to the onset of illness. However, this incubation period can vary from two to ten days.

Which flours can be affected?

According to current information, wheat, rye, spelt and buckwheat flour may be affected. STECs have also been found in various baking mixes.

How can infection from flour be avoided?

As a general rule, following the basic hygiene rules reduces the risk of infection. The following must be observed with flour:

- Wash hands thoroughly with soap and water before preparing food and after contact with flour and dry them carefully
- Avoid contact between flour and food for direct consumption wherever possible and also use different boards, plates, bowls and mixing utensils
- Clean and dry surfaces and objects thoroughly with washing-up liquid and warm water after contact with flour
- Do not eat unbaked bread, cake, pizza and biscuit dough; people with weakened immune systems and small children in particular should generally avoid eating raw dough

How can STEC/EHEC bacteria be killed?

STEC/EHEC are killed by boiling, baking, frying and deep-frying. The prerequisite is that a temperature of 70 °C is applied to all parts of the food for at least two minutes. It should be noted that these values do not refer to the use of dry heat. STEC/EHEC are not reliably killed in dry flour (approx. 13 % water content) at 70 °C. These bacteria are also relatively

insensitive to acids, cold or dehydration. This means that STEC/EHEC bacteria cannot be reliably killed even in the freezer.

However, by increasing the water content (e.g. through eggs, milk or water), as is generally the case in dough, STEC/EHEC can be killed by conventional cooking methods. Therefore, no adverse health effects are to be expected with regard to STEC in fully baked doughs.

Is heat treatment of dry flour in the oven useful as protection against STEC/EHEC infection?

STEC/EHEC bacteria are relatively insensitive to dry heat. Such a treatment therefore does not lead to a safe and complete destruction of the STEC/EHEC bacteria in the flour.

Can STEC/EHEC also occur in baked goods?

Whether STEC/EHEC pathogens can occur in baked goods depends on the type of processing. In the case of products that are fully baked, there is generally no risk of the bacteria being transmitted to humans. However, insufficient heating of dough or subsequent dusting of baked goods with contaminated flour could pose a risk of infection.

Can ready-made doughs be contaminated with STEC/EHEC?

Food monitoring data shows that ready-made doughs can also be contaminated with STEC. Consumers must therefore pay attention to whether a dough is only offered for finished baking or also for raw consumption. In the case of dough that is offered for raw consumption (so-called "cookie dough"), it is the responsibility of the manufacturer to offer a safe product, also with regard to STEC/EHEC infections. Only the manufacturer can provide information on the manufacturing process and inactivation steps. If in doubt, consumers should contact the manufacturer directly to find out whether and what measures have been taken to reduce germs.

Is snacking on raw biscuit dough dangerous (in terms of STEC/EHEC infection)?

In principle, contamination of the dough is also possible via the flour. This also results in a risk of STEC/EHEC infection.

The BfR therefore generally recommends not eating unbaked dough. People with weakened immune systems and small children in particular should generally avoid eating raw dough.

Are people who work in mills or bakeries particularly at risk?

People who handle flour should always observe the general rules of hygiene. Flour is a food raw material with a relatively high germ load. For this reason, people who work with flour should wash their hands thoroughly before eating. For general hygiene reasons, eating, drinking and smoking must be avoided during the commercial production of food anyway.

Can you also become infected with STEC from home-mashed cereal flakes? Are they the same as flour?

The conclusions for flour and ready-made dough with regard to microbiological risks cannot simply be transferred to cereal grains. The BfR is not yet aware of any outbreak of illness

caused by the consumption of crushed cereal grains or muesli. Another aspect is that with whole grains there is mainly a risk of localised contamination. With flour, on the other hand, there is the possibility that during the processing steps from grain to flour in the mills, point sources of contamination are distributed in the product, thus increasing the probability of contact with the pathogen.

In principle, however, it can be assumed that the suspected routes of contamination of flour, e.g. wild ruminants in the field, also apply to cereals such as naked oats.

The naked oats and other cereal grains available on the market for the production of cereal flakes are raw products that always have their own microbiological contamination.

The expected microbiological contamination of commercially available cereals is within the range of conventionally produced foods. *E. coli* and coliform bacteria are usually present in small numbers, so the presence of STEC cannot be ruled out. However, there are currently no indications that cereals such as muesli are of particular significance in the transmission of STEC to humans. Products sold in the food retail trade are usually subject to strict quality control by the manufacturers. This also includes microbiological parameters.

To protect against food-borne infections, cereal products that have already been mixed with water, milk, milk substitute products or fruit juices should no longer be kept unrefrigerated but should be consumed immediately. Cereal grains as the starting product should also not be left to stand in liquid, e.g. in water before crushing.

Can young children also become infected with STEC from play dough such as salt dough or homemade modelling clay made from flour?

This is possible in principle because the infectious dose is very low. The risk of infection is related to the amount of dough ingested. It is conceivable that in special individual cases, licking the fingers during kneading can also lead to an infection. Although the high salt concentrations in salt dough create an unfavourable environment for bacteria, there is no evidence that this is sufficient to safely kill STEC.

Can pets also become infected with STEC/EHEC?

Pets can also become infected with STEC/EHEC. However, such illnesses are usually milder than in humans. However, pets can infect humans via smear infection if sufficient hygiene is not observed when handling them. This is particularly important with regard to small children.

What is the BfR doing to protect consumers from STEC/EHEC?

Reference laboratories have been established at the BfR and the Robert Koch Institute (RKI) to deal with the detection, characterisation and risk assessment of STEC/EHEC. At the BfR, *E. coli* from foods sent in by the monitoring authorities of the federal states are characterised in order to identify/characterise human pathogenic STEC, i.e. STEC that cause disease in humans, and to determine whether human infections are attributable to the consumption of certain STEC/EHEC-contaminated foods. The aim is to prevent outbreaks of disease or to contain them as quickly as possible.

Further information on the BfR website

Opinion No. 004/2020 "Escherichia coli in flour - sources, risks and prevention"
<https://www.bfr.bund.de/cm/343/escherichia-coli-in-mehl-quellen-risiken-und-vorbeugung.pdf>

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