

Pathogens in cheese: Researchers follow the traces of deadly bacteria

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Contaminated Quargel cheese caused several deaths in 2009 and 2010. (Photo: Kathrin Rychli/Vetmeduni Vienna) Credit: Kathrin Rychli/Vetmeduni Vienna

If food products are not produced in a hygienic environment, consumers can face the threat of dangerous pathogens. This is exactly what happened in 2009 and 2010 when two different strains of *Listeria monocytogenes* were found in the traditional Austrian curd cheese

known as "Quargel". 34 people were infected, and a total of 8 patients died. Experts from the University of Veterinary Medicine, Vienna analysed the genomes of the outbreak strains and were able to show that the strains displayed distinct properties and entered the food chain independently. The results were published in the journal *PLOS ONE* and will increase the understanding of outbreaks and their prevention.

Listeria is a rod-shaped bacterium highly prevalent in the environment and generally not a threat to human health. One species however, *Listeria monocytogenes*, can cause listeriosis, a very dangerous disease. This pathogen can be present in [raw milk](#) and soft cheeses, smoked fish, raw meat and ready-to-eat products. In Austria, [health care providers](#) are required to report all cases of listeriosis, which can be fatal particularly for patients with [weakened immune systems](#). In 2009 and 2010, a dairy in Hartberg (Styria, Austria) produced Quargel cheese contaminated with *Listeria monocytogenes* leading to a multinational listeriosis outbreak in Austria, Germany and the Czech Republic, ultimately forcing the dairy to shut down.

Detective work: finding the source

"I'm happy to report that we see relatively few cases of listeriosis here in Austria. When an outbreak occurs though, the disease has among the highest mortality rate of all food-borne illnesses", explains lead author Kathrin Rychli from the Institute for Milk Hygiene, Milk Technology and Food Science at the University of Veterinary Medicine, Vienna. The Institute was involved in investigating the causes of the outbreaks back in 2009 and 2010. The culprits: two distinct bacterial strains which had not recently evolved from a common ancestor, and therefore entered the [food chain](#) independently.

Genetics reveal the pathway

In their current study, the scientists sequenced and analysed the genomes of both strains, and assessed their virulence, the ability to infect cells. The samples were taken from listeriosis patients from the outbreak.

The first contamination event from June 2009 to January 2010 was attributed to one *L. monocytogenes* strain very effective at infecting epithelial cells of the intestine and liver cells. It contained additional four virulence genes, making it extremely invasive, and ultimately caused 14 cases resulting in 5 deaths. A few months later in December 2009, the second *L. monocytogenes* strain emerged. It was particularly successful at infecting macrophages, important immune system cells. Over time, this highly infectious second strain replaced the first and by February 2010 had infected a total of 20 people, 3 of whom died. The average age of those taken ill was 70.

Highest level of operational hygiene essential

Listeria expert and co-author Stephan Schmitz-Esser emphasizes the importance of cleanliness in production: "It is absolutely essential that appropriate disinfectants are used properly, lots of salt, and that possible food for the bacteria be limited. Any products *Listeria* is found in must be recalled immediately. Recalls are very expensive for producers, and we need to do everything we can to prevent them." Austria-wide the Institute for Milk Hygiene, Milk Technology and Food Science at the University of Veterinary Medicine, Vienna offers effective *Listeria* monitoring and a range of molecular and microbiological examination methods for the food industry.

What are the symptoms of listeriosis?

Listeriosis generally manifests in healthy people with diarrhoea and stomach cramps, whereas the elderly, newborns and people with

weakened immune systems are more susceptible. Listeriosis can result in septicaemia and meningitis. In pregnant women it can lead to miscarriage or stillbirth. Therefore, experts recommend pregnant women to avoid raw milk, raw meat and raw fish products.

More information: The article "Genome sequencing of *Listeria monocytogenes* "Quargel" listeriosis outbreak strains reveals two different strains with distinct in vitro virulence potential", by Kathrin Rychli, Anneliese Müller, Andreas Zaiser, Dagmar Schoder, Franz Allerberger, Martin Wagner and Stephan Schmitz-Esser was published in the Journal *PLOS ONE*.

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