

Virus cocktails and ice guns could help to tackle food poisoning risk

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Although antibiotics are often used to help combat infections in poultry flocks, overuse can lead bacteria to evolve resistance to the drugs. Credit: Karol Klajar / Unsplash

Harmful bacteria found in chickens that can cause food poisoning outbreaks and devastate poultry flocks could be better controlled with innovative new solutions being developed by researchers.

Bacterial infections are a major problem for [poultry producers](#). Outbreaks of E. coli, for example, can spread quickly through a flock, resulting in high mortality and loss of income for farmers. Other [bacteria](#) such as Salmonella and Campylobacter might not be as serious to the birds, but can lead to illness in humans if consumed.

Although antibiotics are often used to help combat infections in [poultry flocks](#), overuse can lead bacteria to evolve resistance to the drugs, making them even harder to treat in both animals and humans. The use of antibiotics in groups of animals for preventative purposes [is due to be banned in the EU from January 2022](#).

"Alternatives are needed to control these bacterial infections," said Dr. Daniela Silva, research and development manager at ALS CONTROLVET, a company that provides services to promote food safety in Viseu, Portugal.

Dr. Silva and her colleagues are investigating whether viruses that infect specific bacteria could be another tactic. These bacteria-killing viruses, known as bacteriophages or phages, could be sprayed inside [poultry](#) houses to disinfect them or added to the feed or water given to the birds.

Poultry [accounts for around 37% of global meat production](#) and demand is growing in many parts of the world. Europe is [one of the largest producers of poultry meat worldwide](#), with [about 15 million tons produced in 2018](#), and poultry is the second most-consumed type of meat in the EU.

Currently in Europe, [preventative measures](#) such as vaccination are used

to control the spread of harmful bacteria on poultry farms. Strict hygiene measures and frequent testing in broiler houses are also recommended. But economic loss from bacterial infections is still significant, [where it is estimated to be as high as 3 billion euros per year for Salmonella](#) in Europe.

"We need to provide a clean and safe environment for the birds to prevent them from getting infected," said Dr. Silva.



Currently in Europe, preventative measures such as vaccination are used to control the spread of harmful bacteria on poultry farms. Credit: Arisa Chattasa / Unsplash

Phages

She and her colleagues hope that phages might be the answer. When a phage infects a bacterium, it reproduces inside until the new phages burst out, killing the microbe and releasing more of the viruses to hunt down other bacteria of the same type. "As long as there are (more of the same) bacteria, a [phage](#) will be killing and replicating," said Dr. Silva. "Once there are no more bacteria and the infection is controlled, phages have no way of replicating so they will be eliminated by the bird and there are no residues."

Residues left by antibiotics used on farms can be a problem as they are thought to drive antibiotic resistance.

As part of the [Phagovet project](#), Dr. Silva and her colleagues hope to use cocktails of phages to reduce Salmonella on poultry farms. These can be incorporated into a spray that is used to disinfect poultry houses as well as a capsule filled with phages that could be added to an animal's drinking water or feed.

So far, the team has developed a cocktail made up of four phages that was effective against 93% of Salmonella strains tested. In experiments where broiler chickens were infected with Salmonella, they found that the spray significantly reduced the amount of the bacteria. The ingested capsule was slightly less effective.

For E.coli, the researchers are taking a more targeted approach. Since these bacteria mutate frequently, it is hard to find a single mixture of phages that would be effective. Instead, the team has been creating a library of different variants of E.coli found in birds along with the phages that are known to work against them. In the event of an outbreak on a poultry farm, the E.coli variant would need to be identified before a few potential phages could be picked from the library and tested against it.

"Then you just mix them together and provide this solution to the farmer in order to treat that specific bacteria," said Dr. Silva. "We give that to the animals via spray as the bacteria is lodged in their lungs."

The team are due to start large-scale animal trials to verify the results. They hope that their products will become additional tools to help reduce infections in poultry farms. "What we hope is to decrease the rejections upon going to the slaughterhouse and minimize the losses of the producers," said Dr. Silva.



ChillBact's specialised nozzles, which they call ice guns, pump out a fine snow to cool hard-to-reach parts of a carcass. Credit: Thor Ice Chilling Solutions

Campylobacter

But another bacteria, Campylobacter, which is responsible for [the most reported illness from food in the EU](#), also needs to be reduced on poultry

farms. While cases of Salmonella in humans have decreased significantly over the past decade, [cases of Campylobacter illness are steadily increasing](#). Infections can lead to long-term effects in some people who develop arthritis or irritable bowel syndrome. "It seems to be the bacteria that is causing most harm," said Thorsteinn Viglundsson, the managing director of [Thor Ice](#) Chilling Solutions, a company developing advanced cooling technology for food in Reykjavik, Iceland.

Chilling poultry carcasses can reduce the growth of Campylobacter by keeping their temperature under four degrees Celsius. [Factories in Europe typically use air cooling systems](#) that blow cold air on carcasses to do this, but ensuring even cooling can be a challenge. New ways of chilling poultry could help further eliminate Campylobacter bacteria, says Mr Viglundsson.

He and his colleagues are developing a new solution as part of the [ChillBact project](#) that sprays slush ice onto poultry carcasses as they move on production lines in a chill room. Specialized nozzles, which they call ice guns, pump out a fine snow at specific concentrations and temperatures to maximize cooling. Their aim is to target hard-to-reach parts of a carcass such as behind the drumsticks and neck. The number of nozzles and their positions in the room can be adapted to each facility, according to Mr Viglundsson.

Thor Ice has been conducting experiments at their facilities in Iceland and also doing computer simulations to measure how their chilling process affects the amount of Campylobacter on carcasses. They have also been examining the effect of different ice temperatures to figure out which is the most effective. They think that the technology could help control other [harmful bacteria](#) too, where they were able to reduce the amount of E.coli on carcasses during tests.

The team are now fine-tuning their technology and testing if it can

reduce *Campylobacter* in large-scale trials at two poultry production facilities in France. "We reduced 97% of *Campylobacter* when we started out on the project so we are expecting to get the same," said Mr Viglundsson. '(The slurry ice) is under 0 degrees Celsius when we shoot it and that's what we believe is helping to reduce bacteria."

If all goes well, Mr Viglundsson hopes the technology can be adapted for both small and large-scale poultry operations as it can be incorporated into existing facilities to improve the effectiveness of air-cooling systems. "Our technology is like a plug-in to the existing system," he said. "This is one of many ways to make food safer."

More information: Update and review of control options for *Campylobacter* in broilers at primary production, *EFSA Journal* (2020). [DOI: 10.2903/j.efsa.2020.6090](https://doi.org/10.2903/j.efsa.2020.6090)

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