Broken leaves in salad bags raise salmonella risk 2,400-fold – study

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Researchers say bacteria naturally present on leaves grows much faster once bag is opened, even when kept in fridge

Broken leaves in bags of prepared salad can hugely increase the risk of salmonella, a study suggests.

Scientists found that juices released from damaged leaves in bagged mixed salad and spinach increased the risk of the bacteria 2,400-fold. It also increased the bacteria’s virulence, enhancing its ability to cause infection.

Dr Primrose Freestone, who led the study by University of Leicester microbiologists, said: “Salad leaves are cut during harvesting and we found that even microlitres of the juices (less than 1/200th of a teaspoon) which leach from the cut ends of the leaves enabled salmonella to grow in water, even when it was refrigerated.

“These juices also helped the salmonella to attach itself to the salad leaves so strongly that vigorous washing could not remove the bacteria, and even enabled the pathogen to attach to the salad bag container.”

The researchers found that once a bag was opened, the bacteria naturally present on the leaves grew much faster even when kept cold in the fridge. As a consequence, they advised consumers to eat bagged salads as soon as possible after opening.

Significantly, they found that salmonella could grow at a refrigeration temperature of 4C (39.2F), below the previously observed minimum growth temperature of 5.2C, although independent experts suggested confirmation of this would be required through further studies.

The experts urged salad growers to maintain high food safety standards given the potential for a few salmonella cells in a bag at the time of purchase to increase to many thousands by the use-by date.

The study, published in Applied and Environmental Microbiology, did not test bought salads for the bacteria but examined how they grew on salad leaves when they were damaged and their adherence to the surface of their plastic packaging.

The researchers stressed that salads were an important part of a healthy diet but said they were the second most common source of foodborne illness, responsible for a number of salmonella and E coli outbreaks in the US and Europe.

Earlier this year 151 people were infected and two died after an [outbreak of E coli](https://www.theguardian.com/society/2016/jul/18/mixed-salad-leaves-linked-to-e-coli-outbreak-that-has-killed-two-in-uk)in Britain believed to have stemmed from mixed salad leaves.

Contamination can occur from animal or insect contacts, soil, contaminated irrigation and wash waters or non-hygienic equipment and human handling. [Salad](https://www.theguardian.com/lifeandstyle/salad) leaves pose a particular infection risk because they are usually not processed, washing aside, and are consumed raw.

Other experts who were not involved in the study said it highlighted the need for careful storage – akin to other temperature-sensitive food products – and preparation.

Dr Kimon Andreas Karatzas, assistant professor in food microbiology at the University of Reading, said: “Consumers seem to be more preoccupied with nutritional facts, but they should not forget that foodborne pathogens can be deadly.

“Avoiding fresh produce is not a solution, but if possible it would be preferable to buy uncut fresh produce over chopped, and to always wash it before you eat – even the ones that are already washed. Furthermore, keeping these foods in the refrigerator is important.”

Martin Adams, emeritus professor of food microbiology at the University of Surrey, offered some reassurance to consumers. “Prepared salads are generally washed in chlorinated water, a process that reduces levels of bacterial contamination substantially but does not guarantee their complete elimination,” he said.

“It is for this reason that reputable supermarkets and food manufacturers take great pains to assure the quality of their sources of supply and that all reasonable steps are taken to minimise the chances of contamination at source and during production. This study addresses the situation when salmonella is already present in the product and would therefore already be a risk to the health of the consumer.”