**Broken leaves in bags of prepared salad increase salmonella risk, study shows**

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Broken leaves in bags of prepared salad may dramatically increase the risk of salmonella, a study has shown.

Juice from damaged leaves can boost growth of the food poisoning bug more than 2,400-fold, scientists discovered.

It also has the effect of increasing the bacteria's virulence, making it more likely to cause an infection.

Experts warned consumers to avoid ready-cut salad if possible, to rinse bagged salad thoroughly, and not to let it get warm.

The scientists did not measure levels of salmonella in bought salad but investigated the way the bacteria grew on damaged leaves and attached itself to plastic bag surfaces.

Cos, baby green oak, and red romaine lettuce, spinach, and red chard obtained from commercially available bag mixes were all used in the tests.

The experiments showed that juice from broken leaves increased salmonella growth in water by 110%. When the juice was added to a nutrient medium supporting salmonella, the bacteria's growth was boosted more than 2,400-fold.

Lead scientist Dr Primrose Freestone, from the University of Leicester's Department of Infection, Immunity and Inflammation, 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.

"This strongly emphasises the need for salad leaf growers to maintain high food safety standards as even a few salmonella cells in a salad bag at the time of purchase could become many thousands by the time a bag of salad leaves reaches its use by date, even if kept refrigerated.

"Even small traces of juices released from damaged leaves can make the pathogen grow better and become more able to cause disease."

She said the research, published in the journal Applied and Environmental Microbiology, also served as a reminder to consume bagged salad as soon as possible after opening.

" We found that once opened, the bacteria naturally present on the leaves also grew much faster even when kept cold in the fridge," Dr Freestone added.

As part of the study, plastic bags were cut into 2cm long sections and tested to see how well salmonella formed clinging "biofilms" on their surfaces. The presence of juice enhanced the bug's ability to attach to the plastic, researchers said.

Each year more than 500,000 cases of food poisoning are recorded in the UK, according to a recent report from the Food Standards Agency.

While poultry meat was the most common source of infection, some 48,000 cases were linked t o fresh non-meat produce including vegetables, fruits, nuts and sprouting seeds.

Dr Kimon Karatzas, Assistant Professor in Food Microbiology at the University of Reading, said: "The interesting element is that chopped fresh produce provides an environment rich in nutrients which can support pathogens such as salmonella.

"On the other hand, consumption of fresh produce is important for health too and consumers need to strike a balance between the two.

"Consumers seem to be more preoccupied with nutritional facts, but they should not forget that food-borne 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."

Food microbiologist Professor Martin Adams, from the University of Surrey, said he was concerned to hear that the salmonella strain used in the study could grow at refrigeration temperature, minus 4C.

He added: "If salmonella did manage to gain access to a prepared salad then the food would obviously be a risk to the health of consumers but if it were able to grow at chill temperatures then that risk would increase over time.

"It is very important that salad vegetables are washed thoroughly before consumption.

"This is good advice that goes back many years.

"Although prepared bagged salads have already been washed, another washing before use would give an added level of reassurance."

American expert Dr Jeri Barak, Associate Professor of Plant Pathology at the Food Research Institute, University of Wisconsin-Madison, said: "It would be fair to conclude that if salmonella is present in salads, it might grow to infectious doses ...

"For an immuno-compromised group, consumption of raw produce may be a risk; however, this is not new.

"Commonly, this population is warned about consumption of certain foods.

"The rest of us should be reassured that contamination levels of raw produce in the supply chain are low with very few bacteria, and the rates of produce that have been found to be contaminated are between 0-3%.

"But consumers should treat bagged salads as temperature-sensitive food products, like milk and ice cream."

A spokesman for the Food Standards Agency (FSA) said: "Salmonella is not a problem regularly linked with bagged salads - there has only been one incident reported to the Food Standards Agency in the past five years.

"We work with producers and manufacturers who apply stringent controls on the leafy salad supply chain in the UK, minimising potential for contamination and providing for food safety assurance."

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