

Resistant bacteria: Can raw vegetables and salad pose a health risk?

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Salad is popular with people who want to maintain a balanced and healthy diet. Salad varieties are often offered for sale ready-cut and film-packaged. It is known that these types of fresh produce may be

contaminated with bacteria that are relevant from the point of view of hygiene. A working group led by Professor Dr. Kornelia Smalla from the Julius Kühn Institute (JKI) has now shown that these bacteria may also include bacteria that are resistant to antibiotics.

"We have to get to the bottom of these findings," said Professor Dr. Georg Backhaus, president of the Julius Kühn Institute. Antimicrobial-resistant [bacteria](#) are known to occur in manure, sewage sludge, soil and bodies of water. "The worrying detection of these kinds of bacteria on plants is in line with similar findings for other foods," adds Professor Dr. Dr. Andreas Hensel, president of the German Federal Institute for Risk Assessment (BfR). "We are now assessing as a matter of urgency what this finding means with regard to the health risk for consumers."

For the purpose of analysis, the working group purchased mixed salads, arugula and cilantro in German supermarkets. The samples were then analysed in order to determine the total quantity of transferable antimicrobial resistance [genes](#) (the researchers use the term "transferable resistome") in *Escherichia coli*, a mostly harmless intestinal bacterium, on these foods. In their analyses, the experts focused on the part of *Escherichia coli* bacteria that are resistant to the active substance tetracycline. This is because tetracycline antibiotics are used in livestock farming, where they can promote the development and propagation of resistant bacteria in organs such as the intestine. These bacteria as well as part of the antibiotics are excreted and then find their way onto the fields via organic fertilisers like manure. Smalla says that "the results of the comprehensive tests clearly show that a wide variety of transferable plasmids—gene carriers in bacteria that occur outside the chromosomes—have been found with resistance genes in the *E. coli* from fresh produce. Each of these plasmids carries resistance to multiple classes of antibiotics. *E. coli* bacteria with these properties have been found on all three analysed foods."

If these harmless bacteria occur on vegetable foods, they can enter the human intestine due to the consumption of [raw vegetables](#). Once ingested, the bacteria can pass on their plasmids to any pathogenic bacteria that may be present in the intestine. This is known as horizontal gene transfer. In nature, horizontal gene transfer enables bacteria to rapidly adapt to changing environmental conditions. If a patient is treated with antibiotics, bacteria that have incorporated these kinds of transferable resistance genes into their genome have an advantage and multiply more than their less well-equipped competitors. Due to the low level of contamination of [salad](#) with E. coli, it is not known how frequently resistance genes are transferred in the human intestine. There is also little knowledge as to whether and to what extent diseases are caused by such resistant bacteria.

Consumers should always wash raw vegetables, leaf salad and fresh herbs thoroughly with drinking water before eating them in order to minimise the risk of ingestion of pathogens or antimicrobial-resistant bacteria.

Pregnant women and people with compromised immune systems as a result of advanced age, pre-existing conditions or medication intake should additionally refrain from eating pre-cut and packaged salads as a precaution against foodborne infections and should instead prepare salads themselves using fresh and thoroughly washed ingredients shortly before consumption.

However, washing alone is not sufficient to reliably remove the disease pathogens or antimicrobial-resistant bacteria that may be present on vegetable foods. Therefore, in rare individual cases it is necessary that especially immunocompromised persons heat vegetables and fresh herbs sufficiently (at least two minutes to 70°C inside the food) before consumption according to the instructions of their attending physicians.

The study was published in the October issue of *mBio*.

More information: Khald Blau et al, The Transferable Resistome of Produce, *mBio* (2018). [DOI: 10.1128/mBio.01300-18](https://doi.org/10.1128/mBio.01300-18)

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