Research gives new insights into the role food intake plays in fighting antimicrobial resistance

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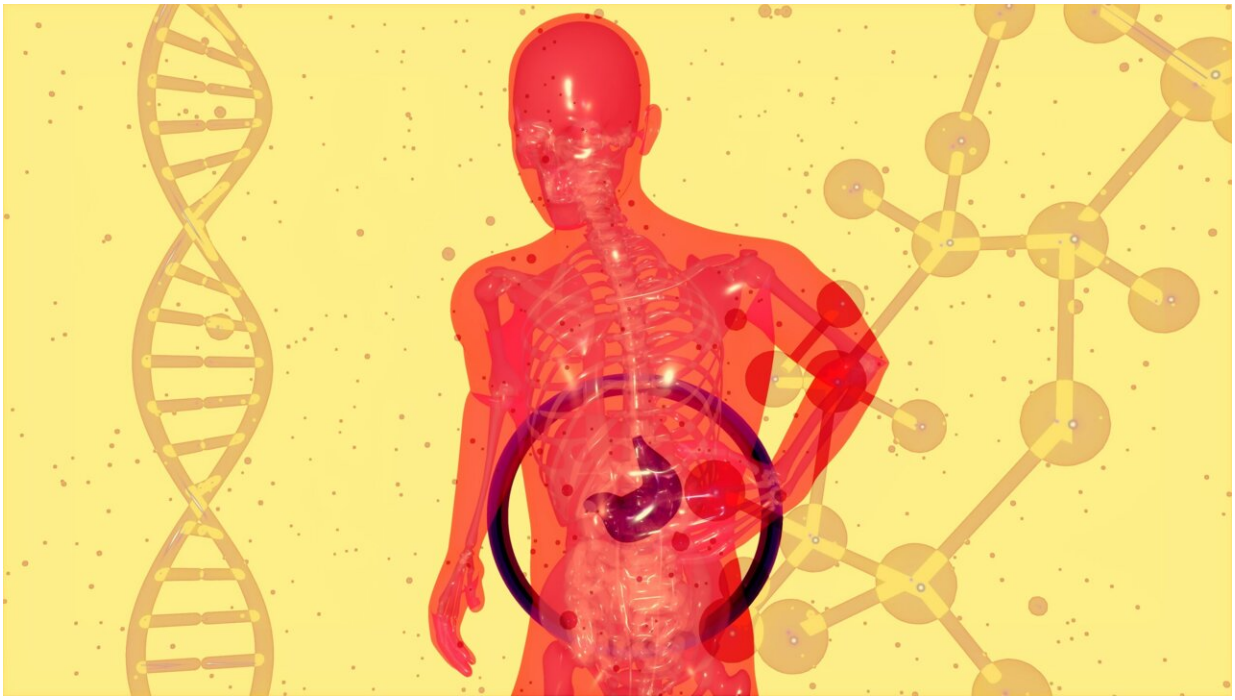

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Cooking food thoroughly and avoiding some types of vegetables and salad during a course of antibiotic treatment could potentially reduce antibiotic resistance, by preventing bacteria carrying resistance genes getting into the gut, according to a new study.

New research from the University of Nottingham has modeled how antibiotic resistance genes build-up through lifetime exposure from food intake and antibiotic treatment. The research published in *PLOS ONE* gives new insights into long term increase in resistance genes in gut bacteria and how this could be prevented.

Antimicrobial resistant bacterial infections represent one of the most serious contemporary global health care crises. Acquisition and spread of resistant infections can occur through community, hospitals, food, water or bacteria that lives inside us or that we may be exposed to—like E. coli.

The research modeled data from a previous study that found antibiotic gene diversity in gut microbiota is age related. The Nottingham study shows that the long-term increase in resistance in human gut microbiomes can be substantially lowered by reducing exposure to resistance genes found in food and water, alongside reduced medical antibiotic use.

The research suggests that reducing intake of resistance genes is particularly effective during periods of antibiotic treatment where there is an increased risk of the retainment of genes. The researchers suggest that dietary advice should be given to those undergoing antibiotic treatment to avoid products at higher risk of carrying ARGs, (even on otherwise harmless bacteria), as well as ensuring that all food consumed during treatment is fully cooked.

Dov Stekel, Professor of Computational Biology at the University of Nottingham has led the study and said, "When you're taking antibiotics is exactly when you are most susceptible to creating longer term problems due to drug resistant bacteria from food. If you eat something that has bacteria on it that doesn't cause you any harm, but which contains some drug resistant genes and you happen to be taking antibiotics when you

eat it then those resistances could become established in your gut ecosystem so next time you need antibiotics they may not work effectively."

The study also demonstrates other factors that can reduce the long-term acquisition and retainment of genes providing resistance to different classes of antibiotics. As genes build up over a lifetime the less exposure to these the better so a conservative approach to antibiotic availability and dosing guidelines, as already implemented in many countries, and as advocated in much of literature on antibiotic resistance, would be a practical approach to reducing the long-term number of acquired resistances.

Reducing the number of acquired genes over a lifetime could also be achieved by policy and practice changes in the food supply chain, including agriculture and post-harvest food production. Research from Nottingham Vet School is looking into this using artificial intelligence to monitor the gut microbiome in livestock.

Professor Stekel adds, "The level of benefit to be gained from alterations in medical treatment and dietary changes is highly dependent upon the level of antibiotic use, which varies greatly between countries. While our general model demonstrates benefit across all levels of prescribing, a more nuanced approach that considers region- and country-specific practices, along with specific details of antibiotic classes and associated resistance genes, would provide a better means of quantifying the potential advantages of these changes."

More information: A model of antibiotic resistance genes accumulation through lifetime exposure from food intake and antibiotic treatment, *PLoS ONE* (2023). DOI: 10.1371/journal.pone.0289941

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