They are everywhere

Antibiotics promote the spread of resistant bacteria. But there are also other influences.

Bacteria that cannot be harmed by antibiotics can threaten the health of humans and animals. This is particularly problematic for antibiotics that are only used once all other substances have failed. These antibiotics of last resort are, according to the specialist jargon, the "last choice". Carbapenems belong to these groups of agents.

Although carbapenems are not licensed for treating livestock, bacteria resistant to these agents (such as *Salmonella* and *E. coli*) have been isolated in some pig and poultry flocks in recent years. These bacteria produce enzymes (carbapenemases) that render carbapenem antibiotics ineffective.

Antimicrobial resistance is encoded in the genetic material of the bacteria. This genetic programming is due to selection, among other things: pathogens come into contact with the agents. The resistant bacteria survive. However, studies show that bacteria can carry resistance genes, even though they have not been exposed to certain antibiotics. How can that be?

The "information" on resistance is in fact not only found on the chromosome of a bacterium, but also on transmissible mobile genetic elements, such as plasmids. These DNA molecules make it possible for resistance to creep into populations where these agents have never been used. The plasmids can be exchanged between different bacteria and, in doing so, spread resistance. ◘

More information:
Hadziabdic, S. et al. 2019. The blaNDM-1 carrying IncA/C2 plasmid underlies structural alterations and co-integrate formation in vivo. Antimicrobial Agents and Chemotherapy 63(8). DOI: 10.1128/AAC.00380-19

Dr. Sead Hadziabdic
from the BfR EFFORT Team

Resistance road trip

Dr. Sead Hadziabdic, veterinarian and scientist at the BfR, has set out to see how plasmids carrying genes that encode the production of carbapenemase change and spread. This work was part of an international EU research project (EFFORT).

Describe your work in a Tweet!
In experimental studies with broiler chickens, we found bacteria in which plasmids carried carbapenemase-encoding genes during the entire fattening period – even though no relevant antibiotic had been used before.

How does this knowledge benefit humans, animals and nature?
It shows just how complex this is. Resistance can be introduced via plasmids from the environment or game animals and transmitted to livestock bacteria. Once in the food chain, they potentially reach humans. Therefore, it is important to prevent the introduction of these plasmid-carrying bacteria into a livestock population.

Your most important tool?
We have examined the genetic material using whole genome-sequencing and then analysed it using bioinformatics. Moreover, an experienced team was needed to carry out the animal experiments and for the subsequent laboratory work.