

## Transmission of livestock-associated MRSA to humans via poultry meat is possible, but the risk is low

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*Staphylococcus (S.) aureus* is a widespread bacterium that colonises the skin and mucous membranes of humans and animals. Around 30% of all people carry *S. aureus* on their skin and/or in their mucous membranes. This colonisation generally goes unnoticed. *S. aureus* is, however, also frequently involved in inflammation of the skin and/or soft tissue. The methicillin-resistant variant of *S. aureus* (MRSA) is resistant to all so-called beta-lactam antimicrobials, in other words penicillins and cephalosporins. These bacteria frequently also exhibit resistance to other classes of antimicrobials. MRSA is also detected in livestock and food. However, clinical data show that the strains found in livestock ("livestock-associated" MRSA, LA-MRSA for short) are currently of only secondary importance for infections in humans. The exception are people who have frequent contact with livestock (livestock professionals such as farmers and vets). They can be carriers of LA-MRSA. Transmission of LA-MRSA to humans via food is something that had not been observed before. Based on the findings of a research cooperation, scientists from the German Federal Institute for Risk Assessment (BfR) and the Statens Serum Institute (SSI) in Copenhagen (Denmark) conclude that it is possible for a certain type of LA-MRSA to be transmitted to humans via poultry meat. Previously, few cases of human infection with this type of LA-MRSA (so-called CC9/CC398) had been described in Denmark. On the whole, however, the BfR still assesses the risk of LA-MRSA transmission to humans as a result of contact with or consumption of (raw) poultry meat as low.

Together with the Statens Serum Institute (SSI) in Copenhagen (Denmark), the National Reference Laboratory for coagulase positive staphylococci including *S. aureus* at the German Federal Institute for Risk Assessment (BfR) investigated Methicillin-resistant *Staphylococcus aureus* (MRSA) strains of a very specific LA-type (CC9/CC398) isolated from colonised or infected patients. These strains were compared with strains that had been isolated from different kinds of animals, food and other sources (Larsen et al., 2016). The background to this study was that cases of CC9/CC398 MRSA were observed in humans in Denmark although there was no known reservoir in the country where this specific LA-type could have originated from. None of the patients infected with these strains had had direct contact with livestock. Neither had strains of this type been previously detected in livestock in Denmark.

The SSI looked at CC9/CC398 MRSA isolated from twelve infection cases in humans in Denmark. At the same time, it also examined an international collection of 185 (methicillin-resistant and methicillin-sensitive) *S. aureus* strains of different origins (humans, animals, food and the environment) that were compiled specifically for this investigation. The collection contained both CC9/CC398 strains and – for the purpose of comparison – strains of CC398, which account for the majority of LA-MRSA types in livestock. Using whole genome sequencing and phylogenetic strain analysis, it was possible to assign 10 isolates from the infection cases to a group of 49 very closely related CC9/CC398 strains in the strain collection. The strains possessed almost identical properties and characteristics, and were designated "ΦSa3 clade".

Besides the isolates from infection cases in humans, 95% of the isolates from poultry or poultry meat also belonged to this "ΦSa3 clade". Only 7% of the isolates in this group were of other origin. Some of the strains from human infections even displayed poultry associated genes. From the findings of their research the involved scientists concluded that CC9/CC398-MRSA from poultry have adapted to humans. The authors also assume that the

strains may have been transmitted via poultry meat to the people concerned. They emphasise, however, that the results are not sufficient to change the current assessment that food-borne transmission of LA-MRSA plays only a minor role in the spread of livestock-associated MRSA in humans.

The findings also show, however, that MRSA are versatile bacteria that can adapt to different habitats. This is why the research team at the SSI is convinced that it is essential to continue intensive monitoring of *S. aureus* at the "human-animal" interface. This monitoring may facilitate early detection of evolutionary and epidemiologic changes of MRSA and appropriate interventions.

The BfR has conducted an additional own study on CC9/CC398 MRSA. In this study further strains of CC9/CC398 MRSA with the same properties as the isolates detected in cases of human infections in Denmark were identified. The majority of these strains were isolated from turkey meat within the framework of national zoonosis monitoring. Tracing of the turkey meat samples from German retail suggests an epidemiological link to Poland as the source of entry into the food chain (Fetsch et al. 2017).

Taken together the results of both studies (Larson et al., 2016 and Fetsch et al., 2017), indicate that a certain LA-MRSA type (CC9/CC398) can be transmitted from animals to humans via food, in particular turkey meat. At present, it is not clear whether this transmission may be the result of consumption and/or handling of (raw) poultry meat. It is also unclear which other factors facilitate transmission and, potentially, subsequent infection with CC9/CC398 MRSA. There is currently no indication that other LA-MRSA types may be transmitted to humans via food. However, data are insufficient to allow for a reliable assessment of the importance of this transmission route.

The BfR still considers direct contact to colonized animals the main pathway for the transmission of LA-MRSA from animals to humans. The findings do, however, underline the potential of MRSA to adapt and mutate. Further investigations are also needed to determine whether these changes may affect the likelihood of transmission or the severity of the illnesses caused.

In view of the study results of Larsen et al. (2016) and Fetsch et al. (2017), the BfR recommends continued intensive national monitoring of MRSA in livestock and food. Efforts to prevent entry into the food chain should be intensified as early as at the primary production stage. In addition, close cooperation between the human medicine and veterinary disciplines in the spirit of the "One Health" concept is essential. This should also comprise further comparative studies of isolates from humans, animals and food. Particular emphasis should be placed on the comparison of strains from the poultry food chain.

#### References:

Larsen et al. 2016: Evidence for Human Adaptation and Foodborne Transmission of Livestock-Associated Methicillin-Resistant *Staphylococcus aureus*, *Clin Infect Dis*. 2016 Nov 15;63(10):1349-1352

Fetsch et al. 2017: Turkey meat as source of CC9/CC398 Methicillin-resistant *Staphylococcus aureus* (MRSA) in humans? *Clin Infect Dis*. 2017 Jan 1;64(1):102-103

#### More information about MRSA on the BfR website

[http://www.bfr.bund.de/en/a-z\\_index/methicillin\\_resistant\\_staphylococcus\\_aureus\\_mrsa\\_-\\_130063.html](http://www.bfr.bund.de/en/a-z_index/methicillin_resistant_staphylococcus_aureus_mrsa_-_130063.html)

#### About the BfR

The Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. It advises the Federal Government and Federal Laender on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

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