



Assessment of Antimicrobial Resistance in the Food Chains in Norway

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Authors' contributions

This work was carried out in collaboration between all authors. The opinion has been assessed and approved by the Panel on Biological hazards of the Norwegian Scientific Committee for Food Safety. All authors read and approved the final manuscript.

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Grey Literature

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ABSTRACT

The Norwegian Food Safety Authority (NFSA) asked the Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM) for an assessment of antimicrobial resistance (AMR) in the food chains in Norway, with focus on each of the following food chains: pigs and pork products; poultry, eggs and poultry products; cattle and bovine products; aquaculture and aquaculture products; fresh produce (fruit, berries, and vegetables); and drinking water.

AMR in imported food has not been assessed in this report. AMR in Norwegian food chains has been assessed in terms of probability of exposure to humans. Due to data constraints, it has not been possible to assess the consequences of this exposure for human health.

VKM appointed a working group consisting of three members of the Panel on Biological Hazards, one member of Panel on Animal Health and Welfare, and four external experts to prepare a draft

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Opinion document and the answer the questions. The Panel on Biological Hazards has reviewed and revised the draft prepared by the working group and approved the Opinion document «Assessment of antimicrobial resistance in the food chains in Norway».

AMR can be described as the ability of a bacterium to withstand the effects of an antimicrobial. The clinical antimicrobial resistance crisis has focused attention on all uses of antimicrobial agents, including their use in human medicine, veterinary medicine, and in agriculture and aquaculture. AMR is considered the greatest challenge to face health care in 21st century, and there is increasing concern and debate about which roles the food production chains play as reservoirs and disseminators of AMR.

This assessment addresses several food chains. The report does not characterise all forms of AMR that may occur in these chains, but puts emphasis on the resistant bacteria and resistance determinants that have emerged at the animal-human interface in recent decades. VKM's choice is based on zoonotic potential and the limited alternatives available for treatment of infections. In order for a comprehensive and detailed assessment to be conducted, these particular resistance forms need to be characterised and assessed separately.

At an overall level, the hazard regarding exposure of humans to antimicrobial resistant bacteria from cattle, milk/milk products, fish/fish products/seafood, fresh produce, water, and food processing in Norway is considered by VKM to be negligible.

Current data regarding possible pathways for transmission of LA-MRSA via contaminated food/meat to the broader human population fail to implicate LA-MRSA from pigs as a foodborne pathogen. Compared with other animal products, poultry and poultry products are regarded as the most important reservoirs of ESBL/AmpC-producing Enterobacteriaceae, quinolone-resistant *E. coli* (QREC), and their corresponding resistance determinants. The probability of human exposure of ESBL/AmpC-producing Enterobacteriaceae and QREC via poultry is assessed as being non-negligible.

Probability of AMR Transfer Associated with Food and Uncertainties:

In this assessment, the probability of transmission of AMR from food chains to humans has been either categorized as negligible or non-negligible according to the following definitions:

- Negligible – the probability of transfer of AMR is extremely low. Negligible probability should be considered insignificant.
- Non-negligible – the probability of transfer of AMR is greater than negligible. Non-negligible probability should be considered significant, but the available data are currently insufficient to enable discrimination between the different levels.

Lack of data has made it difficult to reach any firm conclusions regarding the probability of AMR transmission from food to humans in Norway. Similarly, ranking the probabilities with regard to relative importance is largely not possible with the data available.

The probability of transfer of AMR from cattle, milk/milk products, fish, seafood, and drinking water has been assessed to be negligible.

The probability of transfer of LA-MRSA from live pigs to humans is considered to be non-negligible, while the probability of transfer from pork to humans has been assessed to be negligible.

The probability of transfer of ESBL/AmpC-producing Enterobacteriaceae, quinolone-resistant *E. coli*, and their respective corresponding genes from live poultry and poultry meat is considered as non-negligible.

Processing of food, such as cooking or preservation, can reduce the number of bacteria in the products and thus decrease the transmission of antimicrobial resistant bacteria from food to humans.

It should be noted that both categories of probabilities (negligible and non-negligible) in this assessment are associated with a number of uncertainties. Bacteria are living organisms that are under continuous evolution, and are able to adapt rapidly to changing living conditions. This report is an assessment of the current situation with regards to development and dissemination of antibiotic resistant bacteria and their resistance genes in the food chain. This situation may change as the bacteria continue to adapt to the selection pressures exerted by the worldwide use of antimicrobials. Such bacterial changes, sometimes occurring VKM Report 2015:29 9 in “quantum leaps” due to horizontal gene transfer (HGT), may also rapidly change the probability of transfer of resistance to specific antimicrobials.

Data Gaps:

There is a lack of knowledge regarding the vast reservoir of AMR in the environmental, animal, and food reservoirs. Furthermore, there is lack of data regarding the routes and frequencies of transmission of AMR from live, food-producing animals and foodstuffs of different origins to humans and vice versa.

Keywords: VKM; assessment; Norwegian Scientific Committee for Food Safety; biological hazards; antimicrobials; resistance; MRSA; VRE; QR; ESBL/AmpC.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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