Press Release
Final Report on Project

No. QJ1210284 The introduction of methods for MRSA detection in meat of food-producing animals and effective measures against its transmission in the food chain

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The aim of the project was to determine the prevalence of methicillin resistant \textit{Staphylococcus aureus} strains in farm animals (LA-MRSA) in the human food chain in the Czech Republic. Another aim of the project was to study the characteristics of the obtained isolates and their spread in animal and human populations. For the detection and identification of MRSA isolates, culture methods and molecular biological methods were used, including sequencing techniques.

During the study, information was obtained about the spread of LA-MRSA strains in food-producing animals on pig, cattle and small ruminant farms, during slaughter, subsequent processing and production of semi-finished meat products, and during marketing.

The occurrence of MRSA was monitored in pigs, cattle and small ruminants. It included the environment of housed animals and also the breeders and their staff. A total of 20 pig herds, 25 cattle herds, 11 sheep herds and 9 goat farms were monitored. Samples of nasal swabs, rectal swabs or faecal samples and body surface swabs were taken. Bulk tank milk samples were collected on cattle and small ruminant farms. We found evidence of MRSA isolates on pig (45%), cattle (8%) and goat (12.5%) farms. Even farm workers were found to be MRSA positive on cattle, pigs and goat farms.
In the course of the project implementation, five pig slaughterhouses used by 38 farms and six cattle slaughterhouses used by 36 farms were also monitored. MRSA isolates were confirmed in pigs from 15 different farms (42%) and in cattle from 2 different farms (5%). In three food-producing companies focused on meat processing and production of semi-finished meat products, 492 swab samples were taken from pork and lamb meat, venison, rabbit and the meat and liver of ducks and geese. An MRSA isolate was detected in only one sample of duck liver of Hungarian origin. In the retail market, the prevalence of MRSA was monitored in samples of sliced, packed beef and pork meat and liver. Most of the samples originated from the Czech Republic apart from 20% of the samples, which were imported from EU countries. MRSA strains were detected in pork meat and liver, but their prevalence was low (1%). In all cases, the meat was of Czech origin. In commodities of foreign origin (Austria, Slovakia, Germany and Poland) MRSA was not confirmed in the investigated group of samples.

All MRSA isolates obtained from the beginning of the project were characterized in detail. We studied virulence factors (PVL, TSST, ETA and ETB) with a negative result for all isolates tested. Resistance to beta-lactam antibiotics and cephalosporins is typical for these isolates. However, resistance to tetracycline, erythromycin and clindamycin was also detected. The presence of genes responsible for the production of enterotoxins has been demonstrated occasionally. One of the key typing methods for MRSA strains is MLST and spa typing which allow the comparison of the distribution of MRSA clones in the Czech Republic and abroad, as well as the distribution of clones in different species of food-producing animals.
In MRSA isolates, the occurrence of a total of four MLST types were detected, with ST398 being predominant in food-producing animals. This sequence type is one of the typical representatives of LA-MRSA in EU countries, and is mainly represented by spa type t011 and t034, as in the Czech Republic. All isolates from pigs or pork and liver belonged to sequence type ST398. In cattle, several MLST types were found. In the dominant type of MLST, 8 different spa types were confirmed, with t011 and T034 being the most common.

**Project results**
- During the project implementation, knowledge was acquired of LA-MRSA strains prevalence in the food chain as well as of the sources and means of their transmission routes from farm to the consumer. Out of food commodities which were examined, MRSA was found in pork, pork liver, duck liver and raw cow's and goat's milk.
- The transmission of the monitored bacteria from food-producing animals to farm workers and their family members was confirmed.
- Two methodologies were developed and conveyed to end-users (for the detection of bacteria in *Staphylococcus* genus and MRSA in biological material by PCR and for the identification of MRSA strains carrying meCC gene, using real-time PCR).
- A certified technology was developed to predict the possible occurrence of enterotoxins, usable for safe Foie gras production.

The project results were presented in 20 publications (3 Jimp, 9 Jsc, 8 Jrec) and as poster presentations at conferences (11 times). In the last year of the project implementation, results were summarized at the "Lukeš Day" seminar.