Results

In feces, on carcasses, at cutting and at retail the observed prevalence of cefotaxime resistant E. coli was 32%, 24%, 1% and 1%, respectively. The observed mean log concentrations were 2.3 log CFU/g, 2.4 log CFU/1000 cm², -0.4 log CFU/cm², and at retail it was below the detection limit. To estimate the concentrations of ESC producing E. coli and ESC producing E. coli in faecal samples for modelling mean concentration of ESC producing E. coli estimated to be -5.2 log CFU/cm² with standard deviation 1.47. Calculating back to portions this would imply 0.2% of 100 g portions of raw pig meat at retail to be contaminated with at least 1 CFU ESC producing E. coli. The prevalence of meat being contaminated with ESC producing E. coli at 10 or 100 CFU/100 g was estimated to be 0.01% and 0.001%, respectively. To compare the ESC carriage in all bacteria to that of E. coli, using Tobit regression, we estimated that the qPCR based prevalence of 100 g portions contaminated with any strain carrying bacteria at slaughter, cutting and retail to be 4.0%, 3.6% and 0.9% respectively compared to the culture based prevalence of ESC producing E. coli of 3.6%, 3.5% and 0.2%. This indicates that a significant part of ESC resistance in pig meat is carried by E. coli.

Discussion

Despite the ban of cephalosporins for almost 10 years in the pig production, ESC resistance prevails in the Danish pork industry. The reason for this persistence is not clear, but co- and cross-resistance may play a role (Jensen et al., 2018). The use of any beta-lactam antibiotics in the primary production such as ampicillin or penicillin has effectively reduced spectrum cephalosporin producing Escherichia coli in slaughter pigs. Journal of Antimicrobial Chemotherapy, 68, 569-572. Jensen, LB, Birke, T, Hag, BB, Larsen, LS, Aabo, S, and Korsgaard, HB (2018). Cross and co-resistance among Danish porcine E. coli isolates, Research in Veterinary Science, 119, 267-279.

The key element of Salmonella control programs in Europe is the classification of fattening pig herds according to seroprevalence at slaughter measured by ELISA. ELISA test are typically reliable, accurate and cost effective. However, there is a lack of correlation between serological and microbiological results for detection of individual Salmonella-positive pigs and there is variability associated with the use of different ELISA kits and matrices (Mainar-Jaime et al. 2018).

In this study, we could show that blood samples had a clearly higher mean and median 0D values than meat juice samples, which also influenced the seroprevalence using different cut-off levels. This demonstrates that the matrix influences the 0D values and the seroprevalence, and therefore, the cut-off value should be adjusted depending on the matrix used. We could also show that the seroprevalence was clearly higher in blood samples than in meat juice samples with PrioCheck compared to Pigtype when cut-off 0D values of 20, 30 and 40. Blood samples were studied with a newer Pigtype test than meat juice samples. The newer Pigtype test detected antibodies in 20% of the samples, whereas the PrioCheck test detected antibodies in only 15% of the samples. This indicates that the matrix influences the 0D values, which may explain the higher detection rates compared to PrioCheck test, especially when the cut-off value of 40 was used. Interestingly, higher detection rates were obtained in meat juice samples with PrioCheck compared to Pigtype when cut-off 0D values of 30 and 40 were used. One reason can be the equation for the calculations of 0D values, which differs between the two tests and may influence the results. There was no clear correlation between the ELISA tests in

References

Agerø, Y, and Aarestrup, FM (2013). Voluntary ban on cephalosporin use in Danish pig production has effectively reduced spectrum cephalosporin producing Escherichia coli in slaughter pigs. Journal of Antimicrobial Chemotherapy, 68, 569-572. Jensen, LB, Birke, T, Hag, BB, Larsen, LS, Aabo, S, and Korsgaard, HB (2018). Cross and co-resistance among Danish porcine E. coli isolates, Research in Veterinary Science, 119, 267-279. Lorimer,M.F., Kiermeier, A., 2007. Analysing the occurrence of ESC producing E. coli at retail to be contaminated with at least 1 CFU ESC producing E. coli, using Tobit regression, we estimated that only 1 in 500 portions will be contaminated with at least 1 CFU ESC producing E. coli and 1 in 100,000 portions will be contaminated with more than 100 CFU. Based on qPCR amplification, we also suggest that E. coli is a major carrier of ESC genes in pig meat.

Conclusion

In total, 146 blood samples of fattening pigs originating from 29 farms (1-10 samples per farm) and 94 meat samples from 66 farms (1-5 samples per farm) were selected for this study. The samples were collected from pigs at farm at the end of the fattening period before arrival to the slaughterhouse (Felin et al. 2019) and meat samples of diaphragm muscle were collected from fattening pigs at slaughter during Trichinella sampling (Felin et al. 2015). The samples were stored at -70°C until testing. Presence of Salmonella antibodies was studied in blood and meat juice samples of Finnish fattening pigs with two commercial ELISA tests: Prolab Animal Health, UK and PrioCheck® Porcine Salmonella kit (Thermo Fischer Scientific, Waltham, MA USA). Statistical analyses were performed using SPSS Statistics 24. Correlation between the ELISA tests was estimated by calculation of Spearman’s rho. Additionally, Cohen’s kappa value was calculated to test the level of agreement between the ELISA tests.
our study, which further complicates the comparison of serological results if they have not been studied with same methods. This study show that the ELISA test used can strongly affect the results. This study also demonstrate that the cut-off value should be adjusted depending on the test and matrix used.

References


Kreienbrock L.2, May T.1, Knöll K.N.1, Meemken D.5, Nienhaus F.1, Kornhoff T.1, Wendt A.2, Kreienbröck L.2, Mein T.1, Knöll K.N.1, Meemken D.5, University of Veterinary Medicine Hannover, Field Station for Epidemiology, Bakum, Germany, 2University of Veterinary Medicine Hannover, Department of Biodiversity, Epidemiology and Information Processing, Hannover, Germany, 3QS Qualität und Sicherheit GmbH, Bonn, Germany, 4BALVI GmbH, Lübeck, Germany, 5Freie Universität Berlin, Institute of Food Safety and Food Hygiene, Berlin, Germany.

Introduction

Along the pork food chain many data are generated which potentially give information about animal health and animal welfare. In the context of the project "PPP-InfoS" existing official data and the existing production management data from farmers and slaughterhouse operators were used for the creation of a data information system. This information system serves as a tool for early warning and prevention of health and welfare deficits in pig herds. A continuous improvement process of animal health and animal welfare is supposed to be realized by an aggregation of data into several animal health scores for a benchmark tool.

Material and Methods

After an intensive literature research, several animal-related health indicators for fattening pigs have been identified. Subsequently, by means of a questionnaire, various stakeholders of the pork food chain have been asked regarding the availability of animal health related data and the data flow between the stakeholders. The result is a list of animal health indicators that are standardized and electronically retrievable. The identified meaningful and usable indicators were weighted on the basis of an expert survey and summarized into animal health scores. These scores depict various areas of animal health and provide a benchmarking system for the health status of pig farm units participating. The scores were validated on the basis of a questionnaire on the actual health status of fattening pigs and an anonymized data set provided by QS Quality and Safety GmbH. Based on a research of legal requirements and previous interviews with the stakeholders of the pork food chain, different use cases for a data information system have been created. In addition, a concept has been developed that allows a secure exchange of information while maintaining data protection.

Results and Outlook

A detailed concept for a public-private-partnership data information system for improving the welfare and health of pig herd farm units has been developed. The most important use cases were already implemented by the Balvi GmbH in a demonstrator to illustrate the project result. Efficient use of existing electronically-integratable animal health data through cross-linking is an important step in achieving a steady improvement in animal health. Our elaborated concept is a valuable instrument for the further development of a marketable information system.

The project was supported by funds of the BLE and the Landwirtschaftliche Rentenbank.