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23. The Herd Health and Welfare Index as a benchmarking tool for antimicrobial resistance
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Abstract
The occurrence of antimicrobial resistant microorganisms in livestock, especially ESBL-producing Escherichia coli (E.coli), is an increasing challenge (WHO, 2001). The aim of this project is to analyse the relationship between herd health and animal welfare on the one hand, evaluated by means of a self-developed Herd Health and Welfare Index (HHWI), and on the other the frequency of the antimicrobial resistant microorganisms. The developed HHWI described in this paper includes animal- oriented and management-based parameters that can be easily assessed at farm level, resulting in an easy-to-use benchmarking tool.

Within the FP7-EU research project EFFORT, the health and welfare quality of 180 pig herds in nine participating European countries are evaluated by using the parameters of the HHWI and the occurrence of ESBL-producing E. coli in the study herds by analysing faecal samples.

Introduction
Antimicrobial resistance has been recognized as an important global health risk to humans over the last few decades (WHO, 2001, Kolár et al., 2001). As one of the typical commensals in the gut flora, Escherichia coli represents a potential reservoir of resistance genes for pathogenic bacteria. Their level of resistance is considered to be a good indicator for selection pressure by antibiotic use and for resistance problems (Murray, 1992).

The occurrence of resistant E. coli in animals, usually do not result in clinical infections, which makes it difficult to detect them without sophisticated laboratory tests. Continuous screening for ESBL- producing bacteria in animal populations is a possible, but a time-consuming and therefore expensive solution. The possibility to indirectly assess the risk of the occurrence of antimicrobial resistance by evaluating the herd health and welfare status would save time and resources and support a quick and easy method to risk- oriented in-depth testing for antimicrobial resistance.

The research project EFFORT (Ecology from Farm to Fork of microbial drug Resistance and Transmission) funded by the FP7 programme of the European Commission for Research and Innovation, was set up to achieve the goal to gain knowledge about the epidemiology and ecology of antimicrobial resistance in animals, the food chain and the environment.

The project consortium of 20 European research institutes will analyse the mechanisms of the emergence and spread of ESBL-producing E. coli strains, intending to monitor the transmission of antimicrobial resistance along the food chain.

The main objective of our contribution to EFFORT is to develop a method to benchmark the risk for the occurrence of ESBL-producing E. coli in fattening pig herds by assessing the herd health status and the animal welfare quality by using data on animal- and management-based parameters collected at farm level.
Material and Methods

Different animal health and welfare scores have been developed in the past with regard to different target groups. Most of them have been developed for the purpose of scientific research and not for routine application. Due to the fact that the assessment of slaughter check findings are not standardized within Europe at the moment, the recently developed Herd Health Score (Dickhaus et al., 2009) could not be used within this project in its original composition. Other scores like the one of the Welfare Quality Project® (FP6) or the one of the Bristol Welfare Assurance Programme (BWAP) are too time-consuming to be implemented completely in the project.

The Herd Health and Welfare Index, which was developed for EFFORT, is based on a modified Herd Health Score combined with a selection of on-farm health parameters used in the Welfare Quality Project® (FP6).

The original Herd Health Score (HHS) by Dickhaus et al., (2009) is composed of semi-quantitative indirect herd health parameters including a) the mortality rate, b) the Animal Treatment Index (ATI), which calculates the average frequency of antibiotic treatments per fattening group, c) the duration of the fattening period, and d) the frequency of slaughter check findings.

The assessment of the Welfare Quality® protocol is divided in four dimensions: good feeding, good housing, good health and appropriate behaviour. Each dimension is evaluated in total using twelve parameters: a) absence of prolonged hunger b) absence of prolonged thirst c) comfort around resting d) thermal comfort e) ease of movement f) absence of injuries g) absence of disease h) absence of pain induced by management procedures i) expression of social behaviours j) expression of other behaviours k) good human- animal relationship m) positive emotional state. These parameters focus on animal-based instead of management-based parameters. The scoring of the 12 animal-based indicators takes between 6-8 hours per herd, depending on the size of the herd.

Shortening the protocol of the Welfare Quality® project and substituting the slaughter check findings of the Herd Health Score at the same time, resulting in eight animal-oriented HHWI parameters, rated in three respectively two scores: a) Mortality, b) Antibiotic use measured by the ATI c) Lameness, d) Bursa alterations (e.g. bursitis), e) Runted pigs, f) Tail/Ear/Flank biting, g) Manure on body, and h) duration of fattening period.

Mortality rate: “low”, “medium” and “high” (classification according to the resulting variation after the data collection has been completed)

Animal Treatment Index (ATI): “low”, “medium” and “high” (classification according to the resulting variation after the data collection has been completed)

Lameness of the animals will be scored by observing, how many pigs are putting less (score 2) or no weight (score 3) on at least one leg and the percentage of pigs without any signs of lameness (score 1: no appreciable variation after the data collection has been completed)

Bursa alterations (e.g. bursitis) can be observed as a swelling of the bursae, especially noticeable at the carpel and tarsal joint, taking into account the size and quantity of the swollen bursae. (score 1: without any alterations, score 2: several small swollen bursae, score 3: ≥1 large swollen bursae)

Runted pigs are smaller and lighter than their peers, have little or no fat cover on hips, ribs and backbones and most of the times have prolonged hair (score 2). (score 1: n.a.d.).

Tail, ear and flank biting: will be scored score 2. (score 1: n.a.d.)

Manure on body will be scored by estimating the percentage of animals within the groups, score 1: up to 20%, score 2: 20-50% and score 3: more than 50% of their body covered with manure. Duration of the fattening: scored in three levels (classification according to the resulting variation after the data collection has been completed)

These parameters will be linked to HHWI points to create a benchmarking tool, ranking the participating farms according to their number of index points. The number of index points will be correlated with the frequency of ESBL-producing E. coli, detected within the random faecal samples.

Sampling

The sampling of pig herds took place from October 2014 and will presumably be finished by October 2015, carried out over the period of one year to avoid seasonal influences. Overall 180 pig herds in nine European countries will be evaluated. The farm visits will be conducted by local scientific researchers of the EFFORT project. Before the evaluation period started in autumn 2014, the person responsible for sampling were trained during a project seminar using written guidelines with descriptive pictures for harmonizing the animal welfare assessments throughout the EFFORT project. In Germany the pig fattening farms were randomly selected throughout the country, taking into account the project farm specifications, e.g. non-mixed farms (hobby animals excluded) with at least 150 sows and 600 fatteners, all-in all-out production at compartment level and no contact between the selected herds e.g. through trade.

In order to receive all necessary management information, the farmer was interviewed during the farm visit, followed by an overall assessment of the herd health status and welfare quality as well as on the daily working routine. During the farm visits 25 fresh faecal samples per herd from fattening pigs close to slaughter (7-10 days) were taken. The isolated E.coli strains will be tested by MIC test in order to calculate the frequency of ESBL-producing E.coli per herd.

Results

The assessment of the herd health status and animal welfare quality was already performed in 15 pig fattening herds in Germany by using the Herd Health and Welfare Index.

The results of the assessment in the 15 pig herds show a considerable variation in all parameters. As shown in Tab. 1 the frequency of the parameter “Manure on body” shows the broadest range, while the narrowest range is shown by the parameter of “Runted pigs”. The average rate of runted pigs was calculated with 1%, ranging from 0 to 3% followed by the range of mortality, being also fairly narrow with a range between 0 and 5%. The values of the two other health parameters, “Animal Treatment Index” (ATI) and “Duration of fattening period”, range from 0 to 21 days and from 84 to 150 days, respectively. The frequency of animals with moderate lameness (score 2) ranges between 0 and 13%, and the severe lameness (score 3) ranges between 0 to 3%. The evaluation of bursa alterations shows a range for moderate bursits (score 2) of 0 to 29% and a range of 0 to 1% for severe bursitis (score 3). The frequency of animals with signs of tail, ear and flank biting ranges between 0 to 34%.
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Statistical analysis revealed significant differences in many of the parameters as a result of the different fattening techniques.
Tab. 1: Frequency variations of the eight HHWI parameters in 15 German pig farms

<table>
<thead>
<tr>
<th>Parameter</th>
<th>moderate (score 2)</th>
<th>severe (score 3)</th>
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<tr>
<td></td>
<td>min.</td>
<td>max.</td>
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<tr>
<td>Manure on body (%)</td>
<td>9</td>
<td>70</td>
</tr>
<tr>
<td>Lameness (%)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Bursa alteration (e.g. hemorrh.) (%)</td>
<td>0</td>
<td>29</td>
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Discussion and Conclusion

The preliminary results observed in the participating German pig herds show a wide frequency variation of the eight HHWI parameters, which proves their usability for assessing the herd health status and animal welfare quality as precondition to identify assumed associations between herd health/animal welfare with the frequency of the occurrence of ESBL-producing E. coli.

The analysis of the impact of the herd health status and welfare quality on antimicrobial resistance will be the next step of the EFFORT project.

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Introduction

Surveillance can be defined as the systematic (continuous or repeated) measurement, collection, collation, analysis, interpretation, and timely dissemination of animal-health and welfare data from defined populations (Hoinville et al, 2013). Through early detection and informed response, surveillance reduces the impact of livestock disease on animal production and welfare and on public health. For endemic disease control, surveillance systems are important as they allow prevalence to be monitored over time and interventions to take place when the prevalence of the concerned disease/conditions is higher than expected. When resources are limited, cost effective methods of surveillance are important. This paper compares two monitoring systems; the BPEX Pig Health Scheme (BPHS) and the FSA Collection and Communication of Inspection Results (CCIR). Since 2005, BPHS in England and Wales assesses the presence of 12 different macroscopic conditions detected in the pluck, offal and on the skin of slaughtered pigs. Many of these conditions have been associated with a reduction in performance and consequent increases in production costs. Ante mortem and post-mortem meat inspection (MI) are performed on all slaughtered pigs by meat hygiene inspectors (MHI) and official veterinarians. Data about the conditions of lesions observed are recorded in the FSA system, which provides information to the farmer and the farmer’s veterinarian, allowing actions to be taken on farm to improve animal health and welfare that should result in improvements in food safety. The advantages of using