Risk-based meat inspection as means for improving the safety of pork and the herd health of pigs

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Abstract
The European food safety strategy pursues three main goals: a) increasing the food safety of meat and meat products, b) implementing a system for continuous improvement of animal health, and c) contributing to a rise in animal welfare of farm animals. Tools for achieving these goals are the accentuation of the role of the food business operator as primary responsible person for food safety and the new approach of a risk-based meat inspection, where the method and the intensity of the inspection are to depend on a risk assessment for human and animal health. The objective of the paper is to evaluate data for the food chain information and how different data sets can be used as “tools” for improving food safety and animal health.

Introduction
The traditional meat inspection procedures at slaughter, focussing at identifying health risks for humans by condemning carcasses and organs that show pathological signs has resulted in the eradication and/or control of most “classical” food-borne threats to human health such as tuberculosis, brucellosis and tape worms. The high number of food-borne diseases in humans such as salmonellosis, yersinioses and the health risks due to chemical or pharmaceutical residues (none of them leaves pathological signs recognisable at the slaughter line by traditional meat inspection procedures) prove that the traditional ante-and post-mortem inspection of single carcasses as end product inspection, which was able to control the risks of the past, is not able to prevent and control the risks of today (MCKENZIE and HATHAWAY, 1992).

Therefore the European Commission has issued the so-called “Hygiene Package”, with Regulation 852/2004/EC (“on the hygiene of foodstuffs”), Regulation 853/2004/EC (“laying down specific hygiene rules for food of animal origin”) and Regulation 854/2004/EC (“laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption and the principles of the food chain information”), which describes the transition from the traditional to the risk-based meat inspection. This Regulation in combination with the Regulation 2075/2005/EC (“specific rules on official controls for Trichinella in meat”), Regulation 1244/2007/EC (“requirements for a visual meat inspection”) and with different National Regulations, e.g. the Regulation on the monitoring and control of Salmonella in pork, result in an overall system, which observes the entire food chain “from stable to table”. The new EU legislation is not any longer prescribing exactly the inspection procedure for all Member States in the same way, but defines the common food safety goals. Thus, each EU-Member State has to develop its own and specific risk profile and the ways of controlling and managing the risks in question (MEEMKEN, 2006). The objective of this paper is to evaluate a set of data for the food chain information for fattening pigs and how specific data sets can and should be used as “tools” for improving food safety, animal health and animal welfare. Additionally it was to investigate whether serological monitoring programs in the framework of risk-based meat inspection can be run by using meat juice instead of serum.

Material and Methods
Food chain information as mentioned in Regulation 853/2004/EC and in Regulation 1244/2007/EC should include declarations of the responsible food business operators such as feed mill operators, pig farmers and slaughter house operators on following questions per slaughter batch:
1) Do the animals come from a holding that is part of an “integrated system”, and does the husbandry system fulfil the criteria of “controlled housing condition”?
2) Is the animal health status of the holding of provenance and/or of the regional animal health status indicating any severe disease?
3) What is (has been) the animals’ health status of the herd of origin?
4) Were veterinary medicinal products or other treatments with a withdrawal period greater than zero administered to the animals within a relevant period of time? Are dates of administration and withdrawal periods reported?
5) Did diseases occur that may affect the safety of meat?
6) Are there diagnostic results relevant to the protection of public health including samples taken in the framework of the monitoring and control of zoonoses and residues?
7) Do reports about previous ante- and post-mortem inspections of animals from the same holding of provenance, in particular reports from the official veterinarian, indicate a repeatedly low or a repeatedly high frequency of pathological lesions?
8) Are there production data that might indicate the presence of disease during the fattening period of the slaughter pigs?
9) Is the name and address of the private veterinarian normally attending the holding of provenance available?

Depending on this set of declarations and answers the official meat inspector has to decide which intensity of meat inspection addresses the estimated risks for the consumers. The meat inspection procedures vary from a “visual inspection” without palpation and incisions in order to reduce cross contaminations to a “more intensive inspection” addressing the identified specific risks. Recording relevant animal health data in a practicable way and combining them with retrospective slaughter check results of the same herd explores the possibilities of using the food chain information in the framework of the new meat inspection approach.

A set of serological tests, which provides results for each of the different stakeholders of the meat industry, are added to the food chain information to increase the value of the information about the health status of the animals, the needed collaboration of each stakeholder and the predictability of certain food safety risks. To evaluate the usability of meat juice as specimen for ELISA test kits, which are licensed for blood serum, about 110 blood sera and meat juices were taken at the slaughter line for simultaneously testing the serum and the meat juice of the same animals. To find out the best dilution for meat juice samples, several test runs with dilutions differing from the prescribed blood serum dilution and the tentative meat juice dilution were conducted.

Results
The following criteria combined to a package for the semi-quantitative assessment of the herd health status offer the opportunity of choosing the appropriate risk-based inspection procedure (“visual” or “more intensive”). These “packages” of data are usable to measure the health status of either a fattening group or of a fattening herd over various periods of time:
1. The mortality rate (in %)
2. The frequency of pathological findings in carcasses and organs of previous meat inspections (in %)
3. The frequency of treatments with antibiotic substances within one fattening group measured by the “Animal Treatment Index”.

\[
\text{ATI} = \frac{\text{No. of animals treated} \times \text{No. of treatment days}}{\text{Total No. of animals in the group}}
\]

The ATI stands for the average frequency of medicating every pig in a group with antimicrobial substances, based on the conclusion that a group of pigs that had to be treated repeatedly over several days or even weeks were sicker and represents a higher risk for antimicrobial residues than pigs that never got any treatment against infectious agents (“ATI” by BLAHA et al. 2006).
4. The duration of the fattening period (in d)
5. The serology-based classification of herds into “zoonoses risk groups” (*Salmonella* spp., *Yersinia enterocolitica*, *Mycobacteria avium*, *Toxoplasma gondii*, *Trichinella*, etc.).
6. The serology-based classification of herds into “herd health groups” (*Mycoplasma hyopneumoniae*, *Swine Influenza Virus*, *Actinobacillus pleuropneumoniae*, etc.)

To test the applicability of these criteria, each criterion has been applied in different pilot projects and the range of the single values has been measured. A wide spread of values with a good predictability of risks for humans, practicable ways of recording and documenting these information and a multiple usage are the most important precondition for using these criteria as part of a benchmarking system. In Table 1 the spread of values recorded at about 140 study farms is presented.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Spread of values (Min. – Max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality rate</td>
<td>0 - 12%</td>
</tr>
<tr>
<td>Percentage of pneumonia</td>
<td>0 - 67%</td>
</tr>
<tr>
<td>Percentage of pleurisy</td>
<td>0 - 27%</td>
</tr>
<tr>
<td>Percentage of pericarditis</td>
<td>0 - 13%</td>
</tr>
<tr>
<td>Percentage of milk spot liver</td>
<td>0 - 100%</td>
</tr>
<tr>
<td>Animal Treatment Index (ATI)</td>
<td>0 - 67 treatment days</td>
</tr>
<tr>
<td>Duration of the fattening period</td>
<td>90 - 219 days</td>
</tr>
</tbody>
</table>

Table 2 demonstrates the percentage of correlation between the ELISA test results with meat juice as specimen and with blood serum as specimen by diluting the meat juice ten times fewer than the blood serum.

<table>
<thead>
<tr>
<th>Elisa test kits for the measurement of antibodies against</th>
<th>Licensed for blood serum</th>
<th>Licensed for meat juice</th>
<th>No of samples</th>
<th>Degree of correlation between meat juice and blood serum (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella</em> spp.</td>
<td>YES</td>
<td>YES</td>
<td>107</td>
<td>94 %</td>
</tr>
<tr>
<td><em>Yersinia enterocolitica</em></td>
<td>YES</td>
<td>YES</td>
<td>87</td>
<td>89 %</td>
</tr>
<tr>
<td><em>Toxoplasma gondii</em></td>
<td>NO</td>
<td>NO</td>
<td>40</td>
<td>100 %</td>
</tr>
<tr>
<td><em>Swine Influenza-Virus (H3N2)</em></td>
<td>YES</td>
<td>NO</td>
<td>107</td>
<td>77 %</td>
</tr>
<tr>
<td><em>Swine Influenza-Virus (H1N1)</em></td>
<td>YES</td>
<td>NO</td>
<td>107</td>
<td>70 %</td>
</tr>
<tr>
<td><em>Mycoplasma hyopneumoniae</em></td>
<td>YES</td>
<td>NO</td>
<td>107</td>
<td>85 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>475</td>
<td></td>
</tr>
</tbody>
</table>

Discussion:
The chosen and analysed criteria (mortality, percentage of lung lesions, percentage of pleurisy, percentage of pericarditis, percentage of milk spot liver, Animal Treatment Index and the duration of the fattening period) show a wide in-between herd-variation (Tab. 1). However, in single cases not all criteria values within a herd are only “bad” or only “good” (e.g. high ATI as indicator for an existing health problem in combination with a low mortality rate as indicator for a good herd health status), but there are quite good
correlations e.g. between a high percentage of lung lesions and an extended duration of the fattening period and mostly with a high usage of antibiotics. Because of these facts, only a combination of all these major indicators within a scoring system allows for comparisons, benchmarking and risk-assessments (DICKHAUS et al., 2009).

The demonstrated high degree of correlation between the test results with sera and the test results with meat juice as specimen for ELISA test kits shows that it is possible for the investigated test systems to use meat juice for serologically evaluating the health status of a herd in the framework of the risk-based meat inspection.

Conclusions
There are data and pieces of information about pig herds combined with data from previous slaughter pig groups from the herd in question and with the results of serological testing that allow the assessment of herd health and the prediction of specific food safety risks. The data and criteria, which were tested in this study as “food chain information” can be used for implementing a risk-based meat inspection by which the food safety standard can be considerably raised, and, simultaneously, if a feedback system to the farmer is implemented, they will contribute to improving the herd health status and the animal welfare standard of pig herds. The availability of standardised and validated herd health assessment tools is of an increasing importance, since there is a worldwide move from curing disease to prevention.

References


MEEMKEN, D., 2006, Research on the evaluation systems for food chain information being used in the risk-based ante- and post-mortem inspection of slaughter pigs. Doctoral Thesis, University of Veterinary Medicine Hannover, Germany.