

Development of best practice models for monitoring and control of residues of antimicrobial origin in pigs delivered to an abattoir

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Abstract

Withdrawal periods after antimicrobial treatment have been defined as preventing the presence of residues above the maximum residue limits (MRLs) in meat. However, errors can lead to residues above MRL in pigs delivered to an abattoir. The RIBMINS COST Action network analysed how these residues are detected and handled in different countries, and what the best practices may be when balancing consumer safety with EU policy on minimising food waste. Two questionnaires were developed focusing on pigs, targeting the competent authority and the food business operator. The survey was undertaken in spring 2022 and resulted in 78 answers representing 27 countries. The results showed large variations in detecting and handling residues. Two best practice models have been developed based on the results of the survey. The first uses the approach of monitoring (Model A) whereas the second uses surveillance, implying detaining the tested carcass until a negative test result becomes available (Model B). The advantages and limitations of the two best practice models are discussed.

Introduction

In the European Union (EU), antimicrobials (AM) are prescribed by a veterinarian and the prescription contains information about the withdrawal period required before the animal can be sent to slaughter. Compliance with the withdrawal periods is required to ensure residues of prescribed AM will be below the established maximum residue limits (MRLs) in meat. Marking and registration by the primary producer of treated animals helps to prevent unacceptable levels of residues in the meat that reach the consumers. Hence, procedures are in place to avoid delivery of animals to the abattoir prior to the end of the withdrawal period. Still, errors may occur, leading to presence of residues in the animals at the time of slaughter, with potential consequences along the entire meat chain. The question is how the practices regarding the routine detection and handling of AM residues are applied inside and outside the EU and what the best practices may consist of, when balancing consumer safety with the EU policy on minimising food waste. This was investigated in WG1 of the EU COST Action network RIBMINS, focusing on pigs delivered to an abattoir.

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Material and methods

Two questionnaires were developed, targeting the competent authority (CA) and the food business operator (FBO). The survey was undertaken in spring 2022 and resulted in 78 answers representing 27 countries. The questionnaires can be found on the RIBMINS website <https://ribmins.com/survey-on-residues-of-antimicrobials-in-pigs/>.

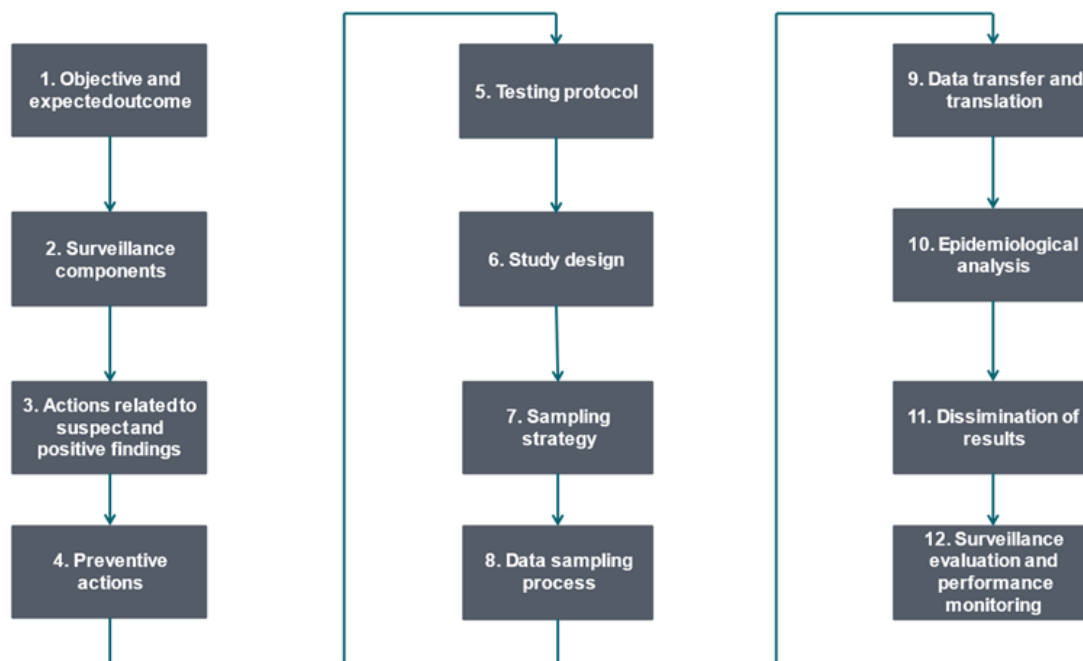


Figure 1. The questionnaires were based on this model, which shows the sequential elements that form part of risk-based surveillance adapted after the RISKSUR and SANTERO projects (<https://www.fp7-risksur.eu/>).

Two different models for a set of best practices for detecting and handling of AM residues in pigs were developed based upon the results of the survey. Moreover, a set of guidelines developed by Codex Alimentarius were used, which present the principles for the design and implementation of food safety assurance programmes associated with the use of veterinary drugs. Next, we used a schematic description of risk-based surveillance, initially developed as part of the RISKSUR project (<https://www.fp7-risksur.eu/>) and further developed for residue monitoring/surveillance (Fig. 1).

Results and discussion

In total, 78 responses to the questionnaires were received during the collection period. Of these, 42 were from CA representatives and 36 from FBO representatives. These responses covered 27 countries. The results showed large variations in the systems in place between the responders from different countries. The variation between CA and FBO responses was relatively small. One particular finding was that in most countries the carcass is not detained, mainly to avoid corrective measures imposed by the CA in case of a positive sample (Table 1).

Table 1: Handling of the tested carcass

When a sample is taken from pig carcass, how is the carcass handled?						
	Carcass detained, until result* becomes available	Carcass not detained	Other handling	I do not know	Total No. of answers	No. of responders
CA	5 (12%)	28 (67%)	7 (17%)	2 (5%)	42 (100%)	42 (100%)
FBO	9 (24%)	19 (51%)	8 (22%)	1 (3%)	37 (106%)	35 (100%)

If carcass is detained until result below MRL becomes available							
	To avoid corrective measures imposed by CA in case sample is positive	Due to export requirements	Other reasons	Not relevant* because tested carcasses not detained	I do not know	Total No. of answers	No. of responders
CA	13 (46%)	5 (18%)	3 (11%)	14 (50%)	2 (7%)	37 (132%)	28 (100%)
FBO	12 (41%)	8 (28%)	1 (3%)	13 (45%)	2 (7%)	36 (124%)	29 (100%)

In essence, two different approaches were used for detection and handling: the first was based on not retaining the tested carcass (monitoring approach), whereas the second was based on detaining the carcass until a negative test result was available (surveillance approach).

Based upon these answers, two best-practice models were developed reflecting the fact that surveillance objectives differ substantially between individual abattoirs/countries as shown by the survey data. In Model A (monitoring), biological laboratory methods can be used for screening, followed by chemical verification of samples that are positive in screening. This implies a cheap testing system overall speaking, but results of positive tests are delivered in about 6 to 8 weeks. The matrix needs to be the kidney because the biological methods have a low sensitivity. In contrast, for Model B (surveillance), it is important that the results become available quickly, because the release of the carcasses is depending on a negative test result. This implies the use of direct chemical testing, which is more expensive than the biological methods. On the other hand, chemical methods have a high sensitivity and therefore meat can be used as a matrix, more clearly reflecting consumer exposure than the use of kidney.

In Model A, the detection of residues above MRL would be interpreted as a process hygiene criterion as described in the Regulation CE No 2073/2005 on microbiological criteria, in which the focus would be on the process. In such cases, a visit would be made to the pig farm where the positive animal came from, but the tested carcass should not be detained and the meat not recalled. In Model B, the results would be interpreted as a food safety criterion involving a visit to the farm as well as the detention of the tested carcass to avoid expensive recalls.

On our opinion, Model A could reflect abattoirs mainly placing meat on the national market, whereas Model B could reflect abattoirs that trade and export most of their meat. The reason for operating with two separate models is to avoid the problems which may arise if the FBO interprets the system as a monitoring (Model A) but the CA interprets it as surveillance (Model B). Indeed, with test results arriving weeks to months after slaughter, meat from the day of slaughter may have been distributed widely, complicating withdrawals. Therefore, there should be agreement between FBO and CA regarding which system is in place in a country or an abattoir: Model A or Model B.

One may argue that the food safety level would be lower in Model A than in Model B. However, the food safety value is low in both models, because the proportion of carcasses tested is minute. This implies that testing should be seen more as a verification of the procedures in place, of which compliance with withdrawal periods is the most important. And here, it should be known that the withdrawal periods may differ widely between countries for the same drug and the same concentration.

Conclusion

We have shown there is a plethora of ways to undertake routine detection and handling of AM residues in pigs. Overall speaking, the survey results pointed to two different approaches, where one involves detention of the tested carcass and the other not. This likely reflects different risk perceptions regarding this kind of residues. Based upon this, we developed two best practice models, where the first makes based upon monitoring (no retention of the tested carcass) and the second surveillance (tested carcass is retained). This is like the approach used in the EC Regulation on microbiological criteria for foodstuffs. The outcome of this study could act as a basis for more evidence-based and harmonised procedures to improve decision-making regarding condemnation of carcasses and by-products that contain (or might contain) AM residues above the MRLs. In addition, these best practice models could reduce food waste without jeopardizing consumer safety, which is in line with the EU ambition to ensure more sustainable and climate-friendly food production.