

3rd RIBMINS Scientific Conference

"Shaping the Future of RB-MSAS"

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Book of Abstracts

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Proceedings of the 3rd RIBMINS Scientific Conference, 29-30 March 2023, Bucharest + online

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Conference programme

Wednesday, 29th March

09.30 – 10.00*	Registration	
10.00 - 10.10	Mihai Andronie	Opening conference
10.10 – 10.15	Madalina Belous	Welcome and housekeeping issues
10.15 – 10.30	Bojan Blagojevic	RIBMINS update
Moderator: Lis A	lban	
10.30 – 11.15	Keynote lecture	Contemporary meat safety standards and the role of meat
	Bert Urlings	inspection
11.15 – 11.45	Break (coffee and pos	ster [#] viewing for live participants)
Moderator: Simo	one Belluco	
11.45 – 12.45	WG1 session: Scope	and targets of meat safety assurance
		WG1 update
	Silvia Bonardi	Management of Shiga toxin-producing Escherichia coli (STEC)
		in cattle in the European Union
	Lis Alban	Development of best practice models for monitoring and
		control of residues of antimicrobial origin in pigs delivered
		to an abattoir
12.45 – 13.45	Lunch break	
Moderator: Drag	gan Antic	
13.45 – 14.30	Keynote lecture	Post abattoir risk based meat safety assurance
	Mick Bosilevac	
Moderator: Dian	a Meemken	
14.30 – 15.30	WG2 session: Farm l	evel controls and risk categorisation of farms
		WG2 update
	Susann Langforth	Status guo and improvements of food chain information for
	C	broilers, pigs, and bovines in Europe: Results from an online
		survey
	Ting-Ting Li	, Harmonised epidemiological indicators: How is the current
		situation of implementation for pigs, broilers, and bovines
		in Europe?
		==

15.30 – 16.00 Break (coffee and poster[#] viewing for live participants)

Moderator: Dragan Antic

16.00 – 17.00	WG3 session: Abattoir level controls and risk categorisation of abattoirs		
		WG3 update	
	Morgane Salines	Risk categorisation of abattoirs in Europe: Current situation	
	Niko Dadios	Multi-criteria risk categorisation of abattoirs with a focus on the food safety management system	
	Janne Holthe	Bacterial dynamics and risk categorisation of two broiler abattoirs in Norway	

Thursday, 30th March

Moderator: Ole Alvseike

10.00 - 11.00	WG4 session: Impact of changes and alternatives to traditional meat inspection WG4 update		
	Arja Helena Kautto	Remote meat inspection with digital devices in small-scale slaughter and game handling in Sweden as part of future	
		sustainable meat safety assurance system	
	Marianne Sandberg	Applications of computer vision systems for meat safety assurance in abattoirs: A systematic review	
	Alex Mason	The Meat Factory Cell: Progress toward AI-driven robotic processing of entire pig carcasses	

11.00 – 11.30 Break (coffee and poster[#] viewing for live participants)

Moderator: Claudia Guldimann

11.30 - 12.30	WG5 session: Meat safety assurance system training, communication and monitoring		
		WG5 update	
	Eduarda Gomes Ne- ves	Official veterinarians in Europe – Demographics and training needs and opportunities in the times of change	
	Maurizio Ferri (online)	Risk based meat safety assurance system – An introduction to key concepts for future training of official veterinarians	
Moderator: Bo	ijan Blagojevic		
12.30 - 13.15	Keynote lecture – Katharina Stärk	Modern meat safety control systems: From research to practice	
13.15 – 13.30	Closing conference		
13.30 - 14.30	Lunch break		

14.30 – 16.00 MC meeting (restricted to MC members and other invited delegates)

*all times are local (CET+1)

[#]for online participants posters will be posted on RIBMINS webpage

Scientific Committee

Bojan Blagojevic (Serbia) Lis Alban (Denmark) Ivar Vågsholm (Sweden) Simone Belluco (Italy) Diana Meemken (Germany) Truls Nesbakken (Norway) Dragan Antic (United Kingdom) Kurt Houf (Belgium) Ole Alvseike (Norway) Miguel Prieto-Maradona (Spain) Sophia Johler (Switzerland) Claudia Guldimann (Germany) Boris Antunovic (Croatia) Madalena Vieira Pinto (Portugal) Brigitte Sperner (Germany) Nevijo Zdolec (Croatia)

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About **RIBMINS**

RIBMINS (Risk-based meat inspection and integrated meat safety assurance) is a COST Action funded by the European Commission covering different activities in the period 2019-2023. The main aim of the RIBMINS network is to combine and strengthen European-wide research efforts on modern meat safety control systems. The network allows exchange of ideas, experience and results of country-level research studies. Other important aims are to create a platform for training relevant participants in the new meat safety assurance systems and thus help the operability, as well as to inform relevant stakeholders about the requirements, benefits and consequences of the new systems. Within RIBMINS, short-term scientific missions, training schools, workshops and conferences are organised. Overall, the network aims to help the full development and implementation of the general principles of meat safety assurance systems across Europe for the benefit of consumers and industry and protection of animal health and welfare.

The RIBMINS network scope of work, ongoing activities and news can be regularly followed at <u>www.ribmins.com</u>, as well as through social media (<u>Twitter</u>, <u>LinkedIn</u>, <u>ResearchGate</u>).



On-site participants of the RIBMINS conference held at the University of Cordoba, Spain (7th - 8th April 2022)

ABSTRACTS OF KEY-NOTE LECTURES

Contemporary meat safety standards and the role of meat inspection

<u>Bert Urlings</u>¹, Martijn Bouwknegt¹, Derk Oorburg¹

¹Vion Food, Department of Quality Assurance, Boxtel, The Netherlands

There is a global consensus that food safety is the responsibility of the food business operator (FBO). In consumption markets, such as East Asia, Pacific, the Americas and Europe, legislation is effective that confirms this policy. However in all these legislative territories, meat inspection of red meat is seen as a task of the competent authority and is thus conditional for export. Only Australia has proven to be brave and to dismiss the post-mortem inspection of slaughter pigs, for reasons of not providing any additional value for public health. The consequence is, however, that Australia is not able to export pork anymore outside its own territory. This example shows the complexity of the current debate about meat inspection. Slaughterhouses, like other FBOs, currently own their responsibility with respect to food safety, but the society is still struggling with the relic that is meat inspection, dating from the late 19th century and consisting of the ante- and post-mortem meat inspection. There are generally two viewpoints on how to evolve from this catch-22: one saying that the meat inspection needs to be renewed, and the other suggesting that we have to dismantle the meat inspection step by step and replace it with the FBO's HACCP plan. There are additional issues: 1. Some hazards are region and time related; 2. Butchering of animals is often seen as local craftmanship and strongly related to regional traditions; 3. The size of many individual companies is limited, so these FBOs use the assistance of the competent authorities to fulfill their legal obligations with respect to, e.g., food safety. All these complicating issues are politically very sensitive and need creative flexibility in order to evolve out of this dilemma. Being narrow minded, and forgetting politics, the best step forward is to embrace all aspects that ensure public health will be improved. A renewed science-based model will control food safety, animal health and wholesomeness of meat. Current private standards, not only in meat, but also in dairy, have shown as very effective in the control of, e.g., Listeria monocytogenes, Shiga toxin-producing Escherichia coli and Salmonella. The role of HACCP in the control of these hazards is undisputed. However, the role of meat inspection in this area is very unclear today. Even for those hazards that were the basis of the current meat inspection, such as tuberculosis, the role of meat inspection for control of animals that are not at risk can be doubted. As such, transforming the current meat inspection into a meaningful supporting system for food safety, and thus for consumer health protection, is vital. Science has to provide the pathways to do so. The lines of further evolvement are: provide room for new initiatives based on private HACCP standards; consider a risk-based approach that recognizes risks such as local production standards in the whole supply chain, including animal husbandry; and lastly, but not least, this transformation will also need an improvement of the official veterinary supervision that could be based on standardized performance indicators, comparable to HEIs.

Post abattoir risk-based meat safety assurance

Joseph M. Bosilevac¹, Terrance M. Arthur¹, Rong Wang¹

¹United States Department of Agriculture - Agricultural Research Service - U.S. Meat Animal Research Center, Clay Center NE USA

In the United States (US) risk-based meat safety begins with practices and interventions used at beef feedlots and swine barns. Best practices in animal husbandry, vaccinations, and feed additives (probiotics) are combined in attempts to reduce the risk of pathogens being present. During harvest at the abattoir, further physical and chemical interventions are applied to hides, pre-evisceration and final carcasses (as well as offal) that further reduce and lower the risk of contamination. Physical interventions include things such as knife trimming, while chemical interventions include washes of organic acids and other compounds. When final chilled carcasses are examined, virtually no pathogens can be detected. Yet, after these carcasses exit the chiller and commence deboning and fabrication, pathogen contamination may be identified in the finished products and trimmings. Therefore, US meat processors monitor trimmings for pathogens to ensure their safety systems are properly controlling pathogens. Similarly, the US Department of Agriculture (USDA) Food Safety Inspection Service (FSIS) monitors manufacturing trimmings and ground products for pathogens to ensure public health. Both groups expect to find sporadic positive tests, demonstrating the monitoring process is fit for purpose. However, occasional high event periods (HEPs) may occur involving multiple positive pathogen tests over a short period of time and that occur without any identifiable failures of harvest or processing safety systems. When HEPs of Escherichia coli O157:H7 were investigated to characterize their cause, the strains were found to be closely related (indistinguishable by DNA fingerprinting) within the HEP. HEP O157:H7 strains also formed stronger biofilms than control O157:H7 strains. It is known that bacteria do not exist in biofilms alone, but rather as a complex community comprised of multiple organisms. When meat processing environments were characterized for the bacteria making up microbial communities in different zones (coolers of finished carcasses, boning/fabrication lines, and meat grinding areas), it was found that certain communities formed stronger biofilms, tolerated routine sanitization steps and protected pathogens if they were a component of the biofilm. These results suggest that HEPs and other contamination events are a result of pathogens harbored in the boning/fabrication environment. Despite the implementation of a safety system of successful interventions, contamination can and does occur at sites after harvest and these sites should be considered and included in a risk-based meat safety assurance system.

Modern meat safety control systems: From research to practice

Katharina D.C. Stärk¹

¹Federal Office for Food Safety and Veterinary Affairs, Switzerland

Strengths and challenges of meat inspection practices have been discussed for some time. More recently, due to the progress of digitalization, the utility of the resulting information in the interest of food safety is of increasing interest. A key development is the trend towards a more risk-based approach, with possible adaptations of both the general inspection protocol as well as the selection of units to be subject to standard or alternative inspection methods. In addition to factors linked to the carcass and the hazards, other aspects are gaining in importance. Meat inspection is not an isolated activity but conducted as part of a system of practices and measures that can all have an impact on the safety of the resulting meat. While the legislative framework has evolved towards becoming more flexible, other systemic factors have changed. For example, Europe is suffering a marked shortage of skilled workers, including veterinarians. Also, the cost of energy has increased dramatically, which impacts on carcass interventions. Also, there is a reduced demand for meat in the Western society, which will ultimately also have an impact on the structure and economy of the meat industry. At the same time, consumer expectations in terms of animal welfare and sustainability are increasing. How to address these challenges while utilizing the latest scientific outputs? As for most complex issues, there is no easy way, but the different objectives need to be addressed jointly trying to find a balanced approach. Different combinations of interventions may be preferred across industries or markets. While technological solutions are available, their transfer to practice seems to be challenging. For example, new opportunities are created by the increasing use of digital, automatic data recording, but legal issues and a lack of trust may hinder the sharing of such information and thus limit its utility. A foodchain approach is a pre-requisite for applying a systemic analysis. This should include actors from primary production as well as consumers. Organisational and economic aspects specific to a sector or country will have to be considered. Some countries have started to use consumer or citizen panels to understand their preferences and needs. From the perspective of the competent authority, the challenge is to provide a legal basis that – while assuring the safety of meat – allows for entrepreneurship and innovation by the industry. Political processes take time and need to consider additional aspects such as international requirements. Policies driven by societal interests such as animal welfare and climate change may incentivise certain practices and thus contribute to the sustainability of the system.

ABSTRACTS OF ORAL PRESENTATIONS

Management of Shiga toxin-producing *Escherichia coli* (STEC) in cattle in the European Union

<u>Silvia Bonardi</u>¹, Simone Belluco², Maria Fredriksson-Ahomaa³, Ivar Vågsholm⁴

¹Department of Veterinary Science, University of Parma, Parma, Italy

²Department of Food Safety, Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro (PD), Italy

³Department of Food Hygiene and Environmental Health, University of Helsinki, Helsinki, Finland

⁴Department of Biomedical Sciences and Veterinary Public Health, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden

Shiga toxin-producing Escherichia coli (STEC) is one of the most important zoonotic foodborne pathogens worldwide, causing gastroenteritis, haemolytic uremic syndrome and haemorrhagic colitis especially in children and the elderly. Shiga toxins Stx1 and Stx2 include many subtypes (i.e., Stx1a, Stx1c, Stx1d, Stx1e and Stx2a–Stx2l) and are the main virulence factors of STEC. In 2021, STEC infections ranked fourth among zoonoses in the EU, accounting for 6,084 notified cases (2.1 cases/100,000 population) and a higher mortality rate than campylobacteriosis and salmonellosis. The most common STEC serogroup associated with human illness is O157 but other serogroups are frequently reported in Europe, such as O26, O103, O80, O91 and O145. The complexity of STEC relates to the difficulty of defining their pathogenicity because the acquisition of virulence properties from other organisms allows new strains to emerge, as for the "hybrid" types, Stx2-producing enteroaggregative (EAEC) E. coli O104:H4 and the STEC/extraintestinal pathogenic (ExPEC) E. coli O80:H2. Ruminants are the primary reservoirs of STEC. STEC-colonized cattle are commonly asymptomatic, but the pathogens can persist for months in the gut, as well as in manure and pen floors. Therefore, faecal shedding and environmental survival favour STEC transmission and hide contamination among bovines. At slaughter, both faeces and hides are sources of carcass contamination. Ingestion of raw or undercooked STEC-contaminated meat is a risk for consumers, especially because even a low dose (<100 CFU) could result in human infection. Nevertheless, even though bovine meat is responsible for the highest number of "strongevidence" outbreaks in the EU, microbiological criteria for STEC in bovine and other ruminants' meat were not included in Regulation (EC) No 2073/2005. As an alternative, to reduce microbial contamination of carcasses, Regulation (EC) No 853/2004 requires that "animals must be clean" when processed in slaughterhouses. In 2013, EFSA proposed harmonized epidemiological indicators (HEIs) for STEC to be included in bovine meat inspection. HEI 5 focuses on classifying the animals according to their hide cleanliness using a scoring system, with the action that excessively dirty animals are slaughtered after clean ones, at slower line speed and with increased process hygiene controls. Currently, there is no harmonised risk management approach in the EU with regards to STEC in cattle. Only a few Nordic countries have implemented monitoring programs based on testing carcasses at slaughter or focused on passive surveillance in bovine herds if human STEC cases are traced back to beef consumption. Therefore, to ensure meat safety, most EU countries still rely on strict slaughter hygiene practices, i.e., on proper meat safety assurance system (MSAS) implementation and FBO own-check criteria in the absence of legislative ones.

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

<u>L. Alban^{1,2}</u>, B. Antunovic³, M. Belous⁴, S. Bonardi⁵, R. M. García-Gimeno⁶, I. Jenson^{7,8}, A. H. Kautto⁹, M. Majewski¹⁰, D. Oorburg¹¹, I. Sakaridis¹², A. Sirbu¹³, M. Vieira-Pinto¹⁴, I. Vågsholm⁹, A. Bērziņš^{16,17}, J. V. Petersen¹

¹ Danish Agriculture & Food Council, Copenhagen, Denmark

² Dept. Veterinary and Animal Sciences, University of Copenhagen, Frederiksberg, Denmark

³ University of J.J. Strossmayer, Faculty of Agrobiotechnical Sciences, Osijek, Croatia

⁴ Spiru Haret Veterinary University, Romania

⁵ Dept. of Veterinary Science, University of Parma, Italy

⁶ Dept. Food Science and Technology, Universidad de Córdoba, Spain

⁷ Centre for Food Safety and Innovation, University of Tasmania, Hobart, Tas, Australia

⁸ FIRST Management Pty Ltd, North Parramatta, NSW, Australia

⁹ Dept. Biomedical Sciences and Veterinary Public Health (BVF), SLU, Uppsala, Sweden

- ¹⁰Dept. of Animal Breeding and Product Quality Assessment, Poznan University of Life Sciences, Poland
- ¹¹Vion Food Group, Boxtel, The Netherlands

¹²Veterinary Research Institute, Hellenic Agricultural Organization - Demeter, Thessaloniki, Greece

¹³FMMAE Ramnicu Valcea, Constantin Brancoveanu University of Pitesti, Romania

¹⁴Veterinary and Animal Research Centre, University of Trás-os-Montes and Alto Douro, Portugal

¹⁵Dept. Biomedical Sciences and Veterinary Public Health (BVF), SLU, Uppsala, Sweden

¹⁶Institute of Food Safety, Animal Health and Environment (BIOR), Riga, Latvia

¹⁷Faculty of Veterinary Medicine, Latvia University of Life Sciences and Technology, Jelgava, Latvia

Withdrawal periods after treatment with antimicrobials (AM) have been defined officially in most parts of the world, preventing concentration of residues in meat above the maximum residue limits (MRL). However, errors may occur, leading to presence of residues in the animals at the time of slaughter. The question is how the practices related to routine monitoring and control of AM residues are applied in- and outside the European Union (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 RIBMINS, focusing on pigs delivered for slaughter. 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 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. Two models for best practices were developed based on the approach utilised for microbiological criteria. The two models reflect that the surveillance objectives differ substantially between the individual abattoirs/countries as shown by our survey data. Model A reflected abattoirs mainly placing meat on the national market, whereas Model B reflected abattoirs with main shares of meat traded and exported. In Model A, detection of residues above MRL would be interpreted as a process hygiene criterion with focus on the process. This implies that a visit would be made to the pig farm from which the positive animal originated, but the carcass tested would not be detained. In Model B, findings would be interpreted as a food safety criterion, implying a visit to the farm as well as detaining the carcass tested to avoid recalls. The advantages and limitations related to the two best practice models are discussed.

Status quo and improvements of food chain information for broilers, pigs, and bovines in Europe: Results from an online survey

<u>Susann Langforth</u>¹, Ting-Ting Li¹, Verena Oswaldi¹, Rudi Isbrandt¹, Smaragda Sotiraki², Sofia Anastasiadou², Truls Nesbakken³, Nina Langkabel¹, Diana Meemken¹

¹Institute of Food Safety and Food Hygiene, Working Group Meat Hygiene, Department of Veterinary Medicine, Freie Universität Berlin, Germany

²Veterinary Research Institute, Hellenic Agricultural Organization – Demeter, Campus of Thermi, 57001, Thessaloniki, Greece

³Department of Production Animal Clinical Sciences, Faculty of Veterinary Medicine, Norwegian University of Life Sciences, Ås, Norway

Food chain information (FCI) according to Reg. (EC) No 853/2004 is data collected along the food chain for animals intended for slaughter. FCI includes inter alia information about the health status, treatment data, and previous ante- and post-mortem reports. The content of FCI determines the intensity and methods for the official meat inspection in the framework of risk-based meat safety assurance systems (RB-MSAS). Official veterinarians are expected to play a central role as risk managers in RB-MSAS and will benefit from the use of FCI. The specifications laid down in the EU regulation, however, are not very precise, causing country-specific implementations. The aim of this study was to obtain an overview of the information content of FCI in European countries to identify similarities, differences and optimisation potential. Separate questionnaires were designed for broilers, pigs and bovines. In total, 32 respondents completed the questionnaire for broilers, 51 for pigs and 58 for bovines. They were from 14, 17 and 18 different European countries, respectively. For broilers, 75% of the respondents regarded FCI as helpful, while for pigs it was 57% and for bovines 48%. The percentage of respondents with access to certain information was mostly the largest for broilers, followed by pigs and bovines. For example, mortality rate was transmitted to 88% of respondents for broilers, to 20% for pigs and to 16% for bovines. In total 81% (broilers), 65% (pigs) and 55% (bovines) of the respondents had access to previous antemortem inspections of animals from the same holding. For post-mortem inspections, this was 91% (broilers), 63% (pigs) and 64% (bovines) of the respondents. Currently, ante- and post-mortem findings must be requested as FCI since they are regulated in Reg. (EC) No 853/2004, but especially for pigs and bovines, information transmission is not implemented Europe-wide. Overall, our study detected a species-specific implementation of FCI with the best data availability for broilers. This is probably due to the common integrated systems in poultry production and since the significance of flock data is higher compared to individually slaughtered animals like dairy cattle. Nevertheless, at least statutory information must be transmitted, which was not always present in the results of our study. There is still potential for optimisation both in the implementation of the FCI and in the regulation itself.

Harmonised epidemiological indicators: How is the current situation of implementation for broilers, pigs, and bovines in Europe?

<u>Ting-Ting Li</u>¹, Nina Langkabel¹, Susann Langforth¹, Smaragda Sotiraki², Sofia Anastasiadou², Truls Nesbakken³, Diana Meemken¹

¹Institute of Food Safety and Food Hygiene, Working Group Meat Hygiene, School of Veterinary Medicine, Freie Universität Berlin, Germany

²Veterinary Research Institute, Hellenic Agricultural Organization – Demeter, Campus of Thermi, Greece

³Department of Production Animal Clinical Sciences, Faculty of Veterinary Medicine, Norwegian University of Life Sciences, Ås, Norway

Harmonised epidemiological indicators (HEIs) were first introduced by the European Food Safety Authority (EFSA) in 2011. EFSA defined HEIs as the "prevalence or concentration of the hazard at a certain stage of the food chain or an indirect indicator of the hazards [...] that correlates to human health risk caused by the hazard". HEIs enable risk categorisation of herds regarding their risk exposure to biological hazards and of abattoirs by their ability to control and reduce the risk. In the framework of a risk-based meat safety assurance system (RB-MSAS), EFSA proposed the utilisation of HEIs or the information they provide as a part of food chain information to adjust current methods for meat inspection if they are insufficient to address the risk. Since the application of HEIs is not regulated by law and EFSA's proposal is a decade old, the aim of this study was to examine which of the HEIs are applied for broilers, pigs and bovines and which corresponding private and/or official monitoring and surveillance systems (MoSS) are in place. An online survey with three speciesindividual questionnaires was conducted. The target groups were official veterinarians (OVs) and food business operators (FBOs) in Europe. We focused on i) whether official or private MoSS were in place, ii) the stage at which the testing was conducted, iii) the test methods, and iv) the test matrices used. In total, 34 participants from 15 countries answered the broiler questionnaire, 51 participants from 17 countries answered the pig questionnaire and 58 participants from 18 countries answered for bovines. Out of the 143 participants, 62% were OVs and 28% were FBOs. The results showed MoSS were mostly in place for pathogens that are already controlled by EU regulations, e.g., Salmonella for all three animal species. In these cases, if HEIs for the regulated pathogens exist and if they are in line with the legal requirements, on average most participants (> 50%) applied these HEIs. Other HEIs that focused on a different stage of the food chain for the same pathogen which is not legally regulated were mostly stated not to have been implemented; the same with HEIs for other pathogens, e.g., Yersinia enterocolitica for pigs. Although most of the participants were performing the mandatory monitoring, the results revealed some deficiencies regarding the application of the correct diagnostics; test matrices and test methods did not match. HEIs provide very valuable data, especially in terms of the novel RB-MSAS, but the survey showed that they are underutilised throughout Europe at the moment.

Risk categorisation of abattoirs in Europe: Current situation

<u>Morgane Salines</u>¹, Thomai Lazou², Jose Gomez-Luengo³, Janne Holthe⁴, Ivan Nastasijevic⁵, Martijn Bouwknegt⁶, Nikolaos Dadios⁷, Kurt Houf⁸, Bojan Blagojevic⁹, Dragan Antic¹⁰

- ¹ French Ministry of Agriculture, Office for Slaughterhouses and Cutting Plants, France
- ² Laboratory of Animal Food Products Hygiene-Veterinary Public Health, School of Veterinary Medicine, Fac-
- ulty of Health Sciences, Aristotle University of Thessaloniki, Greece
- ³ Food Standards Agency, UK
- ⁴ Animalia Norwegian Meat and Poultry Research Center, Norway
- ⁵ Institute of Meat Hygiene and Technology, Serbia
- ⁶ Vion Food Group, the Netherlands
- ⁷ Royal Veterinary College, University of London, UK
- ⁸ Faculty of Veterinary Medicine, Department of Veterinary and Biosciences, Ghent University, Belgium
- ⁹ Faculty of Agriculture, Department of Veterinary Medicine, University of Novi Sad, Serbia

¹⁰Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, UK

In recent years, a risk-based approach has been identified as a step forward in modernising meat inspection in Europe. Risk in this respect is defined as the public health risk to consumers. Risk categorisation of abattoirs based on their process hygiene and harmonised epidemiological indicators (HEIs) has been suggested as one essential component of the risk-based meat safety assurance system. However, to date, only a limited number of papers have investigated abattoir risk categorisation. Therefore, the objective of this study was to (i) provide an overview of the use of risk categorisation systems in poultry, pig, cattle and small ruminant abattoirs in Europe and (ii) explore the criteria, relevance and applicability of risk categorisation approaches for competent authorities (CAs). To that aim, a questionnaire was designed and sent to representatives of 35 European CAs. Of the 35 countries contacted, 18 of them responded (51%). Among them, 14 (78%) indicated that abattoirs in their country were categorised according to their food safety risk in a systematic way, whilst 4 countries (22%) did not categorise abattoirs. The main reported purpose of categorising abattoirs was to adapt the frequency of official controls. A great variability in the described categorisation systems was found between countries, particularly in their complexity and parameters used. The number of included parameters ranged from 1 to 10, the main ones being the outcomes of the CA's official audits (78% of the 14 countries), production figures of abattoirs (64%), the relevance and credibility of HACCP plans (57%) and export agreements of abattoirs (43%). Less than a third of the surveyed countries indicated they utilise results of microbiological testing as a basis for risk categorisation of abattoirs, and no country has formally included HEIs in its risk categorisation approach. The efficiency of such riskbased approaches was evaluated in five countries only (36%), with unclear methodology and criteria for such an assessment. More than 80% of respondents expressed their wish to be provided with a practical method for categorising abattoirs according to the pertained food safety risk. In conclusion, the results of this study demonstrate the need to develop a fit-forpurpose and science-based framework for risk categorisation of abattoirs in Europe.

Multi-criteria risk categorisation of abattoirs with a focus on the food safety management system

<u>Nikolaos Dadios</u>¹, Martijn Bouwknegt², Morgane Salines³, Thomai Lazou⁴, Jose Gomez-Luengo⁵, Janne Holthe⁶, Sigrun Hauge⁶, Ivan Nastasijevic⁷, Kurt Houf⁸, Bojan Blagojevic⁹, Dragan Antic¹⁰

- ¹ Royal Veterinary College, University of London, UK
- ² Vion Food Group, the Netherlands
- ³ French Ministry of Agriculture, Office for Slaughterhouses and Cutting Plants, France
- ⁴ Laboratory of Animal Food Products Hygiene-Veterinary Public Health, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, Greece
- ⁵ Food Standards Agency, UK
- ⁶ Animalia Norwegian Meat and Poultry Research Center, Norway
- ⁷ Institute of Meat Hygiene and Technology, Serbia
- ⁸ Faculty of Veterinary Medicine, Department of Veterinary and Biosciences, Ghent University, Belgium
- ⁹ Faculty of Agriculture, Department of Veterinary Medicine, University of Novi Sad, Serbia
- ¹⁰Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, UK

As a part of the modernisation of current meat safety assurance systems, risk categorisation of abattoirs is suggested as an essential component. Food business operators and competent authorities can use risk categorisation to optimise their food safety controls. The RIB-MINS consortium is developing a risk categorisation tool, with the principles of a multicriteria decision analysis at its basis. These criteria represent the science-based drivers for change in food safety, and they include, amongst other things, the quality of a HACCP plan, quality and results of microbial monitoring and the design of the food safety management system (FSMS). Each criterion is subsequently further specified using subcriteria. As an example, we detail here the FSMS performance assessment (FSMS-PA). No clear definition for FSMS in an abattoir exists, but it typically includes all activities, policies and procedures that are involved or influence the safety of the finished products. Each FSMS consists of different components, of which the most important is the HACCP system. Ideally, a FSMS-PA should be done only against agreed, clear and measurable objectives, typically levels of hazards in the finished products, which in an abattoir are the carcasses at the point of dispatch. The objectives can be of regulatory origin (e.g., ALOP) or from other sources (company targets). We propose two methods to assess the performance of a FSMS, The 'holistic' method, in which a FSMS is broken down in its components, which are then weighted in relation to the hazard, scored individually as to how effectively they are applied in an abattoir and are then combined in a final score for the abattoir. Furthermore, the 'outcome-based' method, in which the FSMS-PA is based solely on an outcome, e.g. the levels of a hazard or indicator microorganisms in various steps of production. The holistic method is better in assessing the FSMS in an abattoir independently of external factors (e.g., prevalences of hazards at farm level) and more effective in identifying the weak points in production, but it is more laborious and subjective. The outcome-based method is less laborious and more objective, as it typically depends on laboratory results, but it does not identify the weak points in the slaughter process and does not isolate the FSMS from external factors, i.e., it does not make clear if an outcome has been achieved because of the actual performance of the FSMS in abattoir or because of external factors (e.g., prevalence of a hazard at farm level).

Bacterial dynamics and risk categorisation of two broiler abattoirs in Norway

Janne Holthe¹, Sigrun J. Hauge¹, Ole Alvseike¹, Gunvor Elise Nagel-Alne¹

¹Animalia Norwegian Meat and Poultry Research Center, P.O. Box 396, Økern, 0513, Oslo, Norway

Good process hygiene in the slaughter of broilers is paramount to achieve safe end products with long shelf lives. Investigation of bacterial loads and composition at different processing stages can give insight into which organisms are able to survive different interventions, such as different time/temperature combinations, air speeds during chilling, and water pressure. Risk categorisation of abattoirs according to their capacity to control hazards based on their process hygiene has been suggested as a contribution to risk-based meat safety assurance systems by EFSA, but this is yet to be implemented in the EU. Risk categorisation may be useful for the abattoirs in sales and marketing, inspire to improve process hygiene and better staff training, and be a tool for the competent authorities in assessment of audit frequency.

At two broiler abattoirs, a total of 120 neck-skins were collected from 4 different sampling points; before scalding, after plucking, after evisceration, and after chilling. Samples (30) were collected from each sampling point over a total of 3 days (2 days in abattoir A and 1 day in abattoir B). Carcasses originated from flocks that had been classified as either positive or negative for Campylobacter on-farm. The bacterial composition was determined using amplicon sequencing of the 16S rRNA gene, and PCR was performed using universal primers 16S-27F-YM and 16S-357R. Bacterial loads on the carcasses decreased along the slaughter line by 2.1, 1.1, 1.1 and 1.0 log cfu/g for total plate count (TPC), Enterobacteriaceae, E. coli and Campylobacter, respectively. Reductions in means from the first to the last sampling point were larger in abattoir B than in A by 0.6–0.8 cfu/g for TPC, Enterobacteriaceae and E. coli. Before scalding, the bacterial communities were more diverse and dominated by *Staphylococcus* spp. (26%), *Escherichia-Shigella* spp. (16%) and *Streptococcus* spp. (9%). *Escherichia-Shigella* spp. had the highest abundances in samples taken after plucking (39%), but this dropped to 7% after chilling. In contrast, Asinibacterium spp. and Afipia spp. increased along the slaughter line, from almost 0% to 26% and 9%, respectively, after chilling. Escherichia-Shigella abundances were higher in the Campylobacter-negative broilers at all sampling points, except after plucking where there was no significant difference in the abundance. The abattoirs were categorised according to the suggested method by Cegar et al. (2022). All samples from chilled carcasses in both abattoirs were below the limit of 3.0 log cfu/g for Campylobacter. Abattoir A was categorised as score 1 for all 3 indicator bacteria, and abattoir B was score 1 for TPC and Enterobacteriaceae and score 2 for E. coli. The geometric mean was 1.0 for abattoir A and 1.33 for abattoir B. Hence, both abattoirs were categorised as low-risk abattoirs (geometric mean of score ≤ 1.5).

Remote meat inspection with digital devices in small-scale slaughter and game handling in Sweden as part of future sustainable meat safety assurance system

<u>Arja Helena Kautto¹, Arianna Comin²</u>

¹Department of Biomedicine and Veterinary Public Health, Swedish University of Agricultural Sciences, Ulls Väg, Ultuna, 750 09 Uppsala, Sweden

²Department of Disease Control and Epidemiology, Swedish National Veterinary Institute, SE-751 89 Uppsala, Sweden

The mandatory post-mortem inspection (PMI) of carcases in commercial slaughter and game handling on-site involves a lot of travelling by the official inspectors to reach the food business operators (FBO). Many hurdles can hamper or delay PMI, causing logistic and economic problems for the FBOs. Since 2019 in Sweden, the possibility to rely on digital devices in remote PMI has been investigated. Such a system must be user-friendly, secure, reliable and economically sustainable. The objective of this study was to investigate the feasibility of getting remote PMI up and running in small-scale abattoirs and game handling establishments (GHE). A technical support person (the sender) using a Wi-Fi connected smartphone was placed on site. A meat inspector (the receiver) with personal computer was located apart from the establishment. The sender filmed the carcasses and organs at the slaughter line and streamed to the receiver in real time. The outcome of remote PMI was compared to the regular PMI performed by meat inspectors at the abattoir and GHE. In order to separate the variation in PMI outcome due to the technique (remote vs. regular) from the interrater variation (inspector vs. inspector), a baseline exercise was set up, where a number of carcases were individually and independently assessed by all inspectors on-site. The performance of PMI was assessed by calculating the overall agreement beyond chance (Fleiss' Kappa) as well as the finding-specific agreement beyond chance (Cohen's Kappa) between inspectors. In the baseline comparison, the overall agreement amongst inspectors in pig slaughter on-site was 36% (95%CI: 29-43%, 243 carcases), and the finding-specific agreement ranged from 11% for lung lesions to 45% for parasitic liver lesions. The overall agreement between the remote inspector and the on-site inspectors was 54% (95%CI: 51-57%, 1009 carcases), and the finding-specific agreement ranged from 34% for parasitic liver lesions to 86% for abscesses. In game handling, the overall baseline agreement among inspectors on-site was 66 % (95%CI: 52-80%, 106 big game) and between the remote inspector and the on-site inspectors 70% (95%CI: 61- 80%, 253 big game). Specific findings were extremely few. Some PMI findings are documented more consistently than others, but there is a substantial inter-rater variability between meat inspectors. Sources of differences in professional judgement are both bias (i.e., the average error in judgements) and noise (i.e., the variability of error in judgements). Many activities (i.e., training) are needed to reach a better precision of decisions. The outcome of remote PMI in comparison to regular PMI on site was at least as reliable as the outcome of regular PMI. This remote PMI method does not negatively affect the inter-rater reliability and could be part of the sustainable meat safety assurance system in remote areas in the near future.

Applications of computer vision systems for meat safety assurance in abattoirs: A systematic review

<u>Marianne Sandberg</u>¹, Sergio Ghidini², Lis Alban^{3,4}, Andrea Capobianco Dondona⁵, Bojan Blagojevic⁶, Martijn Bouwknegt⁷, Len Lipman⁸, Jeppe Seidelin Dam⁹, Ivan Nastasijevic¹⁰, Dragan Antic¹¹

- ¹ National Food Institute, Technical University of Denmark, 2800, Kgs. Lyngby, Denmark
- ² Department of Food and Drug, University of Parma, Via del Taglio 10, 43126, Parma, Italy
- ³ Department for Food Safety, Veterinary Issues and Risk Analysis, Danish Agriculture & Food Council, Agrofood Park 13, DK-8200, Aarhus N, Denmark
- ⁴ Department of Veterinary and Animal Sciences, University of Copenhagen, Grønnegårdsvej 8, DK-1870, Frederiksberg, Denmark
- ⁵ Farm4Trade s.r.l., Via IV Novembre, 66041 Atessa, Italy
- ⁶ Faculty of Agriculture, University of Novi Sad, Trg D. Obradovica 8, 21000, Novi Sad, Serbia
- ⁷ Vion Food Group, Boseind 15, 5281 RM, Boxtel, the Netherlands
- ⁸ Department Population Health Sciences, Institute for Risk Assessment Sciences (IRAS), University of Utrecht, 3584 CM Utrecht, the Netherlands
- ⁹ Danish Technological Institute, Grønnegårdsvej 1, 2630 Taastrup, Denmark
- ¹⁰Institute of Meat Hygiene and Technology, Kacanskog 13, 11000, Belgrade, Serbia
- ¹¹Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Leahurst, CH64 7TE, UK

The work was conducted to investigate the role of computer vision systems (CVS) for detection of carcass contamination and gross pathological lesions in the overall meat safety assurance of bovines, pigs and broiler chickens. Introduction of the new EU legislation on official controls in food production in 2017-2019 opened up the possibility for use of CVS as a complementary tool in meat inspection. A systematic literature review was performed to identify and analyse scientific articles reporting on the performance of CVS used in abattoirs for ante- and post-mortem veterinary inspection and meat safety assurance, including systems for detection of carcass/organ contamination and lesions. In this review, 62 articles were identified and analysed. There were 35 articles reporting on CVS performance in the detection of carcass/organ lesions and 27 in the detection of carcass contamination. CVS for poultry, pig and bovine meat safety assurance were reported in 53, 5 and 4 articles, respectively. To what extent the developed CVS were validated varied. Only three articles reported results from real-time evaluation of CVS performance in abattoir vs performance of the official veterinarian. Most of the reported CVS performance measures (i.e., sensitivity and specificity) were >80%. The challenges reported were related to achieving high sensitivity for detection of the food safety and animal health/welfare related conditions. Furthermore, there were challenges with acquiring high specificity and minimising false positives, with the purpose of minimising food waste, and while maintaining CVS as economically viable for abattoirs. While food safety conditions should be detected for the individual carcasses, animal health and welfare conditions might only need to be documented on a flock level. For most of the identified CVS, there is still a need for further training to achieve better performance.

The Meat Factory Cell: Progress toward AI-driven robotic processing of entire pig carcasses

<u>Alex Mason^{1,2}</u>, Ole Alvseike¹

¹Animalia AS, PO Box 396 Økern, 0513 Oslo, Norway ²Norwegian University of Life Sciences, Faculty of Science and Technology, Kajaveien 5, 1430 Ås, Norway

This work presents the status of a novel Meat Factory Cell (MFC) system, which has been developed during the on-going European Horizon 2020 project "RoBUTCHER". The system builds on previous work to redefine operations typically found in conventional abattoirs, with modern technology and equipment in mind. The aim of the project is to develop a platform that advances and demonstrates the capacity of a robotic system to, eventually, process an entire pig carcass. In doing so, the project seeks to address several increasing concerns for meat processors, including access to scalable, flexible and robust automation, even at small and medium volumes. Increased access to automation is expected to address other broad concerns for the sector, including hygiene, availability of labour and yield. The system uses two off-the-shelf industrial robots, in addition to one bespoke robot for carcass handling and presentation. Several tools (i.e., grippers, knives) have been constructed to enable manipulation and cutting, and an artificial intelligence, working with real-time 3D data, is trained to plan cutting and gripping tasks for each individual carcass. The system has several interfaces, allowing users to operate the system via a web-browser, or even interactively in virtual reality. The input to the system is an entire pig carcass, and the output is in seven parts: two shoulders, two hams, a complete saddle with head and tail, the belly, and finally, the entire gastrointestinal tract. An inspection-friendly logistic unit (i.e., a rack) is enabled to hang and transport all of those parts within a meat factory for inspection, sorting and secondary processing. To date, the system has focused on and successfully demonstrated the ability to perform automated shoulder and ham removals.

Official veterinarians in Europe – Demographics and training needs and opportunities in the times of change

<u>Eduarda Gomes-Neves</u>¹, Margarida F. Cardoso¹, Thomai Lazou², Brigita Hengl³, Silvia Bonardi⁴, Claudia Guldimann⁵, Bojan Blagojevic⁶, Sophia Johler⁷

¹ICBAS-Institute of Biomedical Sciences Abel Salazar, University of Porto, Portugal

⁴Department of Veterinary Science, University of Parma, Italy

⁶University of Novi Sad, Faculty of Agriculture, Department of Veterinary Medicine, Serbia

⁷Institute for Food Safety and Hygiene, Vetsuisse Faculty, University of Zurich, Switzerland

Official veterinarians (OVs) are a vital part of the food safety assurance system, as they perform the official controls for the national veterinary competent authorities (CAs). The way official controls for food products are carried out in Europe has been recently amended by Regulation (EU) 2017/625. In this new context, the OVs play a key role as risk managers at pre-harvest and harvest levels of the meat production chain and need proper training. Under the framework of COST Action RIBMINS, this study utilised an online questionnaire to characterize the profile of European OVs in terms of demographics, qualifications, work experience, employment situation, continuing education, training opportunities and needs. The questionnaire was completed by 1,778 OVs of 31 nationalities working in 30 European countries. On average they were 48.7 years old (min. 23 - max. 77), 53.9% were male, 45.5% were female and 0.6% preferred not to say. On average, the degree in Veterinary Medicine was obtained 22.5 years ago. The highest academic degree is DVM for 74.8% of the respondents, while 15.6% completed an MSc and 9.6% a PhD; 35.9% hold a national specialisation diploma and 4.4% a European one. Previous professional experience and specific training were required to enter the career for 32.4% and 51.2%, respectively. For 61.8% of the respondents, the entity responsible for the training was the national veterinary CA, and 50.2% had to pass an exam. On average, the number of years of experience was 15.2 (min. 0 - max. 48) and 65.3% work full-time. Most frequently, OVs work in pig (47.4%) or cattle abattoirs (44.0%), in a team with one or more OVs (38.5%) or alone (31.3%). The most frequent employer was the regional (37.5%) or the national veterinary CA (35.0%); 68.9% had a long-term/permanent contract. For 69.5% of OVs, the frequency of training opportunities is regular, and the last training activity was less than one year ago for 68.9%; 60.0% prefer lectures face-to-face and on-site practical sessions. The most requested topics for future training are the new legislation on official controls, zoonotic and emerging diseases and risk-based meat inspection (64.4%, 62.0% and 61.6%, respectively), despite these topics having already been approached. The data obtained enable the characterisation of this professional group and help to identify training interests and develop effective future training tools.

²School of Veterinary Medicine, Aristotle University of Thessaloniki, Greece

³Department for Nutrition and Data Management, Center for Food Safety, Croatian Agency for Agriculture and Food, Croatia

⁵Faculty of Veterinary Medicine, Ludwig-Maximilians-University Munich (LMU), Germany

Risk based meat safety assurance system – An introduction to key concepts for future training of official veterinarians

<u>Maurizio Ferri</u>¹, Bojan Blagojevic², Patric Maurer³, Brigita Hengl⁴, Claudia Guldimann⁵, Sandra Mojsova⁶, Ioannis Sakaridis⁷, Boris Antunovic⁸, Eduarda Gomes-Neves⁹, Nevijo Zdolec¹⁰, Madalena Vieira-Pinto¹¹, Sophia Johler¹²

¹ Italian Society of Preventive Veterinary Medicine (SIMeVeP), Roma, Italy

² Department of Veterinary Medicine, Faculty of Agriculture, Novi Sad, Serbia

³ Ministry of Labour, Social Welfare, Health, Women and Family Affairs of Thuringia, Erfurt, Germany

⁴ Croatian Agency for Agriculture and Food Center for Food Safety, Osijek, Croatia

⁵ Veterinary Faculty, Ludwig-Maximilians-University Munich (LMU), Germany

⁶ Faculty of Veterinary Medicine - Skopje, Ss. Cyril and Methodius University in Skopje, North Macedonia

⁷ Veterinary Research Institute, Hellenic Agricultural Organization - Demeter, Thessaloniki, Greece

⁸ University of J.J. Strossmayer, Faculty of Agrobiotechnical Sciences, Osijek, Croatia

⁹ ICBAS, Instituto de Cîencias Biomédicas Abel Salazar, Universidade do Porto, Porto, Portugal

¹⁰University of Zagreb, Faculty of Veterinary Medicine, Department of Hygiene, Technology and Food Safety, Zagreb, Croatia

¹¹Animal and Veterinary Research Center (CECAV), Department of Veterinary Science, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal

¹²Institute for Food Safety and Hygiene, Vetsuisse Faculty, University of Zurich, Zurich, Switzerland

More than a decade ago, the European Food Safety Authority (EFSA) sparked a substantial modernization effort in traditional meat safety systems in Europe by publishing a range of EFSA opinions that were followed, from 2014 to 2019, by amendments to relevant EU legislation. A novel, risk-based meat safety assurance system (RB-MSAS) was proposed to address the latest, most relevant meat-borne hazards and protect human health as well as animal health and welfare. This new framework was thought to offer substantial advantages with regard to the combination and longitudinal integration of prevention and control measures along the meat production chain. Provided that FBOs have full responsibility for food safety, official veterinarians (OVs) are expected to take on a central role and will benefit from the use of harmonized epidemiological indicators (HEIs) and food chain information (FCI). This contribution provides: an introduction to the key concepts of RB-MSAS framework; potential training needs of OVs (i.e., HEIs proposed by EFSA for different animal species to categorize farms and abattoirs according to the risk, and to conduct risk-based meat inspection) as well as an overview of the components of an RB-MSAS along with limitations of the current status of the European meat inspection system that may hamper its development. Future challenges related to the conceptual and practical implementation of a RB-MSAS and potential solutions are also outlined.

ABSTRACTS OF POSTER PRESENTATIONS

Characterization of initial examination procedures in large game performed by veterinarians

Ana Carolina Abrantes¹, Madalena Vieira-Pinto^{1,2,3}

¹CECAV-Animal and Veterinary Research Centre, Trás-os-Montes e Alto Douro University, Quinta de Prados, Vila Real, Portugal

²Associate Laboratory for Animal and Veterinary Sciences (AL4AnimalS), Portugal

³Department of Veterinary Science, Trás-os-Montes e Alto Douro University, Quinta de Prados, Vila Real, Portugal

The initial examination must be systematic and carried out by an operator legally trained for the purpose, according to Reg. 853/2004, or a trained person or a veterinarian. In countries such as Portugal, the initial examination of large game by a veterinarian is mandatory in the epidemiological risk area for tuberculosis (Notice No. 1 of 2011). The objective of this work is to characterize the initial examination procedures performed by twenty veterinarians.

During two hunting seasons (2021/2022 and 2022/2013), initial examination procedures performed in 20 different hunting areas by 20 different veterinarians were observed. The systematicity of the initial examination, performance of the external and internal evaluation (EE and IE) of the carcasses, order of internal evaluation procedures (carcass and viscera) and reasons for rejection were characterized. Most of the 20 veterinarians do not systematically organize the initial examination and may sometimes change the order of procedures. Eight of them (40%) do not carry out an EE of the carcass, so conduct an immediate IE, five (25%) carry out a general EE to know the body condition of the animals, thus defining the order in which the carcasses are opened, and seven (35%) carry out a careful EI (mainly palpation of the joints and location of shot/wounds/dog bites). Regarding the IE procedures, all veterinarians start with the incision of the animalibular lymph nodes in the case of wild boars. Then, 17 of them give priority to the evaluation of the pulmonary complex (visual evaluation and palpation), and 50% also make an incision in the lungs and bronchial lymph nodes. All respondents also performed an evaluation of the liver (visual, palpation and incision), but the evaluation of the intestines and mesenteric lymph nodes is often lacking.

In terms of unfit carcasses, it was observed that whenever there are lesions compatible with tuberculosis, all veterinarians opt for total rejection of the affected carcass. As the main conclusion, it was observed that the initial examination is not systematically carried out with the same criteria and its procedures are not harmonized. Proper training should be given to veterinarians for them to have sufficient knowledge about large game diseases to identify the pathological lesions at the scene of initial examination and to ensure correct hygiene procedures and effective elimination of unfit meat and offal.

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Raw meat marketed in Northern Tunisia: Molecular analysis and Salmonella resistance

Essia Sebai², Amel Abidi², <u>Hafidh Akkari¹</u>

¹Laboratory of Parasitology, National Veterinary School of Sidithabet, Tunisia ²Laboratory of Bioactive Substances, Centre of Biotechnology of BorjCedria, Box 901, Hammam-Lif, 2050, Tunisia

Salmonella frequently cause food-borne illness in humans. There are few data on the prevalence, antimicrobial susceptibility and genetic diversity of *Salmonella* isolates in retail meats in Tunisia. A total of 315 samples of chicken (60), beef (144), minced meat (56), lamb meat (33), merguez (typical Tunisian sausages) (10) and marine fish (12) were collected from various local outlet stores and abattoirs in the area of "Grand Tunis", Tunisia between 2016 and 2018 (last available survey). Salmonella was recovered from 80 samples with the highest occurrence in chicken (48.3%) followed by beef (29.8%), minced meat (10.7%) and lamb (6.0%). No Salmonella were isolated from 12 fish and 10 merguez samples. Nine serovars were identified among the isolates, with the predominance of Salmonella Typhimurium (n=25) followed by Salmonella Kentucky (n=14), Salmonella Suberu (n=12) and Salmonella Zanzibar (n=11). Isolated Salmonella were characterized by serotyping, pulsed-field gel electrophoresis (PFGE), plasmid content and antimicrobial resistance profiling. Sixteen (20.0%) Salmonella isolates displayed resistance to antimicrobial agents: ampicillin (13 isolates), streptomycin (five isolates), cefoperazone (two isolates) and furazolodine (two isolates), with seven of these isolates displaying multiple resistance to at least two of these antimicrobial agents. PFGE analysis showed homogenous restriction patterns in each serovar. All ampicillin-resistant strains carried bla_{CMY}. PFGE using XbaI and BlnI showed that certain clones were widely dispersed in different types of meats and meat brands from different store chains in all three sampling years. These data indicate that Salmonella Typhimurium is a common serovar in retail meats and includes widespread clones of multidrug-resistant strains. Continuous monitoring of its prevalence and resistance in the food supply, along with other Salmonella serotypes of public health importance, will significantly enhance the surveillance of Salmonella infections and future outbreak investigations.

Turkish consumers' attitudes toward cultured meat

<u>Cigdem Basfirinci</u>¹, Aleyna Akcay¹

¹Trabzon University, Turkey

The livestock industry causes many undesirable effects on land use, water consumption, climate change, waste production, greenhouse gas emissions, global warming and biodiversity. Concerns over the impact of global meat production regarding the ecological footprint are leading to increasing interest in cultured meat. Cultured meat is produced by culturing animal cells in an in vitro laboratory process, which could potentially be more efficient and environmentally friendly than conventional meat production. The production of cultured meat may in the future contribute to covering the global protein demand. However, it also raises its own ethical issues, e.g., due to the continuing need for foetal calf serum in the culture media. Also how consumers perceive cultured meat is largely an open question. This study addresses Turkish consumers' perceptions and attitudes toward cultured meat through analyzing in depth interviews with 52 meat consumers reached by convenience sampling and 41 vegan and vegetarian consumers reached by snowball sampling method. Taken together, findings reveal that participants have a general awareness of cultured meat. Specific results show that vegan and vegetarian participants, whose main motivation is animal welfare, consider cultured meat as a positive development. Meat consumers, vegans and vegetarians are all curious about the taste of artificial meat and express their willingness to try it. But in general, consumers' attitudes towards cultured meat are negative. They are particularly concerned about issues such as health, content, taste, price and risks of cultured meat, and these perceptions vary between vegans, vegetarians and meat consumers. This research presents the first study of Turkish consumers' acceptance of cultured meat, and it is part of a research agenda towards understanding the consumer acceptance of cultured meat as an alternative protein source.

The presence of Escherichia coli in fresh meat samples in Tirana's market

<u>Bizena Bijo</u>¹, Frans Meminaj¹, Egon Andoni¹, Fatmira Shehu¹

¹Agricultural University of Tirana, Faculty of Veterinary Medicine, Albania

Food borne diseases caused mainly by Escherichia coli, Salmonella species and Staphylococcus aureus are the major causes of mortality and infections especially in the developing countries. These pathogens are transmitted mainly through consumption of contaminated food, and the presence of these organisms in meat and raw meat products has relevant public health implications (Zafar et al., 2016). From the period of June to October 2021, a study was performed with 90 fresh meat samples equally taken from three meat brand shops considered among the biggest in Tirana, Albania's capital city. All three stores applied Good Hygiene Practices (GHP). Thirty samples each were taken of poultry, beef and pork meat. Sampling was based on the ISO/TS 17728:2015 method. Within one hour, the samples were transported to the Laboratory of Food Microbiology at the Food Safety and Veterinary Institute in Tirana. BS ISO 16649-2:20013 method was applied during the experimental procedure, which describes the enumeration of β -Glucuronidase positive *E. coli* by pour plate. Results were calculated based on the formula: count per g = count/volume tested x dilution. The results obtained in the chicken meat samples indicated that three samples (10%) had unsatisfactory results, specifically with loads of 750, 1300 and 1700 cfu/g E. coli. One sample had an acceptable result of 420 cfu/g E. coli, and the rest were satisfactory. In the beef samples, three samples (10%) that had an unsatisfactory result were observed, specifically with loads of 700, 780 and 810 cfu/g E. coli. Three samples had acceptable results of 140, 370 and 480 cfu/g (10%) E. coli, and the rest were satisfactory. In the pork samples, it was observed that three samples were within an acceptable limit of 120, 140 and 200 cfu/g (10%) E. coli, and the rest were satisfactory. The test results demonstrate the microbiological quality of poultry, beef and pork meat. The interpretation of the results is based on Commission Regulation (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs. This study shows a higher E. coli load in chicken and beef than in other meats. We found that the stores from which the samples were taken, even though they declared the implementation of GHP, neglected some hygienic aspects, so there was a lack of medical certificates for some of the employees and non-respect of the meat expiration date. These findings do not exclude the possibility of contamination of the meat along the production chain prior to marketing. This research highlights the necessity for systematic microbiological meat evaluation and hygienic practices to ensure the quality of meat products.

Assessment of agonic aspiration of blood lung lesions as an animal-based indicator of electrical stunning ineffectiveness in pigs

M.F. Ferreira¹, I. Pires^{2,3,4}, M.M. Vieira-Pinto^{2,3,4}

¹School of Agrarian and Veterinary Sciences (ECAV), University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal

²Department of Veterinary Sciences, University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal

³CECAV—Veterinary and Animal Research Centre, University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal

⁴Associate Laboratory for Animal and Veterinary Sciences (AL4AnimalS), 5001-801 Vila Real, Portugal

During the slaughter of pigs, agonic aspiration of blood (AAB) may result from an inadequate exsanguination with accidental trachea severing, that can be favoured by an ineffective stunning. In pigs, electrical stunning ineffectiveness can be individually assessed by evaluating animal-based measures such as the presence of rhythmic breathing. This study aimed to investigate the incidence of lung lesions of AAB at post-mortem inspection of pigs (Sus do*mesticus*) as an animal-based indicator of electrical stunning ineffectiveness. The presence of such lesions was also evaluated regarding the grade of extent observed. For that purpose, information about a total of 3584 finishing pigs from 73 random batches was collected at a Portuguese abattoir performing a head-to-body electrical stunning with horizontal bleeding. In the present study, 15.4% of the pigs showed rhythmic breathing at bleeding. AAB lung lesions were found in 27.8% lungs during post-mortem inspection. Statistical analysis did not show any correlation between inefficiently stunned animals and detection of AAB lesions in the lungs. On the contrary, there was a good correlation between animals stunned properly and detected AAB lesions, which highlights the need for future research to better understand the process of (agonic) aspiration of blood. Also, the predominance of blood lesions affecting exclusively or mostly the equivalent side of the lungs (left or right lungs) may indicate that horizontal bleeding can have an impact on slaughter technopathies, leading to lesions resembling AAB lesions. In conclusion, given the conditions of our survey, blood aspiration in pigs' lungs should not be used by official veterinarians as an indicator of compromised animal welfare at the moment of slaughter. On the other hand, this study raises awareness regarding failure of stunning on a first attempt using a stun-to-kill method.

Tail assessment in pigs at the abattoir: What are we missing?

<u>Alice Gomes</u>¹, Claudia Romeo^{2,3}, Ghidini Sergio², Madalena Vieira-Pinto^{1,4}

¹University of Trás-os-Montes e Alto Douro (UTAD) 5001-801 Vila Real, Portugal

²Department of Food and Drugs, University of Parma, Via del Taglio 10, 43126 Parma, Italy

³Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna, via Bianchi 9, 25124 Brescia, Italy

⁴Animal and Veterinary Research Centre, UTAD, 5001-801 Vila Real, Portugal

⁵Department of Veterinary Science, University of Trás-os-Montes e Alto Douro (UTAD) 5001-801 Vila Real, Portugal

Tail biting is recognized as a major welfare problem in pig production. Tail lesions are known to be a port of entry for pyogenic bacteria to access the bloodstream. Since it can take up to weeks for the abscesses to develop, by the time the pig reaches the abattoir, it is possible to encounter carcasses with both purulent osteomyelitis/multiple abscesses and an apparently healed tail. This study aimed to evaluate tail biting prevalence in slaughtered pigs and explore the relationship between tail lesions and tail length, production system and carcass condemnations. Scarred lesions and their importance were also assessed. Data on a total of 9189 pigs with different tail lengths (undocked, docked mid-length, fully docked) and from distinct production systems (conventional, conventional without the administration of antimicrobials, organic) were collected. Total and partial carcass condemnations were registered. Due to the speed of the slaughter line, it was only viable to classify a subset of 3636 animals, who had their tail classified by two scores: the lesion score (relating to recent tail lesions) and the scarring score (which evaluated scarred tissue). Batches with higher lesion scores had a greater chance of total condemnation (p=0.014, OR=1.81), and were even more associated with scarred lesions (p=0.0002, OR=3.24). The major cause for total condemnation was pyaemia. The within-batches probability for local condemnation due to abscesses (p<0.0001, OR=3.65) increased significantly with higher scarring scores. The probability of observing tail lesions also varied with tail length, with undocked pigs having higher odds of showing severe lesions (p=0.0001, OR=3.11, and OR=2.10). Regarding husbandry systems, organic farms had a higher probability of total condemnation when compared to the other two production systems (p=0.0263, OR=2.27, and OR=4.36). Undocked pigs were more likely associated with severe tail lesions and abscess condemnations. Thus, the disuse of the docking procedure should be carefully assessed. It is argued that organically raised pigs have a higher level of animal welfare due to the less intensive production conditions, but tail biting could still be observed in our study. As both tail scores increased, the probability of observing total condemnation was higher. Overall, the scarring score displayed a more relevant role than the scoring system for recent lesions. Scarred lesions can also work as a welfare indicator regarding farm conditions and should be included in the tail surveillance program.

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Total and partial condemnations during meat inspection of finishing pigs in a large abattoir in the North of Portugal: Frequencies and estimation of economic losses

Mariana Guerreiro S. Pinto¹, Maria Rodrigues da Costa², Madalena Vieira-Pinto¹

¹Animal and Veterinary Research Center (CECAV), Department of Veterinary Science, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal

²Centre for Epidemiology and Planetary Health, Department of Veterinary and Animal Science, Northern

Faculty, Scotland's Rural College (SRUC), An Lochran, 10 Inverness Campus, Inverness, IV2 5NA, Scotland, UK

Meat inspection (MI) is undoubtedly a crucial step needed to assure public and animal health. During this activity, pathological conditions can often be found by the official veterinarian (OV). For each gross pathological found, OVs need to apply a judgement criterion to decide if meat is unfit for human consumption, resulting in total or partial condemnations. Condemnations may represent the sanitary profile of the farm having a negative effect on productivity and profitability of food business operators. The main objectives of this study were: to describe the most common post-mortem causes of partial and total condemnations in finisher pigs in a large abattoir in the North of Portugal; and to estimate the cumulative economic losses incurred by producers due to those condemnations. From December 2022 to February 2023 (data collection still ongoing), data on the partial and total condemnation causes was recorded at pig and herd level in one large abattoir in Portugal. Individual costs (deduction from payment) for condemnations of heart (1.50 €/Kg), liver (0.70 €/Kg), and lungs (0.35 €/Kg), were estimated based on abattoir input. Costs associated with total condemnations were estimated using pig meat price and carcass weight (2.252 €/Kg). The cumulative losses in condemnations per farm were computed. From December to January, the records of 4429 pig carcasses belonging to 46 farms were gathered. The most common total condemnations were purulent osteitis (51.2%), osteomyelitis (32.5%) and purulent arthritis (9.3%). A total of 43 carcasses were totally condemned, corresponding to an estimated economic loss of 8521.50 €. Regarding partial condemnations, the most prevalent cause was blood aspiration followed by liver parasitism and pericarditis. The total amount of economic losses regarding lungs, liver and heart rejections were 962.80 €, 1009.40 € and 652.50 €, respectively. Few publications were found on the types and frequencies of partial condemnations. In this study, the estimation of cumulative losses incurred by individual producers may be a useful exercise to raise awareness for health and welfare issues and for the avoidable losses and waste generated. Benchmarking exercises may be useful and should be encouraged to promote the real use of backward tracing regarding relevant findings from the slaughterhouse to the farm of origin according to Reg. (EC) No. 2074/2005 and subsequent use in the food chain information.

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Small contaminations on broiler carcasses are more a quality matter than a food safety issue – A Monte Carlo simulation study

Kacper Libera¹, Len Lipman¹, Boyd R. Berends¹

¹Institute for Risk Assessment Sciences (IRAS), Faculty of Veterinary Medicine, Utrecht University, 3584 CM, Utrecht, The Netherlands

During poultry processing, chicken carcasses can be soiled with different types of contaminating materials including faeces, crop content, bile and grease. Even marginally contaminated chicken carcasses can be classified as unfit for human consumption according to European Union (EU) food safety regulations. However, it is essential to establish if these small contaminations actually increase the already present bacterial load of the carcasses to such a degree that the risk of foodborne disease is significantly elevated for the consumers. Therefore, our study investigated the influence of bacteria counts from different types of small contaminations on the already existing chicken carcass microflora. The bacterial counts (total aerobic plate count, Enterobacteriaceae, Escherichia coli and Campylobacter spp.) were obtained from the literature and used as input for the Monte Carlo model with 50,000 iterations for each simulation. According to the simulations, the presence of minute spots of faeces, bile, crop content and slaughter line grease will not lead to a considerable increase of the already existing biological hazards present on the carcasses and should, thus, be considered a matter of quality rather than food safety. Nevertheless, the producers along with meat inspectors still should care about any visible contaminations of the carcasses, since they might be the signs of improper functioning of the slaughterhouse machinery. However, greater emphasis should be placed on the microbial criteria with proven food safety implications as described in EU regulation 2073/2005.

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Meat inspection legislation in Serbia

<u>Dragana Ljubojević Pelić</u>¹, Miloš Pelić¹, Milica Živkov Baloš¹, Nedjeljko Karabasil², Bojan Blagojević³

¹Scientific Veterinary Institute Novi Sad, Serbia
²Faculty of Veterinary Medicine, University of Belgrade, Serbia
³Department of Veterinary Medicine, University of Novi Sad, Serbia

The aim of this work is to present the current legislative framework of the Republic of Serbia (RS) in the field of meat inspection. Serbia, as a candidate country for membership in the European Union (EU) since 2012, started to harmonize legislation with the EU and published a set of laws and regulations related to animal welfare and food safety, including the official control of food production, processing and distribution. The Law on Veterinary Matters (Official Gazette of the RS, No. 91/05) adopted in 2005 defines duties of a veterinary inspector. The veterinary inspector's duties can be performed by a veterinary graduate with at least three years of work experience in the field, who successfully passed the Inspector Exam. In addition, meat inspection can be performed by a veterinarian with a license issued by the Serbian Veterinary Chamber after having completed a professional training program and being employed at a veterinary station (official veterinarian, OV). The Law on Food Safety (Official Gazette of the RS, No. 41/2009) lists food business operators' (FBOs) duties and responsibilities to ensure that food meets all the hygiene and safety requirements. Based on that national law and regulations adopted on a basis of it, competent authorities perform official controls of FBOs' compliance with the relevant requirements. Meat inspection is practically conducted on the basis of the Rulebook (a by-law that elaborates certain legal provisions or Government regulations) on the method of performing official control of animals before and after their slaughter (Official Gazette of the RS, No. 99/2010). Furthermore, the Rulebook on the method of official control of animals before and after their slaughter for the presence of Trichinella in meat (Official Gazette of the RS, No. 48/2022), the Rulebook on veterinary-sanitary conditions, in terms of regulation on general and specific food hygiene of food of animal origin (Official Gazette of the RS, No. 25/2011) and the Rulebook on the form and content of the stamp, i.e., the certificate of game safety for human consumption, as well as the method and procedure of marking food of animal origin (Official Gazette of the RS, No. 44/2007) are in force. The legal framework for the adoption of Serbian regulations aligned with the EU acquis is established through the adopted rulebooks, and will be further harmonized with the recent EU legislation on meat inspection (i.e., Regulation EU 2019/627).

A multiclass method for the determination of veterinary drug residues in bovine meat using LC-MS/MS

<u>Arzu Yavuz</u>¹, İsmail Azar¹, Vesile Çetin¹, Ali Özcan¹

¹Central Research Institute of Food and Feed Control, Bursa, Turkey

In modern animal husbandry applications, the use of veterinary drugs is extremely important for efficient and safe food production and also animal health. These veterinary drugs can cause residues in foods of animal origin consumed by humans. Foods containing veterinary drug residues pose many risks to human health, especially antibiotic resistance. These risks highlight the importance of monitoring foods of animal origin in terms of veterinary drug residues. Although sensitive and reliable analytical methods for the determination of veterinary drugs in meat are strongly required for meat safety assurance systems, multiclass methods for veterinary drugs are still limited. Today, LC-MS/MS (liquid chromatographytandem mass spectrometry), which has high selectivity and sensitivity, is the most common technique used in the detection and quantification of veterinary drug residues, and the current trend in drug residue analysis is the development of multi-residue methods that can monitor a wide variety of compounds belonging to different classes. In this study, a method for the detection of veterinary drug residues in bovine meat was optimized and validated. Within the scope of the optimized method, veterinary drug residues from nine different groups (sulfonamide, quinolone, tetracycline, penicillin, benzimidazoles, anticoccidials, antiinflammatory nitroimidazole, amphenicol) were analyzed in bovine meat. The analysis of veterinary drugs by LC-MS/MS used at least two product ions obtained from the fragmentation of the molecular ion determined for each veterinary drug. The ratios and retention times of the selected ions were also taken into account in the identification of the analytes. In the validation study, linearity, trueness/recovery, precision (repeatability, reproducibility), CC α and CC β parameters were performed. These parameters were carried out according to the requirements outlined in Commission Decision 2002/657/EC. If there is a maximum residue limit of analytes in Commission Regulation (EU) No 37/2010 in bovine meat, it has been taken into account. The results of this study showed that this method is suitable for the determination of veterinary drugs in bovine meat, and thus, it will contribute to meat safety assurance systems.