

CA18105



RIBMINS

Risk-based meat inspection and
integrated meat safety assurance

Process from traditional to visual-only meat inspection

Lis Alban | 13-Jun-23 | Virtual training school

Traditional inspection

Objective of inspection is to ensure:

- Food safety, animal health and welfare, detection of notifiable infections – and to satisfy trade partners' requirements

Consists of visual inspection, palpation and/or incisions into different organs and tissues

- Detailed specification for post-mortem inspection of finishing pig is presented in next slides
- Based on former EU Meat Inspection Regulation



Traditional inspection – pigs (1/3)

Area	Investigation
Head	Visual inspection
Lnn retropharyngei/mandibularis	Inspection, palpation and incision
Tongue	Visual inspection
Oral cavity and pharynx	Visual inspection
Tonsils	Removed
Trachea	Visual inspection
Oesophagus	Visual inspection
Lungs	Visual inspection and palpation
Lnn bifurcationis	Palpation
Lnn eparterialis	Palpation
Lnn mediastinales	Palpation

Traditional inspection – pigs (2/3)

Area	Investigation
Heart	Visual inspection
Pericardium	Visual inspection
Heart ventricle	Incision to open
Heart septum	Visual inspection
Heart valves	Visual inspection
Diaphragm	Visual inspection
Liver	Inspection, palpation and incision
Gastro-intestinal tract	Visual inspection
Mesenterium	Visual inspection
Lnn gastrici and mesenterici	Inspection and palpation
Spleen	Visual inspection

Traditional inspection – pigs (3/3)

Area	Investigation
Kidneys	Visual inspection
Peritoneum	Visual inspection
Pleura	Visual inspection
Genitals	Visual inspection

Questions raised in the 1990s

- To which extent would visual inspection suffice to detect what needs to be detected?
- Are there other approaches than just looking at the individual slaughter animal that could be more cost-effective?
- Who bears the role for ensuring meat inspection?

White paper about food safety, 1999

Introduced concept of

1. Risk-based approach
2. Stable-to-Table line of thinking
3. Food Business Operator's responsibility

Elements are basic principles for the EU General Food Law

- EU Regulation 178/2002

Concept addressed in former EU Meat Inspection Regulation 854/2004

- Allowed use of *risk assessments*, when considering changing meat inspection
 - **From traditional to a more visual inspection**
 - For young calves and finishing pigs, raised under controlled housing conditions

Risk assessments undertaken in Denmark

To illustrate the effect of changing inspection

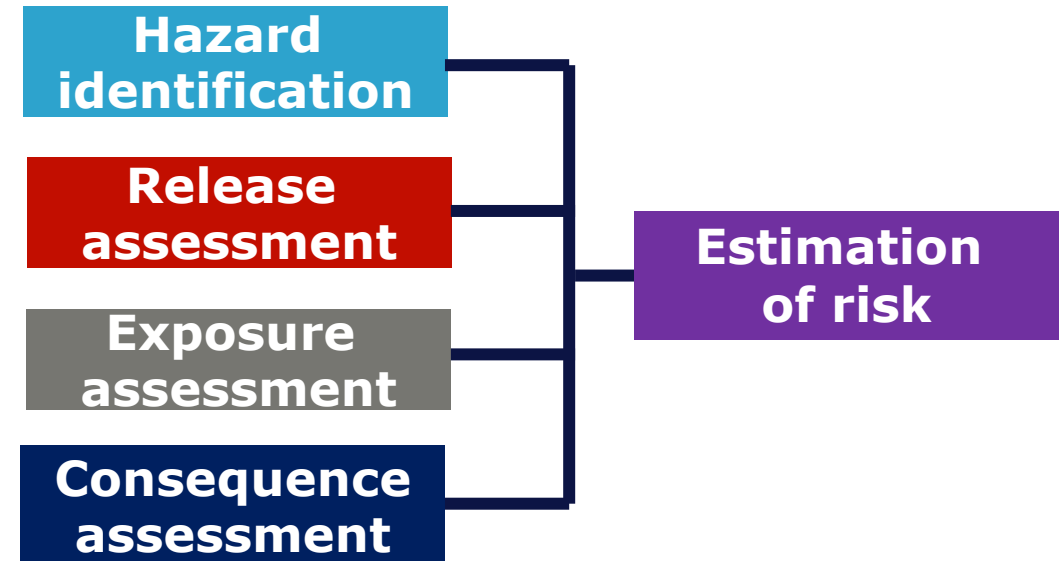
- Cut-by-cut, palpation-by-palpation
- OIE approach to risk assessment

Up-to-date-in-country data used

- Danish meat inspection database
- Samples from slaughter/inspection
- Worldwide published literature
- Expert opinion, when needed

Collaboration

- Academia-Authority-Industry



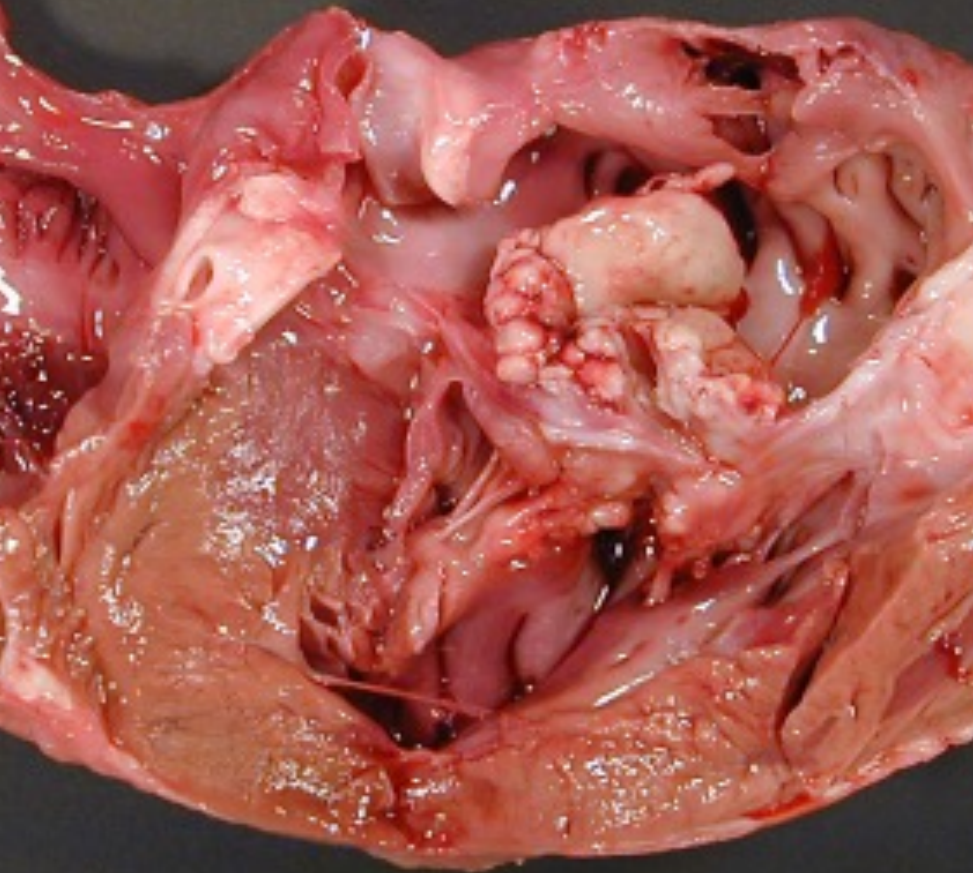


Photo: Henrik Elvang Jensen

Example: The heart

Risk associated with abandoning routing incision?

- Inspection of inner side of the heart is disabled
 - Endocarditis may be overlooked
 - Prevalence 0.01% in Danish finishing pigs
- Hazard identification
 - *Streptococcus suis* and *Erysipelothrix rhusiopathiae*
 - Occupational hazards that are not foodborne
- Release/exposure/consequences
 - Years' of focus on work safety → Not considered a problem among abattoir employees' union
 - 1 case of human meningitis (a farmer) caused by *S. suis* in 3-year study by Statens Seruminstitut

Example: The heart, continued

Conclusion

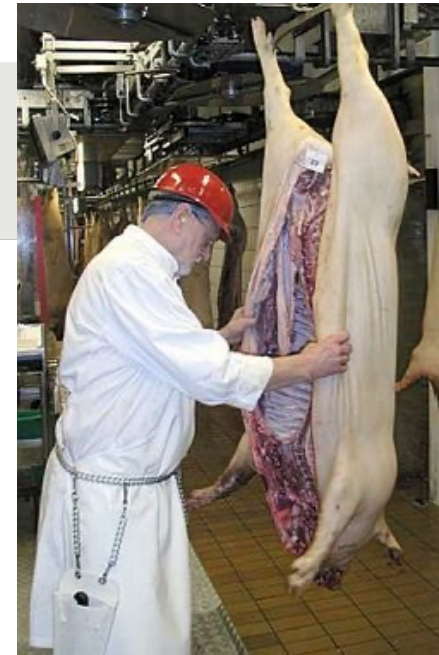
- Presence of endocarditis *per se* does not render the meat unsafe for human consumption

If other lesions are found indicative of systemic infection

- Such as abscesses that could be part of a septicaemia complex
- Then carcass should go to rework area and be subjected to traditional inspection

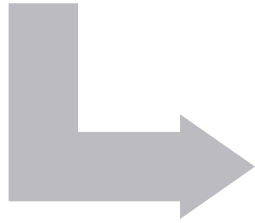
Handling of heart

- Danish solution: heart is opened by an abattoir employee
 - Condemned, if lesions are found
 - To reduce exposure of consumers to *S. suis* and *Erysipelothrix rhusiopathiae*



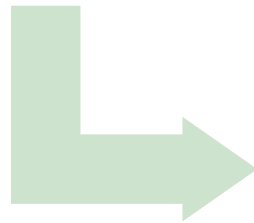
**EU
Regulation
854/2004**

- Opened up for use of risk assessments in indoor finishing pigs



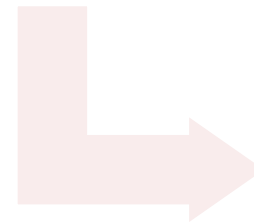
**Risk assessment
for heart and
mandibular
lymph nodes,
2008**

- **Concern:** Risk of overlooking tuberculosis and endocarditis



**Risk
assessment for
intestinal lymph
nodes, 2009**

- **Concern:** Risk of overlooking disease only in intestines or their lymph nodes



**Risk
assessment
for the
lungs, 2013**

- **Concern:** Risk of overlooking embolic pneumonia caused by septicaemia

Process 2004-2013 for Danish risk assessments about replacing traditional inspection with visual-only in finishing pigs, raised indoors

Meat inspection updated + Next steps

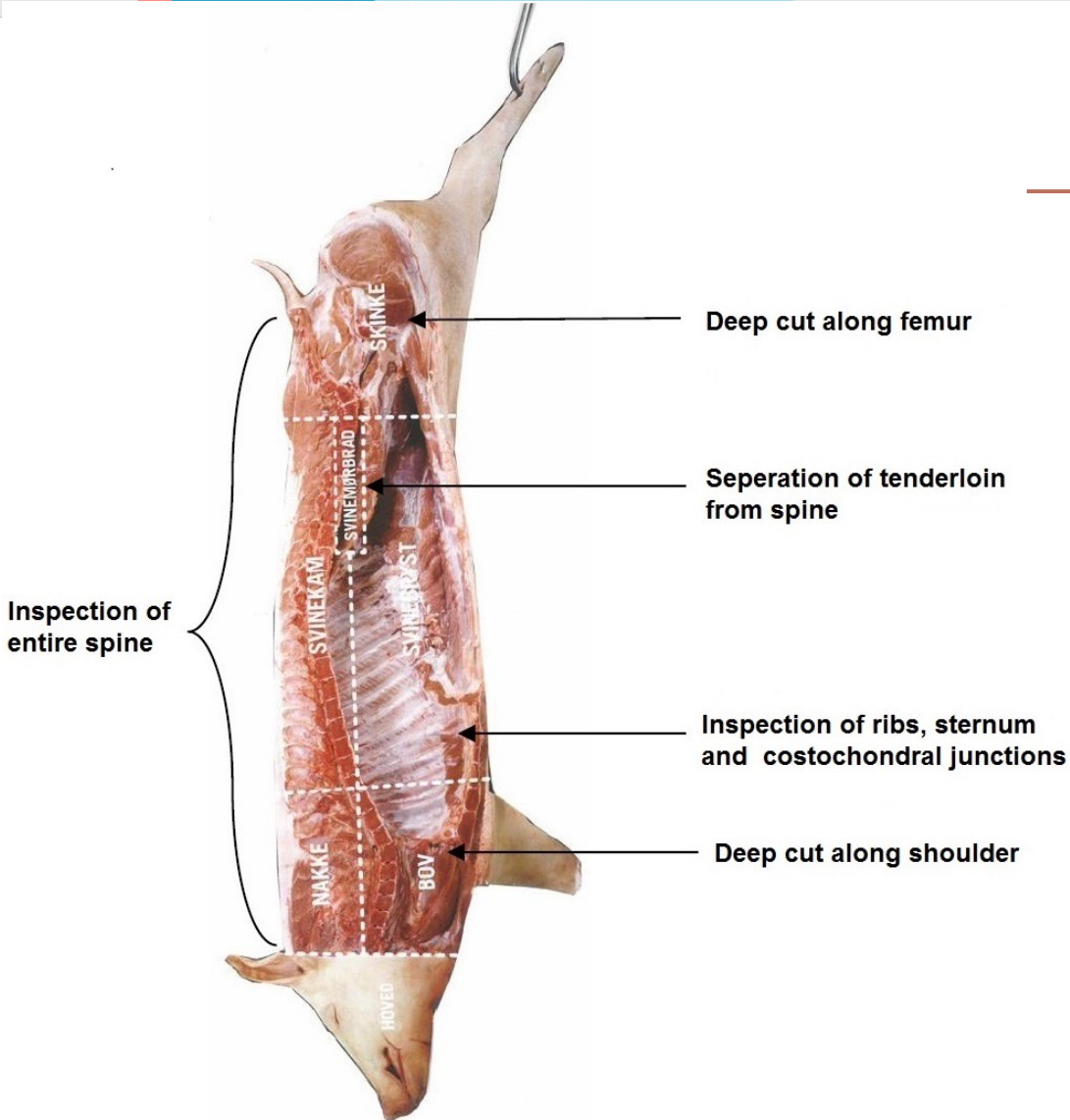
Supply Chain Meat Inspection

- First, routine opening of the heart and incisions into the masseter muscles were abandoned
 - Next, palpation of the lungs was abandoned
- Only for indoor-raised finishing pigs
 - With no serious lesions detected during post-mortem
 - Due to EU legislation at that time + requirements set by trade partners

New question – lesions indicating prior generalised disease

- Microbiological burden in such pigs/sows?
 - Cost-effective detection and handling?

Suspicion of septicaemia



Presence of lesions indicative of septicaemia

- Needs careful evaluation
- In Denmark, so-called "pyaemia" investigation is undertaken in rework area
 - Acute cases → Total condemnation
 - Chronic cases → De-boning

Lesions probably caused by tail bite, which occurred months earlier

- In many cases, lesions are in healing
- Deboning will ensure that abscesses are detected and removed

Low quantitative number of *S. aureus* in finishers with lesions indicative of septicaemia

Table 2

Quantitative presence of *S. aureus* in various sites in each of 19 finisher pigs identified with embolic pneumonia during traditional meat inspection. carcasses (final judgement of the carcass and presence of ulcer).

Numbers of bacteria (CFU) per sample ^a								
Pig no.	Final judgement	Lung	Muscle	Heart	Liver	Kidney	Spleen	Joint
1	De-boning	>200	3	0	1	28	0	0
2	Condemnation	0	2	8	0	0	0	0
3	Condemnation	0	N/a	0	0	0	0	0
4	De-boning	>200	0	~150	87	44	0	0
5	De-boning	0	0	2	0	115	N/a	0
6	De-boning	>200	8	1	0	10	~50	~100
7	De-boning	0	1	0	0	~50	2	0
8	De-boning	>200	5	0	0	0	0	0
9	De-boning	>200	0	0	0	0	0	0
10	De-boning	0	0	0	0	0	0	N/a
11	De-boning	0	0	0	0	0	0	0
12	De-boning	~50	0	0	0	0	0	0
13	De-boning	>200	0	36	0	0	0	0
14	De-boning	>200	0	15	0	0	0	0
15	De-boning	>200	0	5	0	0	0	0
16	Condemnation	0	0	0	0	0	0	0
17	De-boning	0	0	15	0	0	N/a	0
18	De-boning	0	0	0	8	0	N/a	N/a
19	De-boning	>150	3	0	10	0	0	21

N/a.: Data not available.

^a Per sample represents a swap sample from lung, heart and joint and a tissue sample of approx. 1 g from muscle, liver, kidney and spleen. See S explanation.

Study of septicaemia in finishers, 2013-14

Cases collected at one abattoir during 2 weeks in 2013 (N=102)

- Main part of abscesses found in thoracic cavity
- Detected during pyaemia investigation

Location	Number	Distribution (%)
Thoracic cavity	50	42.0
Lumbal spine	21	17.6
Thoracic spine	17	14.3
Foreleg	14	11.8
Hindleg	10	8.4
Other ^a	5	4.2
Total	119	100.0

^a Tail bone, pelvis, jaw, neck, lungs.

Study of septicaemia in finishing pigs, 2013-14

All 102 finisher pigs sent for de-boning

- Accepted afterwards, although one abscess found

Most muscle samples sterile (83%)

- But only 6% sterile abscesses
 - *Streptococcus* sp., *Pasteurella* sp., *Trueperella pyogenes*, *Aeromonas* spp., *Ralstonia Pickettii* (judged as contaminant)

S. aureus only potential human pathogen (toxin production)

- No association between presence of bacteria in muscle and abscess

Data from 6 other abattoirs showed that some abscesses were missed

- Less efficient in finding all abscesses during pyaemia investigation

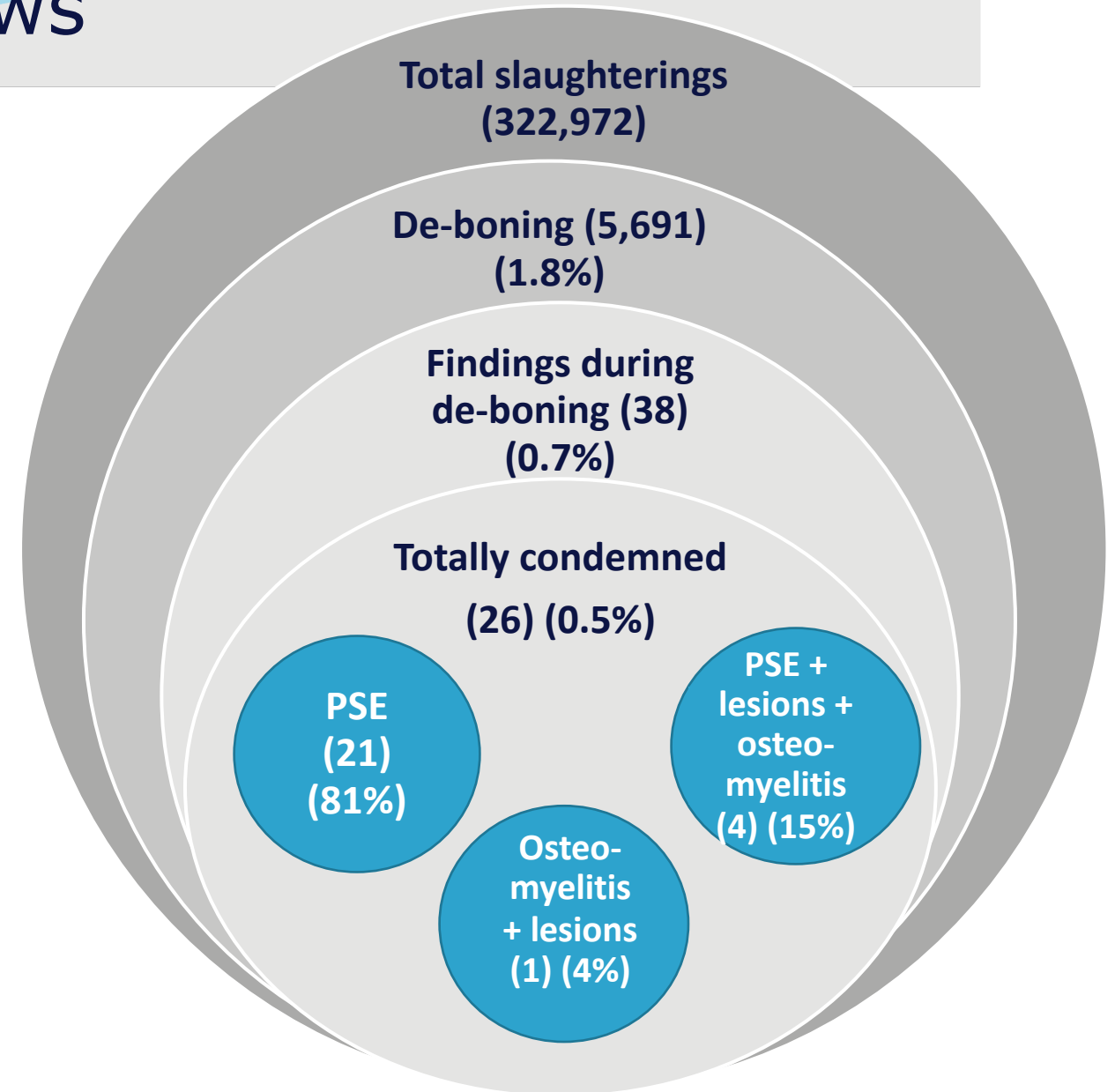
Prior septicaemia in sows

If lesions are found, indicating septicaemia

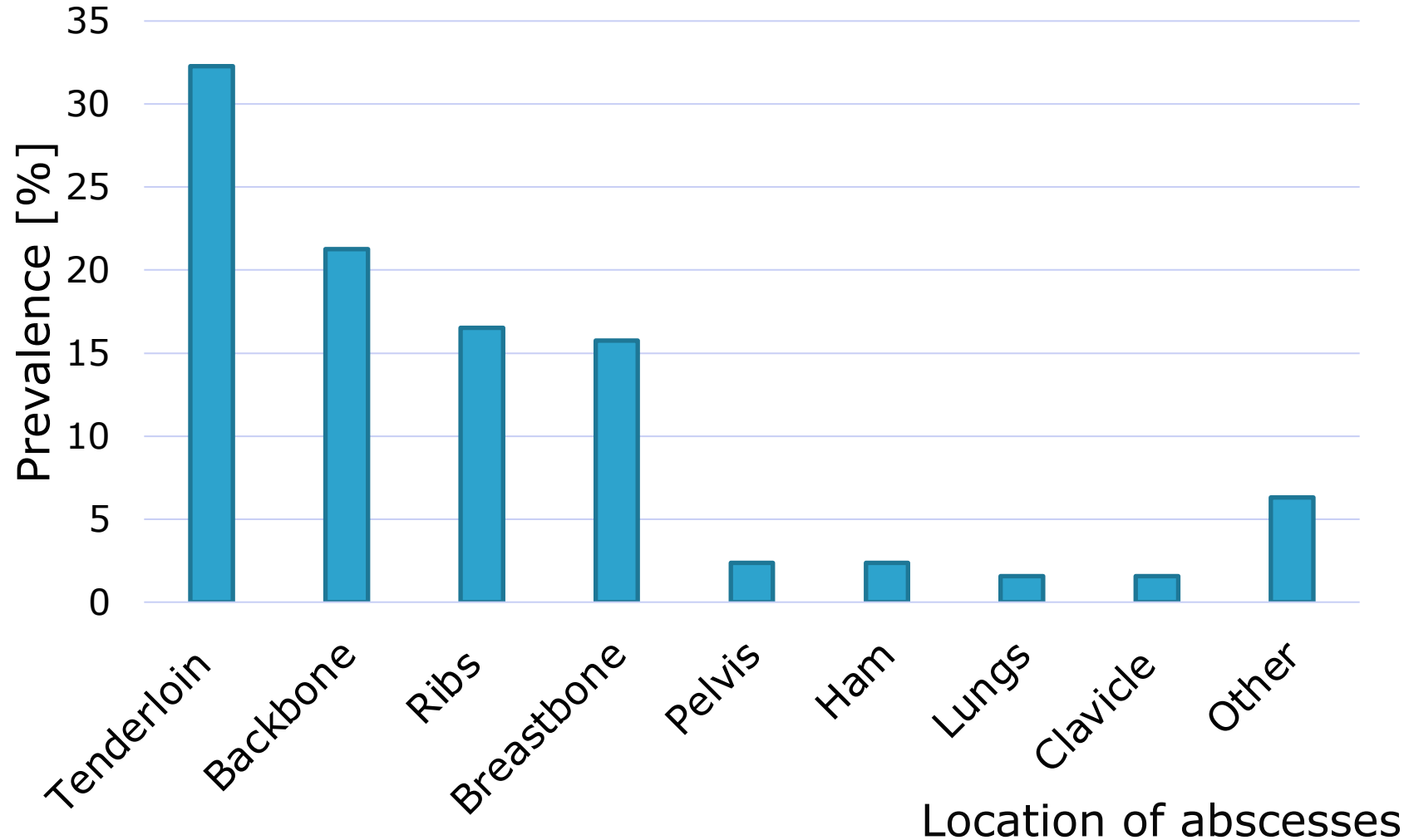
- Sows => destined for de-boning
 - As for finishing pigs

Data from one sow abattoir

- 14 months
- Very few abscesses escape detection during pyaemia investigation
- Only 5 cases out of 322,972 condemned due to septicaemia
 - Pedersen et al., Fleischwirtschaft International (2017)



Location of 127 abscesses in 105 sows/ boars



- Tenderloin most common location in sows/boars
- In contrast to finishing pigs, where thoracic cavity most common location

Studies of implementation of alternative handling of prior septicaemia cases, 2017-19

Study objective: find feasible alternatives to de-boning of chronic cases

- Studies done separately in sows and finishers
- Showed that some abscesses were overlooked in specific areas

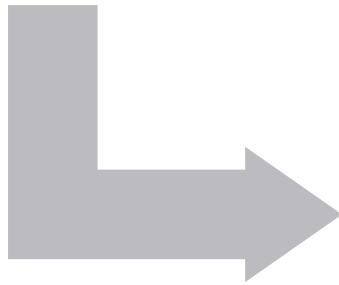
Action/New legislation in Denmark (finishers: 2018, sows/boars: 2019)

- Pyaemia investigation updated + targeted cutting described for own control
- Own control used by abattoirs => will result in lower costs because 1) no need for de-boning, 2) higher value of meat, and 3) no category 2 animal by-products



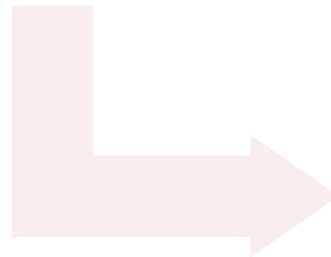
Microbiological burden of finishing pigs with septicaemia, 2013

- **Concern:** Meat from pigs with septicaemia could have high microbiological burden



De-boning of finishers and sows with lesions indicating prior septicaemia, 2013-15

- **Concern:** Osteomyelitis could be overlooked, if carcass is not de-boned



Implementation studies in finishers and sows, 2017-19

- Identify feasible and effective ways of detecting abscesses

Process 2013-2019 for Danish risk assessments about how to handle lesions indicative of prior septicaemia

Results of risk assessments – in general



Finishing pig have few lesions of importance to food safety

- Seriously ill pigs are supposed to be euthanised on-farm
- Body is clearing itself after infection
- Very low count of bacteria in muscles – bacteria also found in healthy controls

In most cases, lesions are macroscopically observable

- Except from endocarditis and small abscesses in lymph nodes
- Embolia in lungs may be overlooked, if few and only located deep in the tissue

Bacteria involved are usually not foodborne, but considered occupational hazards

- May cause infections in existing wounds in humans
- If lungs are considered edible tissue, then palpation should be done!

Tail bite

Infection

Septicaemia

**Clearing of
infection from
body**

Experienced gained



Approach led to a gradual implementation of visual-only inspection

For indoor finishing pigs, routine incisions/palpation was abandoned

1. Mandibular lymph nodes
2. Heart
3. Intestinal lymph nodes
4. Lungs

Unless data/findings during AM/PM indicate a need for additional inspection

Slaughter line modified

- Enabling inspection of plucks hanging over intestines
- Mirrors and lights to ensure documentation

Septicaemia studies provided evidence regarding microbiological burden

- and more cost-effective ways of detection and handling

Communication

Description of changes important

- Risk assessments written in English
- Scientific papers published in various journals

Presentations given, and discussions taken

- At scientific meetings and workshops for people involved in meat inspection

Dialogue with important trade partners

- To obtain acceptance of equivalence



Food Control 69 (2016) 177–184

Contents lists available at ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

The food safety value of de-boning finishing pig carcasses with lesions indicative of prior septicaemia

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danish meat association

66 Research & Development

Evaluation of the food safety risk associated with de-boning of Danish sows

Investigations on sows with chronic purulent lesions indicative of prior septicaemia

By Tanja Østergaard Pedersen, Anne Kristine Bækbo, Jesper Valentin Petersen, Marianne Halberg Larsen and Lis Alban

Assessment of risk associated with a change in meat inspection

- Is mandatory palpation of the liver and lungs a necessary part of meat inspection in finisher pigs?



International Journal of Food Microbiology 196 (2015) 32–39

Contents lists available at ScienceDirect

International Journal of Food Microbiology

journal homepage: www.elsevier.com/locate/ijfoodmicro

Assessment of human health risk associated with pyaemia in Danish finisher pigs when conducting visual-only inspection of the lungs

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Discussion – New EU Regulation difficult to comply with

In June 2014, new EU Meat Inspection Regulation came into force

- Stipulating that meat inspection of all swine should be visual-only
 - Irrespective of age or production system
- Unless food chain information (FCI) or info from AM or PM indicate otherwise
 - Hence, FCI system is a requirement for visual-only inspection

However, countries outside the EU did not allow this

- Creating a difficult situation for pig meat exporting Member States
- In Denmark, outdoor-raised pigs as well as sows and boars slaughtered at the export-oriented abattoirs are still inspected in the traditional way



Discussion – EFSA Opinion from 2011

EFSA identified hazards to be covered by meat inspection

- For swine: *Salmonella*, *Yersinia*, *Trichinella* and *Toxoplasma*
- Visual-only inspection could safely be introduced
 - Without jeopardizing food safety, animal health or animal welfare

Hazard identification should be updated regularly

- Hepatitis E virus? - Relevant hazard?
- Residues of antimicrobials in meat – Relevant hazard?

Septicaemia not covered in the EFSA Opinion

- Therefore, in DK, we did the work ourselves 😊
- Similar studies recently done in Portugal
 - Vieira-Pinto et al. (2020) Foods

Conclusion



Visual-only inspection of swine is safe

- Most lesions are macroscopically observable
- Few lesions in finishing pigs raised indoors
 - More in sows
- Gradual change allowed modification of slaughterline to ensure detection of lesions
- Led to better understanding of how to detect and handle prior septicaemia cases

Food Control 106 (2019) 106705

Contents lists available at [ScienceDirect](#)

 **Food Control**

journal homepage: www.elsevier.com/locate/foodcont

Review

From traditional meat inspection to development of meat safety assurance programs in pig abattoirs – The European situation

Sava Buncic^{a,*,1}, Lis Alban^b, Bojan Blagojevic^c



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