



CA18105



RIBMINS

Risk-based meat inspection and
integrated meat safety assurance

Risk assessment related to changing meat inspection

Lis Alban | 3-Feb-21 | Virtual training school

Meat inspection - historically

Aims of inspection

- To ensure food safety and wholesomeness of meat
 - Later: to ensure animal health and welfare

Rules known since antiquity

- Often connected to religious rites

Germany: leading country in the past centuries

- *Trichinella* epidemics and identification of *Trichinella* =>
 - Renewed interest for meat inspection – trichinoscopy
- Dr. Robert von Ostertag's meat inspection act of year 1900
 - Led to a reduced incidence of bovine TB in humans

100 years later, time for an update



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 178/2001

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

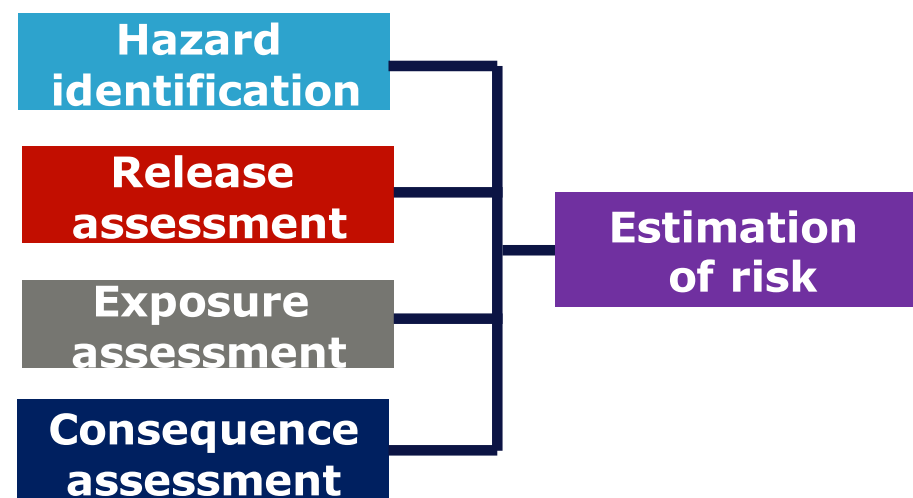
- Cut-by-cut, palpation-by-palpation
- OIE approach to risk assessment

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



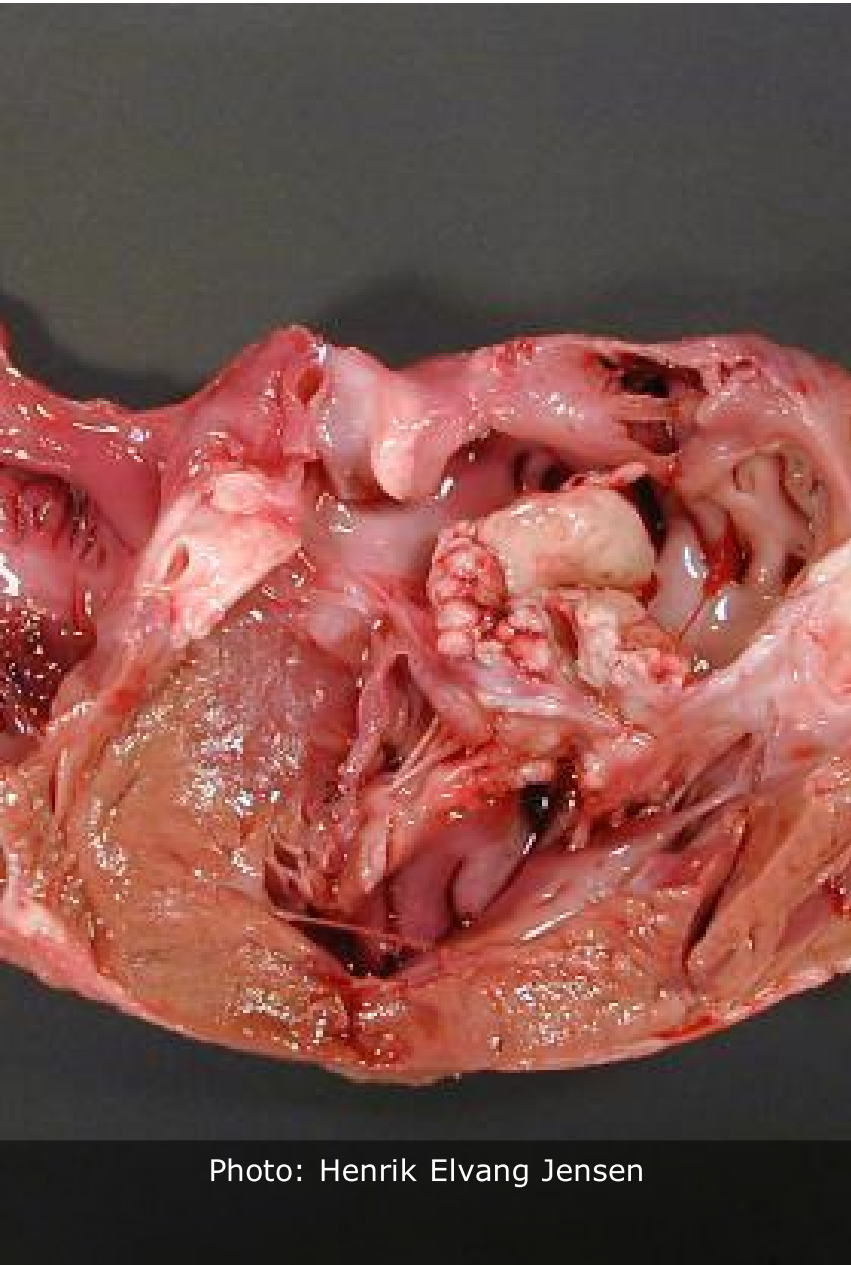


Photo: Henrik Elvang Jensen

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

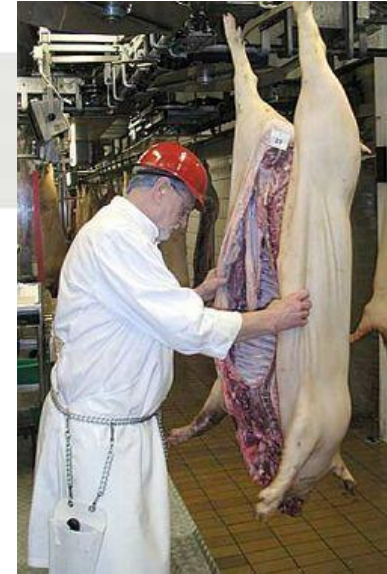
- Presence of endocarditis *per se* does not render the meat unsafe for human consumption

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

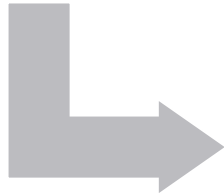
Handling of heart

- 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*



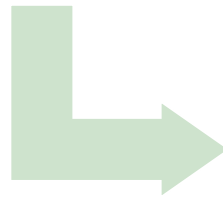
**EU
Regulation
854/2004**

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



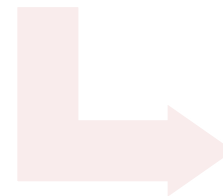
**Risk assessment
for heart and
mandibular
lymph nodes,
2008**

- **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

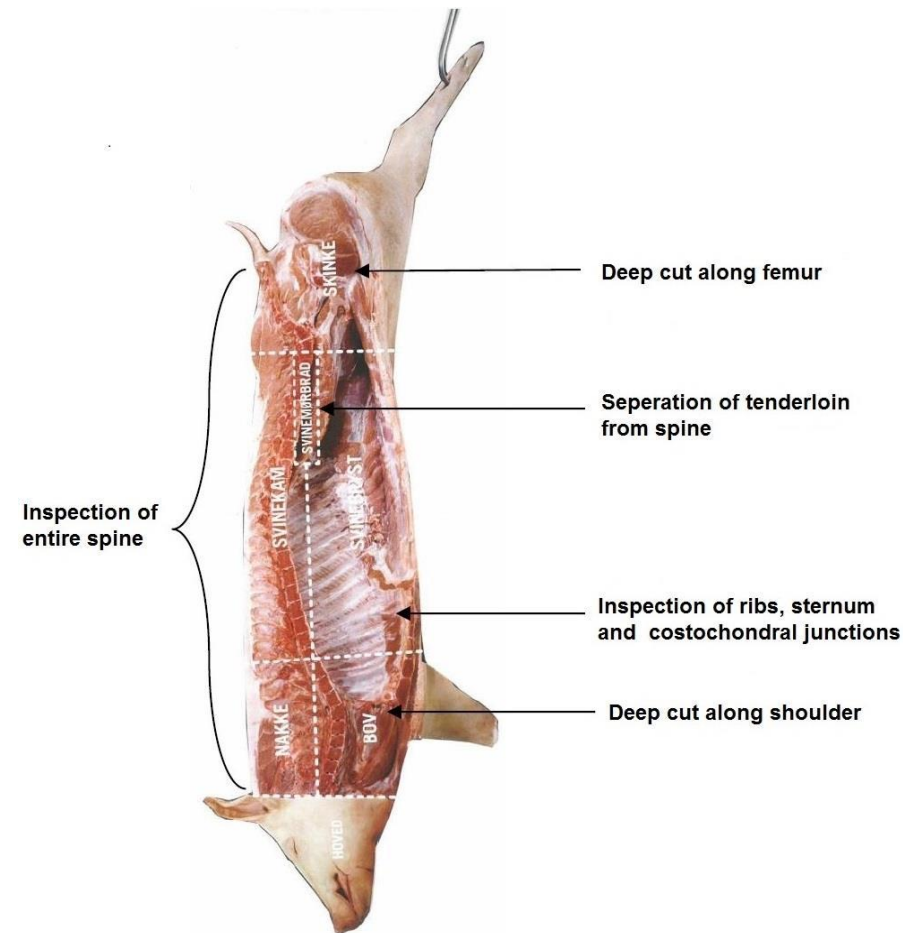
Supply Chain Meat Inspection

- 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

- Microbiological burden in pigs/sows previously suffering from generalised disease?
 - Cost-effective detection and handling of these cases?

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.

Kruse et al., 2015. Int. J. Food Microbiol.

Study of septicaemia in finishers, 2013-14

Cases collected at 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

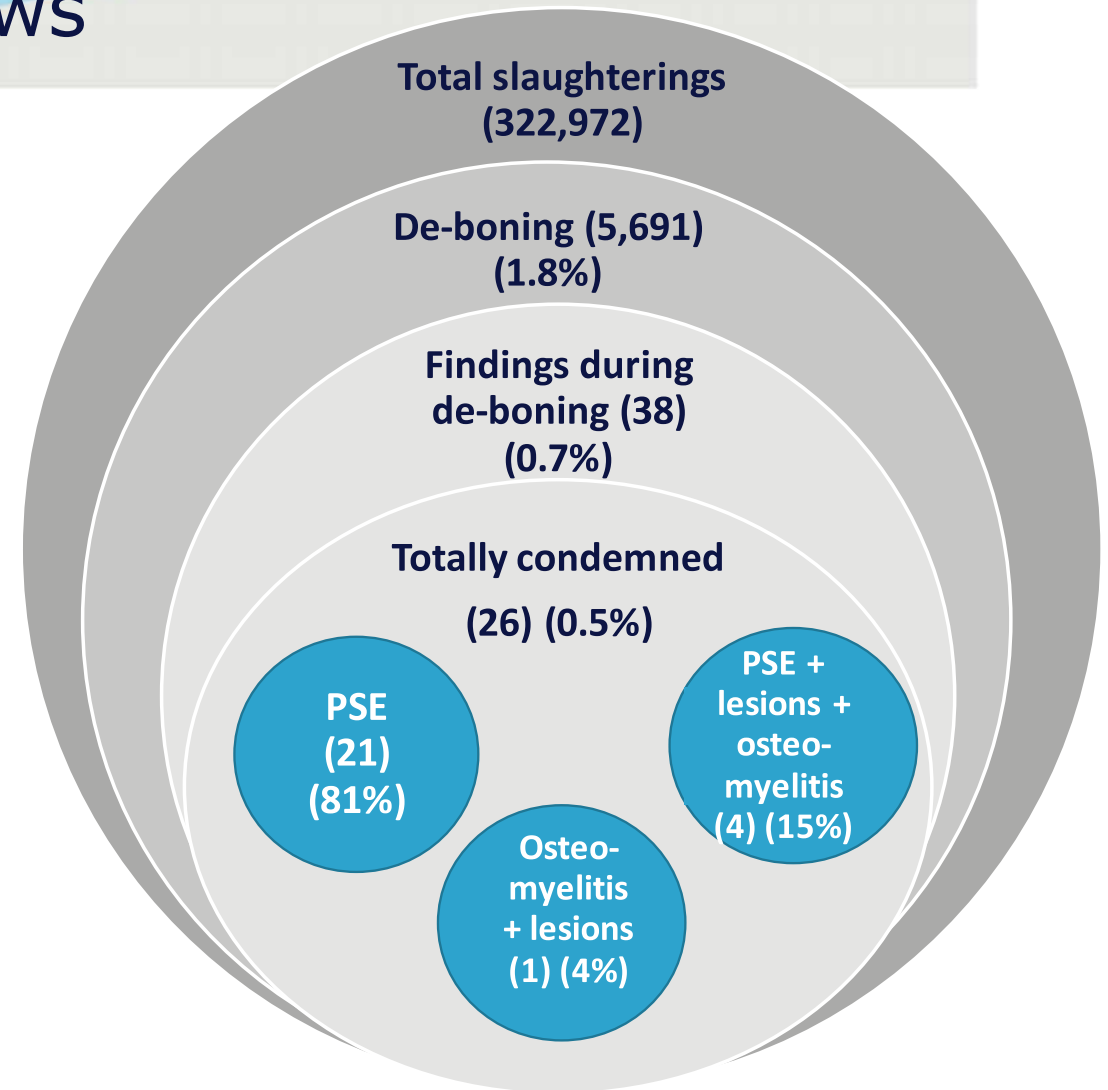
Prior septicaemia in sows

If lesions are found, indicating septicaemia

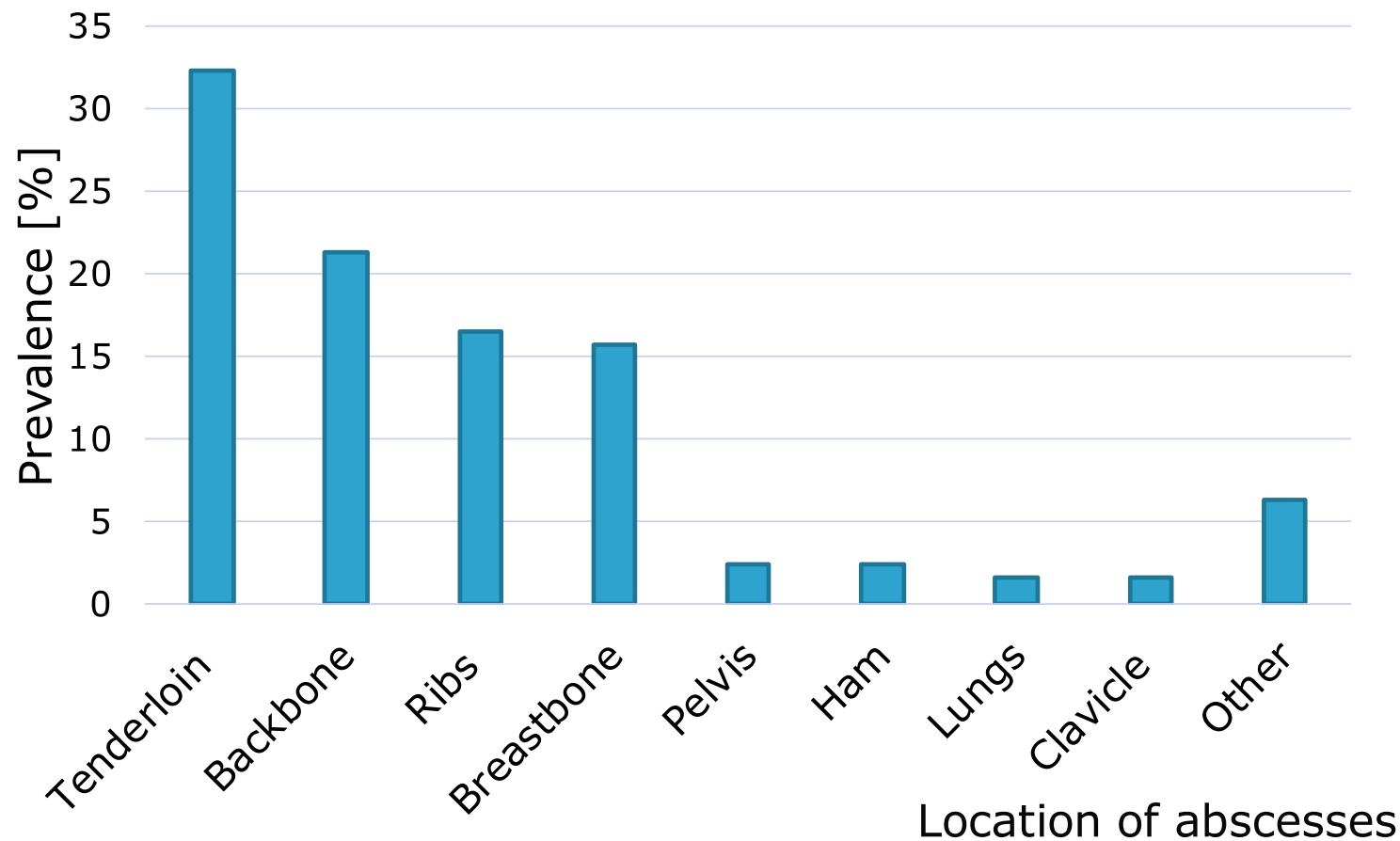
- Sows => destined for de-boning
 - As for finishing pigs

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
 - According to Pedersen et al., Fleischwirtschaft International (2017)



Location of 127 abscesses in 105 sows/ boars



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

Pedersen et al., 2017.
Fleischwirtschaft
International

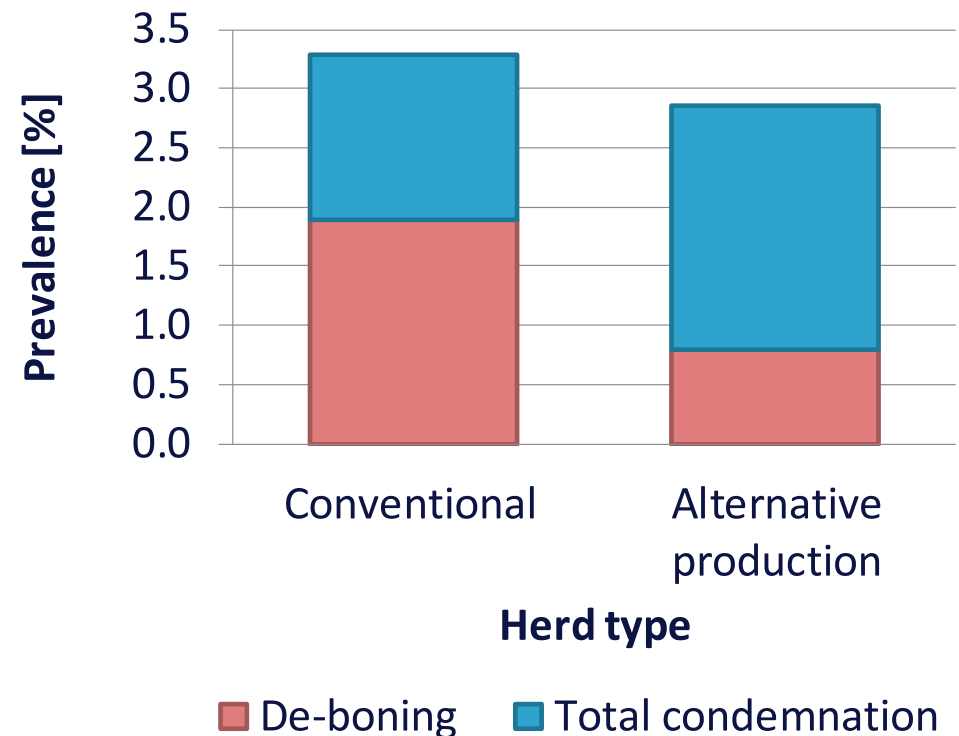
Effect of sow husbandry system?

Does prevalence of de-boning / total condemnation differ between production system?

- Abattoir data (Jan. 2014–Mar. 2015)
- Divided into sows raised in:
 - Conventional or alternative system

Results

- Conventional sows with prior septicaemia less likely to be totally condemned than similar sows from alternative production
 - Could be related to low use of antimicrobials in alternative production



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

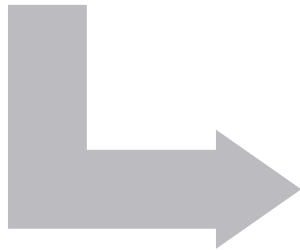
Action/New legislation in Denmark (finishers: 2018, sows/boars: 2019)

- 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



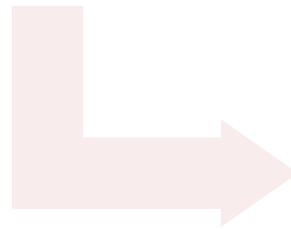
**Microbiological
burden of finishing
pigs with
septicaemia, 2013**

- **Concern:** Meat from pigs with septicaemia 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, 2018-19**

- 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 euthanised and thereby not delivered to slaughter
- 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
- Lungs not considered edible tissue in Denmark

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



Risk communication

Important to communicate changes

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

Presentations given, and discussions taken

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

Dialogue with important trade partners

- To obtain acceptance of equivalence



Process in Denmark – collaboration across parties

Review process in place in DK

- Risk assessments developed by livestock and meat industry in collaboration with University of Copenhagen with Master or Ph.D. students on board
 - Assessments are presented to the veterinary authorities
- The veterinary authorities send the assessment to the Danish Technical University (DTU)
 - For objective, external review
 - Any concern raised by DTU will then be addressed
- Case: Changing handling of de-boning of carcasses with lesions indicative of prior septicaemia
 - Risk assessments accepted
 - But implementation study was judged as required

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 done in Portugal
 - by Vieira-Pinto et al (2020) Foods



Discussion - continued

Development of national risk assessments

- \approx Complimentary work addressing specific issues

EFSA Opinion insufficiently detailed

- When negotiating acceptance of equivalence
 - In-country-up-to-date risk assessments needed

Next step in DK: same work for bovines

Discussion - continued

EFSA recommended development of meat safety assurance systems

- With focus on the hazards that make humans and animals fall ill

Private standards in place

- Listing different requirements - among others for meat safety

RIBMINS Cost Action network 2019-2024

- Bringing together academia, authorities and stakeholders
- To look further into development of feasible meat safety assurance systems

Challenge: Food Chain Information

- Usefulness: how, to whom, where and when?





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

Risk assessment: effective tool and constructive process

- Involving evidence and people
- Publishing in English is necessary
- Dialogue with different stakeholders is needed
- External review system valuable
 - Safe structure, but patience required

Thank you for the attention.
Please join us at



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