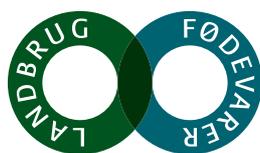
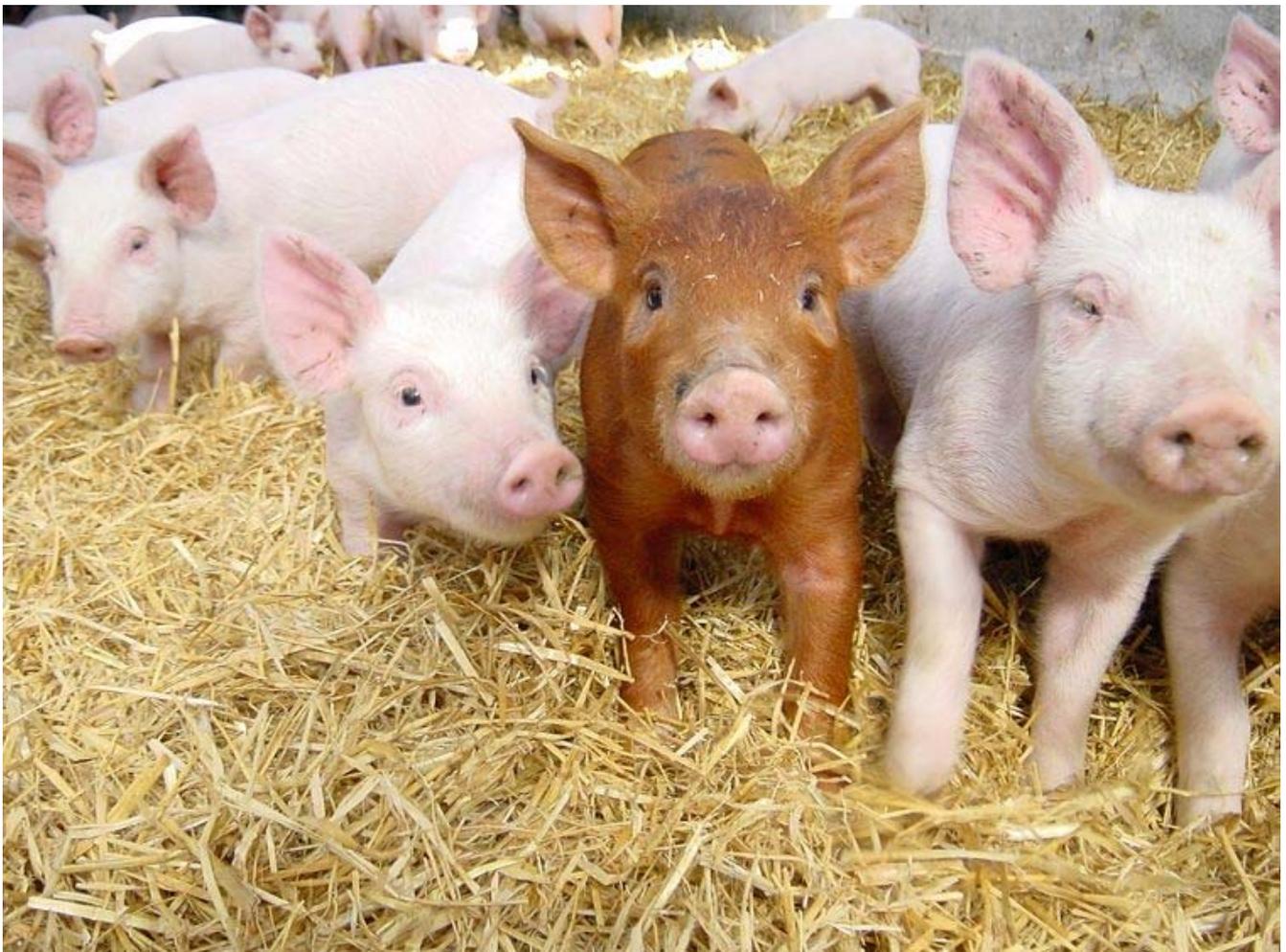


Is palpation of the intestinal lymph nodes a necessary part of meat inspection of finisher pigs?

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Preface

The basic principles behind the present meat inspection are more than a hundred years old. Since then, the disease picture has changed in Denmark. Previously, the challenge was to handle animals with serious infections as tuberculosis and brucellosis. The traditional meat inspection was here a worthy tool. However, the main challenges for Danish pork are currently *Salmonella* Spp. and *Yersinia enterocolitica* – and here, traditional meat inspection is not the answer. It is therefore appropriate to evaluate all elements of meat inspection to ensure that the best methods are applied. According to the current meat inspection circular, a number of specific intestinal lymph nodes must be palpated for each carcass. But why? What kind of lesions might be found in these intestinal swine lymph nodes? And are those lesions caused by a zoonotic agent? – Or in other words: Can humans be infected from eating meat from a finisher pig in which a lesion in the intestinal lymph node passed control? That is the focus of the following risk assessment.

Summary

According to present rules, meat inspection requires that a number of specific intestinal lymph nodes are inspected and palpated in every slaughtered swine. But why? - And is this in fact necessary? Could a visual inspection of the stomach and intestines be sufficient? To find an answer to this question, a qualitative risk assessment in finisher pig from indoor herds was undertaken. The method follows international guidelines on risk assessment and is based on existing data and literature as well as expert opinion from professionals.

The assessment shows that the far majority of swine disorders which brings pathological changes to the stomach, intestines and intestinal lymph nodes result in lesions which are found by inspection of the stomach and intestines alone. The far most prevalent lesions are caused by hazards which are not zoonotic, and hence, are not transferred to humans. Exceptions from this are Salmonella, Campylobacter and Yersinia which – despite of a relative high frequency in live pigs – only occasionally causes changes in the gastro-intestinal tract or the intestinal lymph nodes. Therefore, palpation of the intestinal lymph nodes does not essentially contribute to the judgement on whether a carcass is suitable for human consumption or not. Likewise, the handling of intestines today is performed in such a professionally-secure way that exposure is limited regarding employees.

Thereby, tuberculosis is the one disease with relevance to food safety which manifests itself in the intestinal lymph nodes only. Since 1980, Denmark is officially recognised as being free of bovine tuberculosis, which is a hazard that can pass to humans. Avian tuberculosis is rarely seen within Danish finisher pigs and when it occurs it is primarily detected as changes in the mandibular lymph nodes and/or the intestinal lymph nodes. In these cases, the action taken is local condemnation, whereas lesions outside of the intestinal lymph nodes results in total condemnation. On rare occasions, avian tuberculosis might pass on to humans, but according to the literature this is not considered to be caused by pork. Immuno-compromised humans infected with avian tuberculosis might fall very ill, if not medically treated.

The mesenterium including intestinal lymph nodes are today used for production of animal feed. In the future, the raw material might as well be used for production of spray-dried protein as an element in the manufacturing industry. During production, heat treatment takes place at high temperatures (90-110° C) and for a long time (more than four hours). This effectively secures the elimination of bacteria.

There is no increased risk related to introduction of exotic, contagious livestock diseases when refraining from palpation of the intestinal lymph nodes. This is so, because these diseases are detectable by obvious clinical symptoms in the live animal or in lesions in other organs than the intestinal lymph nodes.

Omitting palpation has only a negligible significance with respect to animal health or welfare, since the lesions which are relevant for these purposes almost in total are observed in connection with meat inspection – also in situations where the intestinal lymph nodes are not inspected or palpated. You might miss some disease cases, primarily those which presents themselves as no macroscopic lesions besides from a swollen lymph node. This is estimated to be of negligible significance to the farmer's or the authority's surveillance on animal health or welfare.

All in all, there is only a negligible risk involved in inspecting the stomach and the intestines instead of inspecting and palpating the intestinal lymph nodes. This assessment covers only finisher pigs from indoor herds.

1. Background

1.1 Introduction

There is a need for an update on the rules on meat inspection to make them match the elements of infections which are causing human disease today. This is the viewpoint underlying the changes in 2006 to the European legislation on food, which make it possible to change existing routines in practical meat inspection. Three demands are to be met:

1. A risk assessment must be undertaken. This must prove that the proposed changes do not impact food safety negatively
2. Only finisher pigs from indoor herds may be slaughtered differently from what is described in the traditional meat inspection
3. The owner of a pig herd must give in food chain information to the abattoir prior to slaughter, e.g. information about medical treatments

In 2008, a risk assessment was undertaken assessing the effect of omitting the routine incision into the mandibular lymph and the opening of the heart of finisher pigs. Both incisions have been conducted on a routine basis on every carcass. The risk assessment showed that food safety is not jeopardized when these routine incisions are not conducted. Neither is the risk of introducing exotic contagious diseases in domestic animals (Alban et al., 2008). This risk assessment is available in English on the internet

(<http://www.lf.dk/Aktuelt/Publikationer/~media/lf/Aktuelt/Publikationer/Svinekod/palpererapport.ashx>).

The risk assessment is also described in a short article by Alban et al. (2009).

During the spring of 2009, the new procedures of meat inspection were tested in two abattoirs – Danish Crown in the cities of Esbjerg and Sæby. The experience from these pilot experiments will be implemented in the new form of meat inspection in a number of Danish abattoirs from September 1, 2009. An interim evaluation shows that a change to a visual control of hearts and lymph nodes is possible (Anon., 2009b). And according to section 20 in the revised Danish circular on meat control of August 28, 2009, the mandibular lymph nodes, the heart and the epicardium are just to be inspected. The heart and the epicardium, though, must be further examined when lesions indicating generalised infection are present on the carcass (Anon., 2009a).

This new form of meat inspection is called Supply Chain Meat Inspection – The Danish Way to stress the farm-to-table view in which information about the herd is an element in the decision making regarding which kind of meat inspection an animal must go through.

According to present rules on meat inspection every carcass must have the intestinal lymph nodes palpated (Anon, 2004). But is this necessary? Or is a visual inspection of stomach and intestines sufficient? Before answering to this, it is necessary to study the basis of judging the carcasses.

1.2 Judging the carcasses

In connection with meat inspection a set of ratings are used (Table 1). Unconditioned approval (UA) is used when the entire carcass and every organ are approved for human consumption. The rate total rejection (TR) is used for carcasses where a general condition is present which makes the meat unsuited for human consumption. In case of local lesions without significance to the rest of the carcass or other organs the rate local rejection is

used (LR), whereby parts of the meat or specific organs are discarded whereas the remaining carcass is approved. The rating also includes approval of a carcass for de-boning or manufacturing. In 2008, 0.4 % of the carcasses were totally rejected while 68 % were unconditionally approved (Table 1). In a very few cases (0.02 %) the carcass was approved for de-boning. Approximately the same distribution of rating was seen in 2006 and 2007 (Appendix A).

Table 1

List of various possible ratings of finisher pig carcasses as well as the distribution of findings in 2008 according to the Danish abattoir database

| Rating | Description | Prevalence |
|------------------------------------|--|------------|
| Unconditioned approval - UA | The entire carcass and all organs are approved. The meat is suited for human consumption no matter the way of preparation. | 68.0% |
| Total rejection - TR | The entire carcass and every organ are discarded. Adequate for carcasses which are not suitable for human consumption because of a general condition or local lesions, suffering or contamination which is not to be eliminated or which has an impact on the general condition. | 0.4% |
| Local rejection - LR | Discarding of parts of the carcass, some organs or parts of organs in connection with cleaning the regional lymph nodes. This always includes the regional lymph nodes. The rating is used on local lesions or disorders without an impact on the general condition. Locally rejected material without signs of disease may be approved for manufacturing of feed if certain conditions are met. | 31.6% |
| Approval for de-boning - AD | All bones, joints and visible pathological changes are discarded. Used in case of diseases in which the skeletal musculature and organs are approved suitable for human consumption. In cases where further changes are found during de-boning those lesions must be included in the total rating. | No data |
| Approval for manufacturing - AM | Meat from pigs with a limited spread of changes in muscles in form of PSE (pale, soft, exudative) or DFD (dark, firm, dry) may be used for manufacturing of meat products after de-boning. Parts with a high grade of changes are locally rejected and unchanged parts are approved. | 0.02% |

Source: Jensen et al. (2006), Anon., (2009b) and the Danish abattoir database

1.3 Purpose

The purpose of the present work is to assess whether there is a risk when omitting palpation of the intestinal lymph nodes and instead inspecting the stomach and intestines visually during meat inspection. This assessment covers only finisher pigs from herds raised in integrated production systems that are kept in-door since weaning.

Risk is here seen as a negative effect on food safety or an increased probability of introduction of exotic livestock diseases. The impact on animal health and welfare shall also be mentioned briefly.

In order to throw light on this, a qualitative risk assessment on finisher pigs from indoor farms has been undertaken.

2. Material and method

The risk assessment is based on existing data, literature and expert opinion from professionals and follows international guidelines. Thus the following five steps are examined:

1. Hazard identification
2. Release assessment
3. Assessment of exposure
4. Assessment of consequences
5. Risk estimation

As a part of hazard identification, the present meat inspection concerning palpation of intestinal lymph nodes is described and hazards relevant to the risk assessment are identified (1). Next, it is assessed how often each hazard is found in live finisher pigs from indoor herds (2). This is followed by an assessment on how often the specific hazards occur in pork or pork products, which are consumed by humans or animals (3). Then, the consequences of this are examined (4). Eventually, all information is gathered for an assessment on the final risk (5).

3. Hazard identification

3.1 *In general*

3.1.1 *Intestinal lymph nodes and their function*

Intestinal lymph nodes can be seen as protective organs for the organism since they function as filters of the floating lymph. Hereby, they play a significant role in the reaction against infections and other harmful actions to the body. Every group of lymph nodes receives lymph from certain areas of the organism. Pathological lesions in an area which is drained by a group of lymph nodes will be reflected in changes to these lymph nodes.

Presence of an agent will usually cause instant changes in the tissue of the drain area. For instance as abscess creation or reactive hyperplasia, or in case of tuberculosis or actinomycosis: different granulomatous or pyo-granulomatous infections of the lymph nodes. Malignant tumour growth often creates metastatic changes in the corresponding lymph nodes while bleedings – for instance as a result of fractures or contusions – easily are detected by blood infiltrations in the lymph node even though the underlying processes are not directly visible. Here lies the significance of the lymph nodes in the assessment of the carcass. It is therefore of importance that the inspector knows the normal look of the lymph nodes and their ways of reaction to different pathological conditions as well as their position and drain area. The inspector actually has to assess whether the carcass with its organs can be approved for human consumption and - if so - under which conditions (Table 1).

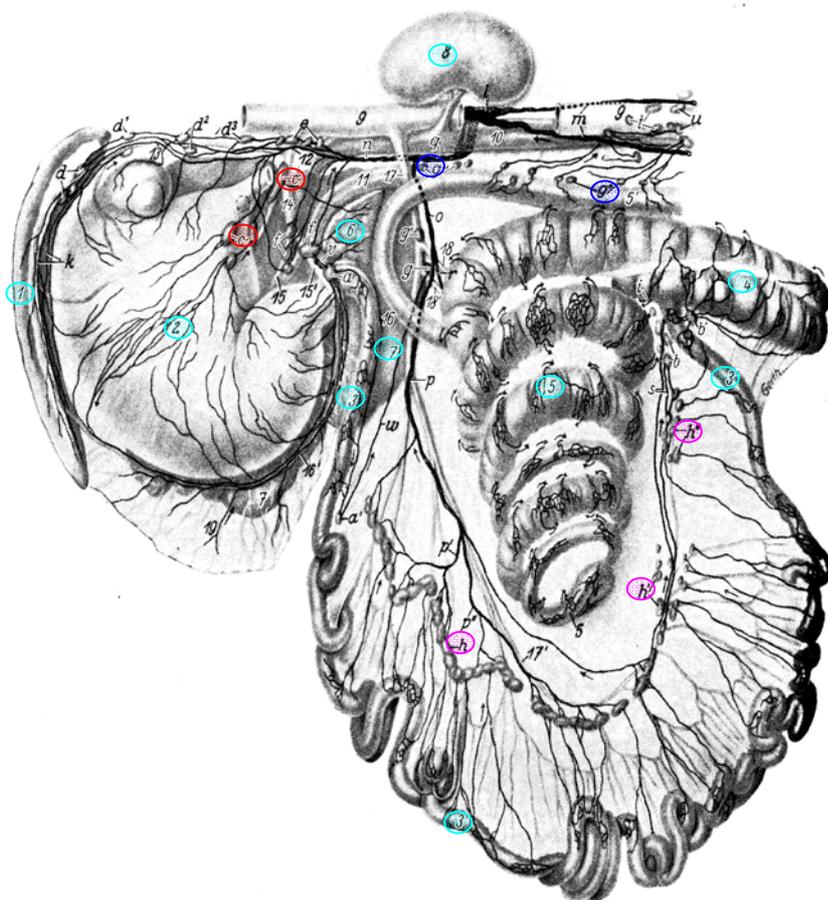
3.1.2 *Organ lymph nodes and meat lymph nodes*

In meat inspection there is a marked difference between organ lymph nodes and meat lymph nodes. Meat lymph nodes receive lymph solely from musculature (and corresponding connective tissue and fat tissue), bones, joints and skin. If the skin in the region is intact and infections of skin or soar can be excluded, reactions in the meat lymph nodes can be interpreted as a manifestation of a general spread of an infectious agent. This indicates that a general infection with blood-borne spread of an agent has occurred. The condition of the meat lymph nodes is therefore of utmost importance for the decision regarding whether an infection is local or general

and thereby for assessment of the destination of the meat from the carcass. All things being equal, a general condition will be assessed more severe than a local condition (Table 1).

In contrast to this, changes to the organ lymph nodes do not necessarily suggest a general pathological condition. Changes to organ lymph nodes might be a reaction to a local intrusion by an agent in the organ from which the lymph node receives lymph. One example of organ lymph nodes is the lymph nodes of the alimentary tract (Jepsen, 1968).

According to present rules on meat inspection the lymph nodes Lnn. gastrici and Lnn. mesenterici craniales et caudales must be examined and palpated in pigs (Anon., 2004). According to teachers at the Danish Slaughterhouse School in Roskilde this is not the group of lymph nodes that is inspected and palpated. Instead the intestinal lymph nodes (Lnn. jejunales) are palpated. This is so because these lymph nodes are easy to observe while Lnn. mesenterici craniales et caudales are not easily found. This risk assessment concerns both intestinal lymph nodes and the lymph nodes mentioned in the regulation. Figure 1 shows the gastro intestinal tract with the corresponding tissue and the mentioned lymph nodes.



Figur 1

①: Milt, ②: Mavesæk, ③: Tyndtarm, ④: Blindtarm, ⑤: Tyktarm, ⑥: Bugspytkirtel, ⑦: Lever, ⑧: Venstre nyre, Tarmlymfeknuder c, c' Nll. gastrici, ⑩: Nll. mesenterici caudalis, ⑪: Nll mesenterici cranialis h, h' og h'' Nll. jejunales. Kilde til billede: Nickel et al. (1984)

It must be assessed which pathological conditions might be neglected as a result of omitting the routine palpation of the intestinal lymph nodes. The intestinal lymph nodes are organ lymph nodes with stomach and intestines as their drain area. Therefore, we will look into the different diseases which affect the stomach and the intestines of swine. Thereafter, we will assess – disease by disease - whether there is a risk of neglecting the specific lesion if the intestinal lymph nodes when inspecting the stomach and the intestines visually. Eventually, it must be assessed 3) whether these pathological conditions are significant to either food safety or the introduction and spread of contagious exotic livestock diseases.

3.2 Pathological conditions in the stomach, intestines and intestinal lymph nodes in swine

3.2.1 Diseases in live pigs

Pigs can suffer from a variety of diseases. Some of them are not present in Denmark either because the disease was never observed or it was eradicated. With the intensification of the livestock production systems, the variation in the pathological picture has simultaneously decreased. Moreover, the diseases are usually dominant in certain age group. On basis of a list of disorders made by the Danish Veterinary Union it is possible to get an overview of disorders in Danish finisher pigs (Table 2). The diseases are divided into three groups: septicaemia, diarrhoea and respiratory disorders. Animals suffering from septicaemia are identified on the background of clinical symptoms either by the producer, the driver or during the *ante mortem* inspection in the abattoir. This group of animals is hereby not slaughtered. Similarly, animals with respiratory disorders have clinical symptoms in other organs than the gastro-intestinal tract. Thus, of these three groups, only diarrhoea is relevant to this risk assessment.

Table 2

List of disorders observed among weaners and finisher pigs divided according to their relevance for the inspection of intestinal lymph nodes

| Disease group | Disorder (agent) | Relevance to intestinal lymph nodes |
|---------------------|---|---|
| Septicemia | Arthritis (<i>Mycoplasma</i> , <i>Streptococcus suis</i>) | With an agent involved in these disorders the clinical symptoms are primarily seen in other organs than the gastro-intestinal tract |
| | Cerebrospinal meningitis (<i>Streptococcus suis</i>) | |
| | Gläser's disease (<i>Hæmophilus parasuis</i>) | |
| | Sequelae to tail bite infection | |
| Diarrhea | Diarrhea (<i>E. Coli</i>) | All agents in this group affect the gastro-intestinal tract |
| | Spirochaetal diarrhea (<i>Brachyspira pilosicoli</i>) | |
| | Proliferative enteropathy (<i>Lawsonia intracellularis</i>) | |
| | Dysentery (<i>Brachyspira hyodysenteriae</i>) | |
| Respiratory disease | Atrophic rhinitis (<i>Bordetella bronchiseptica</i> , <i>Pasteurella</i>) | With an agent involved in these disorders the clinical symptoms are primarily seen in other organs than the gastro-intestinal tract |
| | Pneumonia (<i>Mycoplasma hyopneumoniae</i> | |
| | APP, <i>Pasteurella</i> , <i>Streptococcus</i> spp.) | |
| | Pertussis (<i>Bordetella bronchiseptica</i>) | |
| | Gläser's disease (<i>Hæmophilus parasuis</i>) | |

Source: Holm (2009) and <http://www.infosvin.dk>

The relative distribution of these disorders is shown in Figure 2. In here, the animal daily doses of antimicrobials (ADD) reported to VETSTAT for treatment for a variety of disorders in all Danish finisher pigs in 2008 in presented (Appendix B contains specification in Danish for the data drawn from VETSTAT database). The far most

prevalent disorder group is gastro-intestinal diseases followed by respiratory disorders followed by arthritis. Finally, urogenital tract disorders, metabolic disorders and udder diseases occur but on a much lower level.

A number of food-borne agents are found in pigs e.g. *Salmonella* spp., *Yersinia enterocolitica* and *Campylobacter*. These agents do not necessarily cause clinical disease in pigs. Contrary, human-pathogen verotoxin-producing *E. coli* (VTEC) is primarily related to cattle.

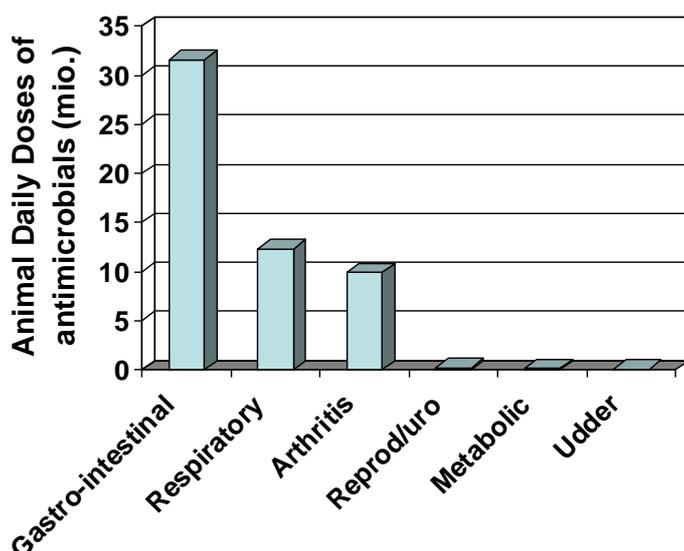


Figure 2. Animal daily doses of antimicrobials (ADD) reported to the VETSTAT database for treatment for a variety of disorders in all Danish finisher pigs during 2008

3.2.2 Pathological manifestations in the carcass

Pathological manifestations observed in the gastro-intestinal tract in finisher pigs includes: Idiopathic conditions, acute infections in the stomach, acute intestinal infection, chronic intestinal infection as well as parasitic gastro-intestinal infection. Furthermore, general conditions as emaciation, anaemia and tuberculosis might result in manifestation observed in the gastro-intestinal tract.

As described in section 3.2.1 *Salmonella*, *Yersinia* and *Campylobacter* are often present in the intestines of pigs. That does not necessarily cause lesions which are observable during meat inspection. These bacteria are human pathogenic.

Tuberculosis might manifest itself solely in the intestinal lymph nodes, and bovine and human tuberculosis are human pathogenic. There is, therefore, generally speaking a risk of neglecting tuberculosis when the intestinal lymph nodes are not examined. This condition is therefore more thoroughly described in this section. More details regarding pathology, cause, agent, assessment and significance are described in Appendix C in Danish.

Tuberculosis is observed in finisher pigs as granulomatous lesions in the intestinal lymph nodes and is caused by contamination by different sorts of *Mycobacterium* species. The most relevant are *Mycobacterium bovis*, *M. humanum* and *M. avium* subspecies *avium*. The two first mentioned types are pathogenic to humans, whereas *M. avium* is considered less pathogenic in that it primarily causes disorders in immuno-compromised patients

such as caused by HIV/AIDS and that do not receive proper treatment. For more than 30 years Denmark has been officially declared free from bovine tuberculosis and a surveillance program is in place. Human tuberculosis occurs primarily among immigrants and it spreads especially from person to person. Avian tuberculosis occurs – rarely – in finisher pigs.

Yet, in the summer of 2009 an outbreak of avian tuberculosis in a swine herd was observed. From June until this moment (September 2009) changes in the intestinal lymph nodes due to tuberculosis were found in 50 to 75 % of the carcasses. Furthermore, changes were found in liver and in lung in some finisher pigs at every delivery from the herd. Because of the widely spread in the herd (and for other reasons) the herd was subjected to official supervision in June 2009 on suspicion of bovine tuberculosis. The supervision was cancelled on September 1st when a laboratory analysis indicated that the disease was caused by avian tuberculosis. The outbreak was probably caused by the use of non-heat treated sphagnum as bedding in the farrowing stable (Bente Johansen, personal message in June 2009; C. Brasch-Andersen, personal message in June 2009).

The health management at the SPF-Denmark company (SPF-SuS) has an approval program that includes peat to avoid contamination by pathogens such as avian tuberculosis. The industry could discuss a requirement that peat used as bedding in swine herds must be approved by the SPF-SuS. Such control could be part of the auditing program conducted as a part of the Danish Standard Scheme for all Danish pigs herd. *Author's comments after finalisation of Danish report in September 2009: this has been implemented in 2010.*

Tuberculosis in swine is practically always a matter of feed infection. The primary complex is either found in the pharynx and in the lymph nodes of the head (mandibular lymph nodes) or in the small intestine and in the intestinal lymph nodes. Just as seen in the recent outbreak, the majority of the cases of infection by *M. avium* cause only local tuberculosis lesions in the mentioned lymph nodes without a general spread. In a few cases, general tuberculosis is developed with lesions in lung and liver. Affected lymph nodes are usually enlarged.

In the present circular about meat inspection an extended examination for tuberculosis in swine is only mandatory when processes have been observed in other places than the mandibular lymph nodes or in the intestinal lymph nodes (Anon., 2009a). On presence of lesions of general tuberculosis, the carcass is rejected. According to the conclusion from a recently conducted risk assessment, there is no increase in risk to food safety when the routine cutting of the mandibular lymph nodes is refrained from (Alban et al, 2008). This is due to the fact that:

- bovine tuberculosis (which is a serious zoonosis) has been eradicated in Denmark (official free-status since 1980) and a surveillance program is in place,
- the occurrence of avian tuberculosis is rare among finisher pigs and occurs mainly because of the use of non-heat treated peat or presence of poultry and swine on the same premises,
- the mentioned lymph nodes are used for animal feed after sufficient heat treatment,
- Mycobacteria are environmentally-adapted bacteria which are found in for instance water, cigarettes and cheese. Humans are usually not falling ill when exposed to *M. avium*, and
- it is the prevailing opinion in the literature that the consumption of pork is not related to the risk of developing avian tuberculosis (Bauer, 1999).

The contagious form of tuberculosis which is likely to be found in cattle in countries with bovine tuberculosis is not known in swine. In practice, swine are always infected by other species; by infected cattle, poultry or humans (Jepsen, 1968).

3.3 Exotic contagious livestock diseases

One of the purposes of meat inspection is to identify exotic contagious livestock diseases. For swine, this includes classical and African swine fever, swine vesicular disease, foot and mouth diseases, Teschen disease and Aujeszky's disease. Other diseases caused by virus – such as circo-virus related diseases – are to be judged in meat inspection according to the general principles regarding acute or chronic inflammation processes. This means, that feverish animals are rejected no matter the underlying cause of fever. Acute or chronic inflammations are assessed with respect to degree of spread: general or local. This as well as other complications present form part of the assessment in which it is decided whether local or total condemnation is the relevant decision.

Denmark is free from a high number of the listed exotic contagious livestock diseases – among these classical and African swine fever, foot and mouth disease, *Trichinella* (domestic pigs) and bovine tuberculosis. A thoroughly investigation into these diseases has been carried out in a previous risk assessment (Alban, 2008). This risk assessment stated that a variety of surveillance programs are in place with the purpose of 1) locate infected animals as soon as possible after introduction in Denmark and 2) to continuously document the Danish status as being free from these diseases.

It has been assessed that the ability to identify all these diseases is not affected if the stomach and the intestines are visually inspected instead of a palpation of the intestinal lymph nodes. This is so because:

- 1) Should one of these unwanted infections enter the country it will occur primarily in other species than swine (*Mycobacterium bovis* and *Brucella abortus*: cattle)
- 2) The infection will not be recognised by palpation (*Trichinella* spp),
- 3) The infection usually results in lesions in other organs than in the intestinal lymph nodes (Classical or African swine fever is seen as multiple bleedings for instance in the spleen, and foot and Mouth as vesicles in the oral cavity and on the coronary band of the hooves. Aujeszky's disease has neurological symptoms in piglets and weaners, and *B. suis* manifests itself by swollen genitals and abortions),
- 4) The infection has never occurred in Denmark (African swine fever, *B. melitensis*, swine vesicular disease, transmissible gastroenteritis)

3.4 Disease pathways

If a slaughter animal carries an infection, which is neglected in connection with slaughtering there is a risk that the carcass contains the infection. After slaughtering the meat is prepared in different degrees. This is done at the abattoir (cutting-up), in a manufacturing industry (e.g. sausage production) or in the consumer's home (usually involves heat treatment). In some cases, by-products are used in for manufacturing of mixed products for human consumption. Certain infectious material can survive these different ways of preparing the meat; and some will grow while others will be reduced or eliminated. Waste from slaughtering of approved slaughter animals is used for manufacturing of animal feed. In this way, pets might be exposed to infectious material unless the industry takes appropriate care of it. Besides from infectious material, other remnants might be neglected in the meat inspection such as heavy metals, antimicrobials and colouring agents.

3.5 Identification of relevant hazards

The function of the intestinal lymph nodes in connection with meat inspection is primarily to make the inspector aware of possible pathological conditions in the stomach, intestine and lymph nodes. In some cases, conditions in the stomach, intestine and intestinal lymph nodes might be neglected if the intestinal lymph nodes are not palpated on a routine basis. The hazard identification indicates that this especially includes infections relevant to

animal health (*E. coli*, *Brachyspira hyodysenteriae*, *Brachyspira pilosicoli* and *Lawsonia intracellularis*). A few infections are relevant to food safety (*Salmonella* spp., *Yersinia enterocolitica*, *Campylobacter* spp.). There is no certainty in the literature with regards to whether avian tuberculosis is a hazard regarding pork. The prevailing opinion is that there is no risk (Bauer, 1999).

The hazard identification shows, that if the stomach and the intestines are visually inspected instead of palpating the intestinal lymph nodes, a few cases of pathological conditions in stomach, intestines and intestinal lymph nodes might be neglected. A number of these conditions are caused by pathogens, among which the majority do not have a zoonotic potential but solely result in animal diseases. A few of the pathogens have a zoonotic potential and it is those that are relevant. *Salmonella*, *Campylobacter* and *Yersinia* are human-pathogenic hazards. These agents might be prevalent in the gut of pigs. Tuberculosis might be present in gastro-intestinal tract solely, and some types of tuberculosis are zoonotic. There might be a risk of not finding all cases of tuberculosis, if the intestinal lymph nodes are not inspected. Some of the pathological conditions that are not caused by pathogens e.g. anaemia, emaciation and dietary disorders are primarily of aesthetic importance. It is assessed that there is no risk related to exotic contagious livestock diseases from omission of routine palpation of the intestinal lymph nodes.

4. Release assessment

Pathological manifestations are routinely reported to the Danish abattoir database. Between 1996 and 2008 several codes were used to describe lesions in the gastro-intestinal tract: Emaciation, acute and chronic intestinal infection, hernia, acute and chronic peritonitis, and lesions indicative of tuberculosis (which also covers other causes of lymph node lesions than those caused by *Mycobacterium* Spp.).

Table 3

The distribution of various lesions found during meat inspection of the gastro-intestinal tract of Danish finisher pigs as well as prevalence of total rejection*, 2006-2008, Denmark. Brackets indicate percentage of slaughtered pigs

| Lesion | Code | 2006 | | 2007 | | 2008 | |
|------------------------------|------|-------------------------|-----------------|-------------------------|-----------------|-------------------------|-----------------|
| | | Number of Registrations | Total Rejection | Number of registrations | Total rejection | Number of registrations | Total rejection |
| Acute intestinal infection | 30 | 2,643 (0.01) | 2,403 (0.01) | 2,808 (0.01) | 2,560 (0.01) | 3,634 (0.02) | 3,335 (0.02) |
| Chronic intestinal Infection | 31 | 26,268 (0.13) | 5,529 (0.03) | 24,907 (0.13) | 5,961 (0.03) | 26,713 (0.14) | 6,519 (0.04) |
| Acute peritonitis | 40 | 2,794 (0.01) | 2,693 (0.01) | 2,932 (0.02) | 2,808 (0.01) | 3,350 (0.02) | 3,206 (0.02) |
| Chronic peritonitis | 41 | 142,436 (0.71) | 2,680 (0.01) | 140,582 (0.72) | 2,653 (0.01) | 133,385 (0.72) | 2,982 (0.02) |
| Hernia | 42 | 238,161 (1.19) | 1,733 (0.01) | 191,128 (0.98) | 1,493 (0.01) | 171,750 (0.92) | 1,342 (0.01) |
| Emaciation | 74 | 10,009 (0.05) | 9,631 (0.05) | 9,310 (0.05) | 8,883 (0.05) | 9,323 (0.05) | 8,905 (0.05) |
| Tuberculous changes | 78 | 1,888 (0.01) | 35 (0.0002) | 2,977 (0.02) | 58 (0.0003) | 2,553 (0.01) | 24 (0.0001) |

*: The assessment depends not only on the lesion mentioned in the table but also on other lesions observed concurrently on the carcass and organs.

The most frequent lesion is umbilical hernia, which is often seen in connection with local, chronic peritonitis (Table 3). A variety of causes lies behind hernia, among these are genetic and navel infection which has developed into an umbilical hernia. This lesion rarely results in total rejection. Chronic intestinal infection which is mostly caused by *L. intracellularis*, is number three in frequency (0.13-0.14 %) and between 21 and 24 % of these carcasses were totally rejected. Regarding acute intestinal infection, most carcasses were totally rejected (91-92 %). Emaciation rarely occurs (0.05 %) but in these cases total condemnation is always certain. Finally, carcasses with lesions indicative of tuberculosis are only seldomly rejected probably because they are restricted to the mandibular lymph nodes and the mesenterial lymph nodes. The final decision to with regards to local or total condemnation is also based on other findings on the carcass and in organs - as described in Table 1.

Table 4 presents the most frequently reported causes for condemnation sorted accordance to frequency of local condemnation. Chronic pleuritis is observed in nearly 25 % of all finisher pigs. This lesion hereby makes up far most of all local condemnations (73 %). All other causes for local condemnation are low prevalent and occur each in less than 2 % of the finisher pigs. When looking at total condemnation, osteomyelitis, bite and infection in tail and pyemia make up 79 % of all causes of total rejection. This is in accordance with the causes for condemnation stated in Table 1: such findings express a general condition.

Table 4

Distribution of causes of condemnation in 18 million finisher pigs slaughtered in Denmark in 2008

| Code of remark / lesion | Registrations of finisher pigs | | | |
|------------------------------------|--------------------------------|-----------|--------------------|--------|
| | Local condemnation | | Total condemnation | |
| | Percentage | Number | Percentage | Number |
| 23 Chronic pleuritis | 23.28 | 4,325,885 | 0.01 | 2,429 |
| 71 Scar / contusion | 2.08 | 385,601 | < 0.01 | 623 |
| 63 Abscess in leg | 1.73 | 320,927 | 0.04 | 6,708 |
| 18 Abscess in throat / breast | 1.64 | 304,063 | 0.04 | 7,897 |
| 69 Tail bite infection | 1.10 | 203,881 | 0.11 | 20,545 |
| 42 Hernia | 0.92 | 170,408 | 0.01 | 1,342 |
| 41 Chronic peritonitis | 0.70 | 130,403 | 0.02 | 2,982 |
| 68 Abscess in hind part of carcass | 0.68 | 126,547 | 0.06 | 10,554 |
| 43 Abscess in peritoneum | 0.61 | 113,531 | 0.02 | 2,820 |
| 73 Eczema/scabies | 0.58 | 106,908 | < 0.01 | 433 |
| 17 Abscess in the head | 0.53 | 98,749 | < 0.01 | 439 |
| 66 Chronic bone fracture | 0.52 | 97,107 | < 0.01 | 498 |
| 21 Chronic pneumonia | 0.51 | 95,252 | 0.01 | 2,078 |
| 62 Chronic joint infection | 0.34 | 62,691 | 0.02 | 3,171 |
| 11 Chronic pericarditis | 0.27 | 50,822 | < 0.01 | 304 |
| 56 Retained testicle | 0.27 | 50,348 | < 0.01 | 12 |
| 65 Acute bone fracture | 0.26 | 49,130 | < 0,01 | 162 |
| 64 Osteomyelitis | 0.23 | 43,592 | 0,14 | 26.162 |
| 31 Chronic intestinal infection | 0.11 | 20,194 | 0,04 | 6.519 |
| 34 Torsion of the spleen | 0.10 | 17,934 | < 0,01 | 1.362 |
| 14 Pyemia | 0.05 | 8,665 | 0,08 | 14.056 |
| In total | 32.03 | 5,952,784 | 0,42 | 77.460 |

Palpation of the intestinal lymph nodes involves an increased risk of spread of zoonotic bacteria such as *Salmonella* spp., *Y. enterocolitica* og *Campylobacter* spp. In opposition to this, a visual inspection of stomach and intestines involves no increased risk of spreading. This allows of an inspection of stomach and intestines with plucks as shown in Figure 3.

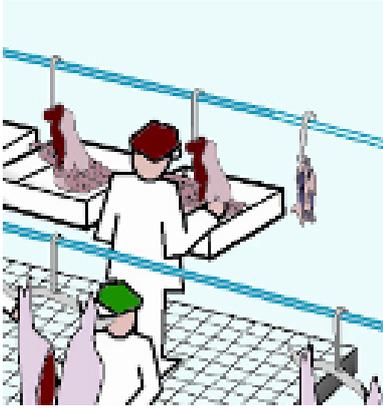


Figure 3. Inspection with plucks hanging below the intestines

When visually inspecting the stomach and intestines instead of a palpation of the intestinal lymph nodes you may - as previously mentioned - neglect some cases of finisher pigs infected with *Salmonella* spp., *Yersinia* og *Campylobacter*. The result of these agents are usually none or just weak lesions. Furthermore, *Yersinia* and *Campylobacter* are widely spread among living swine. This means that the occurrence in intestinal matter is already today substantial.

This exposure is dealt with in the gut scraping unit in the abattoir which in itself constitutes a hygiene zone (O. Pontoppidan, personal message, July 2009). A surveillance programme for *Salmonella* spp. is furthermore in place in Denmark. This includes for instance separate slaughtering of finisher pigs from the herds considered to be at highest risk of *Salmonella* and that intestines from such animals are discarded (Alban et al., 2002; Anon., 2005).

As the production system has become more intensified, the variation in the pathological picture of finisher pigs has reduced. Respiratory disorders and diarrhoea occur frequently in finisher pigs from indoor herd. The majority of lesions that are related to diarrhoea are observed directly in the intestines and do not depend on an inspection or palpation of the intestinal lymph nodes. Human pathogenic agents such as *Salmonella*, *Yersinia* and *Campylobacter* occur frequently in the intestines in finisher pigs without necessarily resulting in observable lesions in neither the intestines nor the lymph nodes. Examination of the intestinal lymph nodes is therefore not considered an action which prevents the occurrence of these bacteria. These agents are already today dealt with in another way. Tuberculosis is therefore the only disorder which is relevant for the present risk assessment. Denmark has since 1980 officially been free from bovine tuberculosis and a surveillance program is in place. Avian tuberculosis occurs rarely in finisher pigs and when it does the primarily findings are lesions in the mandibular lymph nodes and/or the intestinal lymph nodes. The judgement in these cases is local condemnation. Swine are totally rejected in case of tuberculous lesions in other organs than the mandibular lymph nodes and the intestinal lymph nodes, e.g. in lungs and liver, since this indicates a general infection. Lung and liver are still to be inspected in meat inspection of all Danish swine.

5. Assessment of exposure

In the following it is examined if and how mesenterial tissue and intestinal lymph nodes can reach a consumer or an animal. Likewise, the probability that pathogenic bacteria are found in these products after manufacturing is assessed. Mesenterial tissue and intestinal lymph nodes are covered by the definition of category 3 material and is additionally defined in the EU regulation regarding food safety concerning by-products made from meat (Anon., 2002a). There are specific requirements regarding category 3 material with regards to collection, trans-

port, storage and not least manufacturing. Manufacturing requires besides from a grinding a combination of time, temperature and pressure which among other things ensure the elimination of living microorganisms. A heating of animal by-products – after grinding – reaching a core temperature of >100°C for a minimum of 125 minutes is an example of a heating method which effectively kills all pathogens.

5.1 Production of fat used for feed

Today, Daka Proteins in the city of Løsning receives all by-products from the slaughtering of Danish finisher pigs approved for human consumption. This includes for instance mesenterial tissue including the intestinal lymph nodes. Daka manufactures the by-product into fat for feed as well as meat and bone meal. These processes are described in the following. The information comes from Daka Proteins (M. Englund, personal message 2009).

The mesenterial tissue is mixed with the rest of the slaughter offal and is transported to Daka where the by-products are grinded to a particle size of maximum 70 mm. Then, metal is detected and removed. A mincer subsequently chops the material into a particle size of maximum 19 mm. The product is then heated up until 85 °C to 90 °C. The heated fluids are separated as much as possible.

The liquid phase is heated up until 105 °C and is then divided into three parts: fat, lime water and dry matter. The lime water is concentrated and is lead back to the dry matter to the pressing cake. The fat is cleaned and sterilized by heating up until 110 °C for one hour. The final product consists of pure swine fat used as feed for swine.

The pressing cake is dried at 110 °C for approximately four hours. The meat meal (a product with high protein content) is then sifted out and the pieces of bone are grinded into a low protein product. Meat/bone meal is part of feed for pets. Through tests it is documented that the heating ensures the elimination of all agents. According to the company, *Salmonella* spp. is occasionally found in the final product as a result of re-contamination. Positive batches are discarded and then re-manufactured (heat treatment). The equipment is disinfected. The company continuously maps why and where *Salmonella* occurs in order to prevent future incidences. The company has incorporated a own-control program that includes a systematic sample taking for chemical and microbiological analyses.

It is assessed that the described heat treatment ensures that the product is free of microbiological hazards.

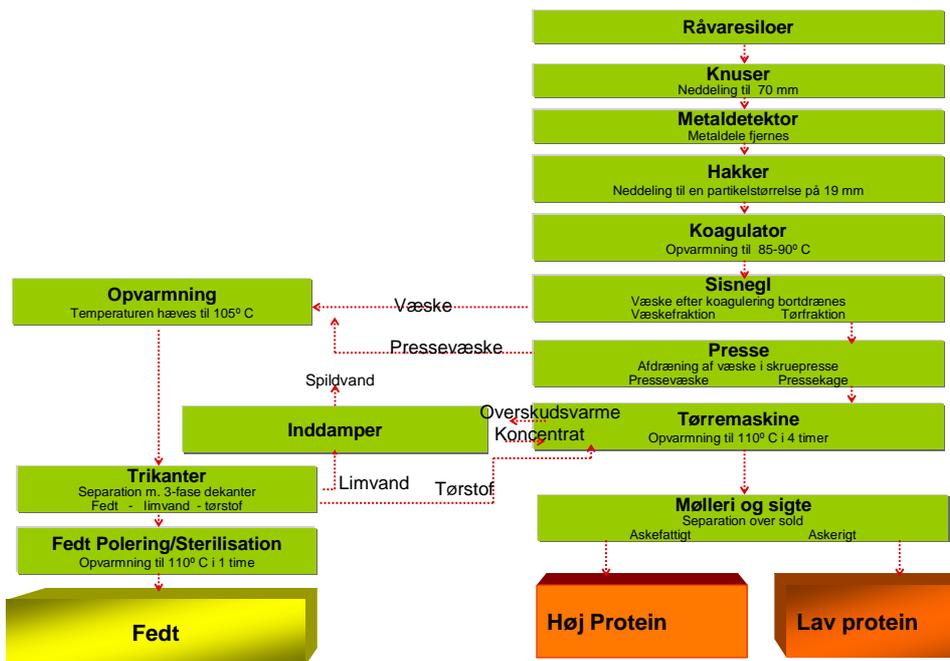


Figure 4. Description in Danish of the wet pressing process in the production at Daka Proteins. Source: M. Englund, 2009

5.2 Production of spray-dried protein

As described in section 5.1 the mesenteric tissue with the corresponding lymph nodes are today used in the production of feed for animals. As from the summer of 2009 it was proposed to use parts of the edible by-products in the manufacturing of spray-dried protein which then is supposed to enter the food production as an additive or as feed for animals. These by-products will be minced and heated up until 90 °C at the abattoir. The hot mass is loaded on road tankers and taken to a factory in Denmark which then takes over the manufacturing. During transport the temperature is kept at minimum 80 °C. Fat and protein are separated as described for Daka in the city of Løsning. Then the protein part is spray-dried (Andersen 2009).

The process of production will need to be approved by the authorities as well as a own-control program will be designed and put in place. It is assessed that the process effectively ensures the elimination of all pathogens.
Authors comment after finalisation of report: The production has not been initiated by July 2010

5.3 Handling of stomachs and intestines

Own-control programs are in place with respect to manufacturing of both stomachs and the small intestines. Stomachs and intestines are scraped and emptied, and mucus is removed. This is done in the gut scraping unit in the abattoir. This step in the process can be done manually as well as by machine. The fresh intestines and stomachs are then cooled down by ice to a temperature of maximum 3 °C before transport from the abattoir to the manufacturing company. The low temperature impedes the growth of *Salmonella* if present.

The icy stomachs are speed-frozen either in cartons or they are plate-frozen and marketed as frozen. It appears from the product specifications (data sheet) that the stomachs are to be heat-treated prior to consumption. Stomachs are primarily sold to countries outside EU although a part is sold to other EU-countries.

The scraped, emptied and icy intestines are bleached at the manufacturing company. The intestines are sorted by size and iced before being preserved with salt. They are then put in a net and stored on ice. Sometimes the intestines are transported abroad for the sorting of size and then returned to Denmark for salting. Salting is a sort of preservation which reduces the food safety risk associated with a large number of pathogens. Intestines are sold to countries outside EU, within the EU as well as on the national market.

Mesenterial tissue including lymph nodes is today used as feed for animals. In the future, this raw material might also be used in the manufacturing of spray-dried protein and thereby used as an ingredient in the manufacturing industry. Heat treatment in the production of animal feed as well as spray-dried protein takes place at high temperatures (90°C to 110 °C) for more than four hours. This effectively ensures the killing of bacteria present and eliminates any risk to the consumers. Stomachs and intestines are cleaned and iced and should be heat-treated prior to consumption. Both products are sold for human consumption.

6. Assessment of consequences

6.1 Differentiation into zoonotic and non-zoonotic pathogens

By tradition, meat inspection has not distinguished between zoonotic and non-zoonotic pathogens. Meat inspection at the abattoir has been practised with the purpose of diagnosing pathological conditions which is believed to make the meat unsuitable for human consumption. As the inspector is making a decision he is not primarily focused on the risk to consumers when observing pathological changes. In other words: whether a disease can be transferred to humans when consuming the meat. In fact, the inspector cannot with certainty define the specific agent (Jepsen, 1968). Hence, in the classical meat inspection it is of no significance whether an agent is human pathogenic or not. The basic principles have been that acute, general conditions or general systemic disease determine a total condemnation of the carcass.

Today's knowledge is more comprehensive than yesterday's when it comes to pathogens observed with the different diseases in swine. Furthermore, indoor production of finisher pigs results in a more uniform set of pathological conditions. This is due to the fact that only a very low number of herds have different animal species in the same stable. Production has become more intensified and vaccines are used on a wider scale. This entails less variation in the pathological changes in finisher pigs than previously seen. Likewise, there is a greater knowledge about the zoonotic potential of the pathogens today compared to previously. Some pathogens can be transferred to humans through contact, others through meat, while a large group does not transfer disease to humans at all.

This knowledge will be accounted for in future meat control. For instance, a survey on endocarditis in swine showed that this is primarily an infection with *Streptococcus suis* and *Erysipelothrix rhusiopathiae*. The first of these bacteria is known to cause only a few numbers of infections in humans and is primarily considered an occupational risk. The latter bacteria is known to cause soar infections in humans working with animals or carcasses and considered an occupational risk whereas infections through consumption are not known. This knowledge is now applied in Denmark to the assessment of carcasses with endocarditis: If no other lesions on the carcass are present indicating a general disease (such as septicaemia or pyemia) the carcass will be approved while the heart will be locally discarded since the pathogens are not transferred in meat (Anon., 2009a).

Table 5 shows various pathogens which occur in finisher pigs divided according to zoonotic potential. It shows that *Salmonella* spp., *Y. Enterocolitica*, *Campylobacter* spp. make up the group of agents with zoonotic potential observed in Danish finisher pigs. This is also reflected in the statistics on humans. It ought to be mentioned, though, that *Campylobacter* spp. in pork poses a limited risk to humans. This is because the use of blast chilling – executed on carcasses after slaughtering – drastically reduces the prevalence of *Campylobacter* in pork (Alban et al., 2008).

Table 5
Various pathogens in finisher pigs divided according to zoonotic potential and by findings in Denmark, 2009

| Zoonotic potential | Found in Danish finisher pigs | Not found in Danish finisher pigs |
|--------------------|--|---|
| Yes | <i>Salmonella</i> spp., <i>Y. Enterocolitica</i> , <i>Campylobacter</i> spp., | Bovine tuberculosis, <i>Trichinella spiralis</i> , <i>Brucella abortus</i> , <i>B. suis</i> *, <i>B. melitensis</i> |
| No | <i>L. intracellularis</i> , <i>Oesophagostomum dentatum</i> and <i>O. quadrispinulatum</i> , <i>Hyostrongylus rubidus</i> , <i>Brachyspira hyodysenteriae</i> and <i>B. pilosicoli</i> | Foot and mouth disease, African and classical swine fever, Aujeszky's disease, Swine vesicular disease, Transmissible gastroenteritis |
| Limited | <i>E. rhusiopathiae</i> (occupational risk), <i>S. suis</i> (occupational risk), Avian tuberculosis (not considered to spread through swine meat but is found in the environment) | |

*: *B. suis* has been observed on few occasions in certain areas of Denmark among swine from outdoor herds.
Source: Alban et al. (2008)

By tradition, meat inspection has not distinguished between zoonotic and non-zoonotic pathogens. Meat inspection at the abattoir has been practised with the purpose of diagnosing pathological changes which results in a judgement that the meat as unsuitable for human consumption. Likewise, there is greater knowledge about the zoonotic potential of the different pathogens today compared to previously. Some pathogens can be transferred to humans through contact, others through meat, while a large group does not result in disease in humans at all. This knowledge will be incorporated in future meat inspection.

6.2 Consequences of infection by avian tuberculosis

The following is based on a description in Alban et al. (2008). In this it is shown how *Mycobacterium avium* can infect birds and animals such as swine and cattle. It is only potentially pathogenic to humans. The clinical cases of infection with *M. avium* can be divided into three main groups: 1) lung infections in patients with an already existing lung infection, 2) glandular infection of the throat in children who are otherwise well 3) multiple lung infection in patients with a seriously reduced immune system such as in AIDS patients. This third group was especially significant during the 1980s and the 1990s because of the HIV epidemic. Today, treatment of this group of patients has improved so that the infection can be treated.

Avian tuberculosis can be transferred to humans. Immuno-compromised humans might be very ill if not treated correctly.

6.3 Consequences to animal health and welfare

The Danish authorities conduct control regarding use of medication and animal welfare. The control visits is based on a risk assessment. This means that on basis of a series of risk parameters, individual herds and veterinarians are visited.

The Danish Veterinary and Food Administration has identified a variety of lesions in the registration obtained during meat inspection. Herds with a high proportion of animals with a certain diagnosis/lesions (or a combination of these and other risk parameters) can thereby be identified for welfare control. The relevant lesions are stated in Table 6.

Data on meat inspection provide the veterinarian and herd owner with a means of detecting disorders which maybe otherwise were not observed before slaughtering. Likewise, it is possible to keep an eye on the prevalence of problems in the herd already recognized. The calculations can be made up from production control or by making up one's own calculations out of the raw figures collected from the so-called landmandsportalen (farmers portal). This method is used by veterinarians but takes a good deal of prearrangement until the calculations and handling of the many data is in place. Experience from counselling proves a great difference in how much the registration on disorders in meat inspection is actually implemented in daily routines in the herds. In some herds, these data are not used at all while in other herds attention is continuously kept on the prevalence of for instance chronic pleuritis in finisher pigs.

Table 6

Provisional draft on relevant lesion possibly found during meat inspection of pigs regarding animal health and welfare, according to the Danish Veterinary and Food Administration, 2009

| Code | Description | Code | Description |
|-----------------|-------------------------------------|---------------------|---|
| 221 | Acute epicarditis | 501 | Fresh bone fracture |
| 222 | Chronic epicarditis | 502 | Old bone fracture |
| 230 | Endocarditis | 542 | Dysplasia of hip or joint |
| 251 | Atrophic rhinitis | 580 /581 / 588 /582 | Abscess in hind part tail-related |
| 585 / 569 | Abscess, head | 601 | Tail bite/ tail infection |
| 570 / 571 / 576 | Abscess, throat / chest | 602 | Scar / Contussion |
| 668 | Injection lesion | 132 /131 | Emaciation |
| 289 | Chronic pleuritis | 113 | Rejected on slaughtering – if reason given |
| 320 /321 | Acute intestinal infection | 114 | Dead in stable – if reason given |
| 325 | Chronic intestinal infection Intes- | 111 | Dead on arrival – if reason given |
| 331 | Intestinal protrusion | 902 | Been beaten / Bite wounds |
| 361 / 362 / 363 | Hernia | 455 | Pregnant |
| 615 | Shoulder contusion | 570 | Scare, throat (abscess, throat) |
| 402 | Acute inflammation of kidneys | 510 | Enlarged claws (stable) |
| 412 | Chronic inflammation of kidneys | No code* | Tail length, defect biclaws, degenerative arthritis |
| 421 | Cystitis | 625-629 | Contusions in other places |
| 431 | Acute endometritis | 336 | Gastric ulcer |
| 432 | Chronic endometritis | 614 | Ulcer in ear |
| 485 | Semi boar | 385 | Ascaris suum in liver |
| 531 | Acute joint infection | 568 | Ascaris suum in intestines |
| 532 | Chronic joint infection | 634 | Scab |
| 584 | Abscess leg/toe | 385 | Liver spots |

*: There is no code in the existing system

The farmer can also order an extended health control (USK). This is profitable when a herd has problems with respiratory diseases or gastric ulcer or with reproductive problems in sows. With a USK a great number of organs from slaughter animals are examined in connection with the slaughtering. Hereby, an overview of the problem is created as well as a possibility of a quantitative assessment (<http://www.vet.dtu.dk/Dyrslaegen/USK.aspx>). A change in the meat inspection with respect to omitting the routine palpation of the intestinal lymph nodes has no relevance to this possibility.

Whether meat inspection findings are used by authorities (for welfare reasons) or the veterinarian and owner of herd (for animal health) the registration at the abattoir much be carried out with great carefulness. Data of a bad quality is off course less useful if of any use at all.

7. Risk estimation

In the hazard identification it was assessed that the risk of introduction and spreading of exotic contagious livestock diseases is not increased if the intestinal lymph nodes are not palpated routinely. *Salmonella*, *Yersinia*, *Campylobacter*, and avian tuberculosis are considered a possible hazard to food safety. Table 5 gathers the assessment on the specific elements (release, exposure and consequences).

When it comes to *Salmonella*, *Yersinia* and *Campylobacter* these human pathogens occur in the intestinal tract in finisher pigs without necessarily giving rise to clinical disease nor pathological manifestations. Thus, an inspection of and a palpation of intestinal nymph nodes is not a sufficient way to handle these three pathogens. Therefore, for many years these agents have been dealt with by focusing on hygiene an own-check program in the abattoirs. Furthermore, in Denmark *Salmonella* is controlled through a national surveillance program.

According to the risk assessment, avian tuberculosis is the only relevant hazard. It follows from Table 5 that the occurrence of avian tuberculosis is very low in finisher pigs. This is not considered a risk since mesenterial tissue and the associated lymph nodes are solely used as animal feed after a sufficient heat-treatment. If a consumer is exposed to avian tuberculosis in pork, the consequences are limited since avian tuberculosis is not regarded as meat-borne – according to the prevailing opinion in the present literature. However, in cases of tuberculous changes in other organs than mandibular lymph nodes and intestinal lymph nodes, a total rejection is the judgement – since this is an indication of a general infection. Lung and liver is still to be inspected in the meat control of all swine. In that way there is in all together no risk involved in omitting routine palpation of intestinal lymph nodes.

Table 5 Totalling specific elements of risk assessment in risk estimation

| Risk to | Agent | Release | Exposure | Consequences | Risk estimation |
|-------------|----------|----------|------------|--------------|-----------------|
| Food safety | Avian TB | Very low | Negligible | Low | Negligible |

In the USA, a visual inspection and a routinely palpation of intestinal lymph nodes is mandatory (Anon., 2007). In Australia, on the other hand, only a visual inspection of these lymph nodes is mandatory (Anon., 2002). The latter is equivalent to the routine meat control in New Zealand (Anon., 2000). Note that bovine tuberculosis occurs in both the USA and in New Zealand.

8. Conclusion

All in all, there is no increased risk related to omitting the routine palpation of intestinal lymph nodes. The existing procedures on palpation of intestinal lymph nodes can therefore be changed on three conditions:

1. The finisher pigs originate from Danish indoor herds.
2. The herd applies with the requirements for so-called integrated herds in which the animals have been kept in-door since weaning and has been raised under controlled circumstances.
3. Food chain information has been exchanged between producer and abattoir before slaughter.

With such animals, a visual inspection of stomach and the intestines is sufficient for an assessment of the carcass and organs.

It is assessed that this change in procedure might cause a slightly higher frequency of *Salmonella* spp. in the gut scraping unit. This is handled within the present own-check program.

There is no increased risk related to exotic, contagious livestock diseases. That is due to the fact that these diseases manifest themselves as either clinical symptoms in the living animal or in lesions in organs other than the intestinal lymph nodes.

The proposed change in meat inspection will not have any substantial influence on the assessment on health and welfare in a herd made by the owner, the veterinarian or the authorities.

The present delivering system ensures a high degree of certainty that finisher pigs under the supply Chain Meat Inspection really come from integrated herds. Finisher pigs from ecologically herds or outdoor production are slaughtered and undergo tradition meat inspection in the abattoir in the city of Herning. Furthermore, in connection with every delivery, the animal's origin is checked with the abattoir's database. And, at every delivery the farmer must indicate in writing whether the animals are raised indoor or outdoor.

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Appendix A – Meat inspection judgement

Distribution of ratings executed as part of meat inspection of finisher pigs, Denmark 2006-2008

| Rating* | Year and category | Number | % |
|---|-------------------------------------|------------|--------|
| | 2008 | | |
| | | | |
| | Total number of animals delivered | 18,582,290 | 100.00 |
| Primarily animals with LR + all with TR | Number of animals with remarks | 5,952,786 | 32.03 |
| TR | Of this, animals rejected in total | 77,460 | 0.42 |
| | Remarks in total | 7,070,738 | 38.05 |
| | Remarks on animals rejected | 174,257 | 0.94 |
| UA | | 12,629,504 | 67.97 |
| AM | 080 Degeneration of muscles | 2,883 | |
| | Of this, animals rejected in total | 574 | |
| | | | |
| | | | |
| | 2007 | | |
| | | | |
| | Total number of animals delivered | 19,502,941 | 100.00 |
| Primarily animals with LR + all with TR | Number of animals with remarks | 6,295,939 | 32.28 |
| TR | Of this, animals rejected in total | 82,883 | 0.42 |
| | Remarks in total | 7,467,659 | 38.29 |
| | Remarks on animals rejected | 184,768 | 0.95 |
| UA | | 13,207,002 | 67.72 |
| AM | 080 Degeneration of muscles | 2,862 | |
| | Of this, discarded animals in total | 701 | |
| | | | |
| | | | |
| | 2006 | | |
| | | | |
| | Total number of animals delivered | 19,984,506 | 100.00 |
| Primarily animals with LR + all with TR | Number of animals with remarks | 6,795,927 | 34.01 |
| TR | Of this, animals rejected in total | 79,874 | 0.4 |
| | Remarks in total | 8,055,607 | 40.31 |
| | Remarks on animals rejected | 184,416 | 0.92 |
| UA | | 13,188,579 | 65.99 |
| AM | 080 Degeneration of muscles | 3,168 | |
| | Of this, animals rejected in total | 650 | |

*: LR: local rejection, TR: total rejection, UA: unconditioned approval, AM: approved for manufacturing

Appendix B - Dataudtræk fra VETSTAT

- In Danish

Udtrækket er foretaget d. 23. juni 2009. Følgende parametre er anvendt: Hele året 2008, dyreart svin, kun antibiotikabehandlinger, alle administrationsveje, alle regioner i landet,

Tak til Helle Stege, Københavns Universitet, for assistance i forbindelse med udtræk.

The screenshot shows the VETSTAT web application interface. The search parameters are set to: Periode fra '2008-JAN', Periode til '2008-DEC', Dyreart '15 - Svin', ATC-gruppe 'QJ+J - Antibiotika', Administrationsvej 'Intramammaria', 'Parenteral', 'Peroral', and Fødevarerregion 'Fødevarerregion Esbjerg', 'Fødevarereg'. Below the parameters is a table with the following data:

| Aldersgruppe | Ordinationsgruppe | Doser (ADD) | Gns. antal dyr i perioden | ADD/dyr | Dyredage | Procentdel dyr behandlet/dag |
|--------------|------------------------------------|-------------|---------------------------|---------|---------------|------------------------------|
| | NULL | 00 | 1.219.836 | 0 | 446.460.126 | 0 |
| | 56 - Fravænningsgrise (15 kg IgV.) | 204.285.811 | 5.636.703 | 36 | 2.063.033.100 | 9 |

The screenshot shows a detailed list of antibiotic treatments for pigs. The table includes the following data:

| ATC-gruppe | Doser (ADD) | Gns. antal dyr i perioden | ADD/dyr | Dyredage | Procentdel dyr behandlet/dag |
|--|-------------|---------------------------|---------|---------------|------------------------------|
| 12 - Gastrointestinale lidelser | 151.682.052 | 00 | - | 0 | - |
| 13 - Respirationsvejslidelser | 33.797.256 | 00 | - | 0 | - |
| 14 - Led - lemmer - klove - centralnervesystem - hud | 16.749.620 | 00 | - | 0 | - |
| 15 - Stofskifte - fordøjelse - kredsløb | 762.739 | 00 | - | 0 | - |
| 16 - Andet (kun mink) | 400 | 00 | - | 0 | - |
| 23 - Andet (aquakulturer) | 10.190 | 00 | - | 0 | - |
| 30 - Coccidiose (fjerkræ) | 8.533 | 00 | - | 0 | - |
| 31 - Enteritis (fjerkræ) | 89 | 00 | - | 0 | - |
| 99 - Vacciner og sera | 316.647 | 00 | - | 0 | - |
| NULL | 00 | 5.636.703 | 0 | 2.063.033.100 | 0 |
| 57 - Slagtesvin - salgspolte (50 kg IgV.) | 54.306.716 | 7.323.874 | 7 | 2.680.537.931 | 2 |
| 0 - Ikke angivet | 90.481 | 00 | - | 0 | - |
| 10 - Reproduktion - urogenitalsystem | 169.808 | 00 | - | 0 | - |
| 11 - Yver | 51.915 | 00 | - | 0 | - |
| 12 - Gastrointestinale lidelser | 31.620.959 | 00 | - | 0 | - |
| 13 - Respirationsvejslidelser | 12.280.683 | 00 | - | 0 | - |
| 14 - Led - lemmer - klove - centralnervesystem - hud | 9.874.336 | 00 | - | 0 | - |
| 15 - Stofskifte - fordøjelse - kredsløb | 89.089 | 00 | - | 0 | - |
| 16 - Andet (kun mink) | 6.548 | 00 | - | 0 | - |
| 20 - Rødmundesygge | 27 | 00 | - | 0 | - |

Appendix C - Patologiske manifestationer i slagtekroppen

- In Danish

Der refereres i følgende afsnit fra Jensen et al. (2006) samt Jepsen (1968). I enkelte tilfælde er der også benyttet ekspertvurdering.

Akutte infektioner i maven kan være en følge af kronisk mavesår, som hos svin især skyldes foderets formålingsgrad. Ukomplerede tilfælde betinger lokal kassation. Det vurderes, at denne læsion ingen betydning har for fødevarer sikkerhed eller eksotiske smitsomme husdyrsygdomme.

Idiopatisk tilstande: Universel tarmlødning er en idiopatisk hæmoragisk non-inflammatorisk intestinal tilstand hos svin. Den viser sig ved pludselig massiv blødning til tarmlumen. Tilstanden er som hovedregel kompliceret med sekundær anæmi eller choklignende symptomer, hvilket betinger total kassation af slagtekroppen. Ukomplerede tilfælde betinger lokal kassation. Det vurderes at tilstanden kan observeres visuelt. Tilstanden har ingen betydning for fødevarer sikkerhed eller udbredelsen af eksotiske smitsomme husdyrsygdomme.

Akutte tarminfektioner ses sjældent hos slagtesvin. Årsagen til uspecifik mave-tarm infektion kan hos voksne dyr skyldes diætiske fejl, der betinger ubetinget godkendelse af slagtekroppen. Lette, ukomplerede tilfælde betinger lokal kassation. Akut, svær betændelse kan dog ses hos alle husdyrarter (især meget unge dyr) og forårsages typisk af *Salmonella* spp. Tilstanden kan erkendes visuelt og betinger total kassation. Salmonellainfektioner hos lidt større dyr forekommer dog typisk som subkliniske infektioner, der ikke kan erkendes visuelt. Det vurderes, at læsioner som følge af infektion med *Salmonella* spp. har betydning for fødevarer sikkerhed, idet mennesker kan smittes gennem svinekød. Tarmens udseende afhænger af, hvor alvorlig den bagvedliggende tilstand er. Milde tilfælde medfører ingen eller kun let svullet udseende, men mere alvorlige tilstande medfører svulne, røde, kar-injicerede tarme og røde eller stærkt svulne lymfeknuder.

Kroniske tarminfektioner forekommer hyppigt hos svin. De hyppigste udgøres af proliferativ enteropati, svinedysenteri, og spirokætal diarré. I ukomplerede tilfælde foretages lokal kassation. Den hyppigste komplikation er afmagring. Proliferativ enteropati, hvor *Lawsonia intracellularis* er involveret, forekommer i tre former hos slagtesvin: Proliferativ enteritis, nekrotiserende enteritis og regional ileitis. Den tilgrundliggende tilstand er en hyperplasi af tyndtarmens mucosa, som i visse tilfælde undergår nekrose. Svinedysenteri og spirokætal diarré er begge karakteriseret ved kroniske hyperplastiske og nekrotiserende læsioner i blindtarm og tyktarm. Sidstnævnte tilstande forårsages af henholdsvis *Brachyspira hyodysenteriae* og *B. pilosicoli*. Det vurderes, at de ovennævnte læsioner i tarmene vil være visuelt erkendelige i en del tilfælde. Mere afhelede tilfælde – eller mindre voldsomme tilfælde – vil derimod være mindre visuelt erkendelige. De ovennævnte patogener har betydning for dyresundhed, men ikke for fødevarer sikkerhed eller eksotiske smitsomme husdyrsygdomme.

Lejeforandringer inkluderer rektalprolaps, broktilstande og tarminvaginationer. Sådanne forandringer bedømmes ud fra omfanget af cirkulationsforstyrrelse, disses alder samt komplikationer. Dette vil også gøre sig gældende for tilfælde af tarmslyng.

Parasitære infektioner som følge af *Oesophagostomum dentatum* og *O. quadrispinulatum* kan manifestere sig i tarmen hos slagtesvin i form af dannelse af subserøse granulomatøse noduli i tyktarmen. Sådanne læsioner betinger lokal kassation. I tilfælde af at mange dyr har voldsomme læsioner, er der tale om en betydning for dyresundhed i besætningen. Læsionerne har der imod ingen betydning for fødevarer sikkerhed eller eksotiske smitsomme husdyrsygdomme. I udendørsdrevne svinebesætninger kan der forekomme infektion med svinets røde maveorm (*Hyostrogylus rubidus*). Den er dog ikke observeret i Danmark i de sidste 25 år (J. Boes, personlig meddelelse, 2009). Ukomplerede tilfælde vil betinge lokal kassation. Tilstanden har ingen betydning for føde-

varesikkerhed eller eksotiske smitsomme husdyrsygdomme. Der skal her erindres, at alene slagtesvin fra indendørs besætninger vil kunne indgå i integreret kødkontrol. Spolorm er meget udbredt blandt danske svin. Infektionen manifesterer sig i form af ormepletter på leveren eller ophobning af voksne orm i tyndtarmen. Tarmvæggen kan være fortykket i tilfælde af massiv ormebyrde. Spolormene vaskes ud af tarmene i forbindelse med tarmrensning. Der er ingen betydning for fødevarerikkerhed, fordi de voksne orm ikke smitter, og fordi æg fra spolorm skal modnes uden for grisen i 3-4 uger før de er infektiøse (J. Boes, personlig meddelelse, 2009).

Afmagring og hungerødem er kroniske generaliserede komplikationer, der optræder som følgetilstande til funktionsforstyrrelse i fordøjelseskanalen eller utilstrækkelig fodring. Disse to tilstande, der optræder samtidigt, er karakteriserede ved mangel på organ- og depotfedt, serøs fedtvævsatrofi, systemisk atrofi af muskelvæv, samt mørkpigmentering af lever, hjerte- og skeletmuskulatur. Det er vurderingen, at disse tilstande er visuelt erkendelige, og at de er uden betydning for fødevarerikkerhed. Slagtekroppen fremstår ikke som egnet til menneskeføde, æstetisk set. Tilstanden betinger derfor total kassation.

Anæmi optræder som følgetilstand til hæmoragiske tilstande i fordøjelseskanalen. Hos svin er der hyppigst tale om en følge af blodtab til tynd- og tyktarm i forbindelse med universel tarmløbning eller hæmoragisk enteropati (hos søer og gylte) som følge af *L. intercellularis*. Anæmi betinger total kassation af slagtekroppen. Selv om slagtekroppen vurderes som værende uegnet til menneskeføde, er der ikke tale om en egentlig betydning for fødevarerikkerhed, men snarere at kroppen fremstår som uæstetisk. Tilstanden kan erkendes visuelt.