

Evaluation of the usefulness of carcass-weight, meat-percentage or identity of pig-producer in future-risk-based meat inspection

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Abstract

In the search for new and risk-based ways of conducting meat inspection, a pilot study was conducted with the aim of investigating whether carcass weight in combination with meat percentage, or producer-identity could be used as indicators for rejection of finisher pig carcasses. Data covering April 2010 to March 2011 were obtained from one Danish abattoir. Data about production type and herd size were obtained from the Danish Producer Registry. The total number of recordings included 4,665,812 pig carcasses delivered by 3,267 producers. Lesions leading to total rejection were found in 6,752 of the carcasses (0.1%). Among the rejected carcasses the most frequent lesions were: acute pleuritis (17.7%), rectal stricture (16.9%), osteomyelitis (15.3%), circulation disorders (14.6%), infected tails (14.5%), pyemia (10.7%) and emaciation (9.9%). Among the accepted carcasses the most frequent lesions were: chronic pleuritis (23.6%) and contusions/bursitis (2.3%). A logistic regression analysis indicated that rejection could be predicted by carcass weight, but the effect was too low in order to be suitable for meat inspection purposes. The effect of producer was, however, strongly significant. About 46.0% of the producers did not get any carcasses rejected because of lesions during the study period. Of the 1,659 (51.0%) of the producers that had 1.0% rejected carcasses in the study period, 454 had rejections two or more months in a row and large size deliveries. Among the 101 producers who on average got >1.0% of their carcasses rejected (high-risk), 43 producers seemed to have persistent problems because they experienced rejection at least 2 months in a row. When investigating herd size and production type for these herds in the Danish database for producers, the herd sizes were on average 1,133 pigs – and hence of a medium size in a Danish perspective. The production type was mainly integrated. Since some producers deliver to more than one abattoir and more frequently than once a month, a further exploration of data from all Danish abattoirs on data of delivery is needed before any conclusions might be drawn regarding the usefulness of producer as an indicator for meat inspection. An investigation of the most frequently reported lesions in carcasses originating from the low- and high-risk herds will also be conducted in order to reveal presence of persisting disease problems in those herds.

Introduction

The traditional meat inspection procedures were established 100 years ago, when the prevalence of animal and zoonotic diseases in Europe were very different from today. The implications of using outdated meat inspection principles might be that new emerging diseases are not in focus, and that resources are spent for limited food safety, animal health and welfare value. Hence, meat inspection is currently up for discussion. How can it be conducted in a more cost-effective way than at current where each carcass receives the same amount of attention?

It might be speculated that certain indicators might be used to allocate carcasses into two groups, where one group has a low probability of being rejected and the other group has a higher probability. And hence, the meat inspectors would be able to conduct a more extensive meat inspection of the latter group than of the first, which could undergo a more superficial inspection.

In Denmark, around 21 million finisher pigs are slaughtered and inspected annually. In the search for new and risk-based ways of conducting meat inspection, a pilot study was conducted with the aim of investigating whether carcass weight in combination with meat percentage, could be used as indicators for rejection of finisher pig carcasses. This was judged relevant to study, because meat percentage is measured by use of the AutoFom system prior to meat inspection at some of the large Danish abattoirs. It was also hypothesized that in some pig herds disease – or conditions leading to disease (and

rejections of carcasses at slaughter) – is persisting. In a statistical analysis, this would be seen as clustering on producer level. Again, it was judged as relevant to study the effect of producer on the probability of rejection, because it would be easy to sort pigs/carcasses by producer. Other factors like production size and production type were also investigated.

Material and Methods

Abattoir data describing findings at meat inspection of finisher pigs (weighing 109.9 kg) from one Danish abattoir from April 2010 to March 2011 were selected from the abattoir company's database.

During meat inspection, a carcass could get between one and four different remarks based on lesions observed on the carcass or in the organ systems caused by infectious or non-infectious diseases. Remarks indicating generalised infection would lead to rejection in agreement with the current Danish meat inspection circular which is based on the EU legislation on meat inspection.

The pigs with lesions that led to rejection were defined as cases, whereas the other pigs acted as controls. Controls could also have lesions such as chronic pleuritis or parasite-affected livers. Such disease codes would typically have led to local condemnation of the affected organ.

Observations that had a meat percentage <1 and a weight above 109.9 kg were excluded from the analyses. An unrealistic low meat percentage was considered as an artefact in the data. Only slaughter pigs (weight below 110 kg) were included in the analysis because an animal weighing more than 109.9 kg was not considered a finisher pig but a gilt/boar or a sow which might have another disease pattern than finisher pigs.

The descriptive statistical analyses and the logistic regression (GLIMMIX) were conducted in SAS. The Figure was made in Excel.

Information about herd production type and size were obtained from the Registry of producers (CHR-registry).

Results

Descriptive results

The total number of pig carcasses slaughtered and inspected during the study period included at the abattoir was 4,665,812. Among those, lesions that led to total rejection were found on 6,752 corresponding to a rejection rate of 0.1% (Table 1). The pigs were delivered by 3,267 producers. The monthly number of producers delivering carcasses as well as the monthly number of slaughtered pigs is given in Table 1.

Among the cases (rejected carcasses) the most frequent acute lesions consisted of pleuritis (17.7%), osteomyelitis (15.3%), circulation disorders (14.6%), infected tail (14.5%), pyemia (10.7%), emaciation (9.9%), gastric ulcers (8.2%), Erysipelothrix rhusiopathiae infection (7.7%), and peritonitis (3.9%). The most frequently recorded chronic lesions were: rectal stricture (16.9%) and chronic peritonitis (2.9%).

The most frequently recorded remark among the controls (accepted carcasses) was chronic pleuritis (23.6%) followed by contusions/bursitis (2.3%) and abscesses in the head (1.4%). The numbers of carcasses with lesions that indicated that the pig had suffered from acute diseases or chronic diseases were summed up per month in Table 1.

Multi-variable analysis

The results of the logistic regression analysis indicated that rejection could be predicted by carcass weight, but the effect was too low to be of practical relevance during meat inspection.

The effect of producer was, however, strongly significant. The history of lesions related to the deliveries for each producer was therefore further explored.

Carcass rejection rate

The average rejection rate was 0.13% (min.: 0, median: 0 and max.: 33%) (Table 1).

Table 1. Number of pig producers, carcasses, rejected carcasses and carcasses with lesions caused by acute or chronic disease, delivered per month to a Danish abattoir, April 2010-March 2011.

Month	No. of producers delivering	No. of delivered carcasses	No. of rejected (%)	No. of carcasses with lesions caused by**	
				acute disease	chronic disease
April*	1552	329,230	416 (0.13)	1,230	97,349
May*	1578	319,587	424 (0.13)	948	94,023
June*	1584	359,285	456 (0.13)	1,077	104,601
July	1592	365,947	587 (0.16)	2,365	103,715
August	1581	363,465	541 (0.15)	2,455	101,912
September	1687	404,443	528 (0.13)	2,729	111,175
October	1707	405,162	539 (0.13)	2,998	105,595
November	1761	420,350	675 (0.16)	3,489	111,582
December	1797	412,729	611 (0.15)	3,145	108,216
January	1785	447,840	720 (0.16)	3,231	116,325
February	1756	405,139	613 (0.15)	3,021	112,585
March	1795	432,635	642 (0.15)	3,309	125,299
Total	3,267	4,665,812	6,752 (0.14)	29,103	1,274,176

* A revision of codes was conducted in July 2010 – hence lower number of the acute disease lesions in April/June 2010.

**Carcasses that are accepted could have recorded lesions of acute or chronic character.

A total of 46.0% the producers did not get any carcasses rejected at all because of disease during the entire study period (Figure 1). These might be considered as zero-risk herds. Only 101 producers (3%) had 1% of their carcasses rejected (high-risk herds) and the remaining 1,659 producers (51%) had 1% percentage of their carcasses rejected (low-risk herds).

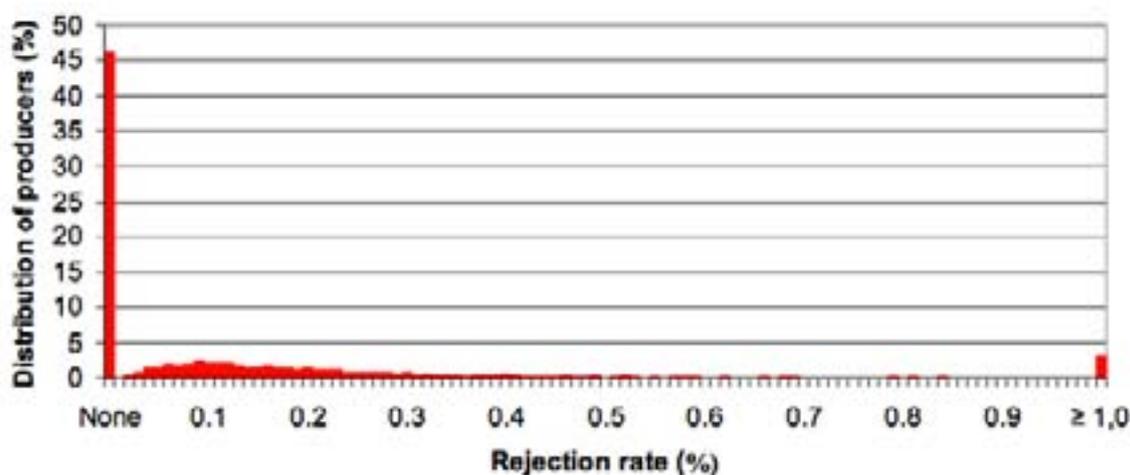


Figure 1. The distribution of rejection rates among the 3,267 Danish pig-producers delivering finisher pigs to one abattoir from April 2010 to March 2011. Further inspection of the low- and high-risk herds

An inspection of the 1,659 low-risk herds revealed that 454 had experienced rejection of carcasses in 2 months in a row. The main characteristics of those were that they had large size deliveries with a mean of 556 (min.: 113, median: 497, max.: 2060) implying that the herds were large. Of the 101 of the high-risk herds, 43 had carcasses rejected 2 months in a row and the main characteristics for them were small deliveries with a mean of 127 (min.: 21, median: 86, max.: 586). According to the Danish Producer Registry, the average herd size for the 43 herds was 1133 pigs (min.: 200, median: 1631, max.: 8000). All of the 43, except from two, were integrated herds.

Discussion

The first analyses showed that carcass weight was a statistically significant predictor for rejection. The effect was, however, too low for practical use when categorising a pig into one or another meat-inspection regime. The same analysis revealed that cases of rejection were clustered around the random variable herd-identity. This variable was therefore further explored as a possible candidate for categorising into differentiated meat-inspection regimes.

The number of rejected cases from each producer was a function of the number of delivered carcasses; large herds having more carcasses rejected (Table 2). The overall rejection rate was 0.1% but the variation was wide (min.: 0, max.: 50%). About 46.0% did not experience rejections due to disease during the study period while 51.0% experienced a low rejection rate. Only about 3.0% of the producers experienced a high rejection rate and carcasses that were rejected 2 months in a row. The findings that some producers were associated with increased risk of rejection of their pigs might be related to management – or it might have been that the delivery consisted of a pen or two with slow-growing pigs. Some of the producers deliver to several abattoirs. The average herd size for these herds was found to be medium in a Danish perspective and almost all of them were integrated herds. Hence, no particular factors were revealed that could characterise this group of producers so far except from individual management. Hence, before making any conclusions about the producer-effect as an indicator of rejection in meat inspection a more thorough investigation of the overall deliveries (on delivery date) for each producer must be made. The 46.0% of the producers that never got their pigs rejected would be of particular interest. In addition, the most frequent lesions recorded in carcasses originating from the low-risk herds and high risk herds that had experienced rejection of carcasses in 2 months in a row needs to be explored in order to investigate whether these herds have persisting disease problems.

New strategies in meat inspection need also to be fundamental in the practical feasibility. Analyses of whether a change in logistics in the meat inspection would be possible in practical life needs therefore also to be conducted.

Conclusion

Future meat-inspection strategies could be based on allocation of producers into two groups; carcasses from the high-risk group would be subjected to a more extensive meat control whereas the low-risk group could undergo a more superficial inspection. This study of pig-deliveries from one year from one abattoir revealed that 46.0% of the producers never had a single carcass rejected. Of the producers who had more than 1.0% of their carcasses rejected only 43 herds delivered and had rejected carcasses two months in a row or more.

Further studies of the effect of producer as an indicator for rejection will be conducted.