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# Relationship between tail lesions and lung health in slaughter pigs

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ABSTRACT

Tail lesions are associated with poor health either because they serve as a point of entry for pathogens or because of shared risk factors. This study investigated the relationship between carcass tail lesion and lung lesion severity scores in slaughter pigs. Carcasses were scored after scalding/dehairing for tail lesion severity (0–4). Lungs were scored according to an adapted version of the BPEX pig health scheme. Severity of enzootic pneumonia (EP-like lesions) was recorded on a scale of 0–50. Severity of pleurisy was scored on a 0–2 scale with score 2 equating to severe pleurisy or those lungs that remained attached to the chest wall ('lungs in chest'). The database for assessing pleurisy lesions contained all pleurisy scores (n = 5628). Lungs with a score of 2 for pleurisy were excluded from the analysis of all other lung lesions as such lungs could not be assessed for other lesions (n = 4491). Associations between tail lesions and different lung lesion outcomes were analysed using generalized linear mixed models (PROC GLIMMIX) with random effect for batch.

Males were more affected by moderate (OR = 1.9, 95% CI 1.51–2.34) and severe (OR = 5.8, 95% CI 3.45–9.70) tail lesions than females. EP-like lesions and pleurisy were most commonly observed. Pigs with severe tail lesions tended to have more 'lungs in chest' than pigs with moderate tail lesions (P = 0.1). No other associations between tail lesions and lung lesions were found. Males had higher odds of having EP-like lesions (OR = 1.2, 95% CI 1.05–1.36) than females. Tail lesions on the carcass may not be an accurate predictor of lung health. However, tail lesions are important welfare indicators and respiratory disease is a significant infectious condition affecting pigs. Thus, recording of tail and lung lesions at meat inspection provides valuable information regarding on-farm health and welfare of pigs.



## 1. Introduction

The primary function of meat inspection conducted at slaughter is to protect public health by ensuring food safety. However the data collected also has potential to serve as a surveillance tool for pig health and welfare on farm (EFSA, 2011; Harley et al., 2012a; Stärk et al., 2014; Vial and Reist, 2014). Pig health schemes such as Wholesome Pigs Scotland (WPS) and BPEX Pig Health Scheme (BPHS) report on a variety of pathological lesions associated with reduced performance or animal welfare problems (Sanchez-Vazquez et al., 2011). Respiratory diseases cause substantial economic losses in intensive pig production (Holt et al., 2011; Merialdi et al., 2012). These diseases are multifactorial resulting from the interaction of infectious agents, host factors and environmental conditions (Merialdi et al., 2012) and their diagnosis, monitoring and control represent a major challenge for the pig industry. Another important challenge for the pig industry is tail biting which has important welfare and economic implications (EFSA, 2007). Tail biting lesions are often associated with carcass condemnations, trimmings and reduced carcass weight, especially when the lesions are severe (Valros et al., 2004; Walker and Bilkei, 2006; Kritas and Morrison, 2007; Marques et al., 2012; Harley et al., 2014). Thus, both tail biting and respiratory disease are among many factors associated with reduced performance. However, the relationship between general pig health and risk of tail biting is uncertain (EFSA, 2014). Clarity on the nature of this relationship is required to assist in resolving both health and behavioural problems on farms. Evaluation of the potential of tail lesions to act as an 'iceberg' indicator of health and welfare issues on farms is also necessary (Spoolder et al., 2011). Damage resulting from tail biting provides a route of entry

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**Table 1**
Tail lesion scoring system (adapted from Kritas and Morrison, 2007; Harley et al., 2012b).

| Score | Description |
|---|---|
| 0 | No evidence of tail biting |
| 1 | Healed or mild lesions |
| 2 | Evidence of chewing or puncture wounds, but no evidence of swelling |
| 3 | Evidence of chewing or puncture wounds with swelling and signs of possible infection |
| 4 | Evidence of chewing or puncture wounds with severe swelling/infection or open, gaping wound in cases of complete tail amputation |

**Table 2**
Description of lung lesions recorded at meat inspection modified from BPHS (BPEX, 2014; Sanchez-Vazquez et al., 2011; Smith et al., 2011; Ellerbroek et al., 2012).

| Disease | Description | Scoring system |
|---|---|---|
| Enzootic pneumonia-like lesions (EP-like lesions) | • Red-tan-grey discolouration<br>• Collapsed, firm, rubbery<br>• Cranioventral lobes affected<br>• Lobular pattern | Each pair of lungs is divided into a cranial lobe, middle lobe and caudal lobe. A score is assigned based on the area of the lobe affected. A score of 10 is assigned to the cranial and middle lobes if totally diseased, and a score of 5 to the caudal lobes[a] |
| Pleuropneumonia (APP) | • Focal bronchopneumonia with overlying pleurisy<br>• Middle or caudal lung lobes affected | Binary: present or absent |
| Pleurisy | • Inflammation of the pleura<br>• Fibrinous pleural adhesions<br>• Mild or localised form describes discrete areas of inflammation of the pleura<br>• Severe or extensive pleurisy involves whole lobes of the lung | Three categories: 0 absent, 1 mild, 2 severe (incl. lungs attached to chest wall; 'lungs in chest') |
| Abscess | • Abscesses in the lobes | Binary: present or absent |
| Pyaemia | • Multiple small abscesses in lung parenchyma | Binary: present or absent |

[a] Accessory lobe not scored due to line speed.

for pathogens which can then be haematogenously disseminated to different organs including the lungs (Huey, 1996; Schrøder-Petersen and Simonsen, 2001; Heinonen et al., 2010). This results in an increased risk of carcass condemnation, mostly due to abscess formation (Huey, 1996; Valros et al., 2004; Marques et al., 2012). Pigs with moderate tail lesions had higher odds of having abscesses or pleurisy/embolic pneumonia and this risk increased with more severe tail lesions (Marques et al., 2012). Elbers et al. (1992) also found moderate correlations between tail inflammation and pneumonia, lung abscesses and severe pleurisy. A number of studies examined the occurrence of tail lesions of differing severity but pathological lesions were often scored as binary, i.e. presence or absence, or only when it was the cause of condemnation (Valros et al., 2004; Sanchez-Vazquez et al., 2011; Harley et al., 2012b, 2014). However, Teixeira et al. (2016) suggested that tail bitten pigs may have a higher rate of mild pathological lesions which do not necessarily lead to condemnation. Kritas and Morrison (2007) found no association between severity of tail biting and percentage of lung surface area that was affected by lesions of enzootic pneumonia. Munsterhjelm et al. (2013) reported that victims of tail biting had higher tail lesion scores than tail biting pigs and also had a higher severity score for respiratory organ inflammation.

Apart from providing an entry point for pathogens, tail biting could be associated with lung disease because both conditions share similar risk factors (Stärk, 2000; EFSA, 2007; Jäger et al., 2012). Tail biting also appears to be associated with gastric lesions (van den Berg et al., 2005) because both conditions are elicited by stress (EFSA, 2007; Swaby and Gregory, 2012). Stress suppresses the immune system and thus contributes to increased incidence and duration of disease (Dybkjær et al., 1998; Proudfoot and Habing, 2015). This may explain in part why tail biting is more common on farms where animals are more prone to disease (Moinard et al., 2003).

The objective of this study was to assess the relationship between tail and lung lesion severity scores in slaughtered pigs at one abattoir in the Republic of Ireland.

## 2. Material and methods

Visits to one abattoir (weekly throughput 15,000 pigs, which represents approx. 25% of pigs slaughtered in Ireland each week) were conducted on 5 days between January and March 2015. A team of three observers worked in 2 shifts of approximately 1.5–2 h each, during which every pig on the line was scored (line speed: 6 pigs/min). After scalding/dehairing, one observer scored carcasses for tail lesions according to severity (Table 1) and recorded sex, kill number and farm identification number. Lungs were removed from the carcass by abattoir personnel. Lungs were identified by attaching numbered pieces of paper which corresponded to the carcass kill/line number by a second observer.

A third observer recorded the number on the lungs and assessed lung lesions using an adapted version of the BPHS scale (Table 2). In brief, severity of enzootic pneumonia (EP)-like lesions was evaluated by assessing the percentage of lung lobe affected by lesions. The main adaptation related to exclusion of the accessory lobe for EP-like lesions due to the line speed. Pleurisy was recorded on a 0–2 severity scale (Table 2). Lungs that remained attached to the chest wall and were not removed from the carcass were automatically given a pleurisy score of 2 and recorded as 'lungs in chest'. Presence of other lung lesions (pleuropneumonia, abscess and pyaemia)