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A study of associations between gastric ulcers and the behaviour of finisher pigs

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ABSTRACT

Gastric ulcers are a common condition in finisher pigs. A study was conducted to investigate the hypothesis that gastric ulceration alters the behaviour of finisher pigs. Two one-hour observations (from video recordings) of home pen behaviour were conducted in finisher pigs, at two farms (one in Denmark and one in Scotland), in the days immediately prior to slaughter. Stomach condition was assessed post mortem according to a pre-established ulcer score index. The behaviour of pigs with healthy stomachs ($n = 36$) was compared with the behaviour of pigs with deep ulceration of the pars oesophagea ($n = 26$). Assessment of various predefined postures and behaviours was made by an observer blind to the gastric ulcer status of the observed pigs. Behavioural data from the two sites were combined in a single analysis. Pigs with gastric ulcers tended to spend less time idle ($p = 0.081$) and less time lying on their left side ($p = 0.064$), and significantly more time standing ($p = 0.009$), or walking ($p = 0.038$) compared to healthy pigs. Pigs with ulcers also showed an increased frequency of posture changes ($p = 0.02$). A decrease in time spent lying on the left and an increase in standing/walking could both be interpreted as attempts to avoid liquid gastric contents pooling in the cranial region of the stomach. This along with the higher level of posture changes observed may indicate some degree of pain/discomfort associated with the presence of gastric ulcers in pigs. This study is the first to identify apparent behavioural differences between finisher pigs with or without gastric ulcers, and further work is needed to establish to what extent the apparent behavioural differences are a consequence of pain or discomfort for the animals concerned. Since gastro-oesophageal ulceration of pigs is associated with pelleting and fine grinding of feed which in turn is linked to increased growth efficiency there may be a dilemma between on one hand concern for preventing gastric ulcers and on the other hand concern for the efficiency and sustainability of pig production.

1. Introduction

The occurrence of gastric ulcers in pigs is an on-going concern in relation to animal health and production. Erosion and ulceration of the lining of the stomach is a common condition in intensively managed pigs (Thomson and Friendship, 2012). It occurs around the area where the oesophagus enters the stomach (called the pars oesophagea). In the early stages of the disease, the pars oesophagea becomes roughened and gradually changes as the surface becomes eroded and can get deeply ulcerated (Doster, 2000). These changes may lead to intermittent haemorrhage followed by anaemia, or massive haemorrhage resulting in death.

The prevalence of gastric lesions in pigs is a major cause for concern in many pig producing countries (and has been for many decades: Baustad and Nafstad, 1969). A recent abattoir study in the UK (Swaby and Gregory, 2012) found that four out of every five slaughter pigs had some signs of ulceration or pre-ulcerative damage, and 6% of slaughter pigs had signs of severe ulceration. A study examining 1101 finisher pigs in Denmark found that 29% had signs of moderate to severe ulceration (Nielsen et al., 2012). Similarly, high gastric ulcer

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prevalences have been found in a number of countries over the last two decades (Thomson and Friendship, 2012). The prevalence of ulcers seen at slaughter can be highly variable between farms (Christensen and Cullinane, 1990; Guise et al. 1997), and on-farm mortality associated with bleeding from ulcers can be high on affected units (Melnichouk, 2002).

The pathogenesis of gastric ulcers appears to be highly multifactorial. The incidence and severity of the condition are associated with nutritional factors, housing and feeding systems, some forms of stress, pig gender, other concurrent diseases and genetic effects (Doster, 2000; Thomson and Friendship, 2012). However, amongst these the physical structure of feed is the most significant risk factor; fine particle size and pelleting significantly increase the prevalence of gastric ulcers (Wondra et al., 1995; Eisemann and Argenzio, 1999b; Robertson et al., 2002; Grosse Liesner et al. 2008; Millet et al., 2012a, 2012b; Cappai et al., 2013; Mösseler et al., 2014; Overholt et al., 2016). It is thought that the more fluid gastric contents associated with these feeds allow reflux of acidic fluids to the non-glandular tissue of the pars oesophagea.

Whilst the incidence of gastric ulcers is high in commercial pigs and the pathology well recognised, there appears to be little information as to how the condition affects welfare. A small proportion of pigs with severe acute ulcers hemorrhage and either die on farm (e.g. Melnichouk, 2002) or show various acute clinical signs of pain (Taylor, 2006), and perforation of an ulcer can also lead to peritonitis (Jackson and Cockcroft, 2007). Such animals clearly suffer impairment to their welfare. However, the majority of pigs with gastric ulcers are not detected under farm conditions, and the welfare status of these subclinically affected animals relative to those with healthy stomachs remains uncertain. Finding out whether these ulcerated pigs suffer is important because the main risk factor for ulceration (the feeding of pelleted feed with small particle size) is used by the industry to improve feed conversion efficiency. So the clear benefits in terms of production efficiency (Doster, 2000) of this feeding strategy need to be balanced against any detrimental effect to welfare; and if there were significant effects on welfare it would seem relevant to consider changing this strategy.

To date no scientific appraisals have been made of the welfare significance of gastric ulcers in pigs. Whilst it might be presumed that ulcers, at least beyond a certain level of severity, have a negative effect on welfare, the extent of this effect has not been quantified. Since behavioural indicators are widely used in the study of pain in pigs (Ison et al., 2016a) and as a first step towards understanding the welfare impact of gastric ulcers, the aim of the present study was to conduct a controlled study of the behaviour of pigs with and without ulcers.

2. Materials and methods

Video footage was collected and analysed from pigs at two different research farms: Grønhøj (GR) farm in Denmark and EasterHowgate (EH) farm in Scotland. Video recordings were taken from all study pigs, and healthy or ulcerated pigs were retrospectively chosen for detailed behavioural analysis based on post mortem appraisal of stomach condition. The experiments at both farms were conducted in accordance with EU Directive 2010/63/EU and following ethical review by SRUC's Animal Welfare and Ethical Review Body, and the Scottish study was conducted under UK Home office licence.

2.1. Grønhøj farm, Denmark

The pigs used in this study were part of a larger study, which aimed to investigate the performance and health implications of gastric ulcers in pigs. In each replicate (batch) of the study, pigs (Dam: DanAvl landrace + DanAvl Yorkshire; Sire: DanAvl Duroc) were housed, from 30 kg, in 10 pens (4.33 m x 2.75 m; two thirds slatted flooring), with 12 pigs (females and barrows) in each pen. Before the trial started, weaners to be included in the trial were fed medium-coarse meal feed. During the trial period pigs were ad libitum fed a pelleted feed from a single electronic feeder (NEDAP, The Netherlands) in each pen. Each pen also had a single drinker and an enrichment device (a vertical wooden log attached to the side of the pen). The pigs were tagged with electronic ear tags (for identification by the feeding system) and were spray marked with an identification system based on stripes, which allowed individual pigs in each group to be identified on video. Lights were on in the experimental building from 0500 to 2100.

Video recordings were made from single cameras positioned above each pen. Footage was recorded onto a digital system (AnnoxNext). The pigs selected for observation came from four separate batches of a larger trial. On the day of slaughter, pigs were transported (for ~1 h) to a commercial abattoir, and kept in lairage for ~1 h before slaughter. Feed continued to be available to the pigs until shortly before moving for transport. Stomachs were collected, marked with pig identification and transported to the Danish Laboratory for Pig Diseases for assessment.

2.2. EasterHowgate farm, Scotland

Seventy-eight pigs (Dam: Large White x Landrace, Sire: Hampshire) were used in two separate batches of 39 pigs. Pigs were housed (from ~ 2 weeks prior to slaughter) in small (2.85 m x 3.7 m for a single pen) straw bedded pens, with ad libitum access to a pelleted feed in a trough (90 cm long) and a single drinker in the pen. Each pen held between 3 and 6 pigs (pens with 4, 5 or 6 pigs were provided with twice as much space as the groups of 3). Lighting was on between 0600 and 1800.

Video recordings were made from single cameras positioned above each pen. Footage was recorded onto a digital system (GeoVision). Prior to moving to the experimental building, pigs had been housed from weaning onwards in larger pens with straw bedding in groups of between 10 and 20 pigs. Pigs were euthanized on-site at EH. On the day of euthanasia, pigs were moved in their whole groups to a different pen. Feed was provided in the home pen until each group was moved for euthanasia. Individual pigs were then sedated before being given an overdose of barbiturates (Euthatal) via injection to the heart. Following confirmation of death, stomachs were dissected out whole and transferred to the SAC Consulting Veterinary Services (SACCVS) for gastric ulcer scoring.

2.3. Ulcer scoring and selection of pigs for observation

Stomachs were scored according to a pre-existing gastric ulcer scoring system (Jensen et al., 2017; Table 1) at the Danish Laboratory for Pig Diseases or at SACCVS by experienced veterinary pathologists. The non-glandular pars oesophagea ('white part') of each stomach was scored for the presence of hyperkeratosis (where the mucosa of the pars oesophagea has become thickened and keratinized), erosion (superficial tissue erosion where layers of the epithelium have disappeared but the basement membrane is intact), ulceration (where the submucosa, nerves and blood vessels are exposed and potentially damaged) and scarring or stenosis of the oesophageal opening. The final ulcer score (ranging from 0 to 10) for any individual stomach is based on the severity of the most severe sign seen (e.g. an erosion score of 1 produces a stomach index score of 4, irrespective of how much hyperkeratosis is present). Based on the stomach score, individual pigs were retrospectively chosen for behavioural analysis (healthy: score 0 or 1; gastric ulcer: score 7 or 8, i.e. 'deep' rather than 'superficial' (score 6) lesions). In the scoring system a stomach can be given a score of 6, 7, or 8 based on the presence and extent of an ulcer, or based on the presence of scar tissue. All selected ulcerated GR pigs had an ulcer (i.e. any pigs which were scored 7 or 8 due to scarring alone were not considered for selection) but all also had signs of scarring from healing or healed ulcers. All ulcerated EH pigs only had ulcers without any distinguishable scar