



A cross-sectional study of the prevalence of foot lesions in post-weaning pigs and risks associated with floor type on commercial farms in England

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ABSTRACT

We carried out a cross-sectional study during 2003 and 2004 to establish the prevalence and risk factors associated with floor type for commonly observed foot lesions in pigs aged 6, 8 and 14 weeks. The overall prevalence of foot lesions was 39.6% in 2283 pigs from 90 representative pig farms in England. The most prevalent lesions were heel/sole bruising (7.1%), heel/sole erosion (10.8%), heel flaps (8.4%) and toe erosion (11.6%). Pigs were kept on either solid (41%), partly slatted (28%) or fully slatted (31%) floors. Of the 104 pens with a solid floor, 26% of pens were outside with straw bedding on a soil base, 33% were indoors with deep bedding on solid concrete, 25% were partly deeply bedded on solid concrete and 16% were sparsely bedded on solid concrete. Only six of the pens with partly slatted floors were bedded.

Multilevel logistic-regression models were built using data from 100 farms to examine the risks for individual foot lesions with prevalences >5%. The prevalence of toe erosions was positively associated with deep bedding, whereas deep bedding and soil floors were negatively associated with the prevalence of heel/sole erosions. Heel flaps and heel/sole bruising were both associated with slatted floors, possibly indicating a common aetiology. The greatest reduction in prevalence of all these lesions, from AfP calculations, would be achieved by moving pigs from slatted floors onto solid floors.

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1. Introduction

A pig's hoof is comprised of the toe, sole, heel and wall. The toe, sole and heel form the volar, weight-bearing surface which is separated from the hoof wall horn by the white-line. There are many types of lesion that can occur on the feet of growing pigs (Table 1). In a study of live pigs on 17 farms, 50.2% of 528 pigs aged 3–12 weeks had a lesion on at least one digit (Mouttotou et al., 1999a) with 47.2% of hind and 35.8% of fore feet affected and approximately equal prevalences on left and right feet. In these pigs, the most prevalent lesions were corrugated heels (10.4%), heel flaps (20.1%), sole bruising (27.1%) and

sole erosion (11.6%). KilBride et al. (in press-a, in press-b) reported that heel flaps are a series of false soles that originate from repeated haemorrhage into the corium in the heel.

The evidence to date on the importance of foot lesions on the health of growing pigs is unknown but it is likely that, in many cases, foot lesions cause pain and discomfort. Brooks et al. (1977) commented that lesions on the weight-bearing surface that penetrate sensitive tissue are the most serious because they are painful and secondary infection (Zoric et al., 2004) might occur. The corium contains nerve fibers and is therefore sensitive (Geyer and Gloor, 1985). However, Brennan and Aherne (1987) reported that most foot lesions do not enter the corium.

The presence versus absence of bedding and solid versus slatted floors have been associated with certain foot lesions (Mouttotou et al., 1999b; Jørgensen, 2003) but no

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Table 1
Description of lesions on the feet of growing pigs based on Mouttotou et al. (1997).

Lesion	Description
Heel corrugation	A corrugated and flaky appearance to the heel
Heel/sole bruising	Congestion and bruising of the solar corium presenting as a dark red pigmentation of the volar horn
Heel/sole erosion	Loss of horny tissue from either the sole or the bulbar heel, in the form of irregular pit-like depressions or deeper grooves
Heel flap	A partial peeling of the superficial layer of the heel horn with a deep groove visible underneath
Overgrown hooves	Long hooves with elongated toes and a concave rather than flat sole
Toe erosion	Loss of horny tissue, which appears as a dark area on the cranial aspect of the volar surface where the axial and volar surfaces of the toe meet
Unequal claw size	A visible inequality in size between the medial and lateral claw of the same foot
Wall bruising	A dark red pigmentation on the horn of the wall
Wall crack	A crack on the axial or abaxial surface of the wall, which varies from a fine crack to a wide fissure with necrotic edges, and started at the weight-bearing surface, extending upwards towards the coronary band. Referred to as false sand cracks in Mouttotou et al. (1997)
Wall penetration	A partial loss of the hard horn of the wall
Wall separation	The disintegration and penetration of the white-line by debris with a visible gap between the wall and the sole
White-line lesion	A black line in the white-line, separating the hard horn of the wall from the soft horn of the heel and/or sole. Small diagonal superficial cracks along the white-line of the abaxial surface of the hooves were also defined as white-line lesions.

one floor type is apparently ideal. There are several other factors that have been associated with the prevalence of foot lesions including a genetic predisposition (Penny, 1979; Newton et al., 1980; Jørgensen, 2003) and lack of biotin in the diet (Webb et al., 1984).

Our objectives were to estimate the pig-, pen- and farm-level prevalence of foot lesions using data from 90 representative English pig farms and to examine the associations between floor type and the most prevalent foot lesions in a sample of 100 British farms.

We hypothesise that floor type and foot lesions are directly associated and that different floor types predispose pigs to different foot lesions. The aim of this study was 2-fold: to guide policy makers on possible changes in legislation for floors in pig buildings and to provide information to scientists and practitioners that might contribute to understanding the aetiology of foot lesions that can direct future work on the prevention of such foot lesions.

2. Materials and methods

2.1. Study population

2.1.1. Sample size

The selection criteria were breeder-to-finisher pig farms with >100 breeding sows. The target population was estimated to be 1870, based on 2003 census data from DEFRA (personal communication). Assuming 90% of herds had growing pigs with foot lesions (Mouttotou et al., 1997) with a 95% confidence interval and 5% precision we calculated that it was necessary to sample pigs from at least 75 farms.

The average herd size was 220 sows based on 2003 data (DEFRA, personal communication). Each sow was estimated to produce 20 pigs/sow/year to give an approximate target population of 1,500,000 weaned growing pigs (6–14 weeks); assuming 50% prevalence of lesions, a 95% confidence interval and 5% precision, with farm and pen-level intraclass coefficients of 0.1 (Dohoo et al., 2003, p. 43), we calculated that a sample of approximately 2850 pigs were required to estimate the prevalence of lesions if 30 pigs were sampled from each farm and 10 pigs from each pen.

To detect a 3.5-fold difference in risk between exposed and unexposed pigs with 95% confidence and 80% power, a sample size of approximately 2179 pigs was required. This was assuming a 10% prevalence of disease in unexposed pigs and farm and pen intraclass correlation coefficients of 0.1. Sample-size calculations were carried out in Win Episcope 2.0.

2.1.2. Farm selection

A sample of farms ($n = 549$) was selected by Assured British Pigs (ABP) from their database. The farmers were contacted and asked to participate in a study investigating the impact of floor types on the health and welfare of pigs. At the time of sampling, the ABP stated that their database contained data on ~85% of the national pig herd (Fearne and Walters, 2003). A total of 98 farmers from England (97) and Wales (1), out of 549 that were contacted, agreed to participate. A pilot study to train the observers and to test both the observation-recording systems and the interview questionnaire was carried out on seven of these farms. The seven farms for the pilot study were the first seven visits arranged; these farms were distributed throughout England. An additional nine farms were convenience selected: five in Scotland and four in England. Data on a total of 100 farms were therefore collected.

2.1.3. Pig selection

On each farm, weaned pigs of 6, 8 and 14 weeks of age were examined for presence of foot lesions. These age groups were also sampled for a concurrent study on PMWS (Woodbine et al., 2007) and blood samples were taken from pigs at 8 and 14 weeks of age. These pigs' feet were examined whilst they were restrained. The 6-week-old pigs were caught and examined only for the research on floor type and foot lesions. On a typical British farm, pigs are weaned at 4 weeks of age at which point litters are combined and moved into a grower pen for approximately 4 weeks before being moved onto finishing pens. Finishing is at approximately 22 weeks of age.

There was only one building with each age group on each farm. From the building, one pen of pigs was selected using random-number tables counting clockwise from the first pen to the left of the entrance. In each pen, 10 pigs

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