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Causes of preweaning mortality in organic outdoor sow herds

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ABSTRACT

The aims of the current study were to identify the causes of preweaning piglet mortality and investigate the effect of season and parity on the proportions of mortality causes. The study was conducted in nine herds over a one-year period, and dead piglets were collected for necropsy once during each of the four seasons. In total, 2672 piglets were necropsied of which 60% were live-born but died post-partum (pp), 32% were stillborn and 8% were euthanised. Intra-partum deaths accounted for 88% of stillborn piglets. Eighty-one percent of necropsied live-born piglets died within four days pp. Half of these had a body weight of < 1 kg at the time of death. Crushed and starved piglets accounted for 83% and 9% of mortalities until day four pp, respectively. Thirty-three percent of the crushed piglets (age zero to four days) had not suckled prior to death and the proportion of these piglets was lower in summer compared to the remaining part of the year (OR = 0.6, 95% CI [0.5;0.9]) and was higher for multiparous sows compared to first parity sows (OR = 1.7, 95% CI [1.1;2.6]).

In conclusion, sow parity and season affected the proportion of crushed piglets before four days of age. Furthermore, the group of crushed piglets was heterogeneous and consisted of both heavy well-fed piglets and small piglets with empty stomachs. Thus, management implementations to lower mortality may differ depending on sow parity, season and individual piglet characteristics.

1. Introduction

Preweaning mortality in the Danish organic pig production is a major concern, leading to poor piglet welfare and economic losses for the farmer. Danish organic sows farrow outdoors all year round in individual huts with a deep straw bedding. Providing sows with the opportunity to perform nest building behaviour has been found to reduce the risk of crushing of piglets (Andersen et al., 2005). In addition, straw bedding provides insulation and helps maintain a warm microclimate in the nest, potentially lowering the postnatal temperature drop in newborn piglets. This enhances the piglets' chances of reaching the udder and ingesting colostrum which potentially increases piglet survival. Despite these beneficial conditions around farrowing, preweaning mortality in Danish organic sow herds is high compared to conventional Danish herds (21.5%) (Jessen, 2016), Dutch organic herds (25.5%) (Leenhouwers et al., 1999), Swedish organic herds (15.2%) (Wallenbeck et al., 2009) and English outdoor herds (13.5%) (KilBride et al., 2014). In a study from 2007/2008 comprising 1200 litters from seven Danish organic sow herds, the mean total preweaning mortality amounted to 33% ranging from 25% to 40% between herds (Sorensen and Pedersen, 2013). The Danish organic pig production is characterised by large litters which together with increasing parity previously have been identified as risk factors for stillbirth, piglet mortality and crushing of piglets up to four days *pp* in Danish organic sow herds (Rangstrup-Christensen et al. 2017a and 2017b). The majority of live-born preweaning mortality occurs within the first four days *pp*, and crushing together with starvation are the most frequently reported causes of death across production systems (Edwards et al., 1994; Wientjes et al., 2012; Westin et al., 2015). However, the proportion of piglets dying from crushing compared to piglets dying from other causes differs between both production systems and herds (Weber et al., 2007; KilBride et al., 2012; Pandolfi et al., 2017). Piglets with low viability are slow in reaching the udder and are at greater risk of dying from starvation (Herpin et al., 1996). Furthermore, low viability piglets are less capable of reacting to posture changes in the sow rendering them more susceptible to crushing. In addition, starvation is a risk factor for crushing, and hungry piglets have been found to spend more time near a standing and sitting sow which increases the risk of crushing (Weary et al., 1996).

Knowledge on the causes of piglet mortality in commercial Danish organic sow herds is needed in order to indicate directions for future investigations working on developing preventive measures to lower preweaning mortality. Therefore, the aim of the current study was to 1) identify the causes of preweaning piglet mortality throughout a one-year period by performing *pm* examinations on a subset of dead piglets from outdoor organic sow herds and 2) investigate the effect of season

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Table 1
Definitions used to determine the cause of death of necropsied piglets.

Cause of death	Description
Prenatal deaths	
Stillborn type I Dead prior to parturition	Uninflated lung tissue (does not float in water) with autolysis of internal organs.
Stillborn type II Dead during parturition	Uninflated lung tissue (does not float in water) without autolysis of internal organs.
Stillborn type II Dead immediately after parturition	Partly inflated lung tissue and intact cartilaginous tips on the hoofs.
Crushing	Subcutaneous oedema, internal and/or external lacerations and/or fractures.
Starvation/emaciation	Prominent spine and ribs with little or no abdominal and subcutaneous fat in combination with scarce content in stomach and intestines.
Non-viable[a]	Body weight of < 700 g or larger piglets with amnion fluids/meconium in the stomach. Both with remnants of the cartilaginous tips on hoofs and completely inflated lung tissue with no pathological findings explaining the cause of death.
Infection	
Septicaemia	Enlarged liver, pleuritis or peritonitis; generalised arthritis.
Enteritis	Necrotising proliferative lesions in intestines.
Pneumonia	Consolidated lung tissue, necrotic areas, fibrinous or fibrous pleuritis on the lungs and/or adhesions to the pleura.
Miscellaneous	Miscellaneous occurring diagnoses such as congenital malformations, anaemia and complications form castration.
Unknown	No pathological findings present.
Euthanised	Reported as euthanised by staff.
Not fit for necropsy	Advanced decomposition.

[a] Only piglets of zero to four days of age.

and parity on the proportions of mortality causes.

2. Materials and methods

The study was observational and performed in nine Danish organic sow herds during a one-year study period from June 2014 until May 2015. Results on sow level risk factors for stillbirth, crushing and early piglet mortality have previously been published elsewhere (Rangstrup-Christensen et al. 2017a and 2017b). Information on sow parity and recordings of total preweaning piglet mortality from all farrowings in all nine herds throughout the one-year period (5857 litters, and 93,665 piglets) are included in the current study. A subset of dead piglets from selected sows were collected for necropsy (3304 piglets from 803 sows).

The nine study herds varied in size from 85 to 910 productive sows per year and were all organic commercial herds. They were included in the project because of their interest in the outcome of the study. Willingness and ability to take on the extra workload associated with participating in the study was a precondition. The total number of productive organic sows in Denmark during the study period amounted to around 6000 productive sows per year of which 3150 were included in the study.

2.1. Animals and housing

All sows in the study herds were Danish Landrace-Yorkshire crossbreds. Danish Duroc boars were used to service 80–90% of sows, and Danish Landrace or Danish Yorkshire (DanAvl) were used for the remaining sows. Herds practiced batch-farrowing with either two, three or four week intervals. Depending on the management, gestating sows were kept outdoors on pasture with access to a large communal hut with straw bedding or indoors on deep straw bedding with access to an outdoor enclosure. During gestation, sows were fed a restricted (2.5 to 3.5 kg/sow/day of a commercial gestation diet (~13 MJ/DE/kg)). All sows had ad libitum access to grass or other similar roughage such as corn or grass silage.

Sows farrowed outdoors all year round and were moved from the gestation unit to the farrowing unit 10–14 days prior to expected date of parturition. Each sow had access to a paddock of variable size (approximately 300 m^2) containing a single hut (~4 m^2) with deep straw bedding. Until around day 10 *pp*, a fender was placed in front of each hut providing piglets with an outdoor area of approximately 1 m^2 keeping them from roaming freely in the farrowing field. Male piglets were castrated (using local analgesia) at day 2 to 7 *pp*. No tail docking or teeth clipping were performed. Piglets were weaned at seven weeks of age. Piglets were cross-fostered in all herds (without using a standardised procedure) in order to equalise and standardise litters between sows. In one herd (herd 5), management routines differed markedly from the remaining herds. There was no use of farrowing batches, and farrowings occurred continuously. In the farrowing field, two sows shared the same paddock but still had individual huts, and piglets were weaned at 10 weeks of age.

2.2. Collection of piglets for necropsy

Collection of dead piglets was performed once every season (four rounds) during the study period. Piglets were collected from one farrowing batch in each herd in each season. The four collection periods were: July 2014, September/October 2014, January/February 2015 and April/May 2015. In five herds with farrowing batches with < 30 sows, piglets were collected from all sows within the batch. In four herds, where farrowing batches exceeded 30 sows piglets were collected from a subset of 25 sows. The 25 sows were selected at transfer to the farrowing field and since sows were allocated into farrowing pens at random stock personnel selected 25 pens of their own choice from whom to collect piglets from. Gilts were included to mimic the percentage (20–25%) of gilts in the herd.

2.3. Necropsies

Dead piglets were bagged and frozen, within a couple of hours after collection, at the farms with an information note stating the sow ear tag number, collection date and whether the piglet was found dead or euthanised. After each collection period, piglets were thawed, and necropsies were performed at the farm. All necropsies were performed by the same trained pathologist (first author) using a standardised protocol where the entire carcass including the skin was examined. The following information about each piglet was recorded: weight, crown to rump length (CTR), Body Mass Index (BMI [weight (kg) ∗ CTR $(m)^2$]), gender, level of decay, presence of cartilaginous tips on hoofs and stomach content and volume. The ultimate cause of death was recorded together with any contributing causes and general remarks and findings from the *pm* examination (see Table 1). Stillborn piglets were identified by testing if lung tissue sank when suspended in water. In addition, stillborn piglets were evaluated to determine if time of death occurred