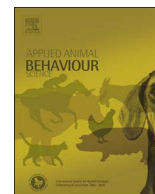




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Reprint of “Rearing piglets in multi-litter group lactation systems: Effects on piglet aggression and injuries post-weaning”

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ABSTRACT

This experiment investigated the effects of rearing piglets in a multi-litter lactation system on piglet aggression at weaning. The following four pre-weaning treatments were applied to 72 sows and their litters ($n = 642$ piglets); (1) Farrowing crate ('FC' – $n = 24$ sows), (2) PigSAFE pens, in which sows and piglets are loose housed, ('PS' – $n = 24$ sows), (3) Farrowing crate and group lactation ('GL_{FC}' – $n = 12$ sows), and (4) PigSAFE and group lactation ('GL_{PS}' – $n = 12$ sows). FC and PS piglets remained in treatment from birth (day 0) until weaning (day 27). GL_{FC} and GL_{PS} piglets were housed in FC and PS, respectively, from day 0 to 14 after which they were transferred (with their dams) to group lactation pens ($n = 6$ sows and litters/pen), where they remained until weaning. Piglet weights were recorded at day 13 and 26. At weaning piglets were mixed into pens of four litters from FC, PS, or GL (2 GL_{FC} litters and 2 GL_{PS} litters) treatments and behaviour was continuously recorded for 2 h. Aggression (reciprocal and non-reciprocal aggression of duration < 5 s) and fights (reciprocal aggression of duration ≥ 5 s; frequency; total and average duration, latency to fight) were recorded for each litter. Six piglets from each litter were randomly selected for skin lesion scoring on day 26 and 24 h post-weaning. GL_{FC} and GL_{PS} piglets had a lower growth rate than FC and PS piglets from day 13 to 26 ($P < 0.01$) but there was no difference in weight at day 13 ($P = 0.11$) or day 26 ($P = 0.17$), or in skin lesions at day 26 ($P = 0.26$). GL piglets delivered fewer bouts of aggression ($P < 0.01$), fought less frequently in the 2 h post-mixing at weaning ($P < 0.01$) and had sustained fewer skin lesions 24 h later ($P < 0.01$) than FC or PS piglets. GL piglets also had shorter fights ($P < 0.01$) and spent less total time fighting ($P = 0.04$) than FC, but not than PS, piglets. These results highlight the possible importance of the early social environment on the development and regulation of aggressive behaviour in the pig. Due to the implications of aggression and injury on both animal welfare and productivity, there is a need for further investigation into the effects of housing piglets in multi-litter lactation systems.

1. Introduction

Increased levels of aggression are observed when young pigs are mixed into groups (Meese and Ewbank, 1973). This aggression is largely associated with the formation of new dominance relationships, which leads to the establishment of a dominance hierarchy (Meese and Ewbank, 1973). However, high levels of aggression can compromise pig welfare by increasing the occurrence of injury (Turner et al., 2006) and stress (Moore et al., 1994), and thus compromising piglet growth (Stookey and Gonyou, 1994).

Genetics, social experience and individual differences (i.e. size of the animal) all contribute to the expression of the aggressive phenotype

in the pig (see Verdon et al., 2015). Under commercial conditions, pigs are commonly mixed into large groups with similarly-aged animals, and, as such, aggressive engagement in these environments may depend increasingly on social experience. Prior exposure to non-litter mates during the suckling period may reduce aggression at weaning by influencing a pigs' perceived fighting ability and, thus, how quickly a pig recognises its position in the dominance hierarchy (see review Hsu et al., 2006).

Piglets that were exposed to non-litter mates during lactation (i.e. 'socialised') contacted an unfamiliar piglet more quickly (Hillmann et al., 2003; D'Eath, 2005) and inflicted fewer wounds (Olsson et al., 1999) in a social confrontation test conducted at weaning. Furthermore,

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D'Eath (2005) found that socialised weaner pigs started fighting sooner, but these fights were shorter and socialised piglets formed a stable hierarchy more quickly than control piglets. While such studies have shown the benefits of social contact before weaning, they generally utilised staged-paired encounters or small group sizes ($n = 4–8$), which are atypical in commercial settings. Only one study to date has investigated the effects of pre-weaning socialisation in commercial-type conditions, and they found no differences in the aggressive behaviour of socialised piglets when compared to control piglets following mixing into groups of 40 at weaning (Morgan et al., 2014).

The frequency and intensity of maternal care can significantly alter the behaviour and physiology of offspring (see Groothuis and Maestripieri, 2013). While farrowing crates may restrict maternal interactions by confining the sow (Singh and Hemsworth, 2013; Pedersen, 2015), alternative loose farrowing environments such as the Pig SAFE pens (Piglet and Sow Alternative Farrowing Environment, Edwards et al., 2012) provide sows with increased opportunity to move around and accordingly increases the opportunity for maternal interactions during farrowing and lactation. However these loose-farrowing and lactation systems require extra floor space and can lead to an increased risk of piglet crushing (see review by Morrison et al., 2011), limiting uptake by pork producers. The use of loose farrowing housing may be enhanced if throughput of sows is maximised by the utilisation of a “two-stage farrowing system” in which sows and their litters are transferred to group lactation pens after an initial period of single-litter housing. Such systems may also protect piglets when they are at the greatest risk of crushing (Marchant et al., 2000). Unlike farrowing crates or PigSAFE pens, group lactation pens allow free interaction between sows, between piglets, and between piglets and sows and thus more closely reflect the natural social unit for pigs. While two-stage farrowing systems provide increased opportunity for sows to move and interact with piglets and other sows, evidence also suggests that these systems may benefit piglet behavioural development. Li and Wang (2011) found that, under experimental conditions, piglets raised in multi-litter group lactation systems were less aggressive than those raised in single-litter systems after being mixed into small groups ($n = 9$), containing familiar and unfamiliar piglets, post-weaning. However, the effects of multi-litter lactation housing on the behaviour and welfare of piglets after being mixed into large groups post-weaning on a commercial facility is unknown.

Increasing our knowledge of early rearing experiential effects on subsequent aggression in the pig may provide opportunities to minimise risks to pig welfare and productivity. This experiment investigated whether a two-stage farrowing system, in which sows and their litters were transferred from farrowing crates or PigSAFE pens to a multi-litter lactation systems at day 14 postpartum, reduces piglet aggression and injuries following mixing at the weaning stage of production, in comparison to piglets raised in single-litter lactation systems. Piglet growth during the lactation period was also examined.

2. Materials and methods

This study was conducted between April and May 2014 in a farrowing and lactation unit at a large commercial piggery in southern New South Wales (NSW), Australia. All farrowing and lactation environments were located in the same commercial unit. All animal procedures were conducted with prior institutional ethical approval under requirement of the NSW Prevention of Cruelty to Animals Act 1985 in accordance with the National Health and Medical Research Council/Commonwealth Scientific and Industrial Research Organisation/Australian Animal Commission *Australian code of practice for the care and use of animals for scientific purposes*.

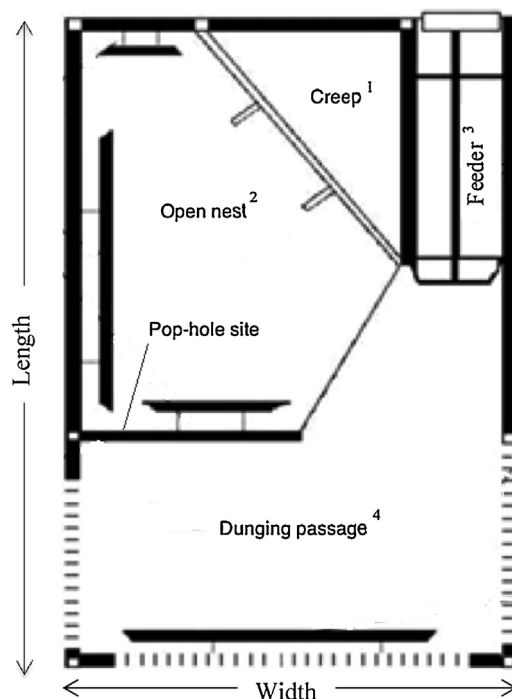


Fig. 1. Layout of PigSAFE pen. Pen dimensions: length = 3.6 m, width = 2.4 m.¹Creep dimensions: length = 1.2 m, width = 1.2 m, creep area = 0.72 m².²Nest dimensions: length = 2.4 m, width = 1.8 m (including creep).³Feeder dimensions: length = 2.2 m, width = 0.6 m.⁴Dunging area dimensions: length = 1.2 m, width = 2.4 m.

2.1. Animals and management

2.1.1. Pre-weaning

A total of 642 piglets from 72 sows (Landrace x Large White) with an average parity of 2.8 (range parity 0–5) over two time replicates were used. Sows farrowed in either conventional farrowing crates ($n = 36$ sows) or PigSAFE pens ($n = 36$ sows). The bottom bars of the farrowing crate (crate 2.3×0.6 m, total area 2.3×1.7 m) operated on a hydraulic ram so that sides swing in when the sow stands and slowly slide out when the sow lies down (proctor crate). The farrowing crates contained a creep area that was heated using a mat below and a lamp overhead. The PigSAFE pens were modified from those developed in the United Kingdom (described by Edwards et al., 2012). These pens were 3.6×2.4 m in dimension and comprised a nest area with piglet protection features, a heated creep, a slatted dunging area and a lockable sow feeder (Fig. 1). The PigSAFE pens also allow “fence-line” social (visual and physical) contact between adjacent sows. Upon entry to PigSAFE pens sows were provided with 2 kg of long straw with additional straw provided as required up until farrowing. In both farrowing environments, minimal fostering was conducted within the first 24 h postpartum and where fostering was required, piglets were fostered within farrowing environment. After farrowing sows remained with their litters in the assigned farrowing environment until 14 days prior to weaning (day 14; average age of piglets was 12.9 days of age).

Also in the same unit were two group lactation pens (6.0×9.5 m), each with the capacity to house six sows and their litters. Each group lactation pen had a solid partition with sloped walls, two heated creep areas and an area for creep feed that was accessible only by piglets (Fig. 2). The flooring of these pens was partially slatted. At day 14, six sows per replicate (and their litters) were randomly selected from the PigSAFE pens and mixed together in one group lactation pen. Similarly, six sows per replicate (and their litters) from the farrowing crates were randomly selected and mixed together into the second group lactation

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