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Behaviour of pre-pubertal gilts and its relationship to farrowing behaviour in conventional farrowing crates and loose-housed pens

Sarah H. Ison[a,*], Cynthia M. Wood[b], Emma M. Baxter[a]

[a] Scotland's Rural College (SRUC), Animal Behaviour & Welfare, Animal & Veterinary Sciences Group, Roslin Institute Building, Easter Bush, Midlothian EH25 9RG, United Kingdom
[b] Virginia Polytechnic Institute and State University, Department of Animal and Poultry Sciences, Blacksburg, VA 24061, USA

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ABSTRACT

Individual variation in the reproductive performance of sows has the potential for greater negative impacts in loose-farrowing systems. Therefore, the ability to select gilts that will perform well would be a major advantage. This study investigated the behaviour of gilts during pre-pubertal tests and farrowing behaviour in conventional crates and PigSAFE (Piglet and Sow Alternative Farrowing Environment) pens. Gilts underwent two phases of behavioural testing. First, gilts were subjected to three individual human interaction and three startle object tests randomly allocated to test sessions over 3 days (i.e. gilts had either a human or startle test first). Three weeks later, gilts underwent three human interaction and three novel object tests, in their stable group of six. Gilts farrowed in individual PigSAFE pens or conventional crates and behaviour was observed for 8 h from the first piglet birth. Data were analysed using linear mixed models and Spearman's rank correlations. A novel finding was the effect of individual test order: gilts that had the human interaction or startle object test first behaved differently. The first test was different whichever test type, with a higher latency to interact with the object or human, and gilts experiencing the startle test first interacted more with the human in all three subsequent tests. Gilts farrowing in crates and pens showed differences in behaviour, most notably, a lower frequency of piglet-directed aggression was seen in pens ($P < 0.05$). Piglet-directed aggression was studied further by comparing gilts that exhibited no aggression, to those showing aggressive behaviour, but no injurious biting, to those causing injury or death. This latter severely aggressive group spent more time alert, piglet focused and standing ($P < 0.05$) compared with the other two groups and tended to show greater ($P < 0.1$) contact duration in the first individual pre-pubertal test. Gilts that crushed one or more piglets were slower ($P = 0.038$) to contact either the human or startle object in the first individual test, than those that did not crush. The impact of first individual test on behaviour in subsequent tests indicates that previous test experience could be influencing subsequent behaviour. Differences in gilts showing severe piglet-directed aggression and between 'crushers' and 'non-crushers' suggests that it could be possible to use pre-pubertal behaviour to predict maternal ability.

1. Introduction

Enclosing sows in crates during farrowing and lactation remains a welfare issue. Despite a growing body of research into alternatives (for reviews see: Baxter et al., 2012; Edwards and Fraser, 1997), no large-scale commercial uptake of crate-free systems on indoor pig farms has occurred, other than in countries where the farrowing crate is banned (Sweden, Switzerland and Norway). The piglet and sow alternative farrowing environment or PigSAFE pen is a crate-free system, designed to improve sow welfare, whilst ensuring ease of management, piglet survival and commercial viability (Baxter et al., 2015, 2011). Results show that the PigSAFE pen produces production figures comparable to those of conventional farrowing crates (Edwards et al., 2012). However, individual variation in sow performance is evident with some individuals performing well, with no pre-weaning losses, whereas others produce high losses (Baxter et al., 2015).

Loose farrowing systems for sows have to be robust enough to cope with individual variation or sensitivity. Thodberg et al. (2002) showed that behaviour during nest-building and farrowing is related to the general reaction pattern during stress, especially in inexperienced gilts. They also showed that the performance reflects

* Corresponding author. Tel.: +44 0 131 6519292; fax: +44 0 131 5353121.
E-mail address: Sarah.Ison@sruc.ac.uk (S.H. Ison).

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an innate pattern of reaction in the individual that can be modified by the environment and previous experience. Another study demonstrated that gilts that savaged their piglets during farrowing were more likely to show 'shy' behaviour during a pre-farrowing human approach test (Marchant-Forde, 2002). Sow behaviour during gestation has been related to farrowing behaviour and piglet survival (Lensink et al., 2009a) and gilt behaviour at six months old was shown to be related to farrowing and performance (Lensink et al., 2009b). However, in these studies several correlations were performed and those that were significant were low, ranging in r_s value from −0.19 to 0.29 between behaviour during gestation and farrowing (Lensink et al., 2009b) and −0.27 and 0.41 between behaviour at six months old with farrowing behaviour and performance (Lensink et al., 2009a). Therefore, the authors of these studies concluded that the value of pre-parturition behaviour in predicting farrowing success was not clear and further study is needed. In order to accurately assess temperament, the criteria outlined by Jensen (1995) need to be fulfilled, individuals must: (1) show consistency in reaction when exposed to the same situation; (2) show consistency in reaction across different situations; (3) show a bimodal distribution of responses; and (4) a genetic basis for differences in response must be demonstrated.

If temperament can be successfully assessed and associated with farrowing behaviour, it could be a useful tool in selecting breeding animals for loose-farrowing systems. This study investigated behaviour of gilts during a set of pre-pubertal tests, and then farrowing behaviour was studied as gilts went on to farrow in either conventional farrowing crates or PigSAFE pens.

2. Materials and methods

2.1. Animals and experimental procedure

All experimental procedures were carried out in compliance with EU Directive 86/609/EEC and were approved by the SRUC Animal Welfare Ethical Review Body (AWERB) before any experiments took place. Twenty-four home bred Large White × Landrace primiparous sows (hereafter, gilts), housed in four groups of six at the SRUC pig research farm in Midlothian, UK were used for this experiment. Initially gilts were housed in their stable groups of six individuals in the commercial finisher shed where they underwent two phases of behavioural testing. The first of these consisted of six tests where the gilt was tested alone (hereafter referred to as individual tests), including three human interaction and three startle object tests, with two tests per day; one in a morning and one in an afternoon session on three days at approximately 20 weeks of age. The second phase consisted of six tests which the gilts underwent in their stable group of six (hereafter referred to as stable group tests), again with two tests per day; one in a morning and one in an afternoon session on three days at approximately 23 weeks of age. At around 25 weeks old, gilts were moved in their groups of six to dry sow accommodation consisting of a straw-bedded area, a dunging passageway and six individual feeding stalls. At around 8 months old, the gilts were artificially inseminated and farrowed in either PigSAFE pens (groups 1 and 4, $n = 10$) or conventional farrowing crates (groups 2 and 3, $n = 11$) (for full pen specifications, see Baxter et al., 2015). Of the 24 gilts tested, two did not hold service (i.e. were not pregnant), so did not go on to the second part of the study and due to a power failure, farrowing behaviour is missing for one gilt.

2.2. Individual tests

Groups 1 and 2, and groups 3 and 4 were tested in two separate batches in October 2009 and January 2010, respectively. Gilts underwent three human interaction and three startle object tests randomly split across three days of the week with a day off in between test days, i.e. each gilt had one test in the morning and one in the afternoon on all of the test days (two tests per day), with a random order of test type (e.g. human–startle–human–startle–startle–human, or any other combination in the six test sessions). Therefore, gilts either had a human interaction ($n = 15$) or startle object ($n = 9$) test first on the morning of the first test day. In both morning and afternoon sessions across the three days gilts from either groups' 1 or 2, or 3 or 4 depending on the test session were alternated for consecutive tests. The test pen for both tests consisted of an empty finisher pen (solid on 3 sides, with metal bars at the back, with no view of other pigs, measuring 3.75 × 2.35 m) located in the same room in the finisher house where the gilts were initially housed. Prior to testing, gilts were habituated to a camera and tripod placed outside their home pen in the days preceding the tests, but gilts were not habituated to the test pen or testing routine. Muck was removed and the pen swept down between each test.

For the human interaction test, the individual gilt was moved into the test pen, the human interactor then climbed into the pen and knelt down in a central position. The test was started when the human was in position and lasted 5 min, before the gilt was returned to her home pen. Evidence suggests that pigs discriminate between familiar and unfamiliar humans using visual cues, including the colour of overalls worn (Koba and Tanida, 1999). Therefore, the human interactor in this study wore red overalls, which was different from the blue overalls routinely worn by stock-people and research staff on the farm.

For the startle object test, an orange bucket was hung on a rope from a pulley system above the centre of the pen. The bucket was pulled towards the ceiling for the start of the test. When ready to start, the test gilt was moved from the home pen towards the test pen and as she crossed into the pen, the bucket was dropped to hit the floor after which, it was immediately raised slightly and the rope tied to leave the bucket hanging approximately 30 centimetres from the floor. The rope was marked to indicate the height at which to hang the bucket. When the bucket was dropped, the stopwatch was started and timed for 5 min after which, the bucket was raised and the gilt returned to her home pen.

2.3. Stable group tests

Two weeks later, gilts underwent stable-group testing, again consisting of three test days across a week with a day off in between each test day as before. Gilts underwent three human interaction and three novel object tests randomly split over the three days. The same test pen was used and the tests were video recorded as before.

The human interaction test was similar to the individual tests. Each group of gilts was moved into the test pen, the human interactor then climbed in from the neighbouring pen, and stayed in a kneeling position in the centre. After 5 min, the human left the pen, and the gilts were returned to their home pen. For the novel object test, an orange and white life-saving ring was attached using chains to the bars at the back of the pen, before the gilts were moved into the test pen. The gilts were then moved into the test pen for 5 min and then returned to their home pen. The novel object was cleaned between tests.

2.4. Test behaviour

All 5-min tests were recorded onto DV tape or SD card using either a Canon XM2 or Canon Legria placed on a tripod behind the test pen. Continuous focal observations of gilt behaviour during tests were conducted using The Observer 9.0 XT (Noldus Information Technology, Wageningen, The Netherlands). The duration of