Applied Animal Behaviour Science 163 (2015) 69–79

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The influence of neonatal environment on piglet play behaviour and post-weaning social and cognitive development

Jessica E. Martin*, Sarah H. Ison, Emma M. Baxter

Animal Behaviour and Welfare, Animal and Veterinary Sciences Research Group, SRUC, West Mains Road, Edinburgh EH9 3JG, UK

ARTICLE INFO

Article history:
Accepted 30 November 2014
Available online 8 December 2014

Keywords:
Play
Alternative housing
Farrowing
Enrichment

ABSTRACT

Research has shown that the domestic pig is highly playful throughout its development and that play is an important aspect of social and cognitive development. Therefore, the neonatal environment is fundamental to successful stimulation of play in neonatal pigs, which could have indirect and direct socio-cognitive effects on pigs post-weaning and therefore influence social interactions known to cause welfare concerns (e.g. aggression during mixing). This study investigated how play pre- and post-weaning developed in two neonatal environments (NE); the conventional farrowing crate (NEC) and a more environmentally complex alternative PigSAFE pen (NEP) and to discover whether this had an effect on piglet' cognitive abilities in spontaneous object recognition tests for two retention times (15 and 60 min) post-weaning. Hourly focal sampling was used to record play behaviours pre- and post-weaning in 72 piglets of mixed sex (36 per NE) from a total population of 117 piglets from 12 litters. Out of the 72 piglets, 24 were used in the cognitive spontaneous object recognition tests five weeks post-weaning. Linear mixed models showed that NEP piglets displayed play behaviours quicker after birth than NEC piglets: locomotor ($F = 7.62_{(1, 11)}$, $P = 0.020$); sow interaction ($F = 5.27_{(1, 11)}$, $P = 0.045$); and social interaction ($F = 23.61_{(1, 11)}$, $P < 0.001$). NEP piglets played more pre-weaning than NEC piglets ($F = 5.06_{(1, 71)}$, $P = 0.051$) and despite initial higher levels of aggression at weaning, displayed less chronic aggression post-weaning as indicated by lesion scores of all piglets ($F = 27.05_{(1, 116)}$, $P < 0.001$). NE was shown to have a significant effect on the 15 min cognitive retention test; with NEP piglets spending more time interacting with the novel object than the familiar, compared to NEC piglets ($F = 5.39_{(1, 23)}$, $P = 0.045$). There was no NE effect for the 60 min retention test. It was concluded that play is fundamental to successful socio-cognitive development (e.g. aggressive conflicts) and relates to play function theories of training for the unexpected. Its effect on play behaviours are short-term and highly dependent on present environmental stimulus, suggesting that any long-term benefits play may have on an animal's welfare can only be achieved by regular stimulation throughout its life (e.g. constant enrichment).

1. Introduction

Research into play behaviour has shown it to be fundamental for the physical, physiological and psychological development of mammals, particularly the development

* Corresponding author. Tel.: +44 0131 6517504.
E-mail address: Jessica.Martin@sruc.ac.uk (J.E. Martin).

http://dx.doi.org/10.1016/j.applanim.2014.11.022
0168-1591/

of cognitive and social abilities (Fagen, 1981; Špinka et al., 2001). As a result play behaviour (or the lack thereof) has been used as a welfare 'iceberg indicator' to highlight concerns for captive animals, e.g. boredom (Held and Špinka, 2011; Dybkjaer, 1992). Mammalian play is a cognitively demanding activity and is concentrated during neonatal development (Špinka et al., 2001).

The domestic pig (*Sus scrofa domesticus*) is a social, intelligent mammal (D'Eath and Turner, 2009; Gieling et al., 2011). The pig's commercial environment, whether indoor or outdoor, imposes physical and behavioural restrictions, and subjects it to several stressful events during its production life (e.g. weaning) (Marchant-Forde, 2009). Several studies on pigs, involving object recognition, spatial memory and problem-solving, have demonstrated a high level of cognitive skill (Gieling et al., 2011; Moustgaard et al., 2002). Research also shows that pig play behaviour extends across all play behaviour categories; locomotor, social and object, and that it has sex and age dependent aspects (Donaldson et al., 2002; Newberry et al., 1988).

Interactions between sow and piglet within the neonatal environment (NE) are critical for piglet survival (English and Smith, 1975; Marchant et al., 2000), but also for socio-cognitive development. Research indicates that several factors are influenced by the NE, including sow/piglet behaviour (e.g. Bolhuis et al., 2005, 2006; Cronin and Smith, 1992; De Jonge et al., 1996; Melotti et al., 2011; Olsson et al., 1999; Siegford et al., 2008). Lack of understanding on how influential these effects on piglet development are may mask just how important the NE is. Research has shown that restriction in this environment can disturb development of social skills and stress coping mechanisms, resulting in higher stress and aggression levels in adult pigs (e.g. Petersen et al., 1995). This supports the theory that play acts as training for the future (e.g. responses to novelty and social interactions; including aggressive conflicts) (Špinka et al., 2001).

The aims of this study were to investigate whether piglets reared in conventional farrowing crates (NEC) or more environmentally complex alternative farrowing pens (PigSAFE pen—NEP) show different play behaviour and development pre- and post-weaning, and whether this results in variation of cognitive abilities post-weaning. It was hypothesised that if play behaviour is key to successful socio-cognitive development of neonates, then the NE must have an indirect significant impact, as play behaviour can be stimulated or restricted by the environment. Therefore, piglets reared in a more complex environment should show greater socio-cognitive development than piglets reared in a standard commercial NE.

2. Material and methods

2.1. Animals and housing

Data were collected at the SRUC Pig Unit (Midlothian, Scotland) between March and June 2011. A total of 117 piglets, bred from commercial cross-bred dams (Large White × Landrace) and sired by Pietrain boars were used. Of the 117, 57 were born in the first NE, the standard farrowing crate (NEC), and 60 were born in the second NE, the PigSAFE pen (NEP). Piglets were produced from 12 sows, with six sows per NE of equally varying parity. Litter size was not equalised and was dependent on natural biological variation. However cross-fostering was permitted as per normal husbandry routines to improve piglet survival. This was done within NE. The pig unit was managed on a batch system, involving a group of sows farrowing simultaneously at three week intervals. As a result of all-in-all-out management, farrowing system type was alternating, so comparisons of the NEs could not be run simultaneously.

The standard farrowing crate (NEC) was used to represent a barren environment as it is a restrictive environment to both sow and piglets in terms of physical movement and mental stimulation (Fig. 1a). The crate had a solid concrete floor, apart from a small dunging area to the rear of the sow ($0.5 \times 0.5\,m^2$). Natural light was provided by windows in the farrowing house. In addition artificial lighting was on between 0700 and 1600 daily, with permanent lighting on in the creep area. Both the sow and her piglets were physically isolated from other pigs. Two handfuls of long-stemmed straw were given daily, which both the sow and piglets had access to, as this was standard farm practise for the NEC. The sow is restricted to the central area via parallel bars, and her piglets are able to move around her and have access to a heated and lit creep area at the front of the crate.

The newly developed Piglet and Sow Alternative Farrowing Environment, or PigSAFE (NEP), was developed based on the design criteria proposed by Baxter et al. (2011) and described in Edwards et al. (2012). Flooring was solid, insulated concrete with a slatted dunging area (Triband metal slats, 9 mm void). Lighting was provided artificially between 0700 and 1600 daily, with night lights remaining on at a lower lux. Sows were provided with 2 kg long-stemmed straw pre-farrowing which was replenished daily if needed. Approximately 24 h post-farrowing straw was removed if dirty and two handfuls of additional long-stemmed straw was provided daily until weaning. NEP provides visual and some physical interaction with neighbouring sows and piglets through the barred windows, and also has sloped walls, which protect piglets from crushing and, inadvertently, add complexity to the environment (Fig. 1b).

Piglets were introduced to solid feed (Compound pellet creep feed, Scotlean Pigs Ltd., primary diets—AB Abri Ltd., Yorks, UK) one week before weaning by floor scattering pellets within the creep area. Weaning occurred at 27 days old, during which piglets were removed from sows and underwent several management procedures (e.g. vaccination and ear tagging) before being moved to weaner pens. Weaner pens were $3 \times 6\,m^2$, with solid concrete floors and solid walls (1.5 m high) and deep-straw bedding. Pens were mucked out and long-stemmed straw for bedding was replenished daily (4–5 kg as required). Lighting regime was 10 h of artificial light (07:00–17:00). Room temperature and ventilation were mechanically controlled; room temperature was set at 25–27 °C for the first few days, dropping to 21 °C after one week. Piglets had