

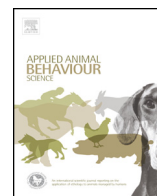


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# Comparison of the behaviour of piglets raised in an artificial rearing system or reared by the sow

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### ABSTRACT

Over the last 15 years, rising sow fertility has led to a considerable increase in litter size. As a consequence, the number of live born piglets may outnumber the number of functional teats, and surplus piglets are removed from the sow at the age of 3–6 days and fed with artificial milk. The objective of this study was to compare the behaviour of piglets raised in a commercially available artificial rearing system (group size: seven piglets) with that of piglets reared by the sow in a loose farrowing pen (seven focal piglets observed per litter). The behaviour of 98 piglets raised artificially (7 batches) and 82 piglets reared by the sow (6 batches) was videotaped on days 4, 11 (artificially raised piglets only) and 18 after introduction of the piglets to the artificial rearing system. Belly nosing, manipulation of a pen mate, play-fighting, aggressive behaviour and resting were assessed by continuous focal observation twice a day in the periods from 05:00 to 10:15 and from 13:00 to 18:15. Data were analysed by using linear mixed-effects models.

Belly nosing was hardly ever observed in piglets reared by the sow, whereas the duration as well as the frequency of this behaviour increased between days 4 and 18 in piglets raised artificially. Moreover, artificially raised piglets spent more time manipulating a pen mate, showed less play-fighting, exhibited more aggressive behaviour and had shorter resting bouts compared with piglets reared by the sow. Finally, total duration of resting decreased from day 4 to day 18 in artificially raised piglets and increased in piglets reared by the sow.

It is concluded that piglets removed from the sow at an early age and raised artificially redirect massaging behaviour to their pen mates, resulting in high levels of belly nosing and indicating impaired animal welfare. Moreover, the small space allowance in the tested artificial rearing system may additionally account for behavioural differences observed between artificially raised piglets and piglets reared by the sow in a loose farrowing pen.

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## 1. Introduction

Over the last 15 years, rising sow fertility has led to an increase in litter size (Tomiyama et al., 2011; Vidović

et al., 2012; Rutherford et al., 2013). Increased litter size is associated with more variation in piglets' birth weight and reduced pre-weaning survival (Milligan et al., 2002; Quiniou et al., 2002; Wolf et al., 2008; Akdag et al., 2009; Andersen et al., 2011). In addition, competition at the sow's udder is increased, and the number of live born piglets may outnumber the number of functional teats (Milligan et al., 2001; Andersen et al., 2011).

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There are several management approaches to deal with surplus piglets (Baxter et al., 2013; Rutherford et al., 2013). Large litters are split into two groups by removing the heavy and strong piglets for a short period of time, thus facilitating access to the udder for the light and weak piglets ('split suckling'; Kyriazakis and Edwards, 1986; Baxter et al., 2013). A common method used to balance litter size between sows is cross-fostering (Cecchinato et al., 2008; Baxter et al., 2013). Piglets are relocated from their biological mother sow to another lactating sow with fewer piglets (Baxter et al., 2013). Furthermore, nurse sows may be used to rear a second litter composed of piglets of other sows once their own piglets have been weaned (Baxter et al., 2013). Finally, surplus piglets can be removed from the sow within a few days after birth, after colostrum intake, and raised in artificial piglet rearing systems (Baxter et al., 2013). They are first fed artificial milk, which is later replaced by solid feed (Baxter et al., 2013). The present study focused on one such artificial rearing system that is commercially available and was conducted according to the Swiss authorisation procedure for mass-produced farm animal housing systems that evaluates housing equipment with regard to animal welfare (Wechsler, 2005). Behaviour of piglets raised in this system was compared with piglets that remained with their mother. The two systems differed in several aspects. The most important of these aspects were the earlier separation from the mother, feeding on artificial milk, the earlier weaning from milk, the smaller group size, the smaller space allowance (and therefore a higher density), the lower quality of bedding material, and being mixed with non-litter mates in the piglets raised artificially compared to the piglets reared by the sow.

One of the said differences that seems relevant and was investigated previously concerns the so-called "early weaning". Weaning of piglets is associated with major changes in their housing conditions likely affecting their welfare. The piglets are separated from the sow, start to ingest solid feed early and are usually mixed with unfamiliar piglets in an unknown environment (Worobec, 1997; Gardner, 2000). Various studies on the effects of weaning at an age of 3 weeks have shown that piglets develop an abnormal behaviour pattern termed "belly nosing" (van Putten and Dammers, 1976; Fraser, 1978; Worsaae and Schmidt, 1980). The behaviour consists of rhythmic up-and-down movements with the snout directed to the body of a pen mate (Fraser, 1978). As a general pattern, it was found that belly nosing increases in frequency and duration as weaning age decreases (Metz and Gonyou, 1990; Bøe, 1993; Jarvis et al., 2008). For example, Gonyou et al. (1998) reported that piglets weaned at the age of 12 days spent more time belly nosing than piglets weaned at the age of 21 days. Similarly, piglets weaned at 7 days of age showed a higher level of belly nosing than those weaned at 14 or 21 days in a study by Worobec et al. (1999).

Mixing with non-littermates, crowding, and lack of straw after weaning may have additional effects on the piglets' behaviour (Dybkaer, 1992). For example, van Putten and Dammers (1976) as well as Bøe (1993) reported that piglets weaned at 3–4 weeks of age and kept in pens lacking environmental stimuli, such as bedding material, to elicit exploratory behaviour manipulated pen mates by

nibbling, sniffing, rooting, or chewing. With decreasing space allowance, piglets weaned at the age of 2–3 weeks were found to show more piglet-directed nosing (Gardner et al., 2001), to play less (Worsaae and Schmidt, 1980), to perform more aggressive behaviour (Worsaae and Schmidt, 1980), and to spend less time lying (Gardner et al., 2001).

Only few studies so far have investigated the behaviour of piglets separated from the sow within the first week postpartum. Orgeur et al. (2001) found that belly nosing and aggressive behaviour was more frequent in piglets reared artificially from day 6 onwards compared with piglets reared by the sow. Widowski et al. (2005) investigated the behaviour of piglets removed from the sow 56 to 92 h after birth and housed in nursery isolator tanks divided into a feeding, dunging, and resting area. They provided the piglets with artificial milk four times per day by using different feeding systems and reported that piglets offered milk in a plastic trough spent more time belly nosing as well as nosing, chewing or sucking ears and tails of pen mates than piglets fed artificial milk through baby-bottle nipples or an artificial udder.

The objective of this study was to compare the behaviour of piglets raised in two different rearing environments. The animals were either removed from the sow at the young age of 3–6 days and raised in a commercially available artificial piglet rearing system (group size: 7 piglets) or reared by the sow in a loose farrowing pen (7 focal piglets observed per litter). The study was conducted on an experimental farm on which we had full control of the two different rearing environments and several batches of animals were included. We specifically expected a high incidence of belly nosing in artificially raised piglets and were further interested in differences in manipulation of pen mates, play-fighting, and aggressive as well as resting behaviour.

## 2. Materials and methods

### 2.1. Animals, farrowing pens, and experimental design

A total of 180 purebred Swiss Large White piglets stemming from seven batches were investigated between March 2012 and September 2013. Piglets were born in loose farrowing pens measuring 2.3 × 3.2 m. The pens were partitioned by a timber wall (1.4 m long and 1.1 m high) into a nesting area with a straw-bedded solid concrete floor (2.3 × 1.4 m) and a dunging area with a partly slatted floor (2.3 × 1.2 m). Several handfuls of cut straw were added daily to the nesting area. The pens were equipped with a nipple drinker for the sow, a bowl drinker for the piglets, a feeding trough, and a piglet box (1.4 × 0.5 m; height: 0.5 m). The piglet box provided a heating plate fitted in the lid and a straw-bedded rubber mat on the floor. Within 24 h after birth, all piglets were marked individually with numbered ear tags. All male piglets were castrated within the first 2 weeks of age under analgesia and isoflurane anaesthesia. According to Swiss animal welfare legislation, tail docking and canine teeth clipping were not carried out. For the experiment, piglets were assigned to two treatment groups: artificially raised piglets ( $n = 98$ ) and piglets reared by the sow ( $n = 82$ ).

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