



Behavioural patterns established during suckling reappear when piglets are forced to form a new dominance hierarchy



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ABSTRACT

Early life experiences considerably influence the behavioural development of the animals in which the social environment plays a crucial role. Neonatal piglets experience intense social (including aggressive) interactions when compete with their littermates for the access to teats on the sow's udder. Competition among piglets is not of equal intensity at all parts of the sow's udder. The middle of the udder is supposed to be a much more competitive and stressful suckling environment, with a higher probability of individuals being involved in fighting with littermates. We investigated whether behavioural patterns established when suckling during lactation reappear when piglets are forced to form a new dominance hierarchy after weaning, and how piglets with different early experiences cope with a new (artificially formed) social environment. We hypothesised that aggression is much more intensive in piglets that suckle in the middle of the udder, with these individuals exhibiting more unstable patterns during the establishment of social order in the new group. Two independent experiments were completed in the present study. During the period of lactation, teat order was examined by labelling piglets according to their position of suckling (A – anterior, M – middle and P – posterior part of the sow's udder). Experiment 1 involved 120 piglets – four mixed groups were created, each containing 30 piglets from all three parts of the udder. Experiment 2 involved 80 piglets – four groups were created, each containing 20 piglets, of which one was a mixed, while the other three were separate A, M and P piglets groups. Results of the present study revealed that behavioural patterns that are established when suckling reappear when forced to form a new dominance hierarchy after weaning, and that the level of agonistic behaviour exhibited by individuals is in accordance to their suckling position. In both experiments M piglets exhibited significantly more aggression than A or P piglets ($p < 0.05$). The results also indicate the general instable nature of social order formation by M piglets. These findings are expected to be useful for optimising the weaning process. Therefore, the suckling position of piglets should be considered when forming weaning groups, with special attention being given to M piglets. However, retaining the natural proportion of A, M and P piglets in the weaning group remains the most effective means of reducing the level of post-weaning aggression.

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1. Introduction

Immediately after parturition, piglets are subjected to stress because of the struggle for access to teats on the sow's udder. Competition for access to teats is followed by the establishment of a teat (social) order. Process of

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teat-order formation normally starts as a group suckling cohesion at the very beginning of lactation, and is generally completed during the second week (Skok and Škorjanc, 2014a). Thus, fighting for teats (suckling position) is most intensive on the first day, after which competition gradually decreases until teat order is established (De Passillé et al., 1988; De Passillé and Rushen, 1989). However, competition among piglets is not of equal intensity at all parts of the sow's udder. Skok and Škorjanc (2013) found that marginal parts of the sow's udder are exploited by only a few piglets, whereas almost all piglets suckled in the middle part at least once during lactation. This phenomenon, which is caused by the geometric constraints of the udder (physical limitations) and termed the mid-domain effect, operates during the first 2 weeks of lactation or until teat order is established (Skok and Škorjanc, 2013). Therefore, the early social environment and experiences of piglets substantially differ, depending on the position that they acquire during suckling. Hence, piglets that tend to suckle frequently at the margin of the sow's udder are probably less frequently exposed to fighting with their littermates. Indeed, the likelihood of conflict and exposure to aggressive behaviour is highest for piglets that exclusively suckle in the middle part of the sow's udder, which is much more "crowded".

Early life experiences (social and physical environment) considerably influence the development of the animal brain, behaviour and cognition and, hence, the expression of acquired behavioural patterns later in life. Offspring exposed to early stress often exhibit deviate behaviours in later/adult life stages (see review by Sanchez et al., 2001; Lupien et al., 2009; Veenema, 2009). Various studies on humans have shown that impulsive aggression, violent behaviour, and antisocial personality symptoms occur because of childhood maltreatment (see review by Veenema, 2009). Increased aggression was also recorded in male rats after exposure to early stress, i.e. maternal separation (e.g. Veenema et al., 2006). Thus, the social environment plays a crucial role in behavioural development. For instance, it was found that neonatal social stress in pigs may cause long-term behavioural, neuroendocrine, and immune regulation changes (Kanitz et al., 2004). In addition, King and Gurney (1954) investigated the effect of early social experience on the aggressive behaviour of adult mice, and reported significantly lower aggressiveness in mice raised separately compared to those raised in a group. However, aggressive behaviour is of vital importance for survival, and is present in all mammals. Therefore, aggression that is mostly expressed at the juvenile stage is essential for appropriate development, including later use as adult aggression (reviewed by Veenema, 2009). While this behavioural pattern has evolved gradually under natural conditions (environment, social structure, etc.), it is important to understand how this behavioural mechanism is expressed under conditions that differ considerably to the ancestral environment, such as the forced weaning and grouping of piglets.

In pig production, weaning normally involves the radical (forced) shortening of the lactation period (early separation from the mother), followed by combining several different litters into one large group. Therefore, aside

from a radical change in food (from milk to creep feeding), weaning is accompanied by considerable stress caused by the separation of piglets from the mother, in addition to outbursts of aggression when the grouped piglets try to establish a new dominance ranking. Indeed, this artificial forming of groups considerably differs to that recorded for wild boar under natural conditions (Kaminski et al., 2005; Poteaux et al., 2009). This extreme situation provides a good basis to study early behavioural development and the later re-appearance of certain behavioural patterns formed at the very beginning of life.

Generally, the individual behavioural characteristics, e.g. strategies to cope with conflict situations, are consistent over time and can be detected already in the early life of piglets, thus, individuals classified as aggressive or non-aggressive at the very first weeks of life are more aggressive also immediately after mixing later in life (Hessing et al., 1993). Furthermore, Puppe and Tuchscherer (1999) have already reported that individual differences in piglets (weight gain and dominance value) derive from their early ontogenetic characteristics (suckling behaviour). Thus, here, we investigated whether behavioural patterns established when suckling during lactation reappear when piglets are forced to form a new dominance hierarchy after weaning. In addition, we evaluated how pigs with different early experiences cope with a new (artificially formed) social environment. We hypothesised that aggression is much more intensive in piglets that suckle in the middle of the udder, with these individuals exhibiting more unstable patterns during the establishment of social order in the new group. In addition, we propose that higher levels of aggression negatively affect weight gain.

2. Materials and methods

This study was conducted at the Pig Research Centre of the Faculty of Agriculture and Life Sciences (University of Maribor, Slovenia) from April 2013 to August 2013. The study was conducted in accordance with national legislation on animal protection ([Law on animal protection, UL RS 38/2013](#)). Two independent experiments were completed to study how suckling position affects the level of aggressive behaviour and growth performance of piglets after weaning.

2.1. Animals and housing

Experiment 1 involved 120 cross-breed piglets from 12 sequential litters. The number of liveborn piglets per litter ranged from 6 to 12. The surgical castration of male piglets was performed 3 or 4 days postpartum. Experiment 2 involved 80 cross-breed piglets from eight sequential litters. The number of liveborn piglets per litter ranged from 8 to 11. Surgical castration of male piglets was performed 3 or 4 days postpartum.

In both experiments, sows with piglets were housed in separate farrowing pens during lactation. Each farrowing pen had a special covered area for piglets, warmed up to 28 °C by a 150 W infrared heating lamp and warming plate. The temperature in the uncovered part of the pen

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