



Influence of origin litter on social rank, agonistic behaviour and growth performance of piglets after weaning

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ABSTRACT

In pig production, mixing of piglets after weaning is a common management practice often leading to severe fighting aimed at establishing a social hierarchy. The intention of our study was to investigate whether social rank of piglets obtained by fighting within 3 days after weaning and mixing was affected by origin litter. We studied a total of 15 groups containing 180 piglets originating from 30 litters in two different experimental parts on two conventional pig farms. Each group was composed of six piglets each from two different litters, thus one group consisted of a total of 12 animals. Agonistic behaviour was analysed continuously during 72 h after weaning. Sociometric measures determining the linearity of the established social hierarchy as well as an individual rank index were calculated. Piglets were weighed the day before weaning and at the beginning of the fattening period. Piglets in groups of 12 established semi-linear hierarchies allowing the assignment of individual piglets to definite rank positions. There was a clear relationship between origin litter and dominance status. In almost all groups, littermates (LM) originating from one litter obtained higher rank indices than their non-littermates (non-LM) originating from the other litter within the same group ($p < 0.05$). High ranking animals tended to perform more attacks than lower ranking piglets and fought more, especially against non-littermates. There were no differences in daily weight gain between piglets of different rank positions or different litters during the entire rearing period. Our results indicate the existence of a litter-associated dominance when mixing piglets from two different litters after weaning, without any influence on daily weight gain, provided that piglets are fed ad libitum with a close animal feeding:place ratio (1.5:1).

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1. Introduction

In modern pig production, piglets are often separated from the sow when they are 3 or 4 weeks old in order to produce a high number of litters per sow and year. At weaning, piglets of different litters are sorted by weight and sex and mixed into new groups kept in special nursery facilities. However, any regrouping of pigs leads to

agonistic behaviour and fighting aimed at establishing a social hierarchy within a group (Meese and Ewbank, 1973). The formation of a social hierarchy in domestic pigs is based on the superiority-subordination relationships of all possible pairs of individuals (Chase et al., 2002; Langbein and Puppe, 2004). In all stages of pig production, an almost linear social hierarchy is detectable being evident especially in small groups of pigs kept in low stocking densities (Dimigen and Dimigen, 1971; Ewbank, 1976; Scheel et al., 1977; Puppe et al., 2008). A linear hierarchy is characterised by a clear ranking from dominant to subdominant (Meese and Ewbank, 1973; Ewbank, 1976; Chase et al., 2002)

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without any circular triads usually considered as a characteristic of a complex hierarchy which can be found in larger groups of pigs. In mixed groups of 10 and 12 weaned piglets, semi-linear hierarchies were detectable (Puppe et al., 2008; Fels, 2008), whereas in groups of six piglets the social hierarchy was nearly linear (Fels, 2008). Semi-linear hierarchies were also detected in fattening pigs with nine pigs per group and in sows with eight animals per group (Puppe et al., 2008).

The existence of dominant and subdominant animals within a group is known to be essential to maintain a stable social structure, and the function of a dominance order is based on the combination of aggressive behaviours performed by dominant animals and defensive behaviours of subdominant individuals. Once established, a stable social hierarchy prevents further fighting among group members which is mainly based on avoidance strategies of subdominant animals. Therefore, the establishment of a social hierarchy is essential for a well-regulated co-existence of pigs and thus, it is known to be an evolutionary benefit preventing animals from suffering aggression and injuries (Meese and Ewbank, 1973; Lindberg, 2001; Mendl and Held, 2001). Nevertheless, mixing of weaned piglets is followed by high rates of aggression and fighting which can cause serious problems in animal welfare as well as in growth performance (Puppe et al., 1997; Bruininx et al., 2001; Merlot et al., 2004). Although aggressive behaviours are usually limited to a short period after mixing, aggression may also continue for a longer time, in particular if the access to important resources is limited. Feed is often such a limited resource, and the presentation of feed is often associated with aggression (Arey and Edwards, 1998; Anil et al., 2003). In order to prevent excessive, violent biting and to limit aggressive behaviours to a short period after mixing, a deeper understanding of factors influencing the procedure of establishment of social hierarchy in piglets is indispensable. Little is known about a relation between origin litter and aggressiveness or dominance behaviour of individual piglets. A relationship between social dominance status of the mother and gilt dominance has been detected (Drickamer et al., 1999). Kranendonk et al. (2007) found that the social rank of a pregnant sow affects the behaviour and performance of her offspring. Piglets from high ranking sows showed a shorter latency time to investigate a novel object, were heavier at weaning and at slaughter and had a higher percentage of lean meat than piglets from low ranking sows. The aim of the present study was to investigate whether there is any relationship between origin litter and social dominance of piglets mixed in groups after weaning. Additionally, the existence of any relationship between social rank of piglets, their origin litter and daily weight gain was also investigated.

2. Animals, materials and methods

2.1. Animals and housing

The present study was carried out in two phases. The first phase of the study was conducted at the research farm of Department of Animal Breeding and Genetics of Justus Liebig University Giessen (Germany). 60 weaned piglets

in newly mixed groups of 12 with six piglets from two litters each were studied in five rearing batches. Piglets used in this part of the trial were cross-breedings of German Landrace, Large White, Pietrain, Duroc and Hampshire. The mean initial weight of all piglets was 7.9 kg with an average weaning age of 26 days. The animals were kept without litter on partially slatted floor (0.38 m² per animal, animal:feeding place ratio 1.5:1) separated from other piglet groups by solid pen walls. The animals had ad libitum access to dry food and water. Piglets were weighed the day before weaning and at the beginning of the fattening period on day 38 after weaning.

The second phase of the study was carried out at the research farm of University of Veterinary Medicine Hannover Foundation (Germany). One hundred twenty piglets from 20 litters of the German National Breeding Programme (BHZP) were studied in groups of 12 with six piglets from two litters each in six rearing batches. The mean initial weight of all piglets was 9.9 kg with an average weaning age of 35 days. The animals were kept on fully slatted floor with 0.3 m² per animal. The piglets had ad libitum access to dry food and water and the animal:feeding place ratio was 1.5:1. Animals in this part of the study were weighed the day before weaning and at the beginning of the fattening period on day 50 after weaning. Based on these data, the daily weight gain of piglets during the rearing period was calculated.

In both trials, piglets were sprayed on their backs with standard colour stock marker on the weaning day to facilitate the identification of individuals and then moved to the rearing house. The piglets were divided according to their weight, sex and origin litter across the groups. The groups were formed as homogeneous weight groups with approximately equal sex ratio.

2.2. Behavioural observations, sociometric and rank analysis

In the two study phases the number and outcome of all agonistic interactions after weaning were analysed by continuous video recording during 72 h after mixing, thus a total of 1080 h were video-analysed. Above each pen, a camera (Panasonic ZC-F11 Ch3) was installed and connected with a time-lapse video-recorder (Panasonic CTR 4024 CBC). Video recording started immediately after weaning when new groups from two different litters each were formed. All agonistic interactions occurred within a group during 72 h after weaning were collected on an individual basis using a $m \times m$ matrix where the winners were marked on the lines and the losers were marked in the columns. An agonistic interaction was defined as a fight or a displacement with physical contact initiated by one individual including aggressive behaviour elements followed by any form of submission performed by the opponent (Langbein and Puppe, 2004; Stukenborg et al., 2011).

In the first phase of the study, sociometric parameters were calculated on group basis using the Software MatMan, version 1.0 for Windows, Noldus Information Technology, Wageningen, The Netherlands, according to Langbein and Puppe (2004). These parameters served as a measure for the degree of linearity of the social hierarchy established

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