



Contents lists available at ScienceDirect

# Applied Animal Behaviour Science

journal homepage: [www.elsevier.com/locate/applanim](http://www.elsevier.com/locate/applanim)



Research paper

## Aggressive behaviour at regrouping is a poor predictor of chronic aggression in stable social groups

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### ARTICLE INFO

#### Article history:

Received 27 April 2016  
Received in revised form 2 February 2017  
Accepted 5 February 2017  
Available online xxx

#### Keywords:

Aggression  
Pig  
Lesion  
Social  
Fighting  
Cluster analysis

### ABSTRACT

Commercial pigs globally are routinely mixed into new social groups. This results in regrouping aggression predominantly during the first 24 h which compromises welfare and productivity. Chronic aggression persists thereafter and is also undesirable. Management strategies are needed that reduce the costs of aggression in both of these contexts. Pigs vary greatly in aggressive behaviour and numbers of skin lesions. This study examined how regrouping behaviour affects immediate and long-term lesion counts with a specific focus on understanding the behaviour of pigs with few lesions in both social contexts. Aggressive behaviour from 1163 growing pigs was observed for 24 h post-regrouping and fresh lesions were counted 24 h and 3 weeks post-regrouping. Similarity between pigs was calculated using all behavioural traits recorded during the 24 h post-regrouping. Clusters of pigs were formed using furthest neighbour clustering with a stopping rule of 80% similarity. Five clusters of pigs representing 90% of the population (1047 pigs) were identified. For each regrouping aggressive behaviour trait and for fresh lesion counts 24 h post-regrouping the means differed significantly ( $P < 0.0001$ ) between clusters. The most extreme clusters were characterised by extremely high or low levels of aggression with the other three clusters characterised by pigs that were unaggressive losers, selectively aggressive or with long fights. Statistically significant ( $P < 0.05$ – $P < 0.001$ ) but numerically small differences between clusters were found in lesion count 3 weeks post-regrouping. Pigs were separately categorised based upon their combination of lesion counts recorded 24 h and 3 weeks post-regrouping. Pigs showing similar behaviour at regrouping displayed wide ranging combinations of acute and chronic lesion outcomes. Pigs with particularly low lesion counts at both regrouping and 3 weeks post-regrouping were found in all 5 clusters. Avoidance of aggressive behaviour at regrouping resulted in few lesions at 24 h but more lesions at 3 weeks. Increasing the proportion of pigs in the population that receive few lesions from both regrouping and chronic aggression may require management strategies that manipulate behaviour in both contexts. Long-term costs of avoiding regrouping aggression, represented by lesion counts three weeks after re-grouping, show that regrouping aggression may retain an important function in domesticated pigs and potentially in other species.

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### 1. Introduction

Aggressive behaviour is a component of the behavioural repertoire of both wild boar and commercially managed pigs. The behaviours performed are similar in these two contexts but the

quantity is typically much increased under commercial production, particularly when unfamiliar animals are suddenly introduced with minimal opportunity to withdraw (regrouping; Mendl, 1995). Regrouping occurs several times in the life of most commercial pigs globally and the aggression associated with this and subsequent chronic aggression in stable social groups can be damaging even when resource needs for survival are fully met (e.g. Séguin et al., 2006; Turner et al., 2009). Regrouping aggression has deleterious impacts on animal welfare and economic productivity and has been the subject of much research to find a cost-effective method to reduce its expression. Less effort has been placed on the con-

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sequences of, and methods to control chronic aggression in stable social groups, although its welfare and economic impacts are likely to be significant (e.g. Tan et al., 1991). Management or breeding approaches that reduce the costs of aggression in both of these contexts are required.

The accumulation of skin lesions has been shown to reflect involvement in aggressive behaviour and the location of the lesions on the body allow interpretation of whether their cause was reciprocated fighting or non-reciprocated bullying (McGlone, 1985; Turner et al., 2006a). Furthermore, high numbers of skin lesions are associated with heightened plasma cortisol and metabolites indicative of muscle fatigue, a poorer growth rate, increased back-fat depth, poorer food conversion efficiency, poorer meat quality and lower reproductive output (Rundgren and Löfquist, 1989; Warriss et al., 1998; Turner et al., 2006b; Tönepöhl et al., 2013). As such, the reduction in skin lesions is an appropriate target to easily measure the success of management change designed to control aggression. Large phenotypic and genetic variation exists between individual pigs of the same breed managed contemporaneously under the same conditions in the number of lesions received from regrouping aggression and aggression in stable social groups (Turner et al., 2006a, 2009; Desire et al., 2015). The phenotypic correlation between the number of lesions received in these two contexts is low (Turner et al., 2009; Desire et al., 2015) and pigs therefore exist which have few lesions in both contexts, have many lesions in both contexts or which have few in one context and many in the other.

Large differences also exist between pigs in the expression of the underlying aggressive behavioural traits (e.g. Erhard et al., 1997; Turner et al., 2006a). Tönepöhl et al. (2013) and Desire et al. (2015) have shown that aggressive behavioural strategies performed at regrouping affect the accumulation of lesions at regrouping, but are also associated with the number of fresh lesions pigs continue to receive many weeks post-regrouping. The association between aggressive behavioural strategy at regrouping and long-term lesion number appears to be mostly independent of fight success and is present at both the pig and pen levels (Desire et al., 2015). However, at present it is unclear what aggressive strategy or strategies are played by pigs which accrue few lesions from both acute regrouping aggression and subsequent chronic aggression in stable social groups. This study seeks to characterise the aggressive behaviour of such pigs during the 24 h following regrouping when aggressive social interactions are most frequent and intense. Pigs which receive few lesions under both regrouping and stable social contexts might be regarded as possessing phenotypes that would be the optimum target of management interventions designed to control aggression. This study therefore aims to provide the basic knowledge, currently lacking, of the behavioural strategies performed by these pigs during the regrouping period which may inform the management approaches that will favour the proliferation of these desirable phenotypes.

## 2. Methods

### 2.1. Ethical statement

The study was carried out in strict accordance with the recommendations in the European Guidelines for accommodation and care of animals. The protocol was approved by the SRUC Ethical Review Committee. End points were in place to prevent injury exceeding levels seen on other commercial animals housed contemporaneously on the same farm. Endpoints determined that if an animal reached this point they would be housed in a hospital pen and veterinary advice sought. No animal was hospitalised or

required veterinary treatment due to aggression during the course of the study.

### 2.2. Animals and housing

The subjects were 1163 grower stage pigs (701 purebred Yorkshire and 462 crossbred Yorkshire x Landrace; 357 males, 119 castrates and 687 females) born and managed in 14 batches on a Swedish commercial farm. Pigs were housed in littermate groups without regrouping until 70.5 (SD 4.3) days of age and 27.6 (SD 5.6) kg bodyweight when they were regrouped into new groups of 15 using the protocol described below. The pens into which the pigs were mixed had a floor space allowance of 0.85 m<sup>2</sup>/pig (29% slats; 71% lightly bedded solid flooring). This space allowance is considerably more generous than that required by the European Union Council Directive 2008/120/EC (0.30 m<sup>2</sup> per 20–30 kg pig) which increased the opportunity to avoid aggressive encounters if pigs wished. *Ad libitum* dry pelleted food was provided from a single space feeder and *ad libitum* water was available from a nipple drinker. The mean ambient temperature was 19.4 (SD 2.9) °C.

### 2.3. Regrouping and lesion counting

Single sex and single-breed groups of 15 were formed by mixing three pigs from each of five littermate groups. As far as possible, pigs of a similar body weight were regrouped together. Immediately before regrouping, the sex, breed, litter details, pre-regrouping lesion count, and identity were recorded for each pig. After 24 h, the animals were weighed, and a post-regrouping lesion count was recorded from which the pre-regrouping lesion count was subtracted. The number of fresh lesions estimated to be within 24 h old (fresh blood, bright red in colour or with recent and continuous scabs) was counted by a single observer throughout. Separate lesions were counted when two injuries were orientated in the same direction but separated by an approximate distance of at least 5 mm of undamaged skin. Lesions were superficial and therefore severity was not recorded. Lesions to the front (head, neck, shoulders, and front legs), middle (flanks and back), or rear (rump, hind legs, and tail) of the body were recorded separately. Around 3 weeks after regrouping at 89.8 (SD 5.2) days of age, lesions were again counted on one occasion.

### 2.4. Behavioural recording

Pigs were video recorded for 24 h post-regrouping and were individually identifiable by spray paint marks applied to their backs immediately before regrouping. The frequency and duration of reciprocal and non-reciprocal aggression were recorded together with the identity of the initiator and winner where these were clear. Reciprocal aggression was defined as a fight that lasted for more than one second where both pigs were involved in pushing, head knocking or biting (Turner et al., 2006a). Two severities of reciprocal aggression were separately recorded; escalated reciprocal aggression included bites delivered at a rate of at least one bite every 3 s while non-escalated reciprocal aggression included bites delivered at a slower rate, head knocks and pushes. The initiator of reciprocal aggression was recorded as the pig which delivered the first bite. Fight success was recorded when a pig pursued a retreating animal over a distance of at least 1 m and did not receive renewed damaging aggression from the loser for at least 3 s. Non-reciprocal aggression involved the delivery of escalated aggression with no retaliation from the receiver. Non-reciprocal aggression could occur as a unique event independent of a reciprocal fight, as a component of a reciprocal fight, or at the end of a reciprocal fight as the loser retreated. Three observers extracted these data from the videos. Analysis of three 1 h samples of data showed

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