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Can tail-in-mouth behaviour in weaned piglets be predicted by behaviour and performance?

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ABSTRACT

This study aimed to identify characteristics of pigs performing tail-in-mouth behaviour (TIM; P, $n = 34$), their recipients (R, $n = 23$) and neutral penmates (N, $n = 31$) at two occasions, the first being at weaning (4 weeks of age) before TIM was observed in the pen and the second being at 9 weeks of age when TIM had emerged, but no clinical tail lesions were observed. The groups ($n = 22$) were formed by siblings, two gilts and two castrates. Behaviour was analysed as 24-h time budgets and continuously sampled during 30 min of the active part of the day. Category (P, R, N) effects were analysed at individual and (directed) dyad level.

P was born significantly smaller than R, but the difference had disappeared at 4 weeks. Growth or sex distribution did not differ between categories. Category differences in performed behaviour were evident at 4 weeks of age, when P showed more overall activity and environmental exploration as compared to R, as well as more bouts of tail-nosing than N. Different aspects of behaviour changed in the different categories between 4 and 9 weeks of age. In P social activity increased significantly and went from no preference at 4 weeks to a significant preference for social actions for R over N at 9 weeks. N was socially passive at 9 weeks while receiving more social behaviour than the other categories. These differences in behaviour suggest that the categories represented different phenotypes of pigs.

1. Introduction

Tail biting is a behavioural disturbance of growing pigs associated with an unsatisfactory environment. It is a significant economical and welfare problem in modern pig production. Although a number of farm-level predisposing factors have been established their effects appear to be interacting heavily with individual characteristics of the pigs, making outbreaks unpredictable (Taylor et al., 2010). The identification of measures able to prevent tail biting requires a better understanding of the initial stages of a tail biting outbreak, especially of the contribution of individual pigs (Edwards, 2006).

Gentle tail manipulation or tail-in-mouth behaviour (TIM), causing no obvious injuries to the tail, is considered to be a behavioural precursor to damaging tail biting (Feddes et al., 1993; Feddes and Fraser, 1994). According to the review by Taylor et al. (2010) this two-stage type of tail biting appears to account for the majority of tail biting in commercial pig production and also of the tail-biting cases described in scientific papers.

The progression from the pre-injury stage, characterized by TIM, to the injury stage in two-stage tail biting takes place can occur rapidly (Fraser, 1987). TIM may also be performed without subsequent injurious biting (Schrøder-Petersen et al., 2003a). There are diverging views among scientist on the categorization of TIM as normal or abnormal behaviour. TIM has been suggested to be abnormal upon observations that only one or a few individuals in a group have been performing the behaviour (Blackshaw, 1981; Beattie et al., 2005), whereas others have reported low-frequency TIM performed by all or a majority of pigs in a population and thereby classified it as a normal activity (Feddes et al., 1993; Schrøder-Petersen et al., 2003a). An obvious reason for this discrepancy, in addition to differences in observational strategy, may be variation in TIM frequency and intensity between populations and/or occasions. Schrøder-Petersen et al. (2003a) suggested that TIM behaviour of low frequency and intensity is normal behaviour that may increase to abnormal levels under certain circumstances, to eventually become actual injurious tail biting.

TIM is thought to be an expression of the motivation to explore both the environment and in a social context (Schrøder-Petersen et al., 2003a,b; Simonsen, 1995; Newberry and Wood-Gush, 1988). The behaviour has been reported to decrease in response to straw provision, increase with age at least in weaners, and typically be

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performed by females and received by males (Schrøder-Petersen et al., 2003a; Simonsen, 1995).

The aim of this study was to identify individual differences in size, growth and behaviour in TIM-performers, TIM-receivers and neutral penmates before TIM behaviour was observed in the pen and when the behaviour had begun or was about to begin in the group.

2. Materials and methods

2.1. Animals and husbandry

The animals (n = 88 pigs in 22 groups) were chosen from a larger experiment (252 pigs in 63 groups) investigating different enrichment regimes, conducted over 13 batches in 2004–2005 at the experimental pig farm of MTT Agrifood Research in southern Finland. The animals represented pure Finnish Yorkshire or Finnish Landrace and their crosses with or without ¼ Duroc.

Housing and husbandry will be described only shortly, as details are given elsewhere (Munsterhjelm et al., 2009). The animals were housed in pens with partly slatted floors at all times. Sows farrowed and nursed in pens of 5.4 m^2 without crates, equipped with a heated creep area. During the first three days litter size was standardized to no more than 12 piglets by cross-fostering onto non-experimental sows. Piglets were subjected to teeth clipping and foreleg taping at one day of age as well as an intramuscular iron injection (1 ml Ursoferran® vet., Serumwerk Bernburg AG, Germany) and castration at day three. Tails were left intact according to Finnish legislation.

The piglets were weaned at an average age of 29.5 days (range 26–36). At weaning groups of weight-matched siblings were formed including two gilts and two castrates. In the nursery (4–9 weeks of age) animals were allowed a stocking density of 0.7 m^2 per animal in pens equipped with a single-space ad libitum feeder (Groba Diplomat AS, Skælskør, Denmark) and two drinking nipples. Climate was controlled according to age. In the fattening unit pigs were housed with a stocking density of 1.2 m^2 per pig and fed from a trough.

The animals were provided enrichment according to one of six schemes being investigated in the original experiment. Pens either were (=E) or were not (=0) bedded with wood shavings and chopped straw thinly enough to show the pen floor during suckling, nursery and fattening stages. Accordingly, enrichment regimes were 1) 000 (referring to 0 in the suckling stage, 0 in the nursery and 0 in the fattening stage; n = 8 pigs in 2 groups); 2) E00 (n = 12/3); 3) EE0 (n = 20/5); 4) 00E (n = 8/2); 5) 0EE (n = 24/6) and 6) EEE (n = 16/4). This experimental procedure was approved by the ethical committee of MTT Agrifood Research Finland (permission number SIK 6/04, 2004-08-26).

Animals had full artificial lighting between 07:00 and 16:00 h and dimmed lighting enabling night-time videotaping for the remainder of the time. They were fed standard pelleted pig diets without additives formulated to fulfill current Finnish feeding recommendations and slaughtered at 20–22 weeks of age.

2.2. Experimental design

TIM was defined as manipulation of the tail irrespective of the reaction by the recipient, but without causing clinical damage. All groups fulfilling three inclusion criteria were selected for the study: 1) no TIM behaviour was observed on video tape during the first day after weaning (age 4 weeks), 2) TIM behaviour was observed on video tape on the last day in the nursery and/or on the first day in the fattening unit (age 9–10 weeks), and 3) no clinical tail wounds were observed from birth to 10 weeks of age. TIM behaviour was defined as taking a tail in the mouth, regardless of the reaction by the other pig. The animals were categorized as TIM performers (P, n = 34 pigs in 22 groups), TIM receivers (R, n = 23 pigs in 19 groups) and neutral pigs (N, n = 31 pigs in 19 groups). One occasion of TIM was enough to categorize an animal as P or R. P observed to receive TIM (n = 7 pigs in 5 groups) were included in the P category. Characteristics of the experimental groups are summarized in Table 1.

The animals were weighed at birth, at weaning at 4 weeks of age, and at the middle and end of the nursery period (age 7 and 9 weeks). Behaviour was monitored with a time-lapse black and white video recording device for 24 h starting at 07:00 h on the first and last day in the nursery (age 4 and 9 weeks), on the first day in the fattening unit (age 10 weeks) and at 14 and 18 weeks of age. The cameras were connected to a video recording device through a multiplexer. The animals were marked individually with permanent drawing ink the day before each monitoring.

Social and exploratory behaviours were extracted by continuous focal sampling at 13:00–13:10, 14:00–14:10 and 15:00–15:10 h according to the ethogram given in Table 2. The time slots were chosen in order to represent the most active part of the day according to Beattie (1994). A bout was considered to end if the animal stopped performing a behaviour for two seconds or more. Time budgets were investigated by instantaneous scan sampling with a 10 min interval for the whole 24 h according to the ethogram in Table 3. Continuously sampled behaviours will be referred to as "daytime behaviours" to be distinguished from 24-h time budgets. All behaviours were recorded on individual level. The recipient was recorded in addition to the performer for all social behaviours.

2.3. Statistical analyses

The SPSS for Windows statistics package, version 22.0 (IBM Corp., Armonk, NY, USA) was utilized for statistical analyses. The experimental unit was the individual. Growth was expressed as the relative change in body weight over a given time span. The distribution of sex within each category was evaluated against a balanced distribution using the Chi-squared test. Scan sampled behavioural variables were analysed as the number of scans in the behaviour over 24 h. Continuous behavioural variables were analysed as total time in the behaviour and as the number of bouts during 30 min of observation. All performed social behaviours (nosing, tail nosing, ear biting, TIM, fighting, pushing and submissive behaviours) were summarized in the variable "total social behaviours", and all received social behaviours except "submissive" were summarized in "received total social behaviours". Being the recipient of a submissive action was, by definition, a response to social activity and thus not considered a true received behaviour.

Daytime performed total social behaviour was subjected to dyad-level analysis in order to investigate category-level preferences for social actions. A dyad is a unit including a performer and a receiver. The dyads were considered as directed, meaning that A directing behaviour towards B was a different dyad than B directing behaviour towards A. Hereby the data included nine different dyads (P → R, R → P, P → N, N → P, N → R, R → N, P → P, N → N, R → R), however, the dyad P → P was excluded from all analyses due to a low n.

Normality was investigated for all continuous variables using histograms, Q–Q plots, Kolmogorov-Smirnov and Shapiro-Wilk tests; and attempts made to transform the non-normal ones. Category and dyad effects on variables that could not be normalized were determined using the Pair-Wise Related-Samples Wilcoxon Test, or, if the within-pair difference was non-symmetrically distributed, the Sign Test. The group effect was counted for by considering the categories or dyads within a group as the repeated feature. In groups with several animals representing the same category or dyad their median was used in the analyses. The tests were

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