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Tail biting behaviour and tail damage in pigs and the relationship with general behaviour: Predicting the inevitable?

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ABSTRACT

Tail biting behaviour in pigs is a common problem in conventional housing systems. Our study examined the consistency over time in tail biting and tail damage and it explored the predictive value of general behaviours observed in individual pigs and in pens as a whole.

Pigs ($n = 480$), reared in conventional farrowing pens with a sow crate, were followed from pre-weaning to slaughter (23 weeks). Post-weaning, piglets were housed barren (B) or enriched (E). Behaviours were observed pre-weaning (averaged per litter) and post-weaning in three phases (weaner, grower, finisher) (averaged per pig/phase). Tail damage of individual pigs was scored weekly from weaning (4 weeks) onwards (averaged per phase). Relationships between tail biting and tail damage with behaviour were investigated both at individual and pen level using mixed or generalized linear mixed models and Spearman's rank correlations, respectively.

Tail biting and tail damage (2.1 ± 0.05, 1 = no tail damage, 4 = tail wound) were already observed pre-weaning. Post-weaning, tail biting and tail damage were less prevalent in E compared to B housing ($P < 0.001$). Tail biting behaviour in individual pigs was not consistently observed over time, i.e. none of the pigs was tail biter in all three phases, so new tail biters were found in later phases and some of the already identified tail biters stopped tail biting completely or temporarily. In B housing 38.3% and in E housing 5.6% of pigs was identified as tail biter in at least one phase post-weaning. B housed tail biters in different phases were likely to originate from litters with a relatively high level of tail biting behaviour pre-weaning ($P < 0.05$–0.01). Generally, post-weaning victims were likely to be a victim again in successive phases of life (B: $P < 0.10$–0.001; E: $P < 0.01$). Tail biting and tail damage were best predicted by behaviours at pen level and less by behaviours at the individual level: a higher activity, and more pig and pen-directed manipulative behaviours were observed in pens with high levels of tail biting. Particularly higher levels of chewing or consuming objects such as jute sacks could be useful in predicting tail bite outbreaks. To conclude, tail biting in pigs starts early in life and is difficult to predict due to its inconsistency, although tail damage is more consistent throughout life. Especially behaviour observed at litter or pen level is a promising tool in predicting tail biting and tail damage.

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1. Introduction

Tail biting is a problem in pig production (EFSA, 2007) from both an animal welfare and economical point of view (Blokhuis et al., 2000; Bracke et al., 2004a,b; Smulders et al., 2008). Tail biting by a pig can be described as grabbing "a tail transversely in its mouth" (Van Putten, 1969) while chewing on it (Taylor et al., 2010) and thereby likely inflicting mild to severe damage to the tail (Keeling et al., 2012; Zonderland et al., 2009). Tail wounds may cause infections to internal organs (Huey, 1996; Munsterhjelm et al., 2013) and, when severely bitten, pigs may become paralyzed and die (EFSA, 2007; Fritschen and Hogg, 1983). To reduce tail biting and tail damage in pigs, tail docking was introduced in several countries many years ago. Nevertheless, in late 1950s the effect of tail docking was already questioned (reviewed in Van den Berg, 1982) and nowadays tail biting and tail damage still occurs, also in docked pigs (see review of Sutherland and Tucker, 2011). As long as tail biting occurs, the need to understand underlying causes of tail biting and the need to prevent the damaging behaviour remain also present.

Tail biting has a multifactorial background (Bracke et al., 2004a; Taylor et al., 2010; Van Putten, 1969) which relates to environmental risk factors and biological characteristics of the pigs. Environmental risk factors include for instance a lack of suitable rooting substrate (Hunter et al., 2001; Van Putten, 1969; Zonderland et al., 2008), a deficiency in nutrients (Fraser, 1987b) or fibre (Pütz et al., 2011), an inadequate feeding system (Jaeger, 2013; Moinard et al., 2003), a high stocking density (Moinard et al., 2003), and a suboptimal air quality (Sällvik and Walberg, 1984; Van Putten, 1969). Biological characteristics of the pigs that may be involved in tail biting are breed (Breuer et al., 2003; Turner, 2011) and sex (Penny et al., 1981; Zonderland et al., 2010), but also individual pig characteristics in terms of underlying personality traits such as nervousness (Van Putten, 1969), fearfulness (Zupan et al., 2012), or coping strategies (Korte et al., 2009). Although many risk factors are known, tail biting remains a rather unpredictable behaviour which is performed by some but not all pigs kept under the same circumstances (Beattie et al., 2005). Providing the pigs with enrichment substrates to be able to satisfy the need to forage and explore (Bracke et al., 1999) is no guarantee for total absence of tail biting (e.g. Munsterhjelm et al., 2009; Van de Weerd et al., 2006; Zonderland et al., 2008). This suggests that other motivations than the need to forage and explore, may also underlie tail biting (Taylor et al., 2010). If tail biting behaviour in different pigs is indeed caused by different motivations or underlying (behavioural) needs, it may be associated with other behaviours as well.

Although tail biting has been studied for many years (e.g. Fraser, 1987a; Van Putten, 1969; Zonderland, 2010), only few studies presented experiments to identify associations between tail biting and other (behavioural) pig characteristics (e.g. Beattie et al., 2005; Statham et al., 2009; Zonderland et al., 2009). The search for predictors of tail biting would benefit from a study that follows pigs from the pre-weaning to the finisher phase and, thereby, assesses not only biting incidences and tail damage, but also other behaviours of the pigs. The first aim of this study was to examine whether individual differences in tail biting behaviour and in tail damage are consistent over time. The second aim was to explore relationships between tail biting behaviour and tail damage with general behaviours both at the individual pig and at pen level. As housing likely affects the prevalence of tail biting behaviour and we assume that different underlying motivations for tail biting (as pointed out by Taylor et al., 2010) are involved in different housing systems, we chose to use both barren and enriched pens in our study.

2. Materials and methods

The experimental protocol followed during this study was approved by the Animal Care and Use Committee of the University of Groningen and of Wageningen University, the Netherlands.

2.1. Animals and housing

2.1.1. Pre-weaning

Piglets ($n = 1210$) were born in five rounds from 80 litters (Tempo × Topigs 20) at the experimental farm of TOPIGS Research Center IPG in Beilen, The Netherlands. Litters diverged in estimated Indirect Genetic Effects (IGE) for growth (Camerlink et al., 2013). IGE effects are not discussed in this paper, but will be presented elsewhere (Camerlink et al., submitted). Teeth and tails were kept intact, but males were castrated in the first week after birth. Piglets were further subjected to standard procedures on farm. Housing consisted of conventional farrowing pens (3.8 m^2, 53% slats) with farrowing crates. Piglets were fed commercial diets, starting with a crumbled pre-starter at seven days of age (or, when needed, replacement milk and then crumbled feed) which was replaced by a weaner pellet at three weeks of age. Piglets continuously had access to water by one drinking nipple. The first week a heating lamp with yellow lighting was present. Throughout the pre-weaning phase mean ambient temperature in the farrowing units was 25 °C. Lighting was dependent on day length, but lamps were on from 7.00 h until usually 16.00 h and daylight entered the stable.

2.1.2. Post-weaning

Piglets ($n = 480$) were weaned at four weeks of age and transferred to the experimental farm "De Haar" in Wageningen, the Netherlands. A minimum of two and a maximum of eight healthy piglets per litter were selected. Allocation of pigs at weaning to B or E pens was balanced for litter and weaning weight. All groups ($n = 80$) consisted of six unacquainted pigs (i.e. from different litters) from one IGE class and were balanced for sex (1:1 ratio) and back test classification (LR:HR ratio in accordance with the whole tested population) (see also Bolhuis et al., 2003; Melotti et al., 2011; Reimert et al., 2013). All pens (±6.7 m^2) had a chain with ball, and once the pigs were eight weeks of age, a jute sack (round 1: 50 × 82 cm, other rounds: 60 × 103 cm) was attached to the pen wall (throughout the article 'objects' is used to refer to 'chain with ball and jute sacks'). The jute sack was replaced by a new one if more than two-thirds of the sack was 'consumed' (i.e. pigs