Breed effects on sensitivity to stress and hypothalamic-pituitary-adrenocortical regulation in pigs

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Introduction

In the current intensive housing systems more than 90% of the annually 146 million slaughter pigs in EU are tail docked to prevent tail biting. Although tail docking is prohibited in Norway, tail biting outbreaks are not uncommon at commercial farms. Consequently, the welfare tail bitten pigs is impaired and economic costs arise due to subsequent injuries and diseases caused by tail damage. It has previously been documented that the majority of the pigs perform and receive tail-biting behavior (Zonderland et al., 2010). Preliminary cost estimation indicates a yearly financial loss of around 6.000 euros in a herd of 4000 finishing pigs with a tail damage prevalence of 5% (Zonderland, unpublished). Tail-biting is estimated to affect up to 11% of the pig population in Finland (Valros et al., 2004). Oftentimes the behavioural abnormality can affect animals in several different pens in the same barn. Tail-biting is a multi-factorial syndrome and therefore difficult to investigate. The occurrence of tail biting is affected by the lack of water supply, deficiencies in nutritional state, the absence of suitable foraging substrates in the environment, and inadequate access to resources, among many other factors. In addition, events such as diseases outbreaks and sudden changes in temperature may trigger the occurrence of tail-biting. Different theories have evolved to explain the occurrence of the behaviour. The most consistent finding is that stressors are the likely triggers of tail-biting outbreaks (Taylor et al., 2010). The occurrence of tail biting is more prevalent in some pig breeds (Taylor et al., 2010). Detailed information on stress responsiveness, measured by cortisol release, under several test situations may offer elements to improve our understanding of what makes some pigs susceptible to tail biting. Individual differences in pig’s ability to cope with the lack of stimulation in modern housing systems may be linked to the development of tail biting, since pigs have individual coping strategies early in life. This seems to play a role in regulation of certain behavioural and physiological responses to short-term stress in adulthood (Geverink et al., 2002).

In order to try to understand why pigs respond differently to a common environment in regard to the development of tail biting behaviour we conducted a study investigating physiological correlates associated with the three phenotypes, tail biters, tail biting victims, and control pigs during basal and stress inducing test situations (transportation, fear test, and isolation test). We predicted that genetic and environmental factors would be linked to tail-biting because they would be likely to influence susceptibility to stress and possibly the predisposition of certain individuals to develop tail-biting. Thus, the goal of this study was to assess the responsiveness of the stress-axis, hypothalamic-pituitary-adrenocortical axis (HPA), using non-invasive method to measure cortisol in biters, victim and control pigs of two genotypes.

Animals, material and methods

Pigs were selected from three commercial Norwegian farms. Farmers informed the experimenters on five difference occasions, via telephone, of tail biting outbreaks at their farms. After a visit and an observation period on the farms, the researchers selected up to two sets of one tail biter, a tail bite victim, and a control pig from the same pen (a trio). The frequency of biting was observed continually for each trio for 60 min. Tail-biters were observed to repeatedly bite the tails of other pigs. Victims were repeatedly bitten, or had bloody tail damage. Controls were not involved in tail biting as a biter or victim, and had healthy tails. Pigs studied were of both sexes, gilts and barrows, and of two hybrids, Landrace X Yorkshire (LY) and Landrace X Yorkshire X Landrace X Duroc (LYLD). Each trio was composed of pigs of the same sex and breed. The next day each pig of the triplets was tested (n = 24 animals) in an arena separated from its pen mates to observe its response to a human wearing a white lab coat (response to human). The duration of the test was 10 min. Following completion of testing at the farm, 30 pigs (10 trios) were transported to the Norwegian School of Veterinary Science (NVH). On arrival to the school, the pigs were weighed and housed in individual pens. On one side of the pen an iron grid allowing visual, auditory, and limited tactile contact between adjacent pen-mates of the same category, i.e. biters with biters, victims with victims and controls with controls.

Saliva samples, using cotton rolls, were taken on several occasions. Firstly, they were collected at the farm before testing and 60 min thereafter. Secondly, the samples were taken before the transport and 60, and 120 min afterwards. Thirdly, saliva samples were also collected in the new home pens at NVH on 3 days at two time points (7a.m. and 4p.m.). Cortisol was measured using ELISA or enzyme immunoassay (Assay Designs, Inc., U.S.A).

Main results and conclusions

In the case of the response to a human at the farm, the results revealed that LY pigs showed higher salivary cortisol concentration in comparison with LYLD pigs. For the second stressor, transportation, we again found a difference in cortisol concentrations between the breeds. Again, LY pigs showed higher cortisol concentration than LYLD pigs. Cortisol levels collected at different times of the day after transportation to the research facility was affected by the breed. The LY breed had higher cortisol levels than LYLD. Overall, breeds show significant deviation in sensitivity to different stressful encounters as well as in basal levels. Pigs of the LY genotype had higher cortisol secretion either in response to challenge or in their basal levels when compared with the LYLD genotype. This is in line with other studies showing that LY are the one with the highest sensitivity to stress (Taylor et al., 2010). The differences across breeds may reflect the contribution of both genetic and environmental influences in HPA axis functioning. In conclusion, our results clearly show that LY crossbred pigs have higher sensitivity to stressors, which may explain their higher predisposition to develop tail-biting behaviour. They seem to have to some extend an inability to cope with stressful circumstances. It is therefore essential to provide the animals, especially LY pigs, with environmental conditions where they can satisfy their biological needs and thus prevent or diminish the chance of tail-biting outbreak. This will have a positive effect for both animal welfare and farmers.

References

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