Non-environmental Factors Influencing Tail Biting Behaviours in Domestic Pigs

Introduction:

Tail biting is a significant behavioural disorder in pig production and a severe welfare issue. While the welfare and health of the victim is affected, the occurrence can also indicate poor mental health or welfare of the biter, as abnormal behaviour may indicate an inability of individuals to fulfil their natural behaviours in certain environments (Brunberg et al 2012). While poor environments have been identified as a factor for tail biting, recent research reveals that genetic and physiological components are also present. Studies by Brunberg et al (2012), Wilson et al (2012) and Zupan et al (2012) show that this behavioural trait could be associated with specific loci, gene expression and physiological phenotypes. This information may provide novel directions for biting management in the form of genetic and physical testing of individuals to drive selection against the behavioural abnormality. In comparison to current management methods such as tail docking, this new strategy would have improved welfare outcomes. Tail docking is extremely painful procedure adversely impacting the health and well-being of the animal. In addition, tail docked aniamsl can still exhibit signs of tail biting, indicating that it is not a totally effective form of management (Zupan et al 2012).

Discussion:

Identification of loci associated with tail biting behaviour can provide better understanding of the biological mechanisms driving the activity. Behaviour is a complex genetic trait that can involve different genes at various loci. A genome-wide association study, like the one performed by Wilson et al (2012) is require to identify the associated loci and genes. Using PLINK, Wilson et al (2012) performed association studies to identify loci that were not only associated with tail biting but alos being a recipient of tail biting, by comparing individuals that did or did not bite or receive a bite, i.e. control specimens. The study identified two loci associated with tail biting and five associated with being a victim. Chromosome 16 and an unassigned chromosome were the two associate with biting. The identified gene has an unknown function and surprisingly there are no genes at this locus that are homologous to previously identified aggression genes in other species. This may suggest a novel locus for aggression. Comparatively genes at the loci associated with becoming a victim, on chromosome 1, correlate to dysfunctional brain activity and susceptibility to mental health problems in humans such as schizophrenia, especially in mutant variations. Both are causal factors for abnormal factors and increased paranoia and feat. These results suggest moderate genetic association with involvement in this abnormal behaviour, and that it could be possible for selection or manipulation of these loci.

Similarly Brunberg et al 2012 observed differences in genetic influences at the level of expression of genes in the hypothalamus. Brunberg et al (2012) also utilised neutral individuals as controls. The study identified 156 transcripts with varied expression in both the hypothalamus and the prefrontal cortex. Of the 156 transcripts, 56% were differently expressed in animals involved in tail biting as victim and biters compared to neutral individuals. Possibly these 19 genes hold key information about the genetic influence on the expression of this behaviour. Additionally, identification of these variations in gene expression allows for development of screening techniques to identify at risk individuals and the ability to select against these polymorphisms.

Brunberg et al 2012 also observed that genes known to influence behaviour showed varied expression, of particular note was down regulation of GTF2I in biters and receivers compared to neutral and increased expression of EGF in biters and receivers. GTF2I deficiency has been correlated to hypersociability and increased social interaction in mice. EGF influences dopaminergic neurotransmission and has been linked to novelty seeking, exploration and persistent behaviours. Considering their known effects on behaviour, they are considered to be highly important genetic factors for tail biting. It is noted that the expression of genes could be influenced by behaviour and it is not possible to determine if variations are a result of or a cause and further research is required.

Alternatively, Zupan et al (2012) investigated the physiological differences in tail biters, receivers and neutrals in two behavioural tests. Thirty pigs were characterised and tested for response to novel object testing and novel arena testing. Measurements for heart rate (HR) and heart rate variance (HRV) were recorded to show autonomic regulation of the heart as either vagal or sympathetic based on high frequency (HF) or low frequency (LF) in HRV. The results showed victims to have reduced parasympathetic tone compared to biters, indicating higher stress during base conditions. This suggests a welfare concern as these individuals have lowest ability to cope with changes and were more fearful of novel experiences. Conversely, biters showed both strong correlation for LF and HF and showed greater novelty seeking behaviour and exploration. It was suggested that the biters perceived the testing and novel stimuli as less aversive compared to victims, and it may have been a positive and exciting experience.

Conclusion:

These studies contribute valuable information on genetic and physiological factors influencing tail biting behaviours. The strong evidence for genetic and physiological factors suggests that selective breeding and genetic manipulation may be possible to reduce the risk of behaviour in individuals both for biting and receiving. Results suggest that genes and phenotypes associated with victims are linked to physiological dysfunction, leading to stress and fear induced behavioural problems, which has significant impact on welfare. If specific genes and chromosomes can be identified then we can utilise genetic markers to screen and test individual genotypes and better assess the future risk of abnormal behaviour. The utilisation of behavioural tests to monitor autonomic nerve response could also help identify problem animals. Individuals at risk of becoming victims and increase likelihood of higher basal stress levels could be identified and managed accordingly to prevent stress related disorders. Tail docking as a management procedure severely impacts welfare. The development of non-invasive management strategies such as genetic testing or selection is preferable. Overall these studies provide inspiration and direction for future research and implementation of improved management strategies to prevent tail biting.

Ellie Mowle