**Application**

Manipulating Lys and Trp content of pig feed could help to reduce harmful social behaviours, with a possible positive effect on production measures.

**Introduction**

Negative social behaviours between pigs, such as ear biting, can cause acute and chronic stress, result in lesions and compromise pig welfare. There is growing interest in the manipulation of amino acid levels in pig diets as a nutritional strategy to affect behaviour (Meer et al., 2017). In the current study, we focused on lysine (Lys) and tryptophan (Trp). Lys is the first limiting amino acid in the majority of pig diets and Trp is the primary precursor of serotonin. To ensure commercial relevance, effects of diet on behaviour should be explored in the context of production. Here, we determined the effects of varying dietary Lys and Trp levels on the social behaviour and performance of pigs.

**Material and Methods**

2,293 PIC Camborough® barrows with a mean starting weight of 11.87 ± 1.35 Kg were used in a randomised complete block design (block = wean date and weight) with a 2×3 factorial arrangement of the following feeding treatments: 1) Standardised ileal digestible (SID) Lys levels: 100% Lys = diets with 100% PIC requirement at the average point of the growth phase (LH), vs 80% Lys = diets with 80% PIC requirement at the beginning of the growth phase (LL); and 2) Trp to Lys ratio of 0.210 (TH), 0.185 (TM) or 0.160 (TL). Pigs were randomly allocated across the 6 treatments over 3 starting dates (wean dates). The pig’s behaviour, the number of pigs showing signs of ear, tail and flank lesions and the severity of those lesions and the severity and location of lesions caused by fighting were recorded over a period of 10 weeks. Feed intake and weight gain were recorded. Statistical analysis was carried out using R Software. Pen was the experimental unit and non-significant fixed effects and interactions were dropped from models. Treatment 6 was stopped after feeding phase 2 after reaching behavioural and production endpoints. Only behaviour and production data from treatments 1-5 were analysed. For lesions, data from all 6 treatments was analysed. Behaviour observations were analysed using principal component analysis (PCA) and linear mixed models. Of the ear, tail and flank bite lesions, only ear lesions occurred frequently enough for statistical analysis. Both ear lesions (total and severe ear lesions) and fight lesions scores were adapted into binary data sets (presence and absence of lesions, lesion score above and below median score respectively) and then analysed using a generalised linear mixed model. Production characteristics were calculated from raw data and then analysed using linear mixed models.

**Results**

We found that the effect of Lys tended towards significant ( F=3.499, df=1, p=0.066) but there was no effect of Trp on PC1 (activity) (F=0.326, df=2, p=0.723). We found no effect of Lys or Trp on PC2 (social behaviour) (Lys; F=0.004, df=1, p=0.953, Trp; F=0.987, df=2, p=0.379). We found there to be a significant effect of Lys (F=4.806, df=1, p=0.032) and barn (F=9.028, df=1, p=0.009) on ear biting behaviour. Pigs on lower Lys diets showed higher levels of ear biting behaviour.

We found a significant effect of the Lys score week interaction on the number of pens showing ear lesions (*X*2 = 18.408, df=2, p<0.001) and a significant effect of both the Lys Trp interaction (*X*2 = 6.997, df=2, p=0.030) and the Lys score week interaction (*X*2 = 6.574, df=1, p=0.0104) on the number of pens showing severe ear lesions. Pigs on LH/TM and LH/TL had significantly lower incidences of severe lesions that other treatments. We found an effect of pig size (*X*2=36.487, df=2, p<0.001) and score week (*X*2=22.464, df=1, p<0.001) on fight lesions but no significant effect of Lys (*X*2=0.071, df=1, p=0.790) or Trp (*X*2=2.919, df=2, p=0.232).

There was a significant effect of Trp (F=3.507, df=1, p=0.036) and feeding phase (F=2406.377, df=5, p<0.001) on pigs average daily feed intake (ADFI), pigs on the TM diet had a significantly higher ADFI than pigs on the TL diet. However, we found no effect of Trp on average daily gain (ADG) (p=0.227). We found a significant effect of the Lys feeding phase interaction on ADG (F=157.73, df=11, p<0.001). At feeding phases 2, 3 and 4, pigs on the LH diet had a significantly higher ADG than pigs on the LL diet. We found a significant effect of the Lys feeding phase interaction on feed conversion ratio (FCR) (F=5.450, df=5, p<0.001). In feeding phases 1, 2, 3 and 4 pigs on the LH diet had a significantly lower FCR than pigs on the LL diet.

**Conclusions**

Results suggest that dietary Lys levels affect the behaviour of pigs, specifically low lysine levels increased ear biting behaviour which is a significant issue. Lys seems to have the greatest effect on the pig weight gain and while there is evidence that the TH pigs did consume more feed, it was not enough to compensate for the effects of the Lys deficit. Tail and flank biting were not common in this population, but the potential remains for Lys levels to affect this behaviour in other populations and so deserves further exploration especially as EU producers are encouraged to maintain intact tails.

Meer, Y.V.D., Gerrits, W.J.J., Jansman, A.J.M., Kemp, B., Bolhuis, J.E., 2017. A link between damaging behaviour in pigs, sanitary conditions, and dietary protein and amino acid supply. PLoS ONE 12.