Chronic Immune System Activation Increases the Growing Pig's Requirement for Sulphur Amino Acids

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A mild disease challenge as commonly occurs in commercial production facilities may significantly decrease performance by redirecting (partitioning) amino acids from body protein synthesis to immune activation. The amino acids that are used by the pig for synthesis of immune molecules may, therefore, be in short supply and hence may limit body protein deposition. Sulphur amino acids (SAA), especially cysteine, are the most abundantly used amino acids for synthesis of immune molecules (Rakhshandeh *et al.*, 2010). The experiment reported here was conducted to test the hypothesis that pigs whose immune system has been activated will respond to higher SAA levels than those without chronic immune system activation.

A split-plot experiment without and with immune system activation as a main plot, and four diets containing different amounts of standardised ileal digestible (SID) sulphur amino acids (SAA to SID lysine ratios of 0.45, 0.55, 0.65 and 0.75) as subplots, was conducted with 64 male pigs (Large White x Landrace x Duroc) weighing 52.9kg ± 0.41 (Mean ± standard error of mean). A two-phase feeding program was employed. Phase 1 (50-75kg) and phase 2 (75-95kg) diets were formulated to contain 13.5 MJ digestible energy (DE)/kg and 0.60 and 0.55g SID lysine/MJ DE, respectively. Pigs were intramuscularly injected each Monday and Thursday with either saline or *E. coli* lipopolysaccharides (LPS, serotype 055:B5, Sigma, 60 µg/kg body weight) for six weeks to mimic chronic immune system stimulation (Rakhshandeh *et al.*, 2010). Week 1 data were excluded for statistical analysis due to severe immune stimulation with negative performance responses.

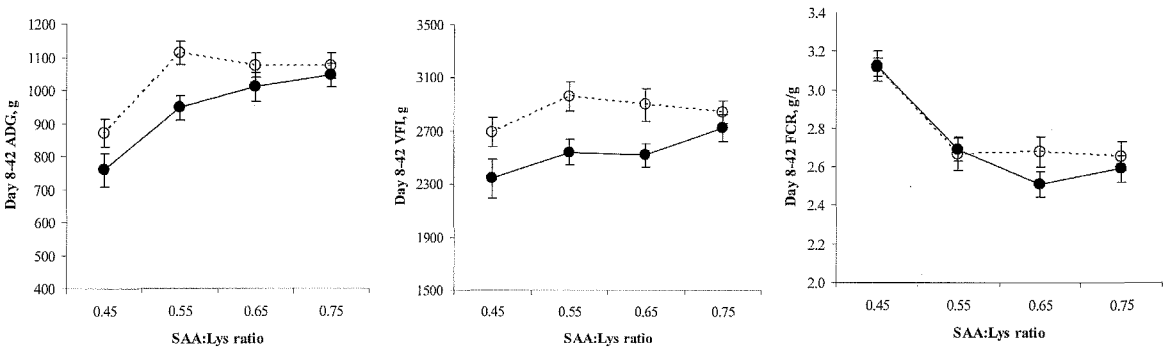

Figure 1. *Performance responses (mean ± standard error of mean) to sulphur amino acid:lysine (SAA:Lys) ratio without (saline injection - - -) and with (LPS injection —) chronic immune system stimulation.*

Measurement of increased daily rectal temperature indicated that the chronic immune system activation was successful over the entire experimental period in LPS-injected pigs (Data not shown). Pigs that received a saline and LPS injection showed a quadratic ($P<0.001$) and linear ($P < 0.001$) response in average daily gain (ADG) to increasing dietary SAA:Lys ratio, with the fastest ADG achieved at SAA:Lys ratios of 0.55, and 0.75, respectively (Figure 1). The SAA:Lys ratio that supported minimal feed:gain ratios were 0.55 and 0.65 for saline and LPS treated pigs, respectively. The results indicate that chronic immune system activation increases the level of SAA needed to support maximum performance. Under the model used, chronic immune system activation increased SAA:SID lysine ratio to support maximum performance from 0.55 to 0.75.

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