

#### Meta-analysis of the response of growing pigs to valine content of the diet

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### Introduction and objective

- Recent experimental evidence suggests that Val is the next-limiting amino acid for pigs in cereal-soybean meal based diets (after Lys, Met, Thr, and Trp, but before IIe).
- Information on the Val requirement for growing pigs is scarce.
- L-Val is now available as a free amino acid, allowing the formulation of diets with a very low protein content.
- Objective: perform a meta-analysis of available data on the response of growing pigs to the Val supply.

#### Data and statistical analysis

- 28 dose-response studies with at least 4 levels of Val were obtained from 20 publications (9 of which were peer-reviewed).
- The composition of feed ingredients (Sauvant *et al.,* 2004) was used to calculate the standardized ileal digestibility (SID) and nutrient composition.
- Data were standardized (Figures 1 and 2):
  - relative to the NRC (1998) Val requirement estimate (as a % in the diet or relative to Lys, depending on the design of the study)
  - relative to the response at the highest level of Val supplementation



Figure 1. Meta-design of the study. The horizontal line indicates the duration of the study (body weight range) and the vertical line the range in Val contents (% of the NRC (1998) value).

# Meta-analysis of the response of growing pigs to the valine content in the diet

Figure 2. Response of pigs to the Val supply ( $\bigcirc$  feed intake,  $\bullet$  daily gain). Studies indicated by a  $\times$  were not analyzed further because the amplitude of the response was <10% or there was no indication for a linear or quadratic response (P > 0.25). The



Figure 3. A bent-stick model was used to account for the decline in Val requirement during the experiment. The green area (left panel) illustrates that, in a dose-response experiment, a partial response will be observed for some of the treatments because the Val requirement declines (solid line) while the Val supply remains constant during the experiment (the 5 dashed lines). If a brokenline relationship is assumed to be true at a given point in time, a bent-stick relationship will be observed for full duration of the experiment (right panel).



The bent-stick model was parameterized using feed intake and daily gain as response criteria with the following model parameters:

- a plateau value for each study
- a Val requirement for each study (i.e., the mid-point of the transition phase)
- a common slope across studies

The duration of the partial response was fixed for each study based on the anticipated decline in the Val requirement during the experiment.

80

90



- Val:Lys).
- increase.
- by respectively 23% and 27%.
- and Table 1):

Figure 4. Relation between the Val require and the Phe content in the diet. Both value as a percentage of the NRC (1998 estimates.



- To maximize growth, 69% SID Val:Lys is required.
- A Val deficiency results in a strong reduction in performance.
- requirement.

## Results

• The responses of feed intake and daily gain to the Val supply were very similar (Figure 2). • Val requirement estimates ranged from 87-117% of the NRC (1998) value for feed intake, and from 84-114% for daily gain (94% on average, which corresponds to 64% SID

• Increasing the SID Val:Lys supply from 64% to 69% resulted in a 5% performance

• A 10% reduction in Val supply below the requirement reduced feed intake and growth

• The Val requirement may increase with increasing amino acid or protein level (Figure 4

rement estimate es are expressed 8) requirement	Table 1. Correlation coefficients between the Val requirement estimate and the amino acid content in the diet.			
	Amino acid	r	Amino acid	r
• r = 0.84	Lys	0.67	Phe+Tyr	0.79
	Met	0.43	Leu	0.47
	Met+Cys	0.48	lle	0.17
	Trp	0.51	His	0.75
	Thr	0.68	Arg	0.06
	Phe	0.84		
175 200				
6				

#### Conclusions

• Most of the studies on Val requirements have been carried out in pigs weighing <35 kg. • Most of the response to a Val deficiency occurs through a reduction in feed intake.

• The amino acid or protein content of the diet may have an impact of the Val