



HAL
open science

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

Jaap J. van Milgen, Mathieu Gloaguen, Nathalie Le Floc'H, Ludovic Brossard, Y. Primot, E. Corrent

► To cite this version:

Jaap J. van Milgen, Mathieu Gloaguen, Nathalie Le Floc'H, Ludovic Brossard, Y. Primot, et al.. Meta-analysis of the response of growing pigs to valine content of the diet. 4th International Symposium on energy and protein metabolism and nutrition (ISEP), Sep 2013, Sacramento, United States. Wageningen Academic Publishers, EAAP Publication, 134, 2013, EAAP Publication. hal-01210465

HAL Id: hal-01210465

<https://hal.science/hal-01210465>

Submitted on 3 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

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

Jaap van Milgen^{1,2}, Mathieu Gloaguen^{1,2}, Nathalie Le Floc'h^{1,2}, Ludovic Brossard^{1,2}, Yvan Primot³, Etienne Corrent³

¹INRA, UMR1348 PEGASE, Saint-Gilles, France, ²Agrocampus Ouest, UMR1348 PEGASE, Rennes, France, ³Ajinomoto Eurolysine S.A.S., Paris, France

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 Ile).
- 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).

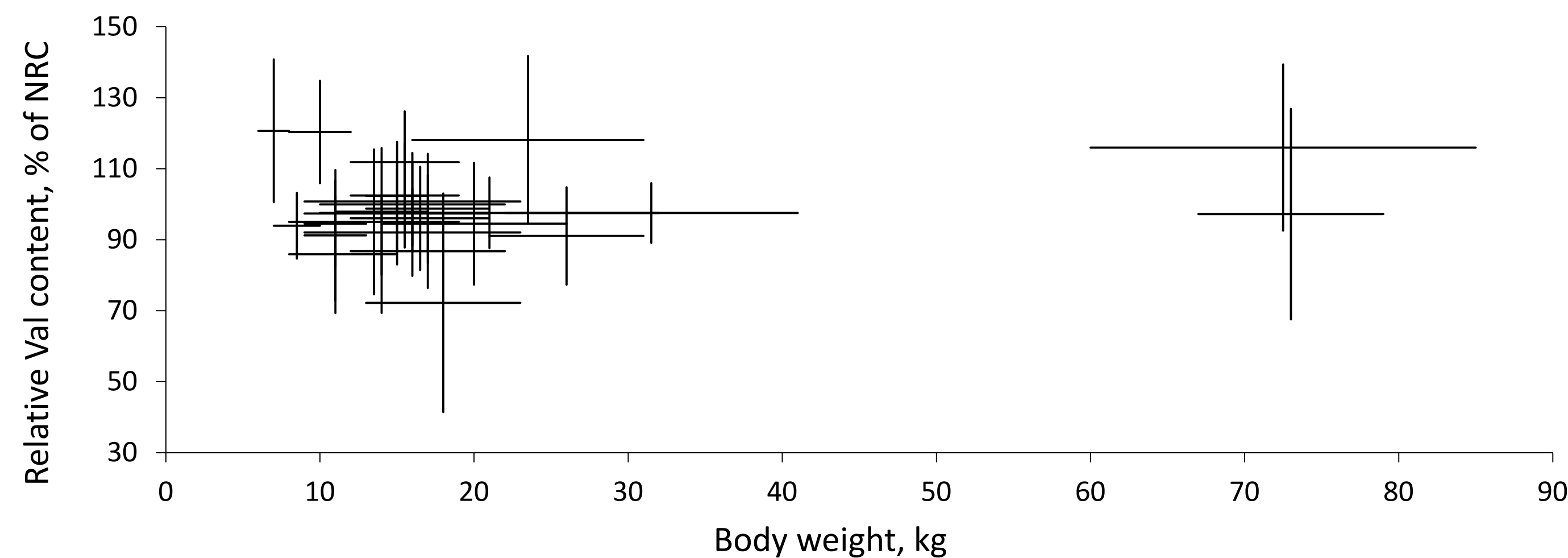


Figure 2. Response of pigs to the Val supply (○ feed intake, ● daily gain). Studies indicated by a ✗ were not analyzed further because the amplitude of the response was <10% or there was no indication for a linear or quadratic response ($P > 0.25$). The study of Jackson *et al.* (1953) was not considered further because of the low genetic potential of the pigs at that time.

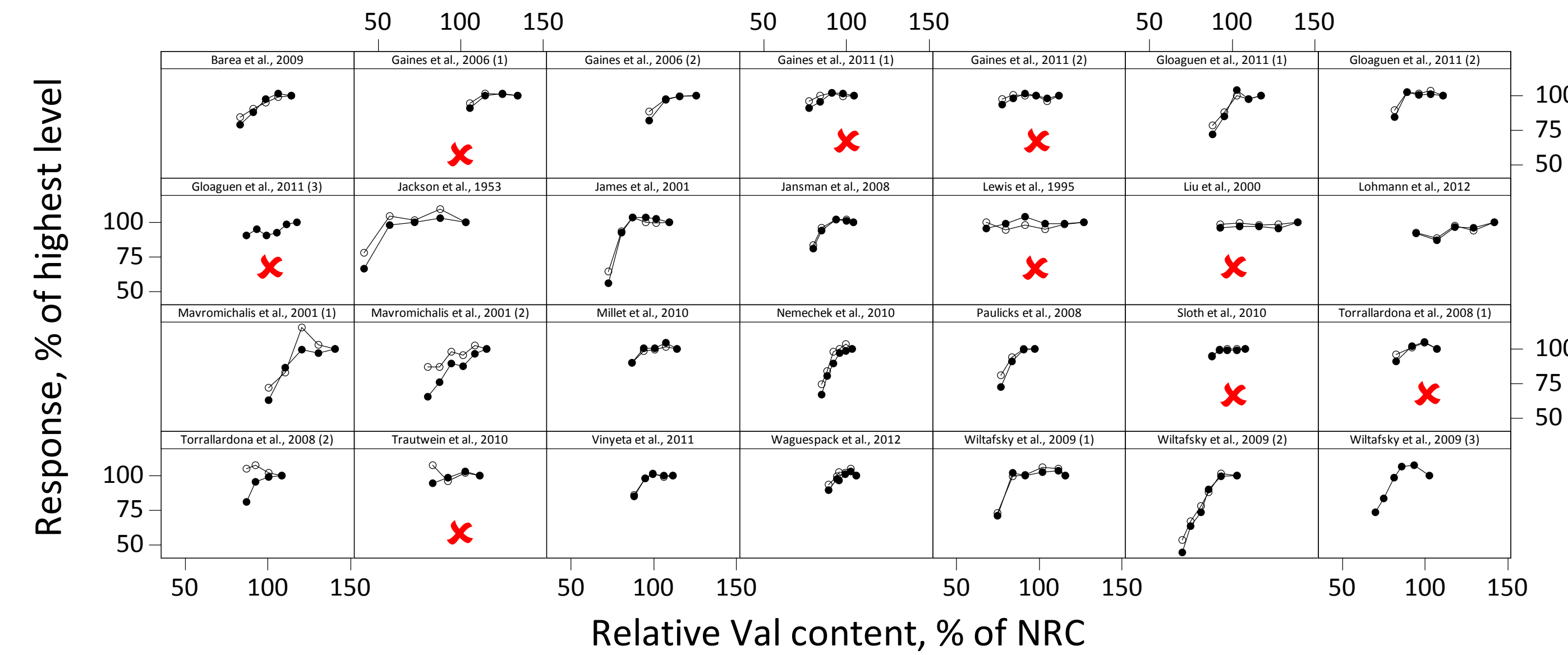
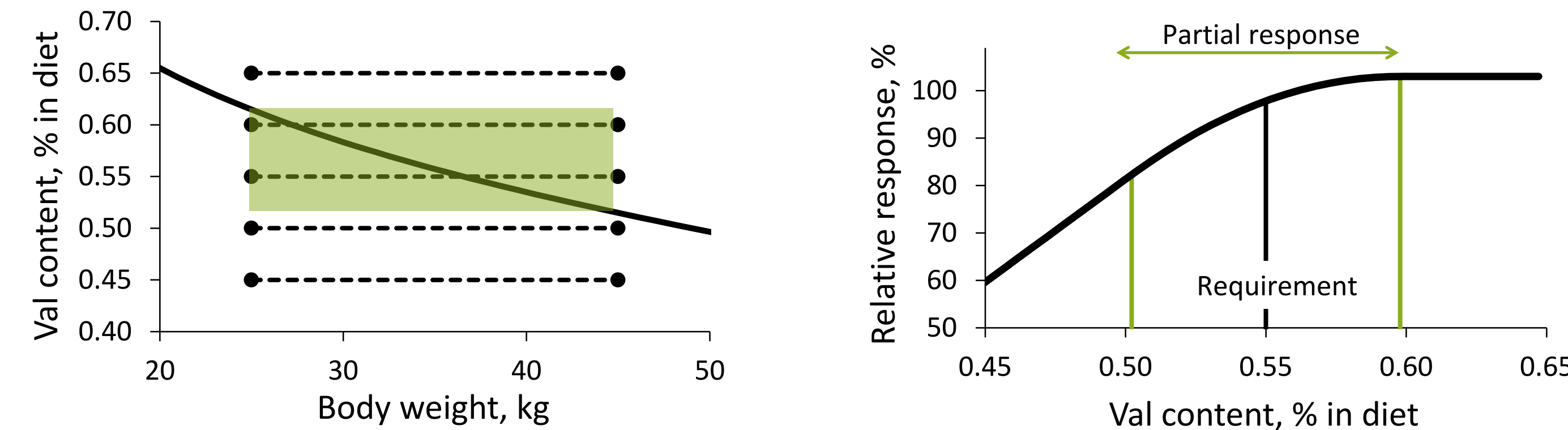


Figure 3. A bent-stick model was used to account for the decline in Val requirement during the experiment. The green area (left panel) illustrates that, in a dose-response experiment, a partial response will be observed for some of the treatments because the Val requirement declines (solid line) while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

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 Val:Lys).
- Increasing the SID Val:Lys supply from 64% to 69% resulted in a 5% performance increase.
- A 10% reduction in Val supply below the requirement reduced feed intake and growth by respectively 23% and 27%.
- The Val requirement may increase with increasing amino acid or protein level (Figure 4 and Table 1):

Figure 4. Relation between the Val requirement estimate and the Phe content in the diet. Both values are expressed as a percentage of the NRC (1998) requirement estimates.

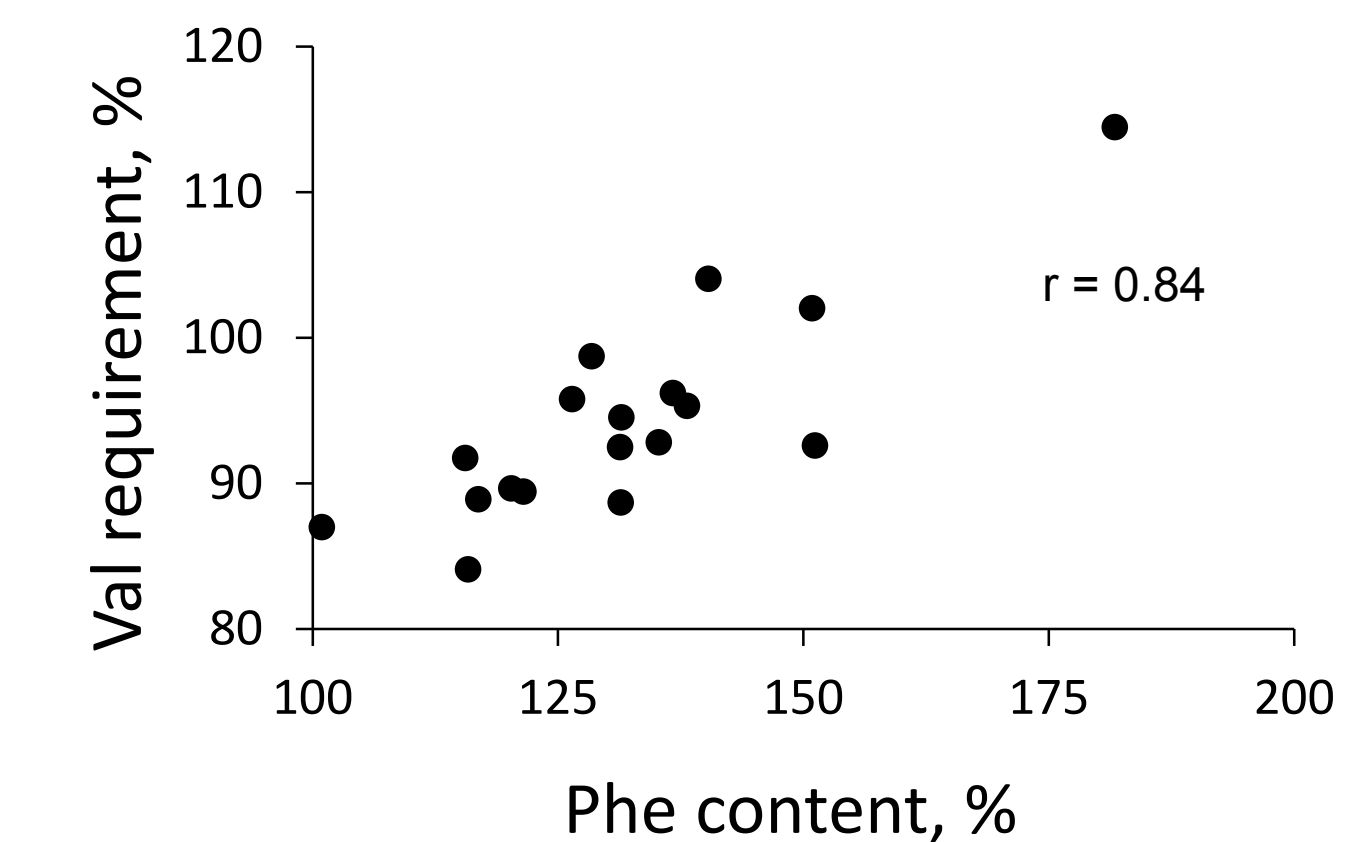


Table 1. Correlation coefficients between the Val requirement estimate and the amino acid content in the diet.

Amino acid	r	Amino acid	r
Lys	0.67	Phe+Tyr	0.79
Met	0.43	Leu	0.47
Met+Cys	0.48	Ile	0.17
Trp	0.51	His	0.75
Thr	0.68	Arg	0.06
Phe	0.84		

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.
- To maximize growth, 69% SID Val:Lys is required.
- A Val deficiency results in a strong reduction in performance.
- The amino acid or protein content of the diet may have an impact of the Val requirement.