Valine requirement in post-weaned piglets

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ALIMENTATION
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Context

- **Reduction in dietary protein levels**
- **Increased use of crystalline amino acids**
- **Improved amino acid balance:**
  “from crude protein to precision protein”
- **More amino acids may limiting (e.g., Val, Ile)**

Ideal amino acid profiles

	INRA (1993)	NRC (1998)*	BSAS (2003)	Soybean meal
Lys	100	100	100	100
Met	30	27	30	23
Met+Cys	60	55	59	47
Thr	65	60	65	62
Trp	18	18	19	21
Val	68	68	70	77
Ile	60	54	58	75
Leu	100	102	100	120
Phe	-	60	57	83
Phe+Tyr	95	93	100	137
His	32	32	34	44

* for protein deposition only

Objective

Evaluate the valine requirement in piglets

Experiments performed

Experiment	Objective
1	Determination of a lysine level limiting performance
2	Response to L-Val and L-Ile supplementation
3	Response to L-Val supplementation (requirement study)

Experimental design

6 wks of age
(~12 kg)

- Piétrain x (Large White x Landrace)
- Blocks of barrows and females
- 15-16 piglets per treatment
- Individually housed

~24 kg

21 days

- Diets based on a cereal mixture (60% corn, 20% wheat, 20% barley) and soybean meal
- L-Lys, DL-Met, L-Thr and L-Trp used when necessary

Response to lysine and CP supply (exp. 1)

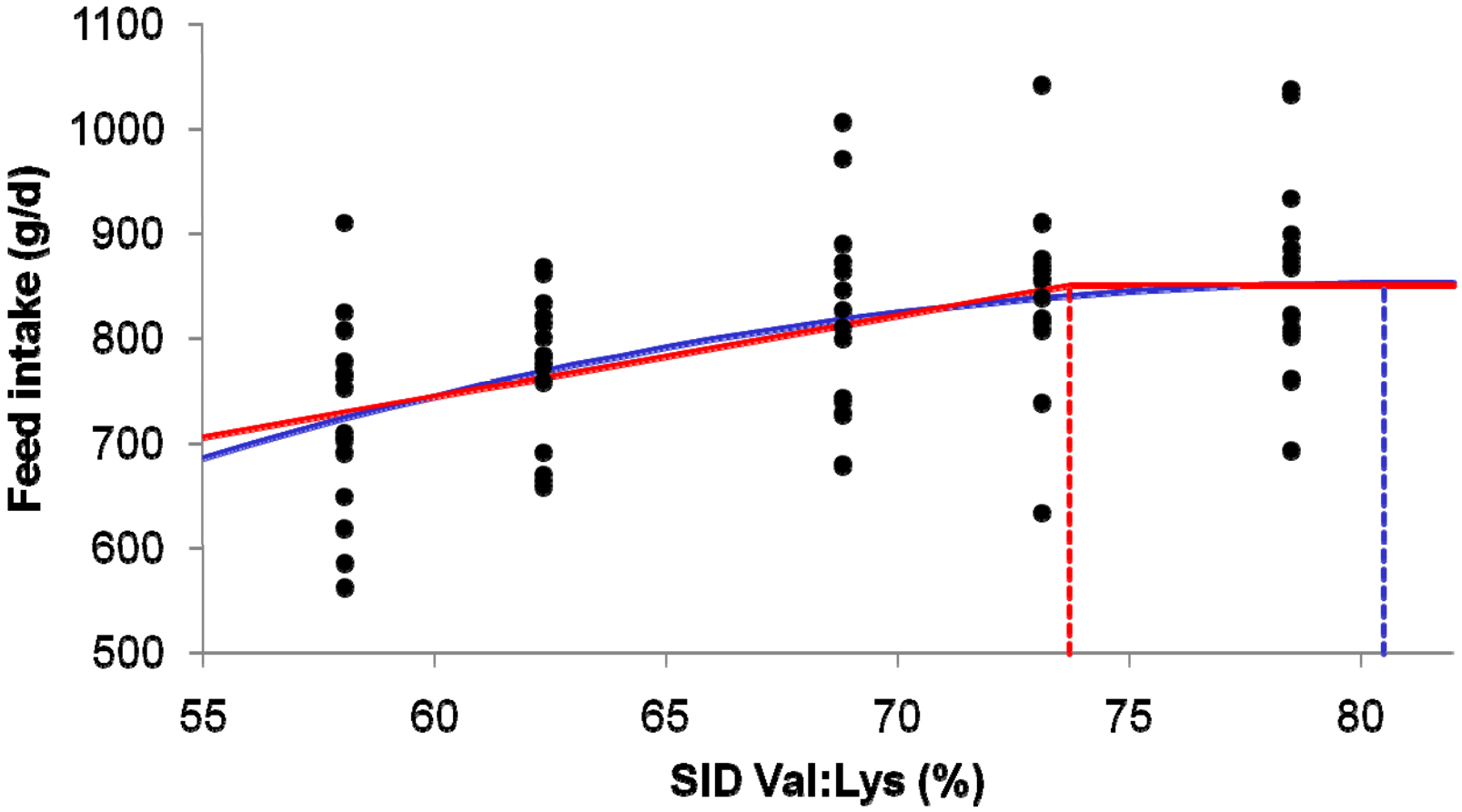
	diet A	diet B	diet C	RSD	*P*
Crude protein, %	17.2 (17.3)	17.8 (18.3)	21.5 (21.1)		
SID Lys, %	1.00 (0.98)	1.20 (1.22)	1.20 (1.17)		
Feed intake, g/d	820	818	803	27	0.18
Daily gain, g/d	486[a]	530[b]	513[b]	36	<0.01
Gain:Feed	0.59[a]	0.65[b]	0.64[b]	0.03	<0.01

Response to valine and isoleucine supply (exp. 2)

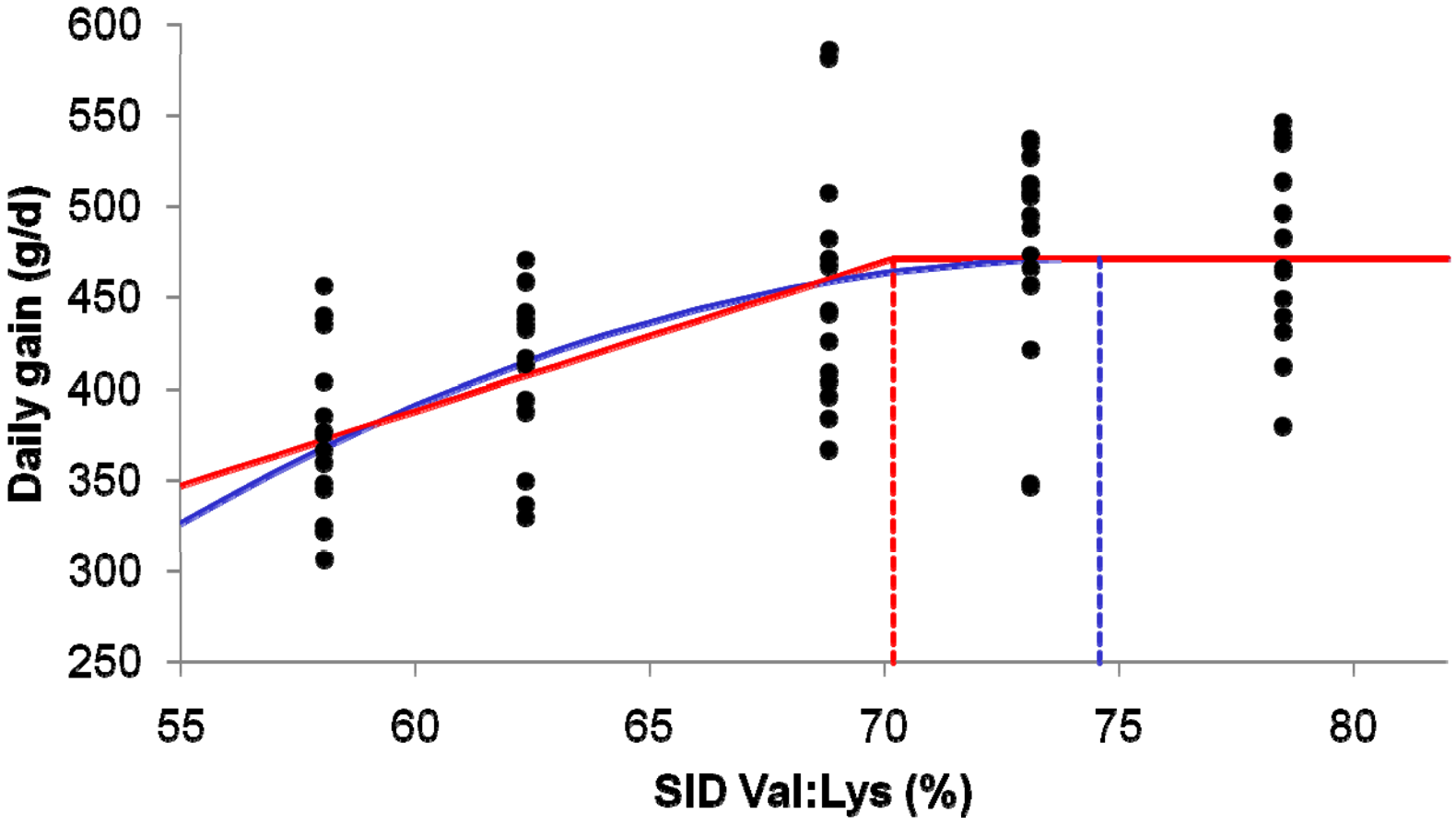
	diet A	diet B	diet C	diet D	RSD	*P*
L-Val	-	-	+	+		
L-Ile	-	+	-	+		
SID Val:Lys, %	57	57	70	70		
SID Ile:Lys, %	50	60	50	60		
Feed intake, g/d	689^{a}	695^{a}	814^{b}	808^{b}	55	<0.01
Daily gain, g/d	401^{a}	393^{a}	501^{b}	484^{b}	41	<0.01
Gain:Feed	0.58^{ab}	0.57^{a}	0.62^{c}	0.60^{bc}	0.03	<0.01

CP: 15.2%
SID Lys: 1.0%
Other essential amino acids: ≥ ideal protein

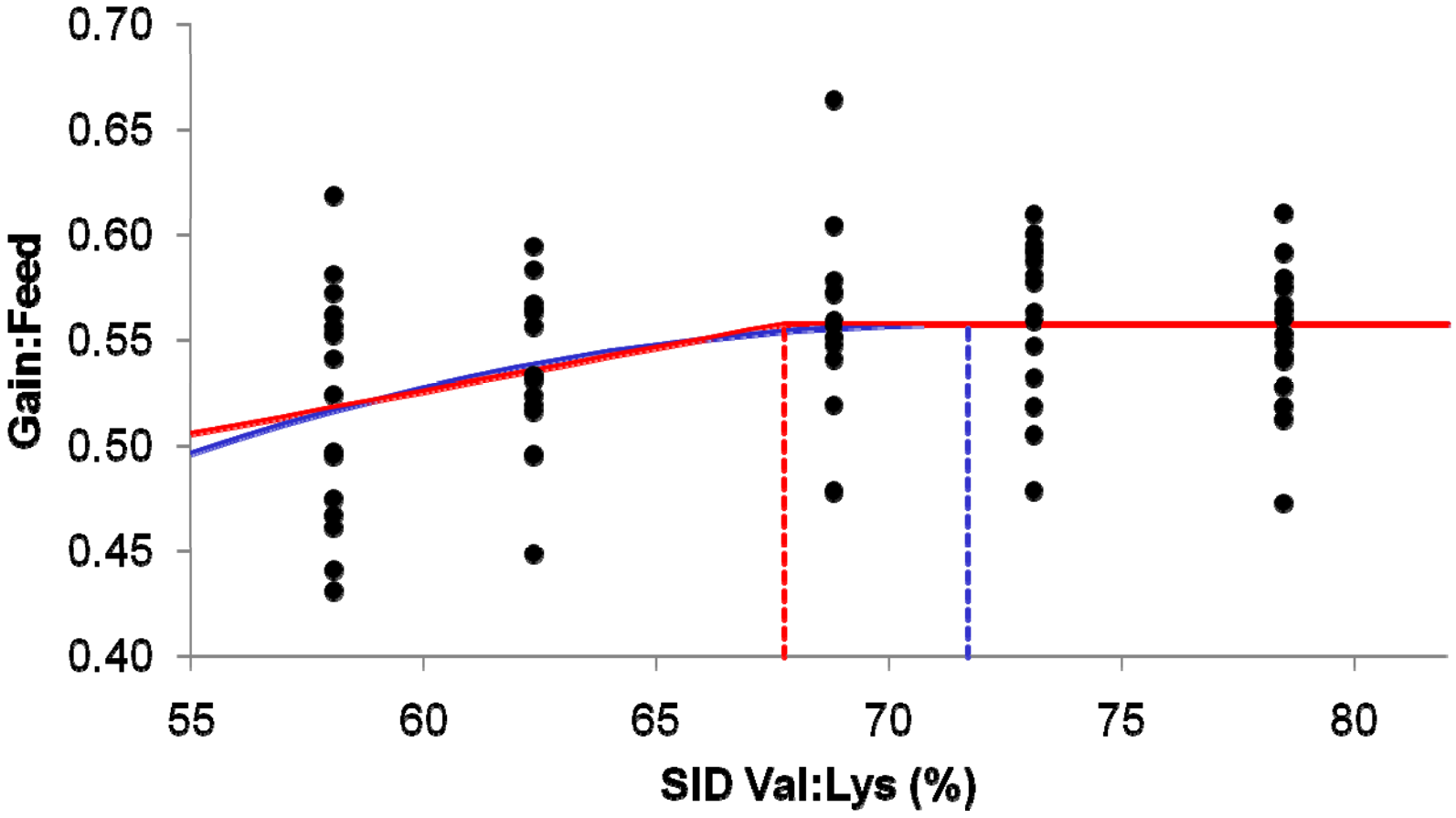
Response to valine supply (requirement study; exp. 3)



Response to valine supply (requirement study; exp. 3)



Response to valine supply (requirement study; exp. 3)



Response to valine supply (requirement study; exp. 3)

	Linear-plateau			Curvilinear-plateau		
	Feed intake	Daily gain	G:F	Feed intake	Daily gain	G:F
SID Val:Lys 'requirement'	73.7	70.2	67.7	80.5	74.6	71.7
Response at 60% Val:Lys (relative to requirement)	87.5	82.3	94.3	87.4	82.9	94.6

Reported valine requirements in pigs

	BW range (kg)	Requirement	relative to NRC
Jackson *et al*. (1953)	13-29	0.40% Val	51%
Mitchell *et al*. (1968)	10	0.55% Val	81%
Chung and Baker (1992)	10	68% Val:Lys	100%
Lewis and Nishimura (1995)	70-	0.33-0.43% AID Val	80-105%
Liu *et al*. (2000)	60-	11.4 g SID Val/d	98%
James *et al*. (2001)	9-15	0.62-0.67% SID Val	90-97%
Mavromichalis *et al*. (2001)	5-10	0.60 g SID Val/ MJ ME	101%
Mavromichalis *et al*. (2001)	10-20	0.53 g SID Val/ MJ ME	105%
Warnants *et al*. (2001)	8-21	0.70% SID Val	101%
Kendall *et al*. (2004)	13-32	65% SID Val:Lys	96%
Theil *et al*. (2004)	18-20	0.59 g AID Val/MJ ME	128%
Gaines *et al*. (2006)	8-12	0.92% SID Val	114%
Gaines *et al*. (2006)	12-20	0.78% SID Val	114%
This study	**12-25**	**68-74% SID Val:Lys**	**100-109%**

Conclusion

The valine requirement for best performance is

<u>70% SID Val:Lys</u>

(higher if a safety margin is used)

For each %-unit Val:Lys supply below requirement, feed intake (1.3%), daily gain (1.8%) and gain:feed (0.6%) are reduced