

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Effect of valine on performance of weaning piglets



Peter Spring<sup>1</sup>  
Lukas Dissler<sup>1</sup>  
Martin Häberli<sup>1</sup>  
Stefan Probst<sup>2</sup>

<sup>1</sup>SHL Zollikofen  
<sup>2</sup>Egli Mühlen Nebikon

EAAP, 2011, Stavanger

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Protein nutrition for...






- Maximum growth and efficiency
- Maximum intestinal health
- Minimum environmental impact

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Dietary recommendations for protein and dAA




LG in kg	10	20	30	40	50	60	70	80	90	100
RP	13.0	12.6	12.3	12.0	11.6	11.3	10.9	10.6	10.2	9.9
VLys	0.74	0.72	0.66	0.61	0.56	0.51	0.48	0.46	0.44	0.43
VMet	0.24	0.23	0.21	0.19	0.18	0.16	0.15	0.15	0.14	0.14
VMet + VCys	0.47	0.46	0.43	0.39	0.36	0.33	0.31	0.29	0.28	0.27
VThr	0.50	0.49	0.45	0.41	0.38	0.35	0.33	0.31	0.30	0.29
VTrp	0.15	0.14	0.13	0.12	0.11	0.10	0.10	0.09	0.09	0.09
Vlle	0.46	0.44	0.41	0.38	0.34	0.32	0.30	0.28	0.27	0.27
VLeu	0.74	0.72	0.66	0.61	0.56	0.51	0.48	0.46	0.44	0.43
VPhe	0.44	0.43	0.40	0.36	0.33	0.31	0.29	0.27	0.26	0.26
VPhe + VTyr	0.71	0.69	0.64	0.58	0.53	0.49	0.46	0.44	0.42	0.41
VVal	0.52	0.50	0.46	0.42	0.39	0.36	0.34	0.32	0.31	0.30
VArg	0.29	0.29	0.27	0.24	0.22	0.21	0.19	0.18	0.18	0.17
VHis	0.24	0.23	0.21	0.19	0.18	0.16	0.15	0.15	0.14	0.14

at 14 MJ DE: **182 g** and **176 g** CP at 10 and 20 kg BW, respectively

ALP, 1011

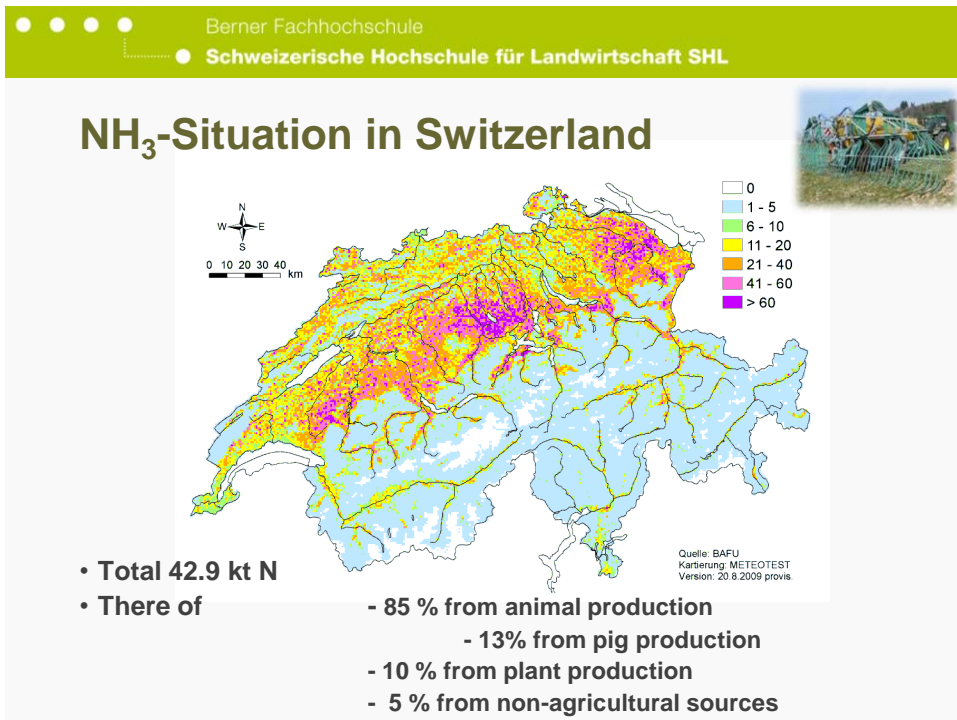
Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Effect of dietary CP on occurrence of diarrhea in weaning piglets



Period	Feeding regimen <sup>3</sup>					
	Noninfected			Infected (ETEC)		
	HP14	LP7	LP14 <sup>4</sup>	HP14	LP7	LP14 <sup>4</sup>
d 1 to 7	16.7	10.1		48.8	29.7	
d 8 to 14	22.6 <sup>a</sup>	7.1 <sup>b</sup>	8.3 <sup>b</sup>	40.5 <sup>c</sup>	20.2 <sup>a</sup>	26.2 <sup>a</sup>
d 1 to 14	19.6 <sup>a</sup>	9.5 <sup>b</sup>	8.3 <sup>b</sup>	44.6 <sup>c</sup>	21.4 <sup>a</sup>	31.5 <sup>d</sup>

(J Anim Sci 2009.87:2833-2843)




Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Recommended rations of valine

Country / Institute	Val:Lys	Year
France; INRA : Institut National de la Recherche Agronomique	70%	1994
USA; NRC: National research Council, USA	68%	1998
Spain; FEDNA: Fundación Española de la Nutrición Animal	71%	2006
Brazil; Rostango, UFV: Universidade Federal de Viçosa	69%	2005
England; BSAB: British Society of Animal Science	70%	2003
Denmark; DIAS: Danish Institute of Agricultural Science	70%	2008
Switzerland; ALP: Agroscope Liebefeld-Posieux	70%	2004
Germany; GfE: Gesellschaft für Ernährungsphysiologie	62%	2006

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL



## Recent trial results

Trial	BW (kg)	n	SID	ADG	Intake	FCR
			Val:Lys			
Mavromichalis et al., 2001	10-20 kg	6	49-71%	71%	71%	71%
Barea et al., 2009	12-25 kg	5	58-79%	73%	78%	72%
Barea et al., 2009	12-25 kg	5	63-78%	72%	72%	72%
Dusel et al., 2008	14-22 kg	4	57-75%	70%	-	68%
Paulicks et al., 2008	12-26 kg	4	60-75%	72%	71%	71%
Torrallardona et al., 2008	9-23 kg	4	59-74%	69%	-	72%
Average				71%	73%	71%

Ajinomoto, 2009


Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## AA-profile of a typical NPr-diet

Parameter	Standard		NPr		Norm
	g/kg	%	g/kg	%	
Lysine	12.4	100	12.4	100	100
M & C	8.0	62	8.0	62	64
Tryptophane	2.6	21	2.6	21	20
Threonine	8.2	65	8.2	65	68
Valine	8.6	71	8.2	65	70
Isoleucine	7.2	60	7.9	54	62
Leucine	13.9	113	12.7	104	100
Arginine	11.1	89	9.9	80	40
Histidine	4.3	33	3.9	30	32
Phe & Tyr	15.1	124	14.3	113	96

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Objective



The objective of these trials was....  
...to investigate whether well established concepts of piglet nutrition can be improved regarding production, production security and ecology by adding the essential amino acid valine.

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Trial design



- Complete randomized block design with 90 piglets
- 3 treatments with 6 pens (5 piglets per pen)
- start: apTrial duration: 28 d
- Piglet weight at trial prox. 8 kg
- Age at trial start: approx. 28 – 32 days
- Breed: Swiss F2-genetics
- Feeding: automatic feeder, meal, *ad libitum*

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Trial design



**Measured parameters**

- Weight (d1, d14, d28)
- Feed intake (d1-14; d14-28; d1-28)
- Feed conversion ratio (d1-14; d14-28; d1-28)
- Fecal score (d1-28)

**Analysis**

- ANOVA, Tukey- Kramer Test,

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## The diets were based on:



- Barley, corn, rice, wheat
- Oat flakes
- Lactose
- Animal fat
- Soy bean meal, soy protein, potato protein
- Wheat bran, oat husk
- Minerals
- L-lysine-HCl, DL-methionine, L-threonine, L-tryptophane
- Acids
- Premix

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Diet: Trial 1



	Std-1	CPr-AAr	CPr-AAr+Val
<b>DE, MJ/kg</b>	<b>14.0</b>	<b>14.0</b>	<b>14.0</b>
<b>CP (g/kg)</b>	<b>180</b>	<b>165</b>	<b>165</b>
<b>d Lys (g/kg)</b>	<b>11.0</b>	<b>10.2*</b>	<b>10.2</b>
<b>Valine</b>	<b>72%</b>	<b>69%</b>	<b>74%</b>


\* CH - recommendations

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

Trial 1		Std-1			CPr-AAr			CPr-AAr+Val			CH*
		cal	Labor	Labor AA:L	cal	Labor	Labor AA:L	cal	Labor	Labor AA:L	AA:L
DM	g/kg		878.2			883.5			881.0		
Ash	g/kg	53	46.4		52	45.8		52	45.7		
CP	g/kg	180	182		165	166		165	166		179
Fiber	g/kg	30	27		30	26		30	26		
Lipids	g/kg	40	38		40	42		40	43		
MJ DE	MJ/kg	14.0	14.2		14.0	14.4		14.0	14.4		
Lysine /DE	g/MJ	0.89	0.85		0.82	0.77		0.82	0.77		0.88
dLysine	g/kg	11.0			10.2			10.2			10.2
Lysine	g/kg	12.5	12.0	100%	11.5	11.1	100%	11.5	11.1	100%	100%
Met+ Cyst	g/kg	8.0	7.7	64%	7.3	7.1	64%	7.3	7.0	63%	64%
Tryptophane	g/kg	2.6	2.6	22%	2.4	2.6	23%	2.4	2.4	22%	20%
Threonine	g/kg	8.2	7.8	65%	7.6	7.3	66%	7.6	7.2	65%	68%
Valine	g/kg	8.6	8.6	72%	7.9	7.9	71%	8.5	8.4	76%	70%
Isoleucine	g/kg	7.2	7.3	61%	6.5	6.5	59%	6.5	6.5	59%	62%
Leucine	g/kg	13.8	13.7	114%	12.7	12.5	113%	12.7	12.4	112%	100%
Arginine	g/kg	11.1	10.9	91%	10.0	9.7	87%	10.0	9.6	86%	32%
Histidine	g/kg	4.3	4.1	34%	3.9	3.7	33%	3.9	3.6	32%	40%
Phe + Tyr	g/kg	15.1	15.2	127%	13.8	13.9	125%	13.8	13.7	123%	96%

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Results Trial 1




Parameter	Std-1	CPr-AAr	CPr-AAr+Val	SE	p
Weight, kg	7.64	7.65	7.65	0.007	0.73
Intake (d1-28), g	582	563	559	14.8	0.53
ADG (d1-28), g	407	370	374	12.05	0,10
FCR (d1-28), kg/kg	1.43 <sup>a</sup>	1.51 <sup>b</sup>	1.53 <sup>b</sup>	0.015	0.0062
Fecal score, % <sup>1</sup>	4.83	4.33	2.16	1.2	0.513

<sup>ab</sup> p<0.05; <sup>AB</sup> p< 0.08  
<sup>1</sup> Percentage of days where a piglet shows diarrhea

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Results Trial 1



Parameter	Std-1	CPr-AAr	CPr-AAr+Val	SE	p
Weight, kg	7.64	7.65	7.65	0.007	0.73
Intake (d1-14), g	368	379	382	11.5	0.69
Intake (d14-28), g	795	739	743	22.9	0.21
Intake (d1-28), g	582	563	559	14.8	0.53
ADG (d1-14), g	285	280	287	10.14	0.89
ADG (d14-28), g	529 <sup>A</sup>	460 <sup>B</sup>	462 <sup>B</sup>	19.60	0.051
ADG (d1-28), g	407	370	374	12.05	0,10
FCR (d1-14), kg/kg	1.30	1.357	1.33	0.023	0.27
FCR (d14-28), kg/kg	1.50 <sup>a</sup>	1.61 <sup>b</sup>	1.61 <sup>b</sup>	0.030	0.041
FCR (d1-28), kg/kg	1.43 <sup>a</sup>	1.51 <sup>b</sup>	1.53 <sup>b</sup>	0.015	0.0062
Fecal score, % <sup>1</sup>	4.83	4.33	2.16	1.2	0.513

<sup>ab</sup> p<0.05; <sup>AB</sup> p< 0.08  
<sup>1</sup> Percentage of days where a piglet shows diarrhea



Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Diet: Trial 2




	Std-2	CPr	CPr+Val
<b>DE, MJ/kg</b>	<b>14.0</b>	<b>14.0</b>	<b>14.0</b>
<b>CP (g/kg)</b>	<b>180</b>	<b>165</b>	<b>165</b>
<b>d Lys (g/kg)</b>	<b>11.0</b>	<b>11.0</b>	<b>11.0</b>
<b>Valine</b>	<b>69%</b>	<b>64%</b>	<b>69%</b>

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

Trial 2		Std-2			CPr			CPr+Val			CH*
		cal	Labor	Labor AS:L	cal	Labor	Labor AS:L	cal	Labor	Labor AS:L	AA: Lys
DM	g/kg		887.3			885.7			886.0		
Ash	g/kg	53	49.2		52	47.1		52	47.2		
CP	g/kg	180	179		165	167		165	168		179
Fiber	g/kg	30	27		30	27		30	28		
Lipids	g/kg	40	41		40	39		40	33		
MJ DE	MJ/kg	14.0	14.4		14.0	14.3		14.0	14.2		
Lysine / DE	g/MJ	0.89	0.86		0.89	0.88		0.89	0.88		0.89
dLysine	g/kg	11.0			11.0			11.0			10.2
Lysine	g/kg	12.4	12.4	100%	12.4	12.6	100%	12.4	12.5	100%	100%
Met+ Cyst	g/kg	8.0	7.7	62%	8.0	7.8	62%	8.0	7.7	62%	64%
Tryptophane	g/kg	2.6	2.6	21%	2.6	2.6	21%	2.6	2.6	21%	20%
Threonine	g/kg	8.2	8.1	65%	8.2	8.2	65%	8.2	8.0	64%	68%
Valine	g/kg	8.6	8.8	71%	7.9	8.2	65%	8.6	9.0	72%	70%
Isoleucine	g/kg	7.2	7.4	60%	6.5	6.8	54%	6.5	6.9	55%	62%
Leucine	g/kg	13.9	14.0	113%	12.7	13.1	104%	12.7	13.1	105%	100%
Arginine	g/kg	11.1	11.0	89%	9.9	10.1	80%	9.9	10.1	81%	32%
Histidine	g/kg	4.3	4.1	33%	3.9	3.8	30%	3.9	3.8	30%	40%
Phe + Tyr	g/kg	15.1	15.4	124%	13.7	14.3	113%	13.7	14.4	115%	96%

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Results Trial 2




Parameter	Std-2	CPr	CPr+Val	SE	p
Weight, kg	8.119	8.117	8.113	0.163	0.68
Intake (d1-28), g	506	497	525	18.24	0.31
ADG (d1-28), g	356	355	372	14.42	0.45
FCR (d1-28), kg/kg	1.42	1.39	1.41	0.024	0.55
Fecal score, % <sup>1</sup>	1.66	1.16	1.83	0.92	0.82

<sup>ab</sup> p<0.05  
<sup>1</sup> Percentage of days where a piglet shows diarrhea

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Results Trial 2



Parameter	Std-2	CPr	CPr+Val	SE	p
Weight, kg	8.119	8.117	8.113	0.163	0.68
Intake (d1-14), g	367 <sup>a</sup>	364 <sup>a</sup>	392 <sup>b</sup>	14.40	0.01
Intake (d14-28), g	646	629	658	28.75	0.73
Intake (d1-28), g	506	497	525	18.24	0.31
ADG (d1-14), g	299	302	320	13.57	0.16
ADG (d14-28), g	412	408	425	21.16	0.79
ADG (d1-28), g	356	355	372	14.42	0.45
FCR (d1-14), kg/kg	1.22	1.2	1.23	0.029	0.65
FCR (d14-28), kg/kg	1.57	1.54	1.54	0.027	0.5
FCR (d1-28), kg/kg	1.42	1.39	1.41	0.024	0.55
Fecal score, % <sup>1</sup>	1.66	1.16	1.83	0.92	0.82

<sup>ab</sup> p<0.05  
<sup>1</sup> Percentage of days where a piglet shows diarrhea

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Discussion

- No effect with added valine
- Other limiting factors?
  - Thryptophane?
  - Isoleucin?
  - Non essential AA (CP)

Berner Fachhochschule  
Schweizerische Hochschule für Landwirtschaft SHL

## Conclusions

- In piglet diets, with an AA profile regarding lysine, methionine/cystine, threonine and tryptophane matching recommendations and a low valine:lysine-ratation of 64 % (calculated) and 65 % (analysed), respectively, there was no effect with added valine on weaning performance.
- Increasing the lysine (M&C, Thr and Trp accordingly) concentration from 11,5 g (0,82 g/ MJ DE; 0,73 dLys/MJ DE) to 12,5 g (0,89 g/ MJ DE; 0,79 dLys/MJ DE) results in improved performance when feeding CP<sub>r</sub> diets.