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EAAP, 2014
COPENHAGEN

ISOLEUCINE, VALINE, AND LEUCINE REQUIREMENTS OF 6-19 KG PIGLETS

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PROJECT OVERVIEW

- August 2012 – July 2015
- 3 dose-response studies **(presented today)**
- Metabolomics on blood/urine samples **(in progress)**
  - Identify metabolites which can be linked to performance
- Method development **(late 2014)**
  - Test a new method for estimating BCAA requirements using blood/urine metabolites identified by metabolomics

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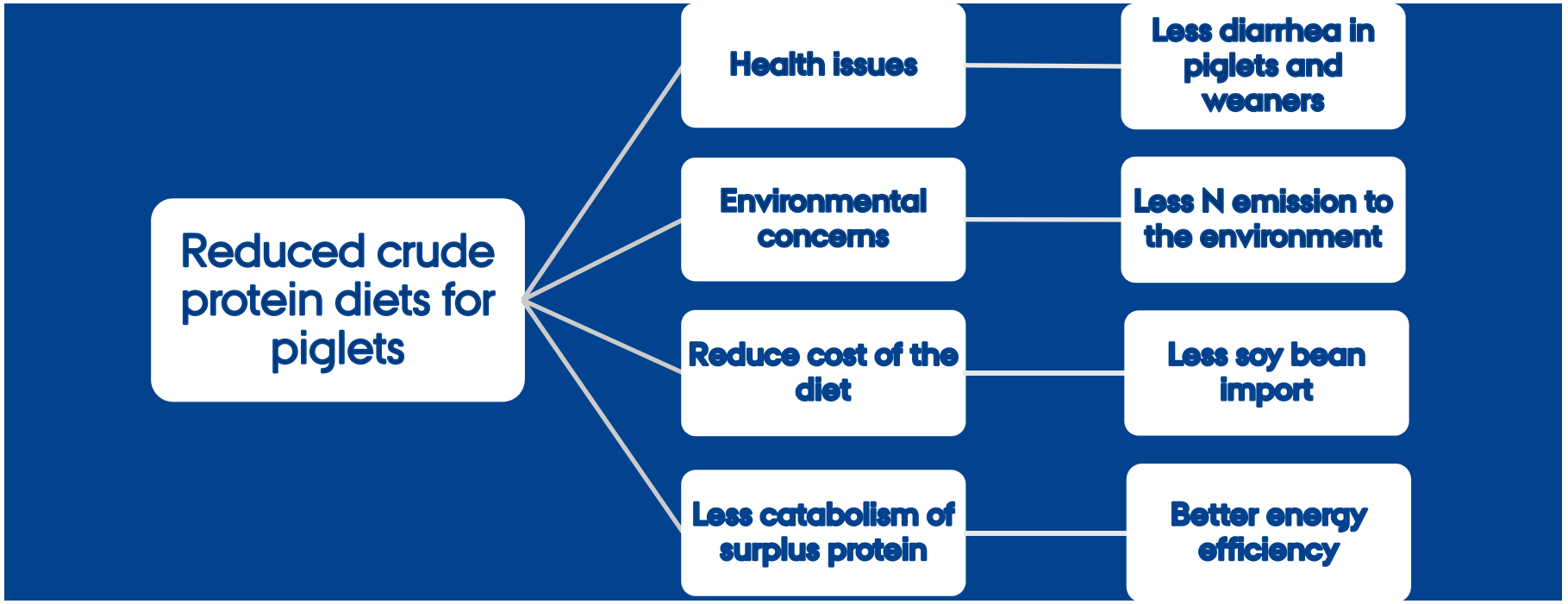
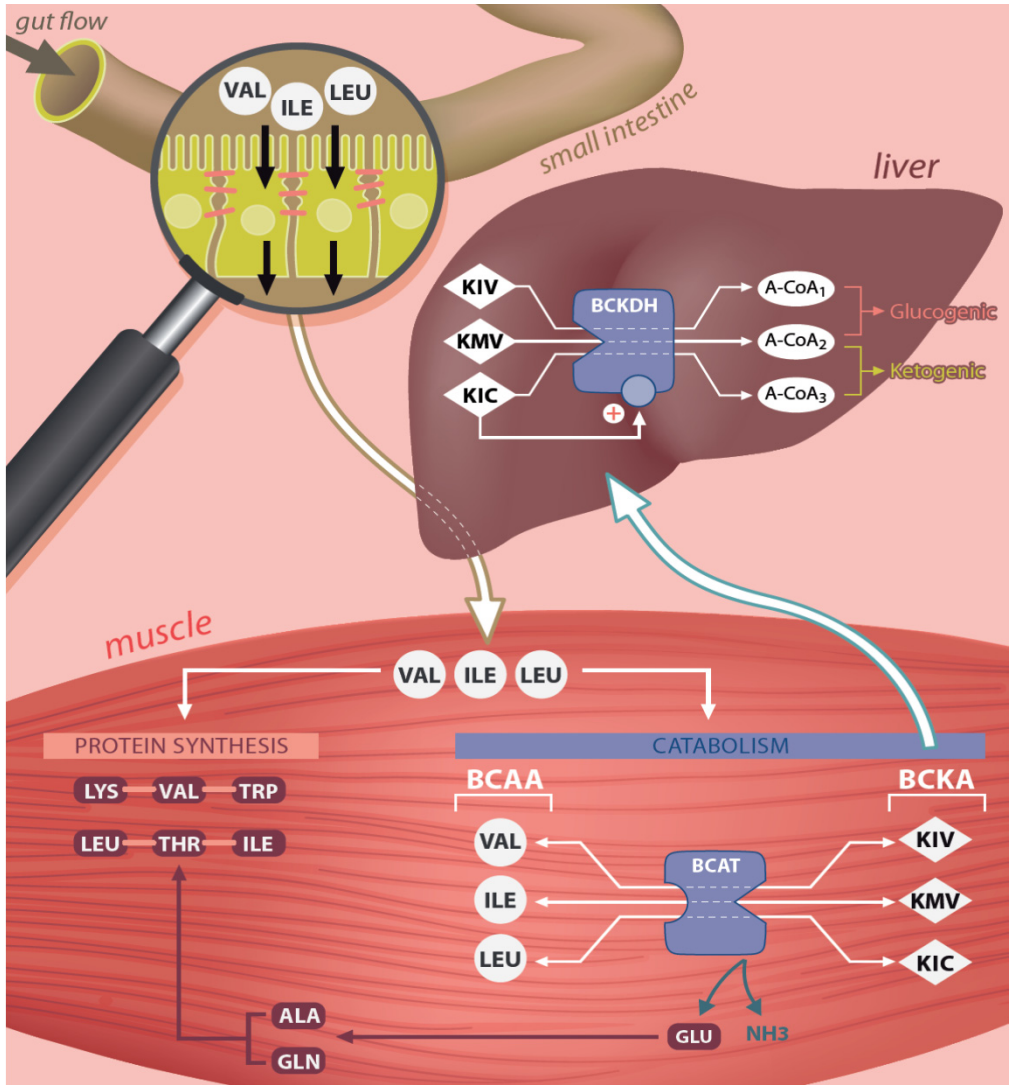
BACKGROUND



- Amino acid ⟷ Keto acid
  - Val ⟷ KIV
  - Ile ⟷ KMV
  - Leu ⟷ KIC
- Keto acid —maybe→ Energy



- Regulated by the same enzymes
- Problem at BCAA imballance
- High Leu = Active enzyme
  - = Leu degradation 😐
  - = Val degradation! ☹
  - = Ile degradation! ☹

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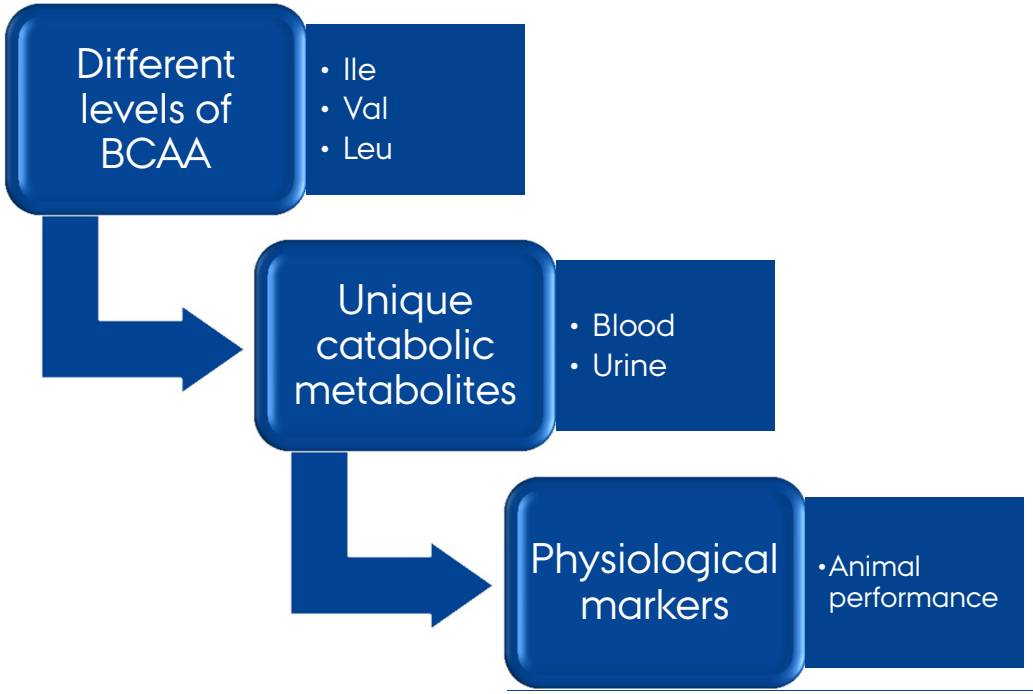
HYPOTHESIS

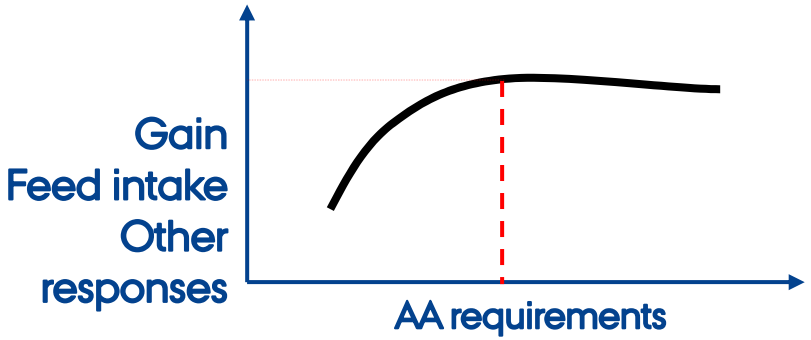


Ile Val Leu

Keep you on track

GENERAL METHODOLOGY

- 6 levels of SID BCAA:Lys
- 16 females pigs per level
- Start 1 week after weaning (7-9 kg)
- Individually penned
- Fed ad libitum for 2 weeks
- Weighing weeks 0, 1, and 2
- Blood and urine samples after weeks 1 and 2



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DIET CHEMICAL COMPOSITION

› Danish recommendation

SID Ile:Lys = 0.53, SID Val:Lys = 0.67, SID Leu:Lys = 1.02

› Lysine was 90-93% of the recommendation for 9-15 kg pigs

› Based on 70% wheat, 10% barley, 10.5% HP300

› Glutamic acid was added to provide similar crude protein

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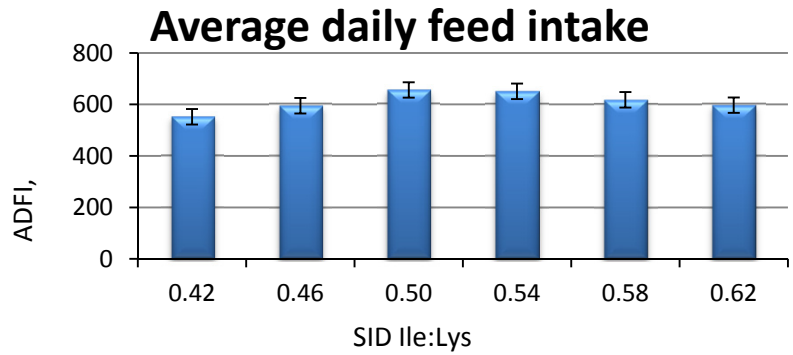
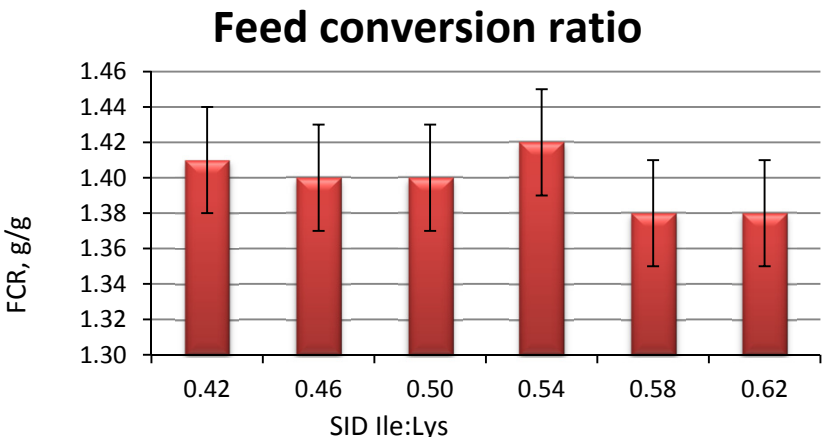
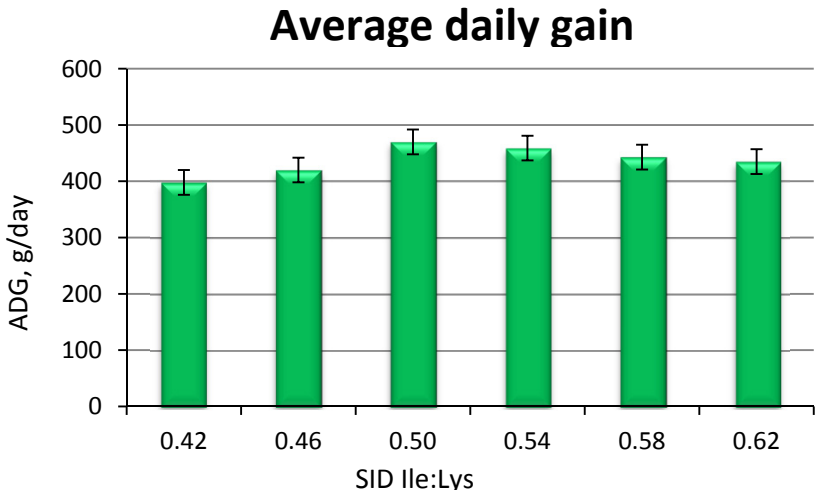
PERFORMANCE PARAMETERS







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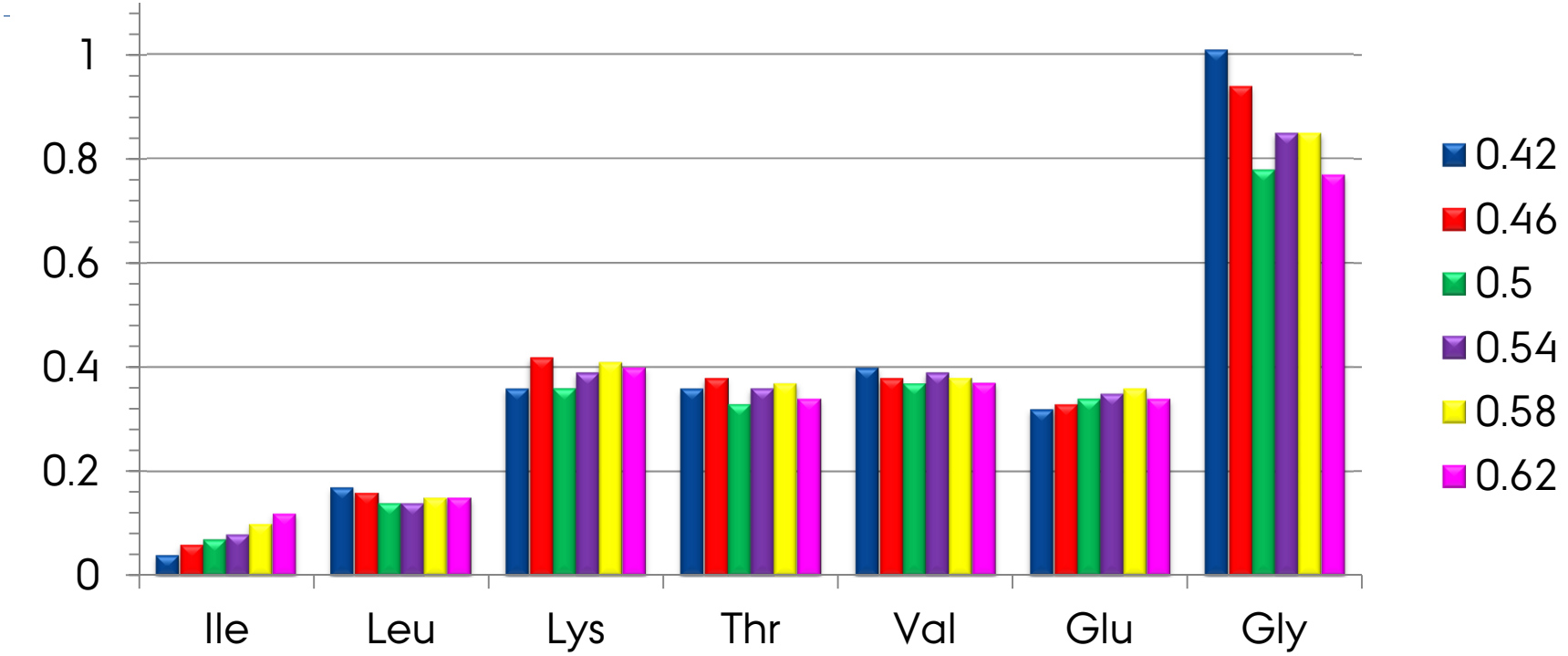
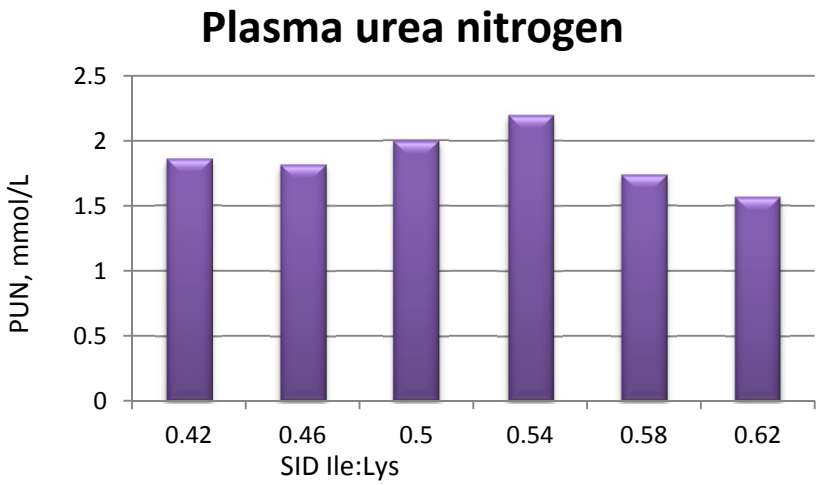
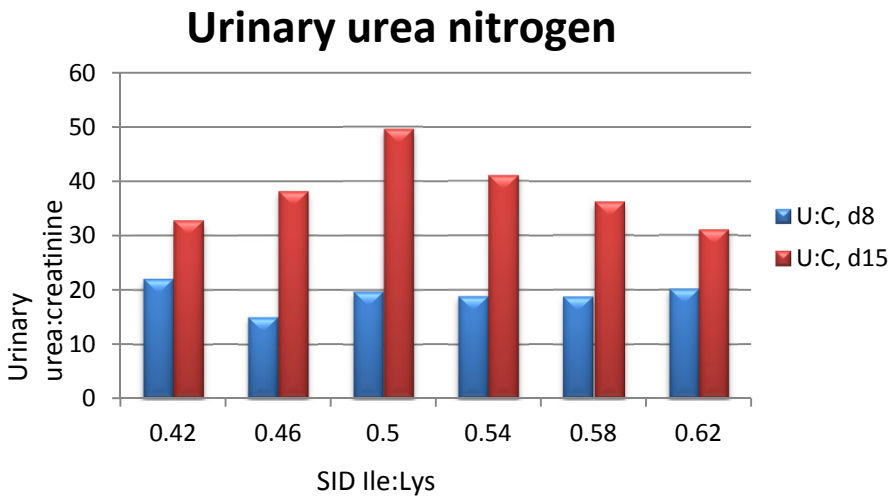
PLASMA AA CONCENTRATIONS



PLASMA AND URINARY UREA NITROGEN





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MODELS

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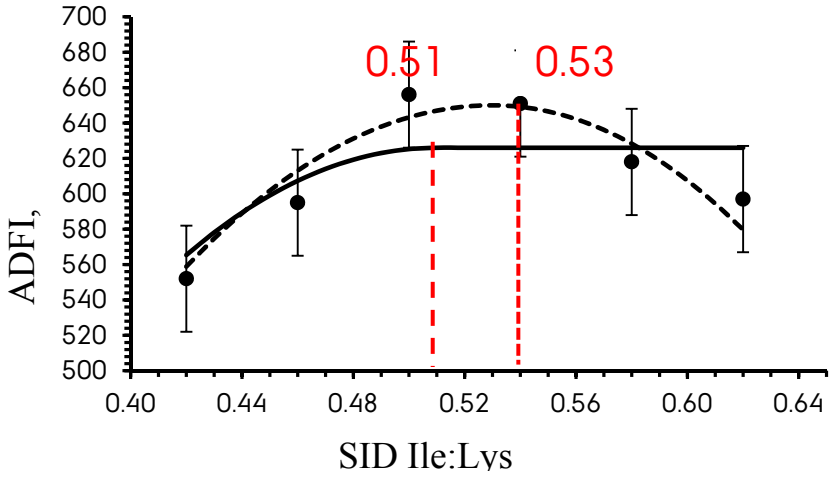

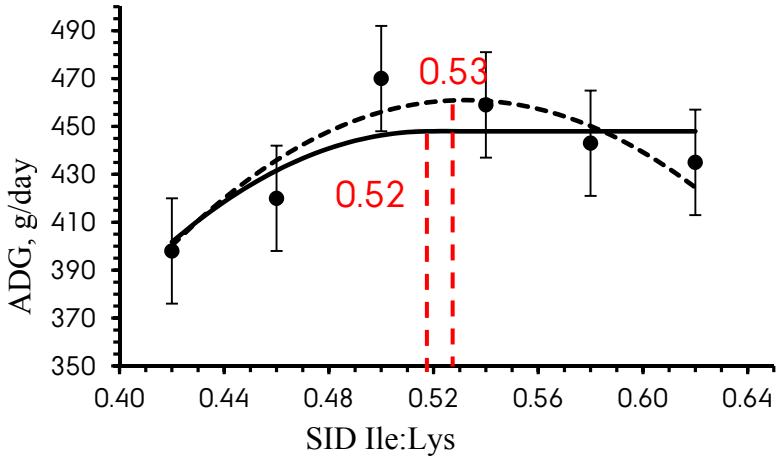

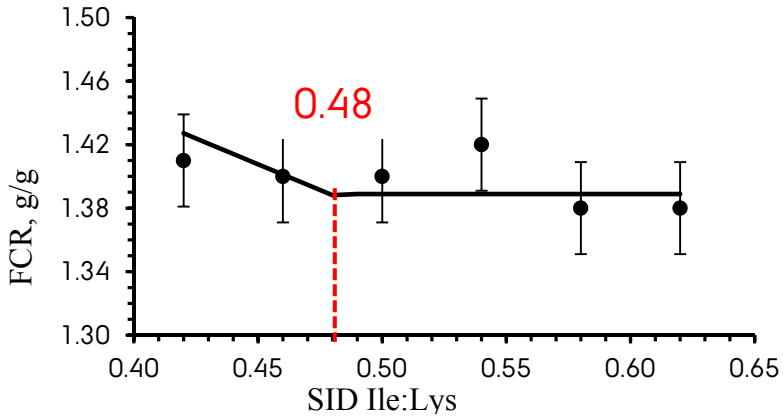

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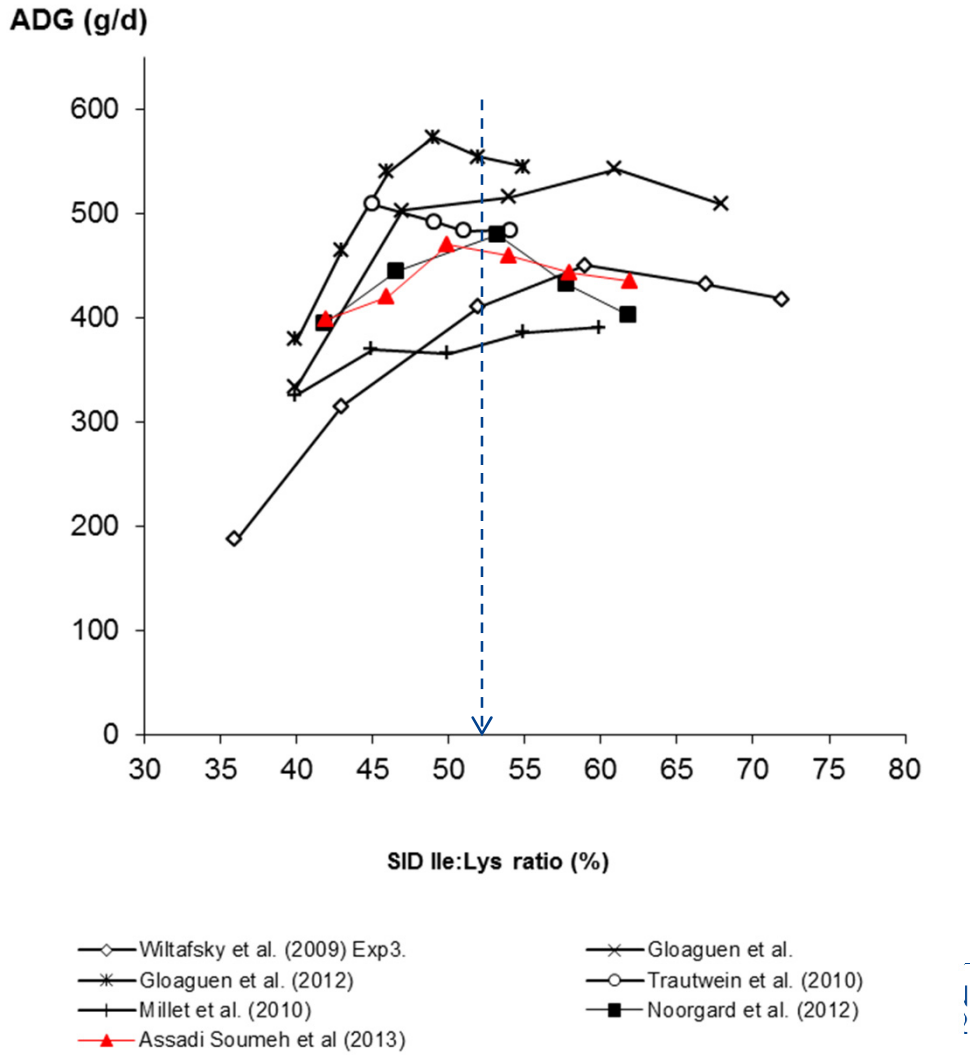
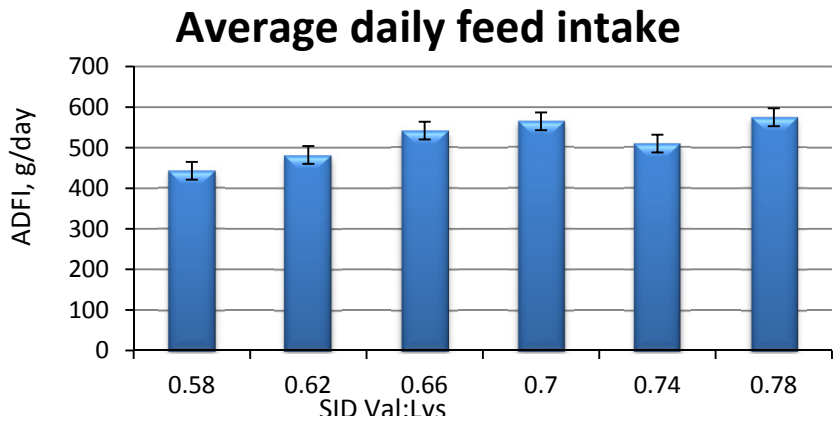
CONCLUSION

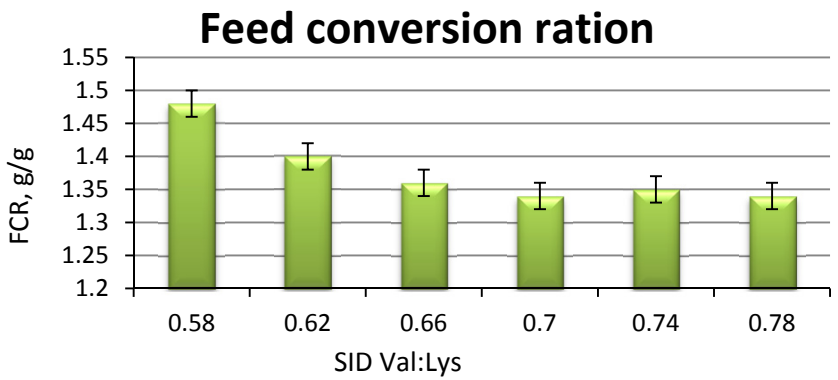
› This study
› 0.52
› Our 2012 study: 0.52

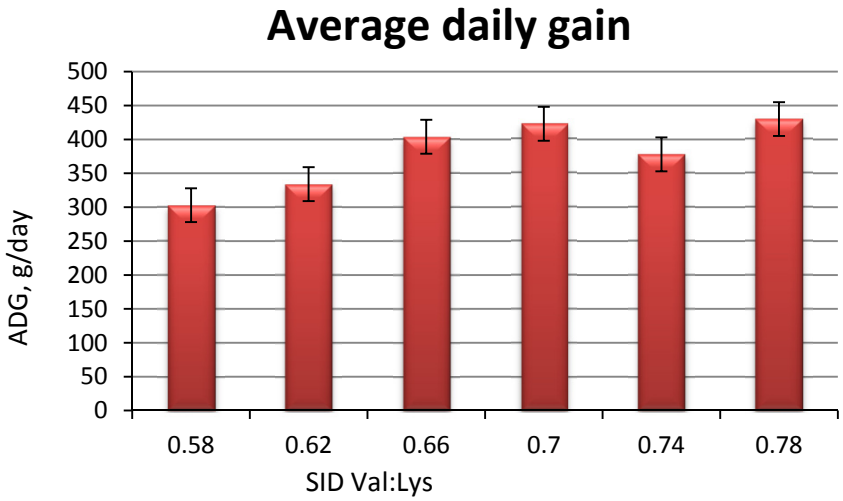
› Recommendations
› 0.52 INRA 2013, France
› 0.54 FEDNA 2013, Spain
› 0.53 VSP 2013, Denmark



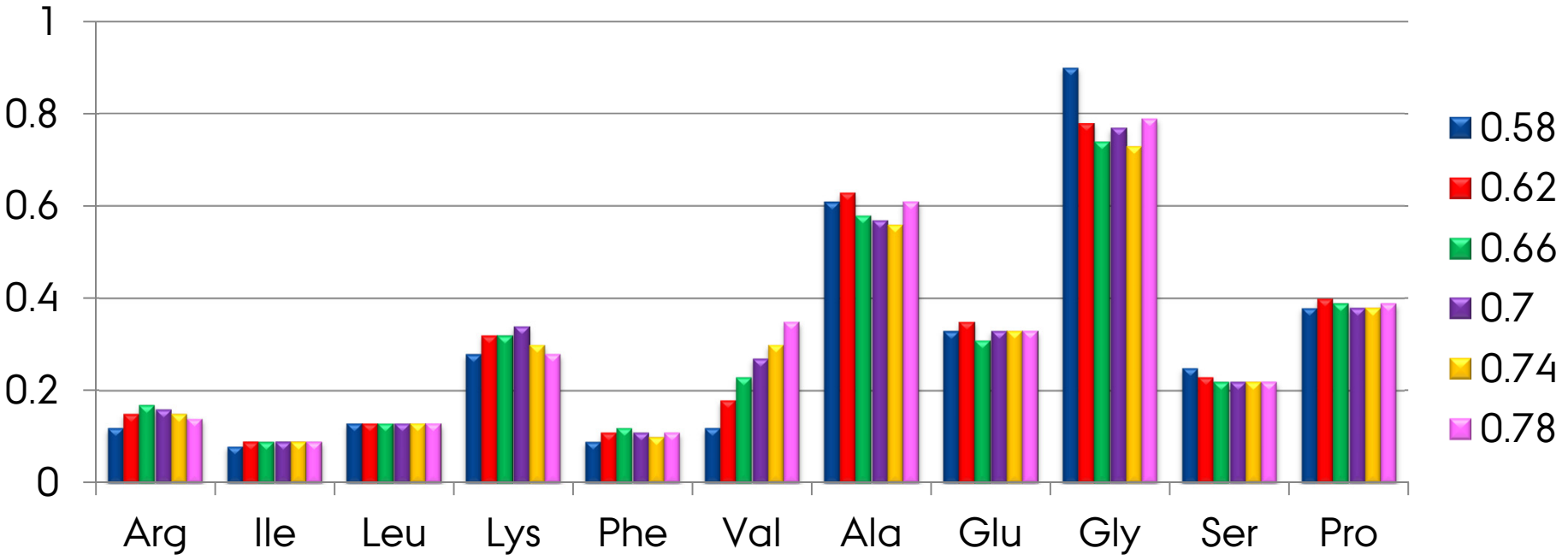
PERFORMANCE PARAMETERS



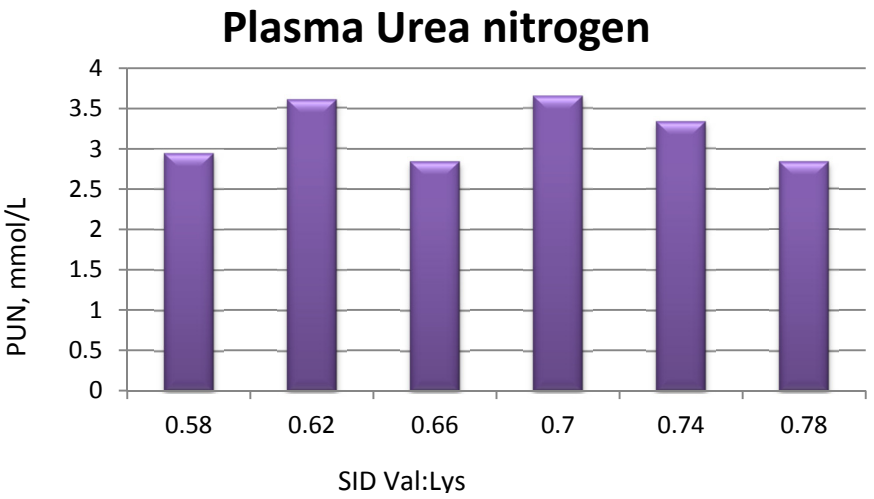


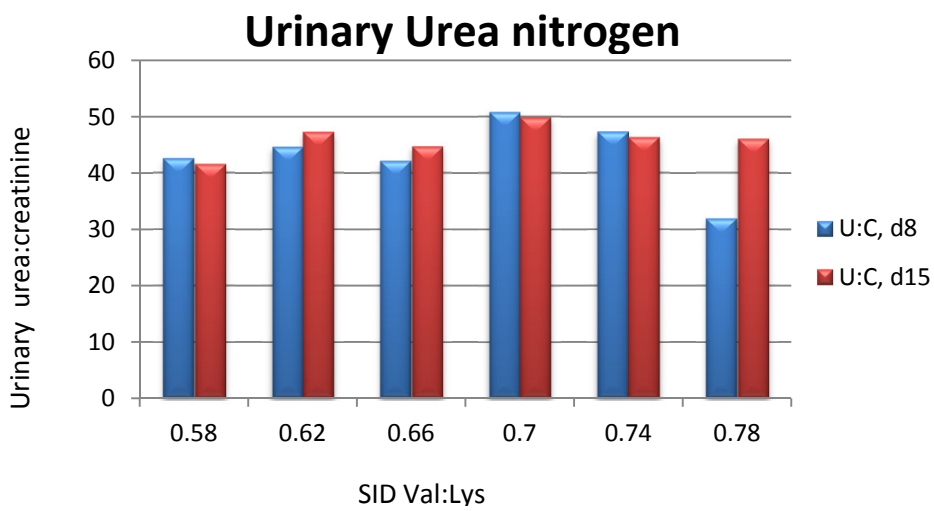


PLASMA AA CONCENTRATIONS



PLASMA AND URINARY UREA NITROGEN





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MODELS

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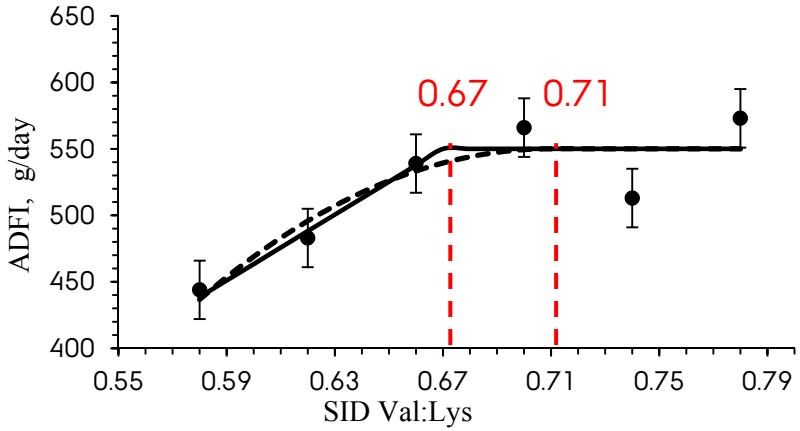

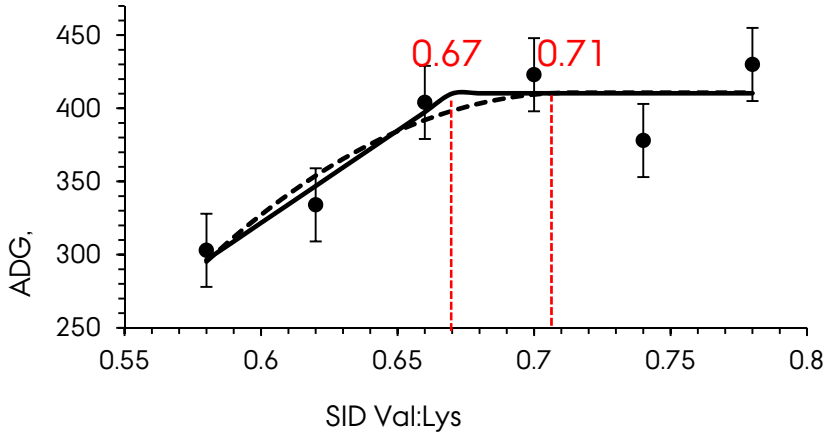

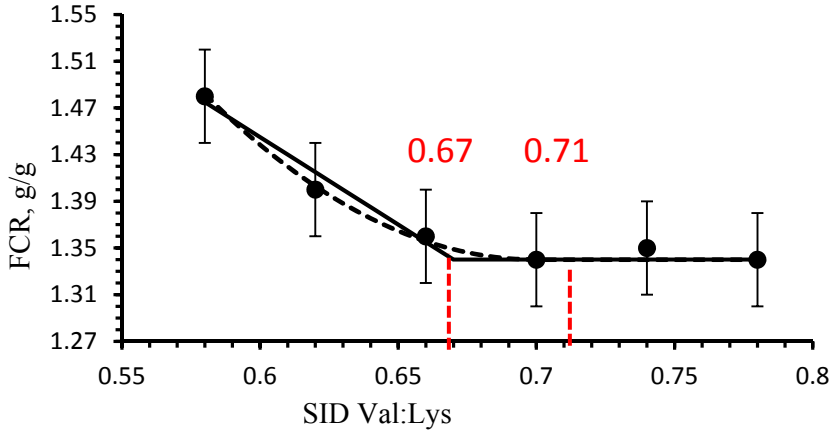

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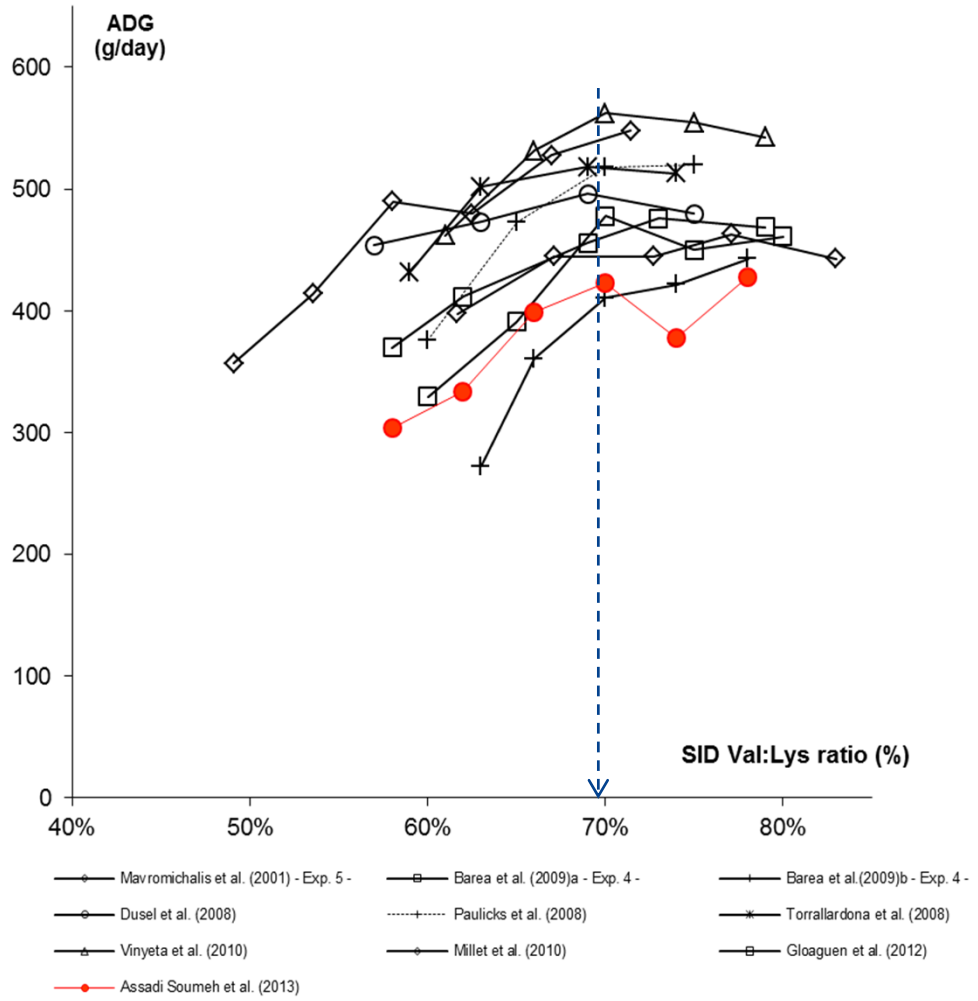
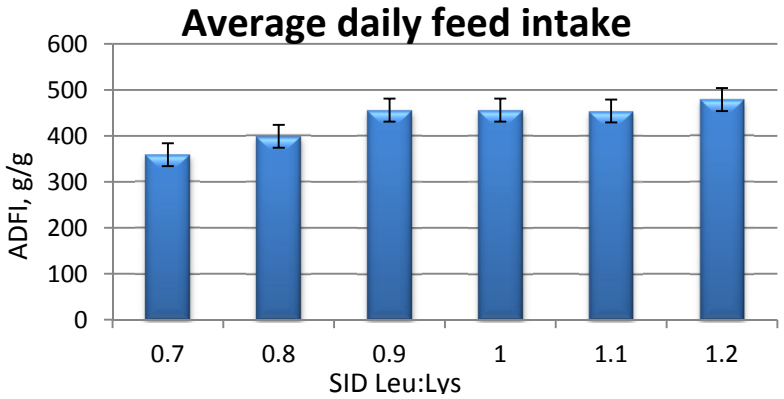
CONCLUSION

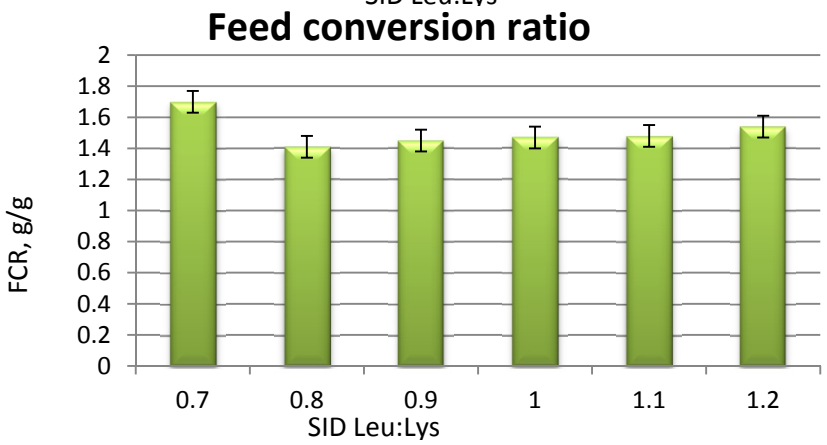
› This study
› 0.70

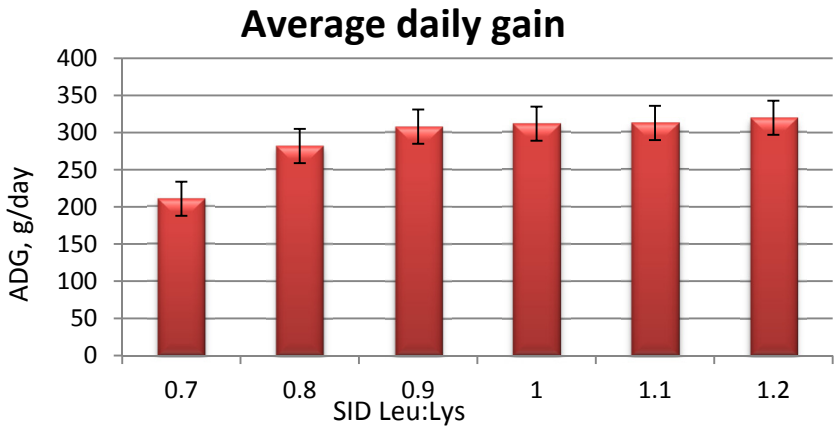
› Recommendations
› 0.70 INRA 2013, France
› 0.69 FEDNA 2013, Spain
› 0.67 VSP 2013, Denmark



PERFORMANCE PARAMETERS







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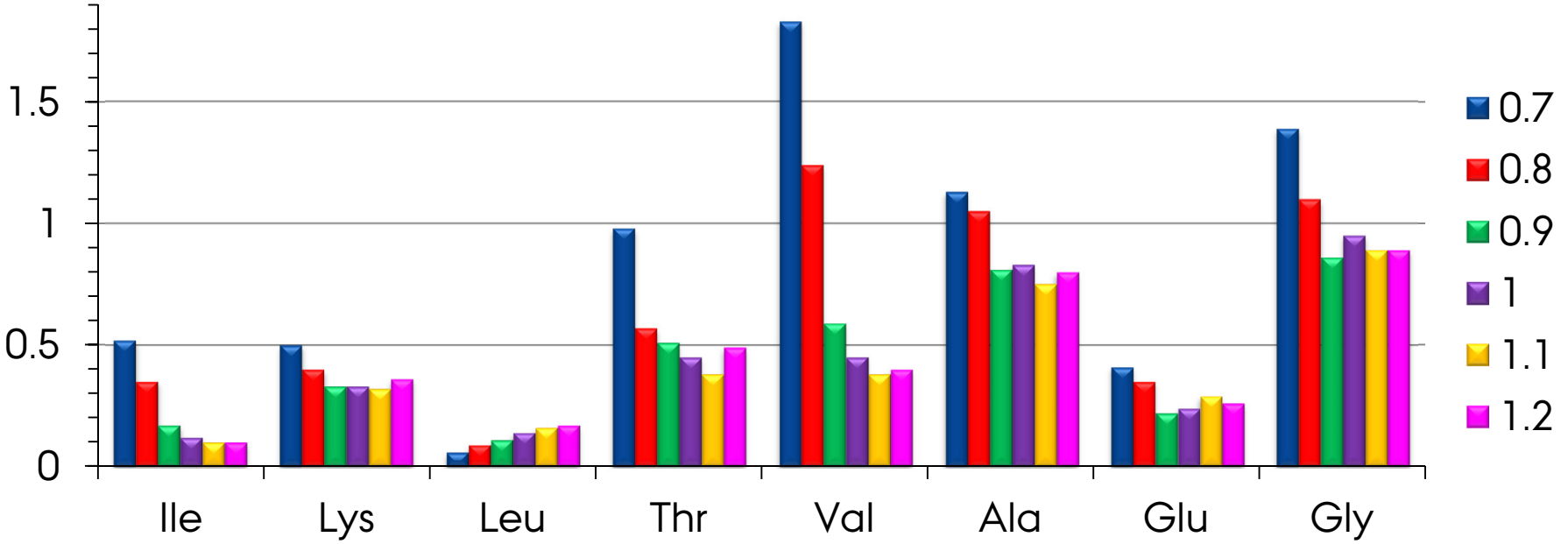

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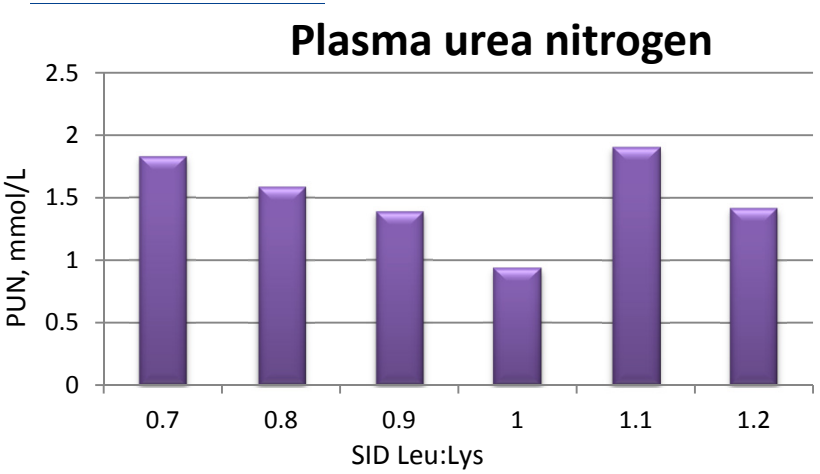

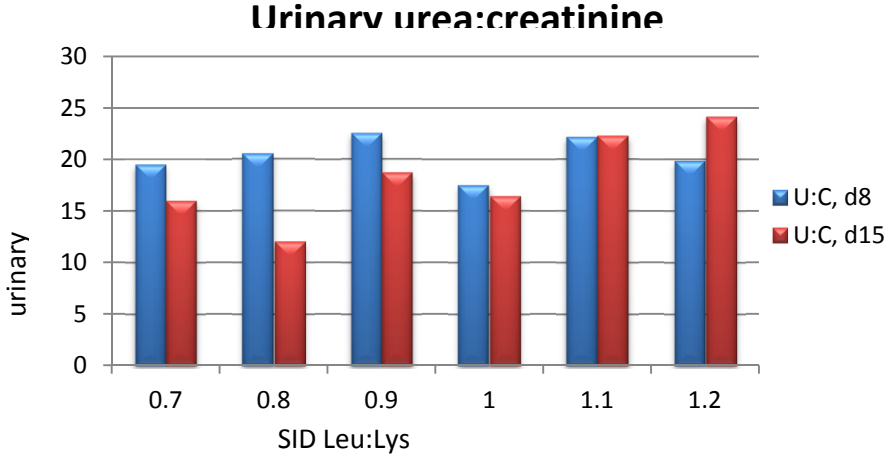

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MODELS

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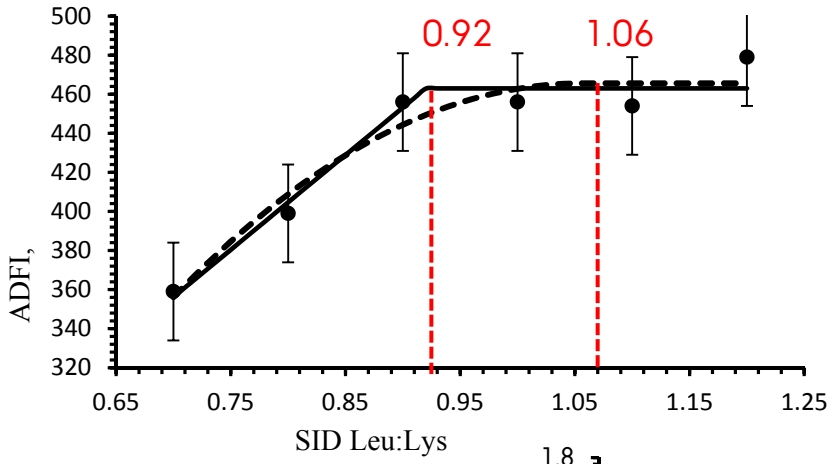

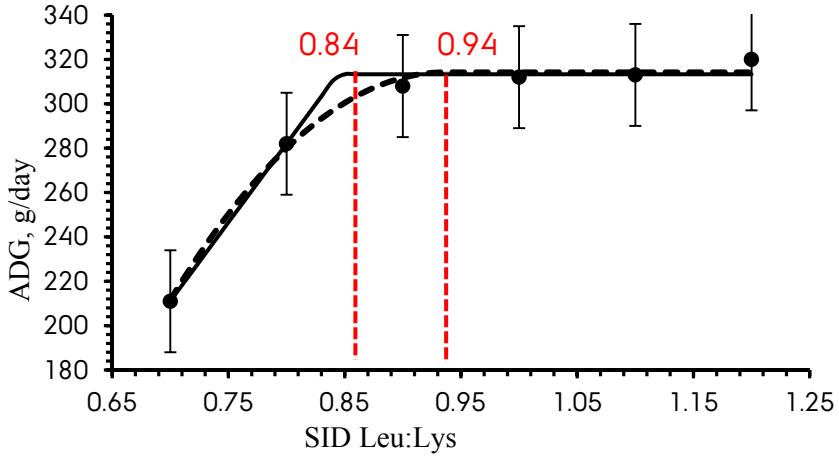

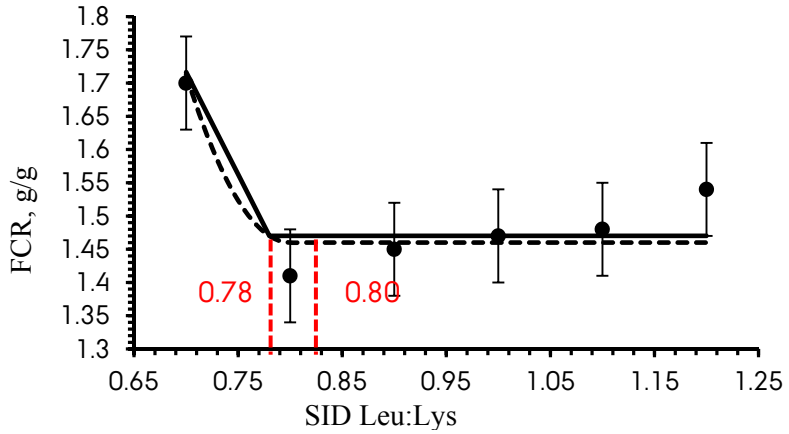

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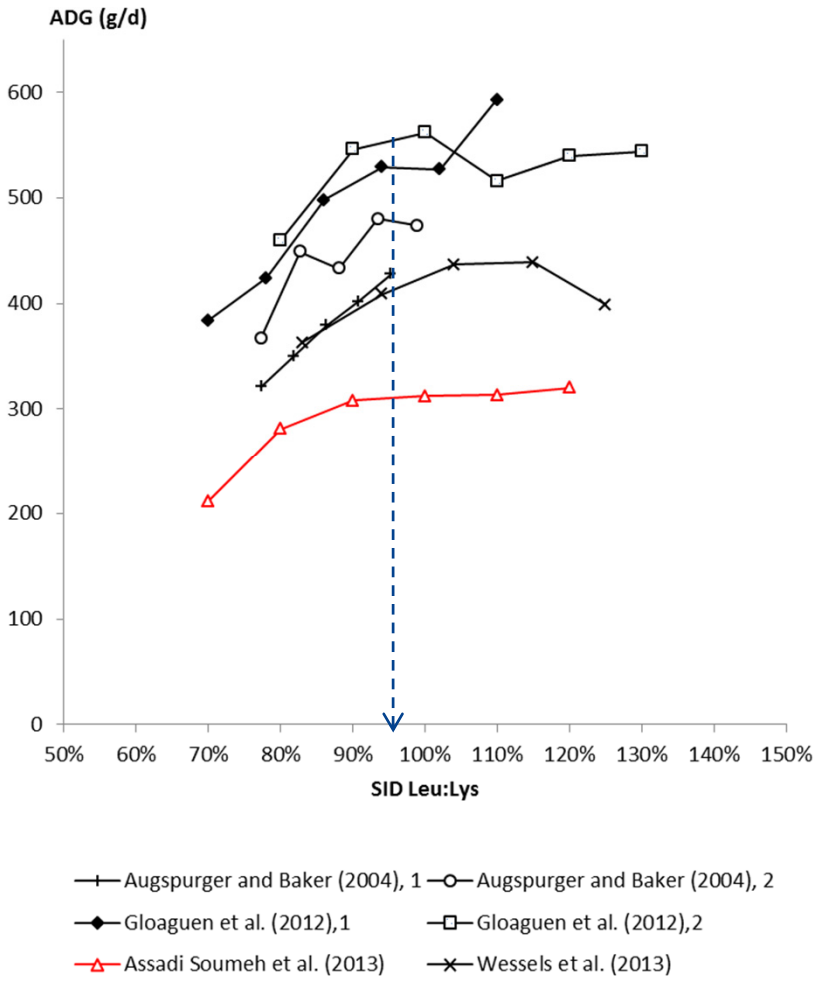
CONCLUSION

› This study: 1.00

› Recommendations
› 1.01 INRA 2013, France
› 1.00 FEDNA 2013, Spain
› 1.02 VSP 2013, Denmark



Ile Val Leu

CONCLUSIONS

› Optimum concentrations based on animal performance:
› Isoleucine: 0.52 SID Ile:Lys
› Valine: 0.70 SID Val:Lys
› Leucine: 1.00 SID Leu:Lys

› Results are close to those reported by recent literature reviews

› Results and conclusions are sensitive to the choice of models

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METABOLOMICS

Samples

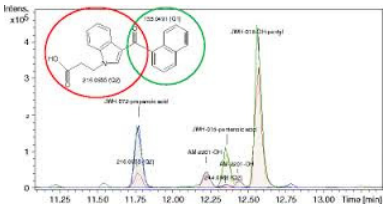
-Blood

-Urine

Data acquisition

-LC-MS

-LC-MS/MS

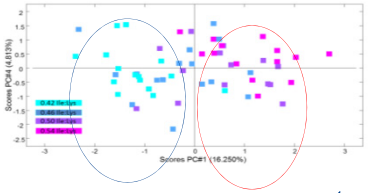


Preprocessing

-Peak detection

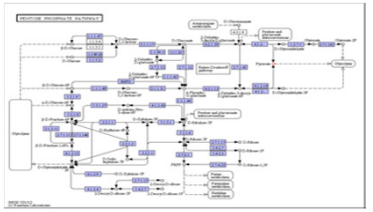
-Alignment

-Normalization



Chemometric Analysis

- PCA
- PLS



Biomarker identification and pathway

- KEGG
- Metlin

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AKNOWLEDGEMENT

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Videncenter for Svineproduktion

AJINOMOTO
AJINOMOTO ANIMAL NUTRITION
AJINOMOTO EUROLYSINE S.A.S.

The Danish Council for Independent Research

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THANK YOU FOR YOUR ATTENTION!

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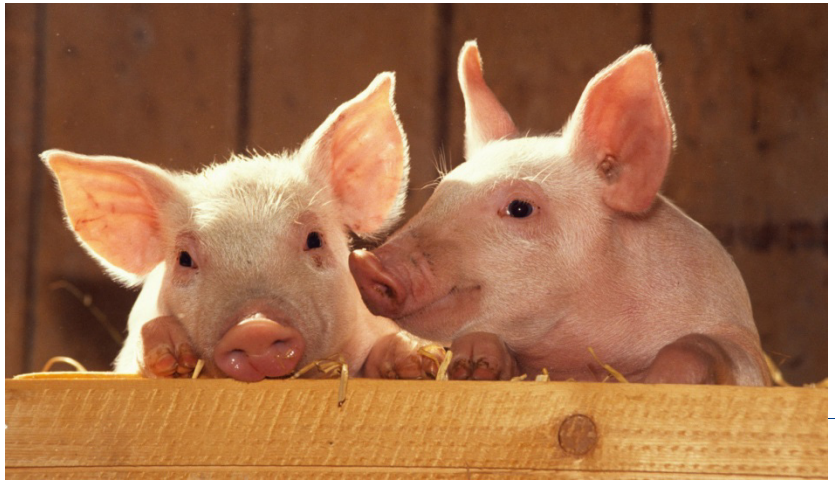

DIET CHEMICAL COMPOSITION

Item	SID Ile:Lys					
	0.42	0.46	0.50	0.54	0.58	0.62
Energy, MJ NE/kg	10.5	10.5	10.5	10.5	10.5	10.5
crude protein, g/kg	163.0	163.0	163.0	163.0	163.0	163.0
Lysine (total), g/kg	12.3	12.3	12.3	12.3	12.3	12.3
SID Lysine, g/kg	11.4	11.4	11.4	11.4	11.4	11.4
Isoleucine, g/kg	5.6	6.2	6.4	6.9	7.1	7.7
Glutamate	34.4	34.6	34.0	33.5	32.6	32.4

DIET CHEMICAL COMPOSITION

Item	SID Val:Lys					
	0.58	**0.62**	**0.66**	**0.7**	**0.74**	**0.78**
Energy, MJ NE/kg	10.4	10.4	10.4	10.4	10.4	10.4
crude protein, g/kg	177	177	177	177	177	177
Lysine (total), g/kg	11.8	11.8	11.8	11.8	11.8	11.8
SID Lysine, g/kg	10.6	10.6	10.6	10.6	10.6	10.6
Valine, g/kg	7.4	7.9	8.3	8.7	9.1	9.6
Glutamate	39.4	39.3	38.8	38.1	37.7	37.5

DIET CHEMICAL COMPOSITION

Item	SID Leu:Lys					
	0.70	**0.80**	**0.90**	**1.00**	**1.10**	**0.78**
Energy, MJ NE/kg	10.4	10.4	10.4	10.4	10.4	10.4
crude protein, g/kg	154.0	154.0	154.0	154.0	154.0	154.0
Lysine (total), g/kg	11.8	11.8	11.8	11.8	11.8	11.8
SID Lysine, g/kg	11.0	11.0	11.0	11.0	11.0	11.0
Leucine, g/kg	8.9	9.9	10.7	12.3	13.0	14.3
Glutamate	35.2	34.4	33.1	32.4	31.0	30.5