Implications of Feeding High Dietary Inclusion Levels of Canola Meal

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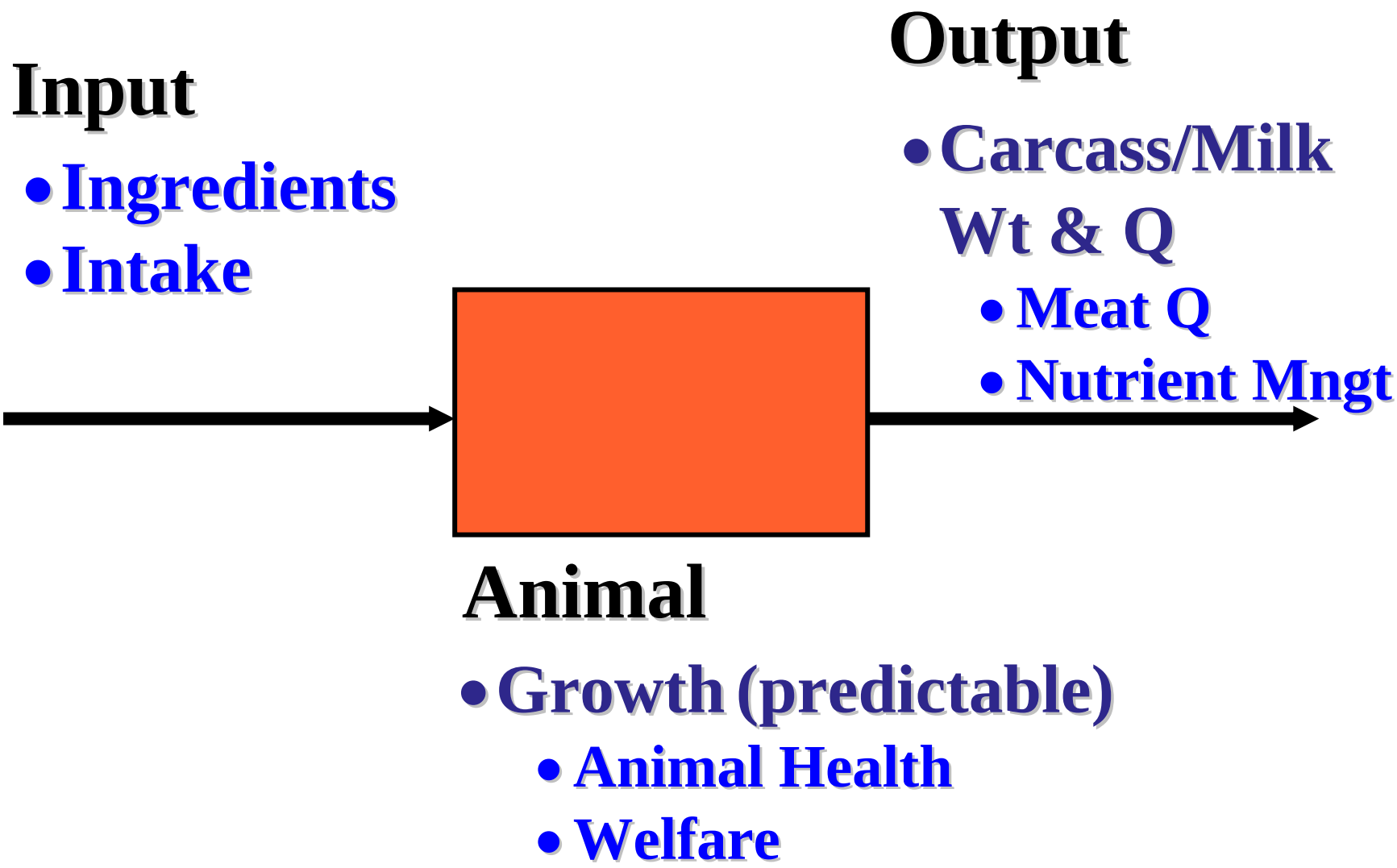
Workshop

- **Requested Focus**
  - **High protein diets and their impact on the animal and the environment**

What is high? Few studies with protein content above 20%

  - **Discussion of required research to manage high protein**
  - **Likely high fiber diets as well**
  - **Focus on monogastric species**

Importance of Ingredient Quality



Implication 1 - FQE

Predictable animal growth and carcass weight and Q

- Use modern feed quality evaluation systems
  - NE and SID AA

Table 3. Estimates of the biological efficiency with which different nutrient classes are used for different metabolic purposes in growing pigs[z]

	Energetic efficiency (%)			
	Microbial fermentation		ATP	Lipid
	Heat	Methane	production	retention
Fatty acids	–	–	66	90
Glucose	–	–	68	74
Amino acids	–	–	58	53
Digested fiber	6	10	50	62

[z]Derived from Black (1995).

Energy Evaluation

Energy Values (kcal/kg) of Typical Feedstuffs

Raw material	DE, kcal/kg	ME, kcal/kg	NE, kcal/kg	ME:DE	NE:ME
Tallow	7,964	7,914	7,104	0.99	0.90
Corn	3,390	3,310	2,650	0.98	0.80
SBM (48%)	3,520	3,210	1,940	0.91	0.60
Wheat	3,310	3,210	2,510	0.97	0.78
Field peas	3,320	3,160	2,320	0.95	0.73
Barley	3,070	2,970	2,280	0.97	0.78
Canola meal	2,760	2,530	1,510	0.92	0.60
Wheat middlings	2,650	2,530	1,830	0.95	0.72

Source: Sauvant et al., 2004.

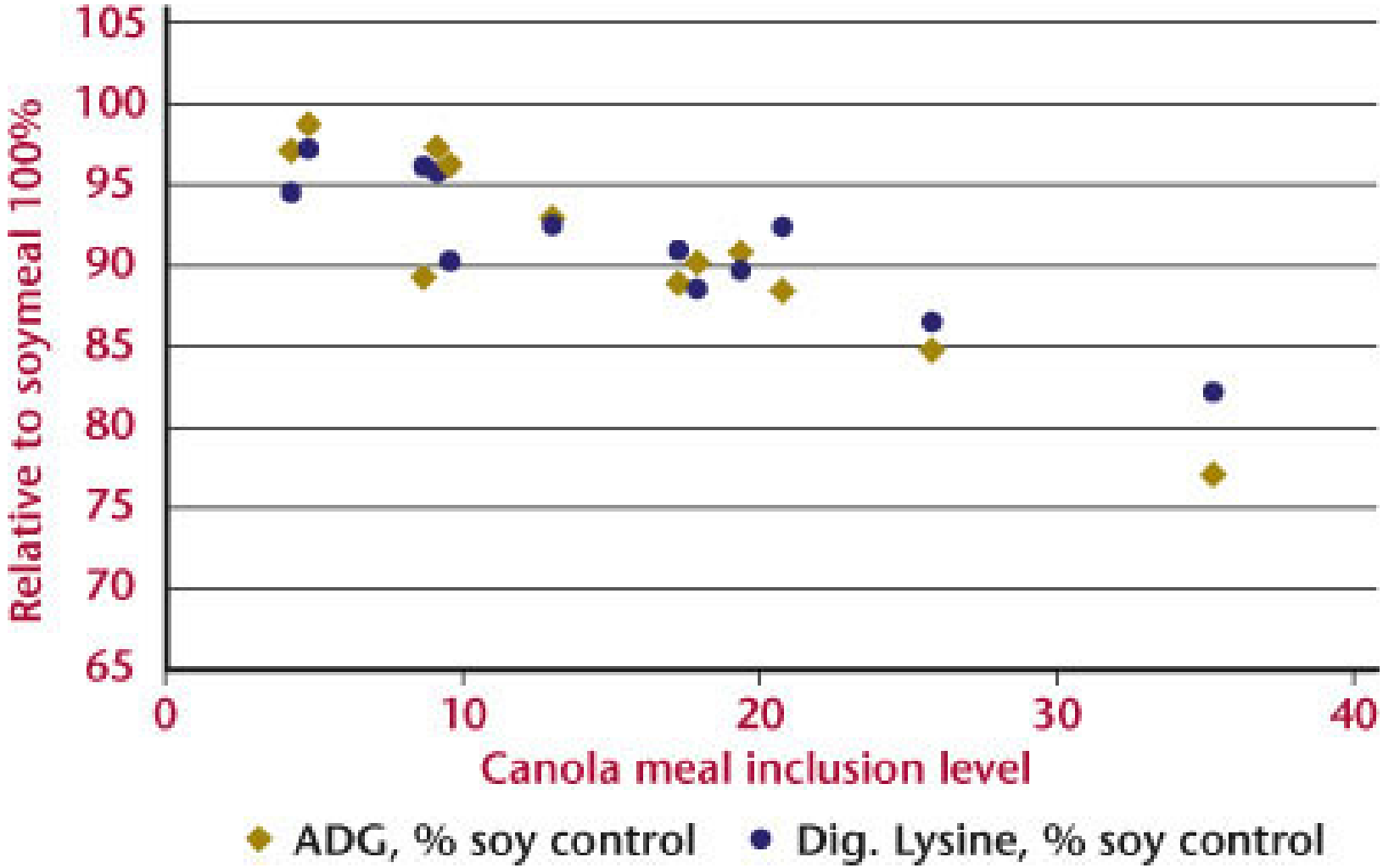
Energy Evaluation

Relative DE, ME, and NE values

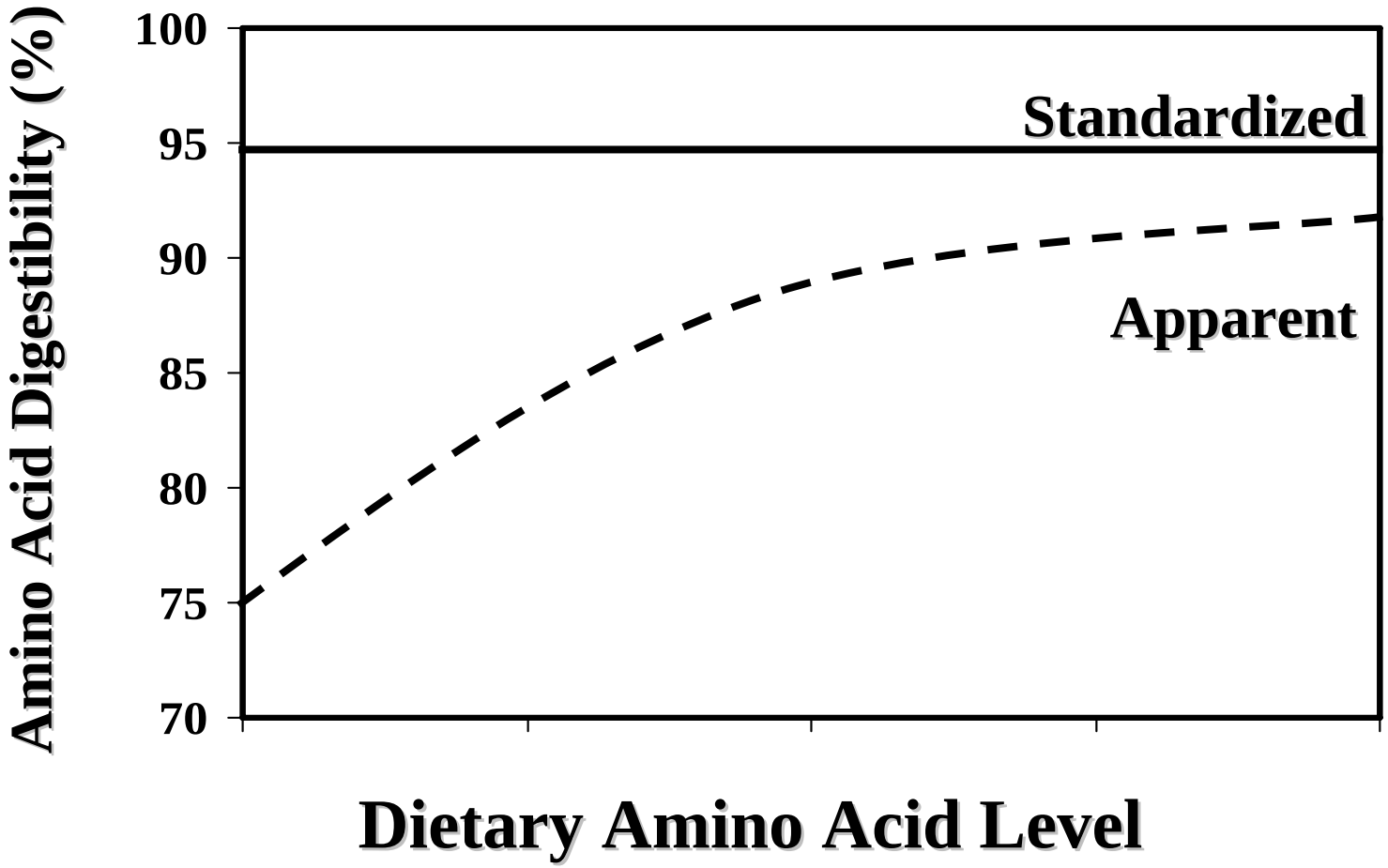
Feedstuff	DE	ME	NE	NE:ME
Animal fat	243	252	300	90
Corn	103	105	112	80
Wheat	101	102	106	78
Barley	94	94	96	77
Reference diet	*100*	*100*	*100*	*75*
Pea	101	100	98	73
Soybean (full-fat)	116	113	108	72
Wheat bran	68	67	63	71
Distiller's Dried Grains	82	80	71	67
Soybean meal	107	102	82	60
Canola meal	84	81	64	60

Source: Adapted from Sauvant et al., 2004.

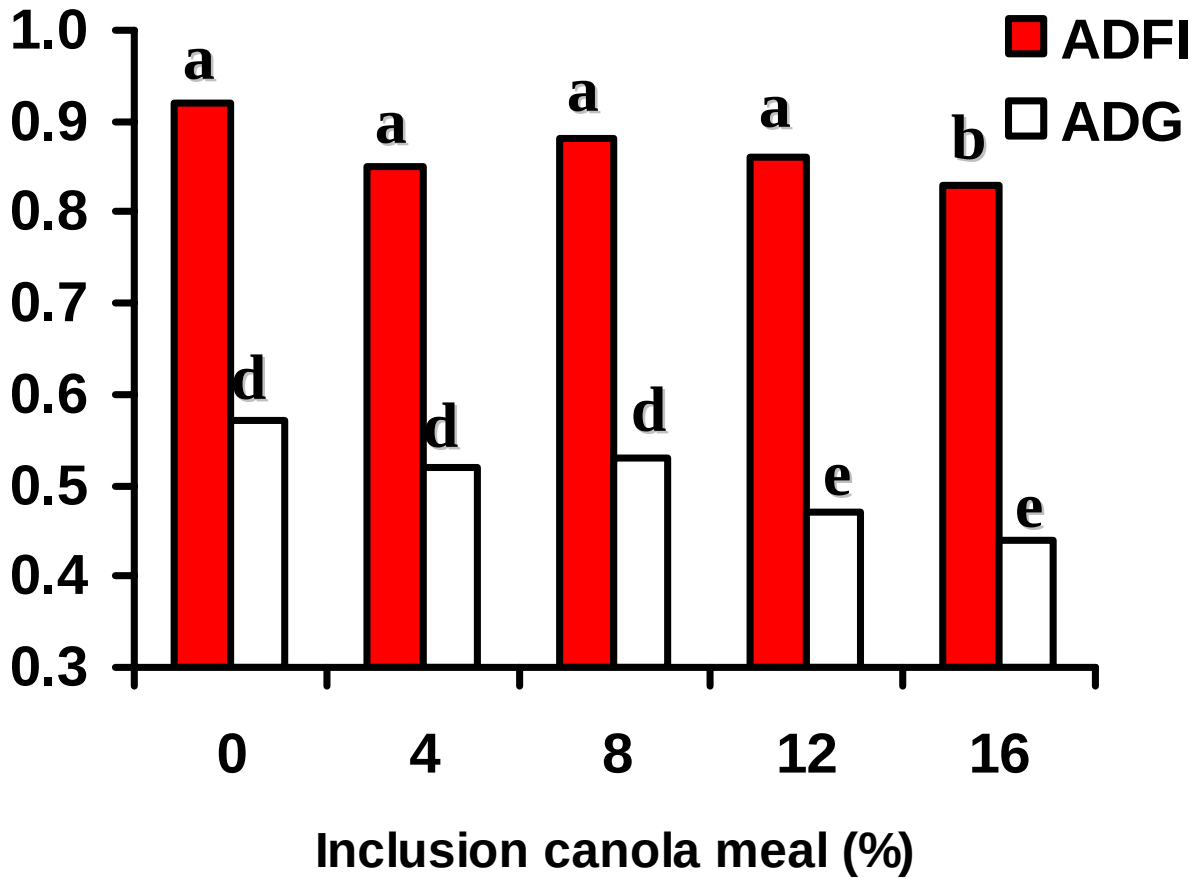
Quality Evaluation



Amino Acid Digestibility



What about intake?



Canola meal replaced SBM in diets for weaned pigs formulated to equal DE and AID Lys

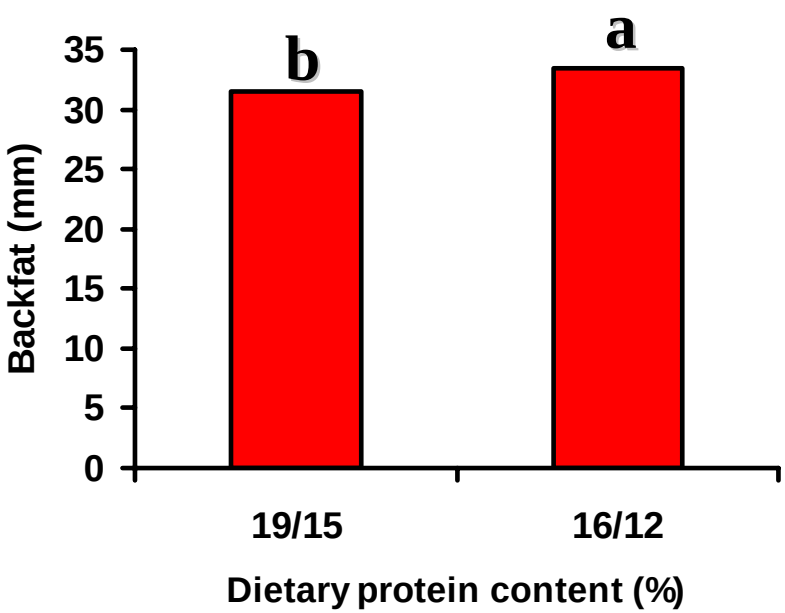
(Ekpe et al. 2001)

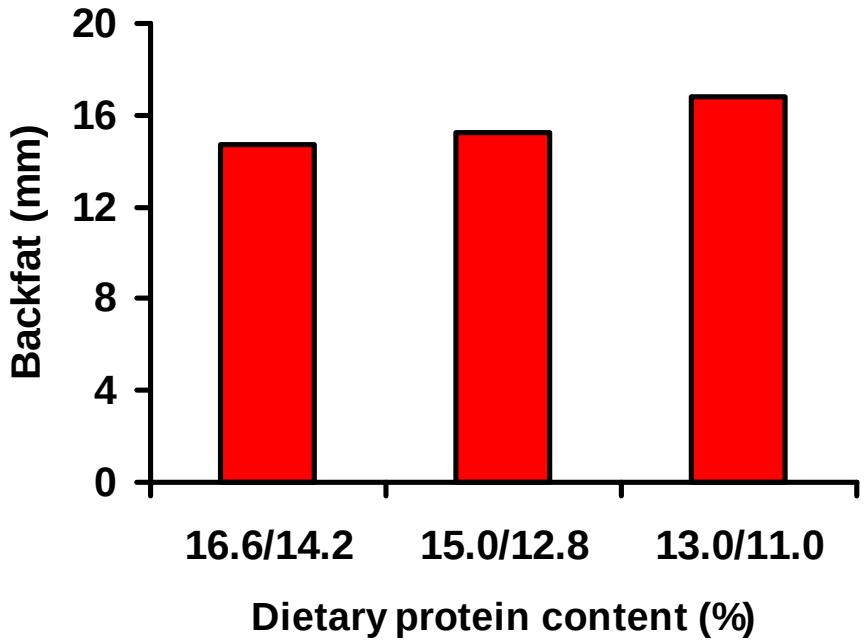
Variation in Quality

All feedstuffs have a range in quality

Implication 2 – Carcass Q

Linear; $P < 0.07$





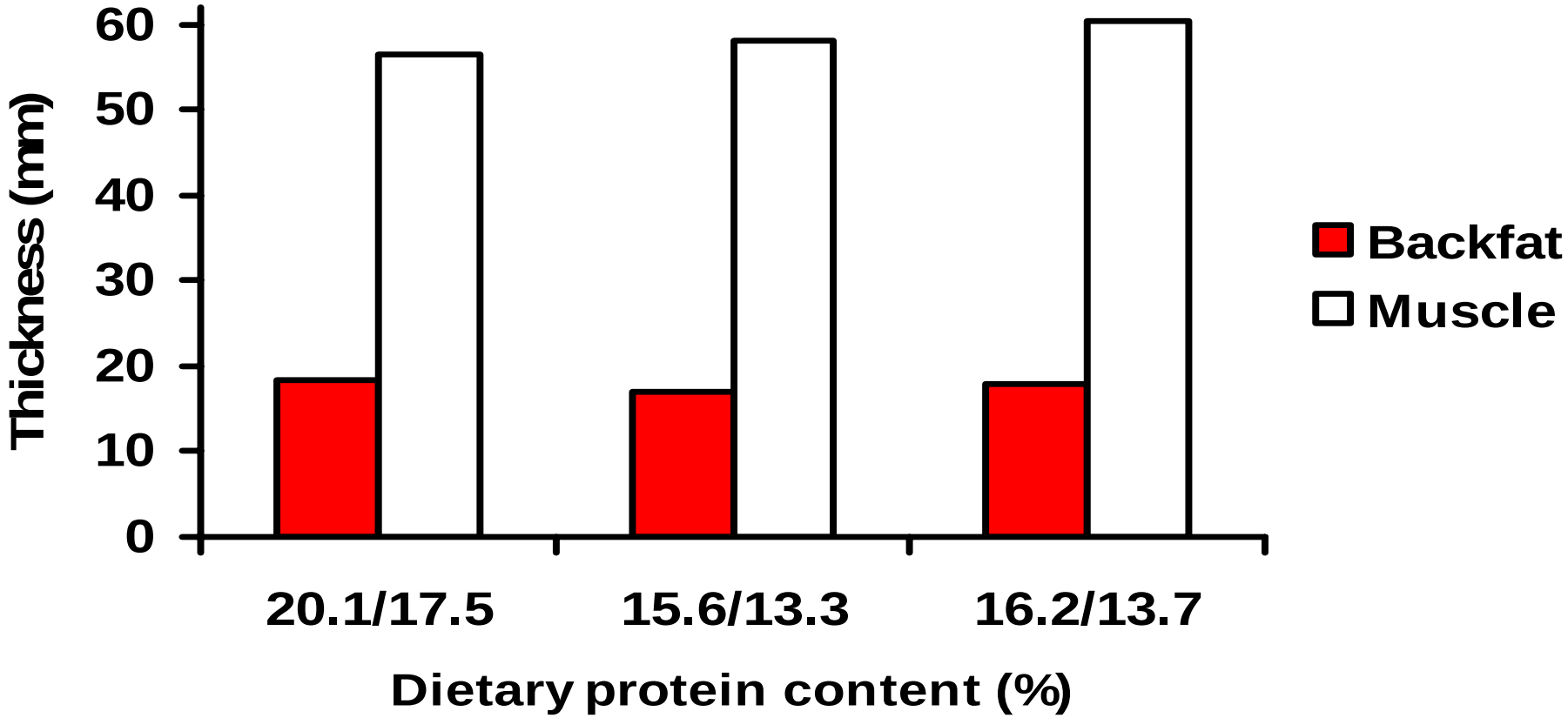
Diets balanced for digestible AA

(Kerr et al. 1993)

(Tuitoek et al. 1997)

Energy Evaluation

0.85/0.70 g/MJ NE



A 4 percentage unit reduction of dietary CP level reduces N excretion (minus 37%) but does not affect growth and carcass composition as long as the ratio between essential AA and NE are kept optimal

(Le Bellego et al. 2002)

Implication 3 – Animal Health

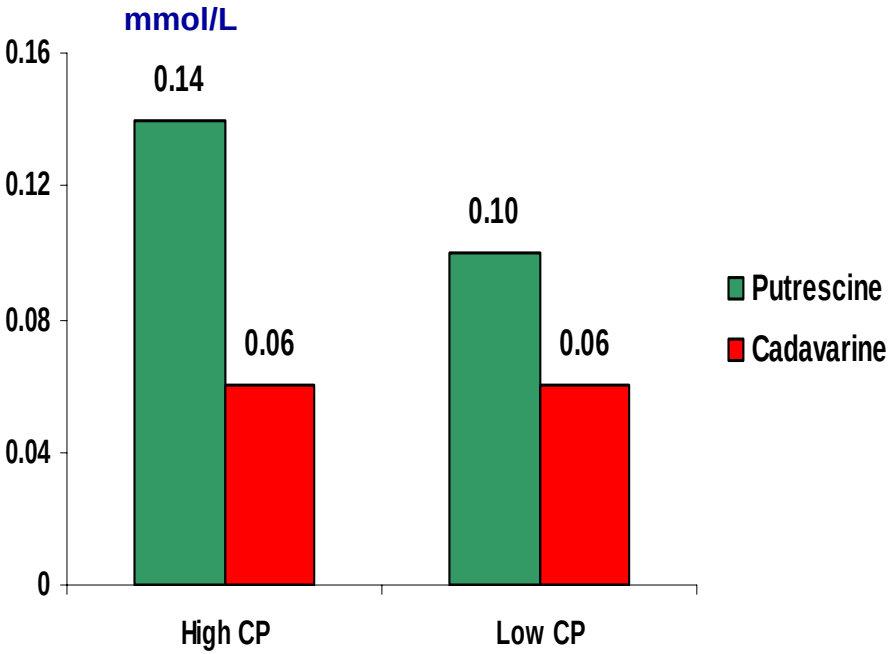
Effect of dietary protein content on ileal amino acid digestibility, growth performance, and formation of microbial metabolites in ileal and cecal digesta of early-weaned pigs

J. K. Htoo, W. C. Sauer, M. Rademacher, Y. Zhang, B. A. Araiza, M. Cervantes, and R. T. Zijlstra

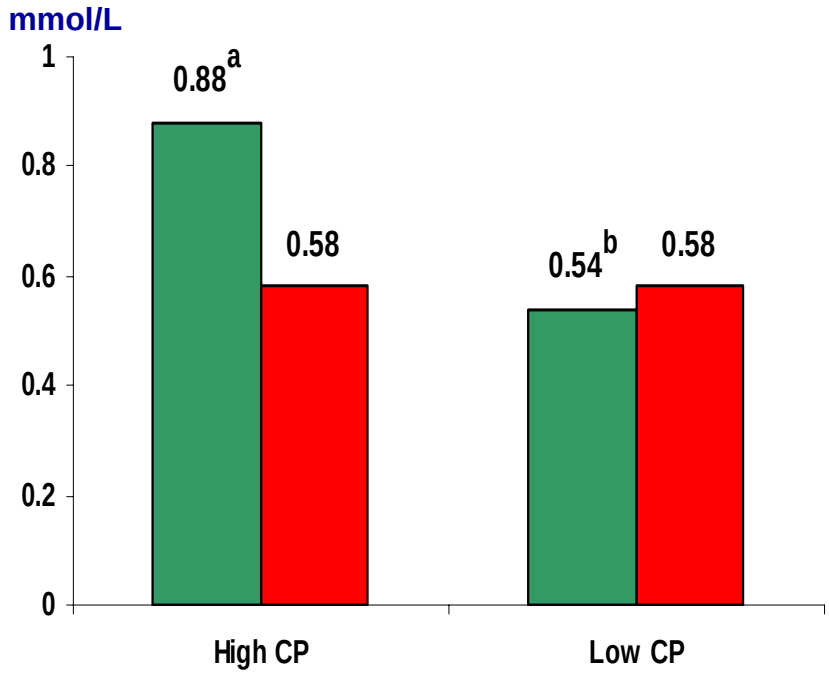
JAS 2007

Lots of studies have confounding protein and fiber effects

Effect of dietary CP level on concentration of putrescine and cadavarine in ileal and cecal digesta



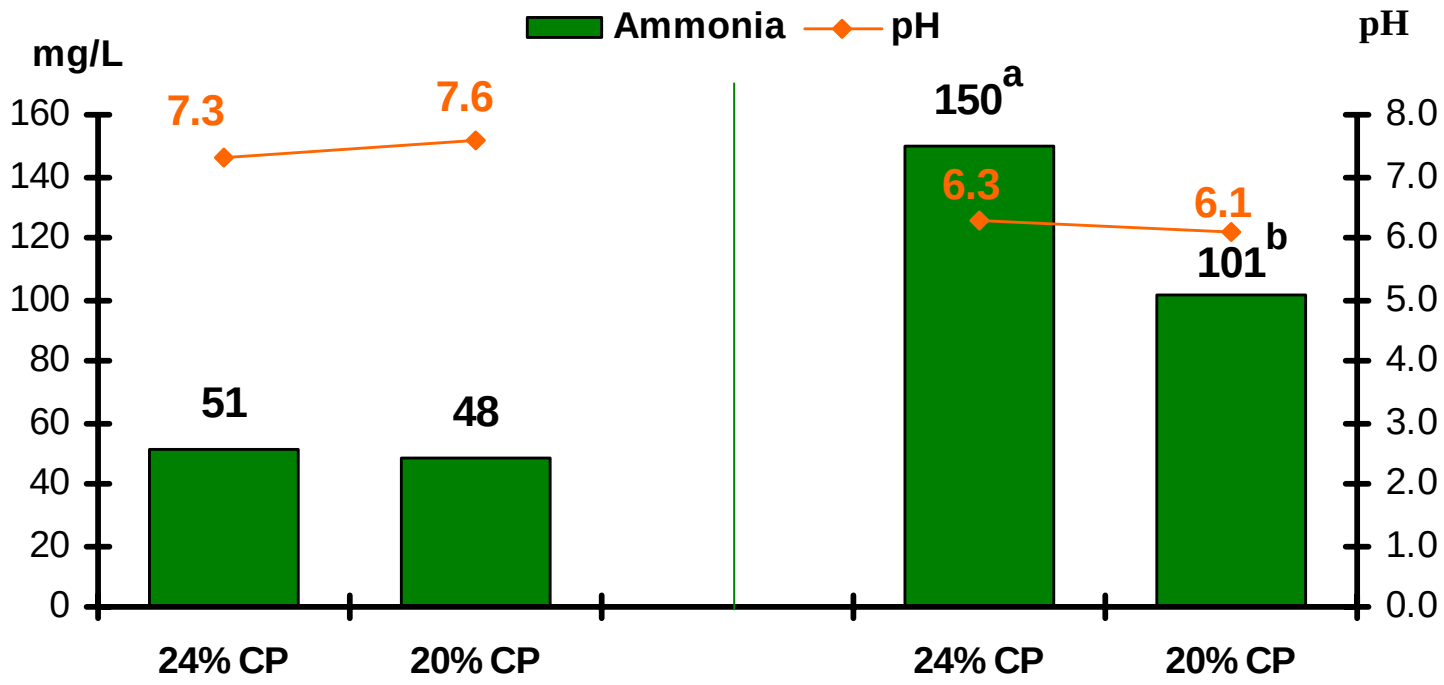
Putrescine and cadavarine in ileal digesta (Exp. 1)



Putrescine and cadavarine in cecal digesta (Exp. 2)

[a, b] Means with different superscripts differ ($P < 0.05$).

Concentration of ammonia and pH in the digesta



Ammonia and pH in ileal digesta (Exp. 1)

Ammonia and pH in cecal digesta (Exp. 2)

[a, b] Means with different superscripts differ ($P < 0.05$)

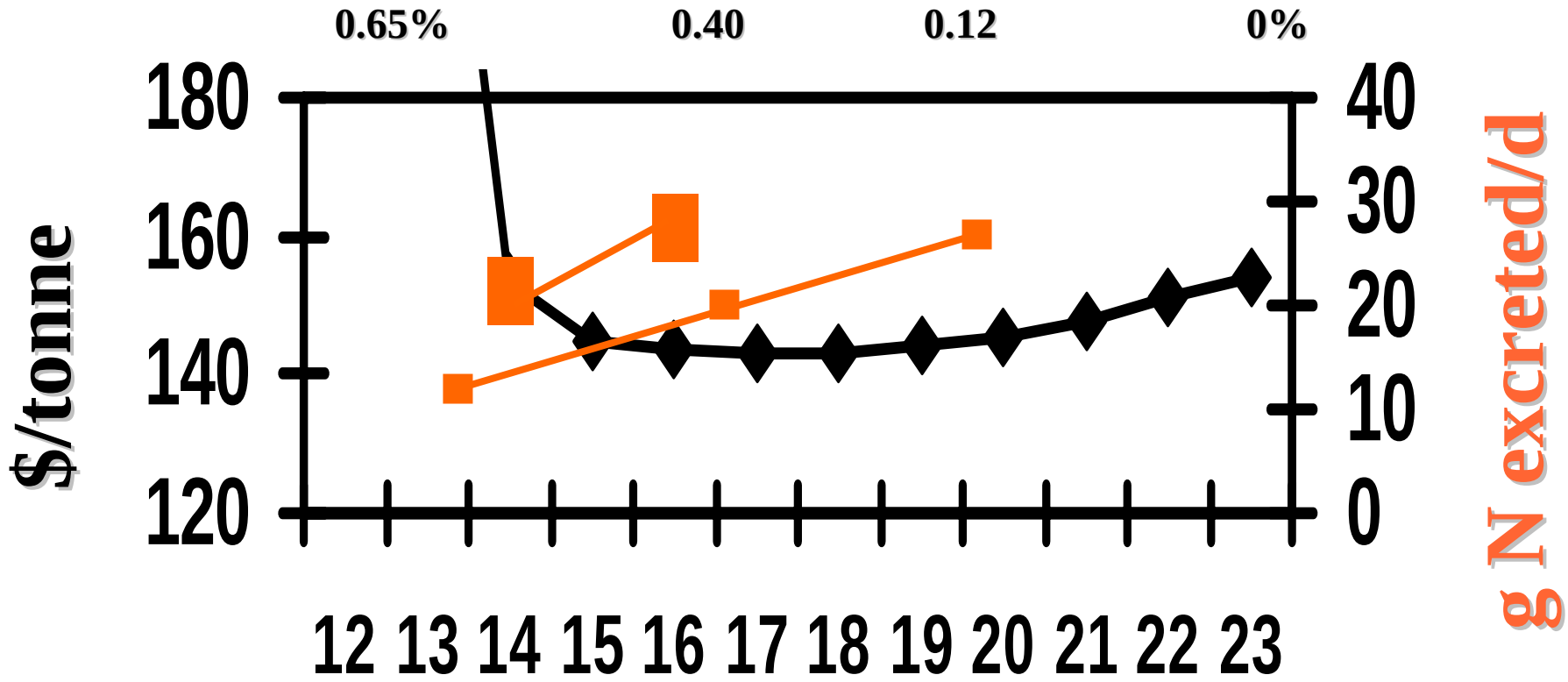
Performance responses and indicators of gastrointestinal health in early weaned pigs fed low-protein amino acid-supplemented diets

C. M. Nyachoti, F. O. Omogbenigun, M. Rademacher, and G. Blank

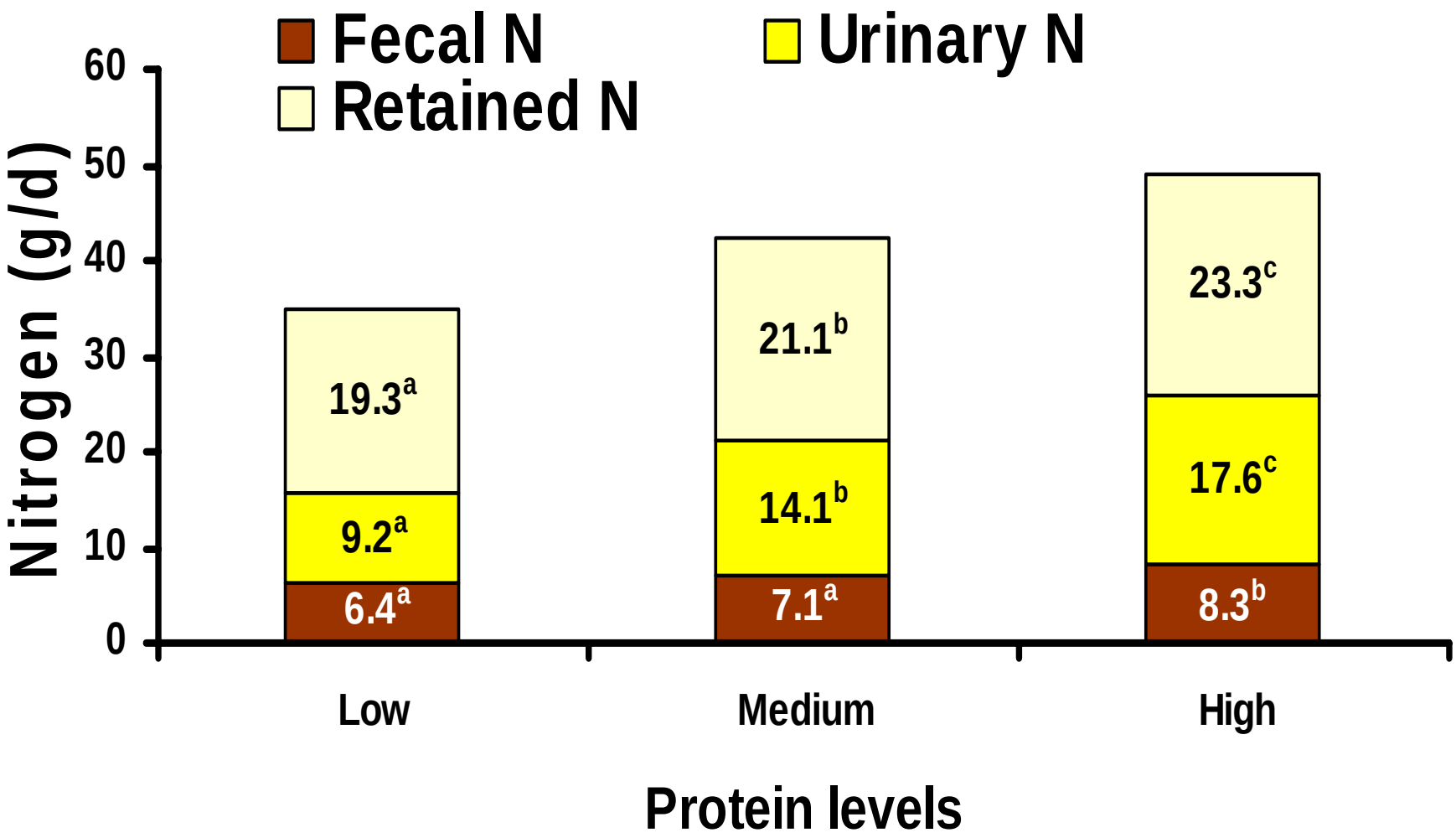
JAS 2006

Item		23	21	19	17	SEM
Water intake, L/d		3.83	3.01	3.24	3.22	0.49
Feces score		0.36	0.20	0.18	0.29	0.13
PUN d 21, mg/L	LQ	120	70	45	40	
Ileum pH	Q	6.7	6.0	6.1	6.3	0.2
Ileum ammonia N, mg/L	LQ	6.7	6.0	6.1	6.3	0.2

Implication 4 – Nutrient Mngt



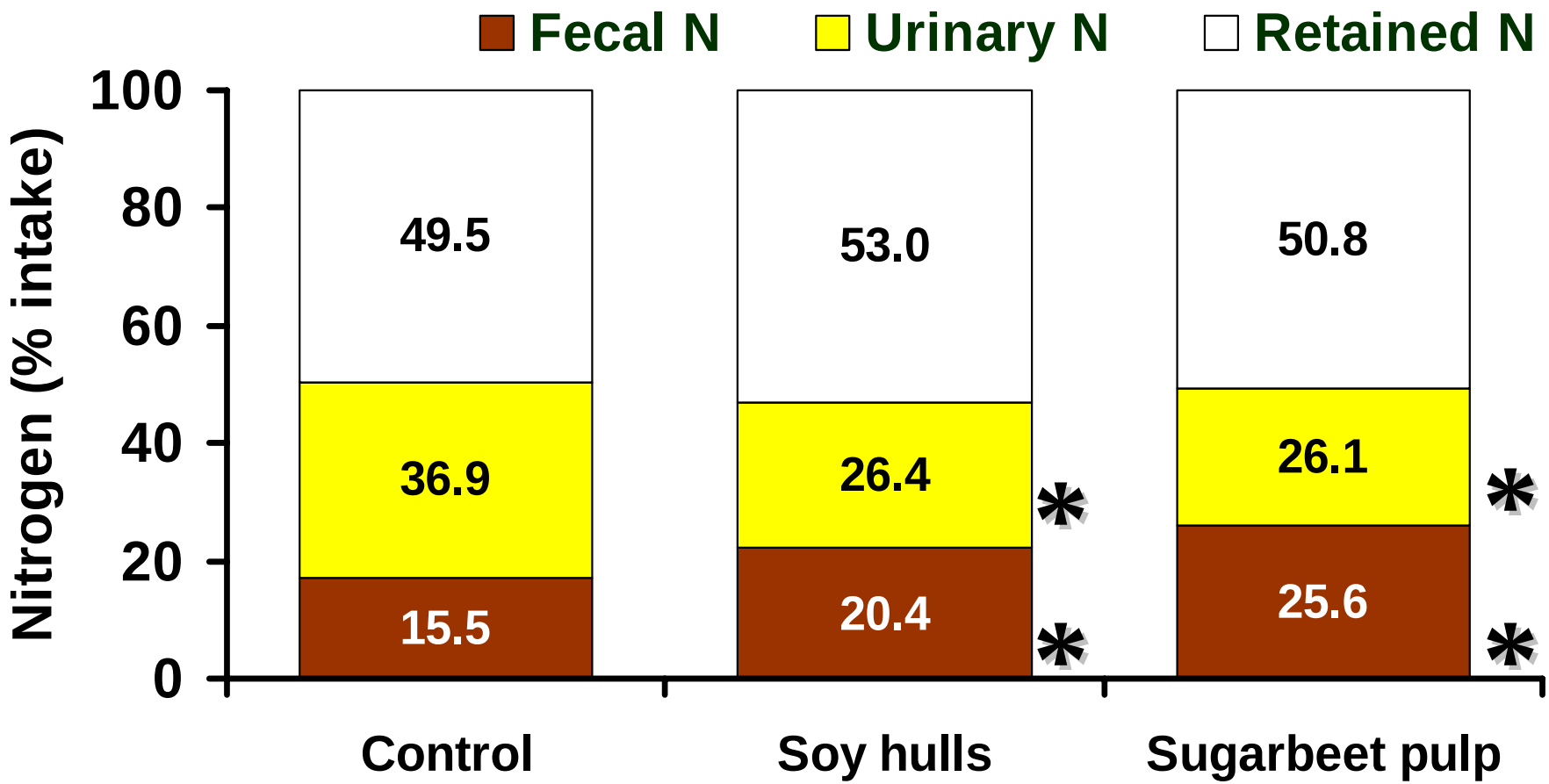
Dietary CP and N Excretion



Low protein + balanced amino acid will reduce N excretion from urine: will reduce ammonia emissions

Zervas and Zijlstra, 2002a

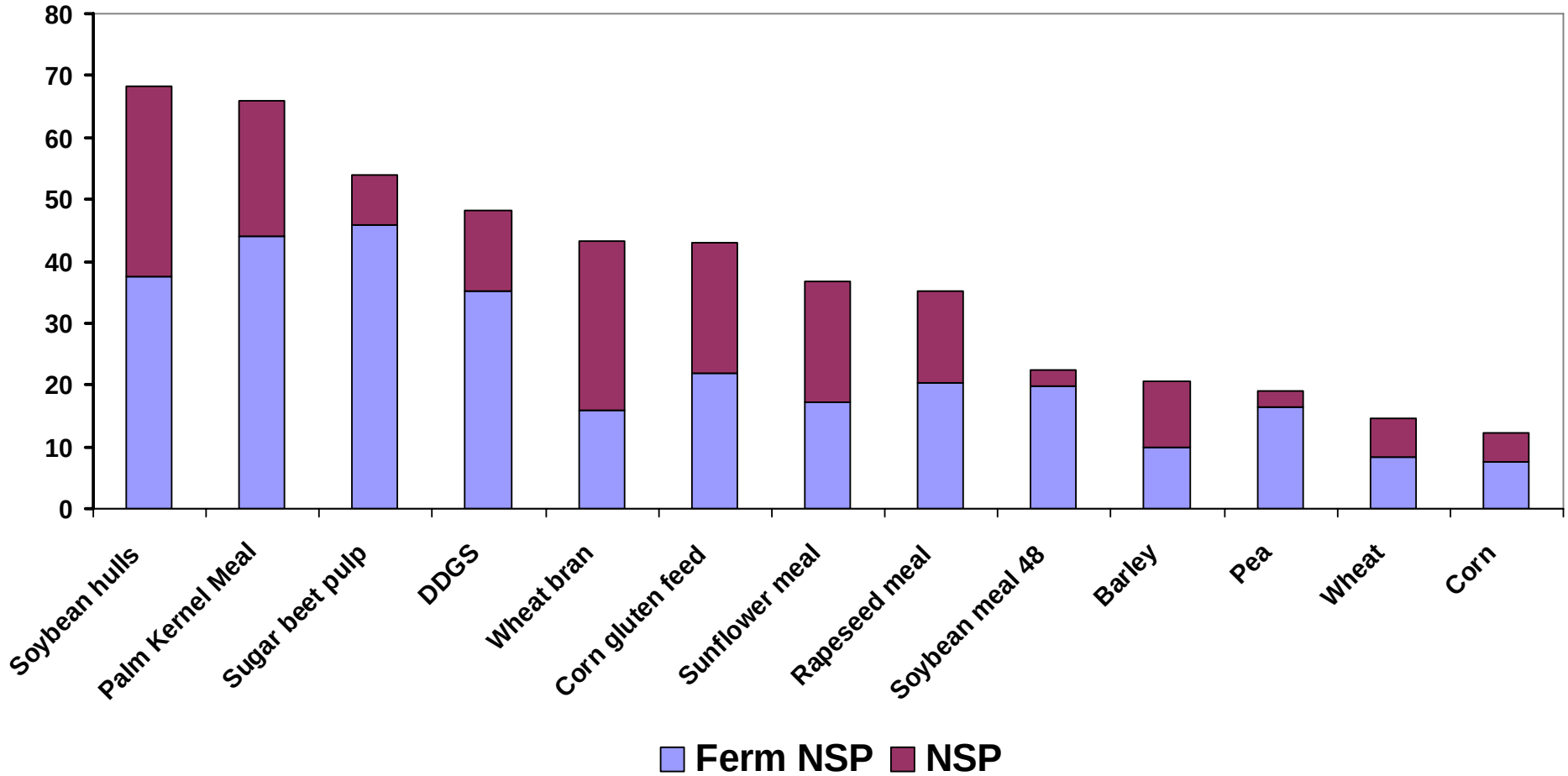
Fermentable Fiber



Fermentable fiber will shift N excretion from urine to feces: will reduce ammonia emissions

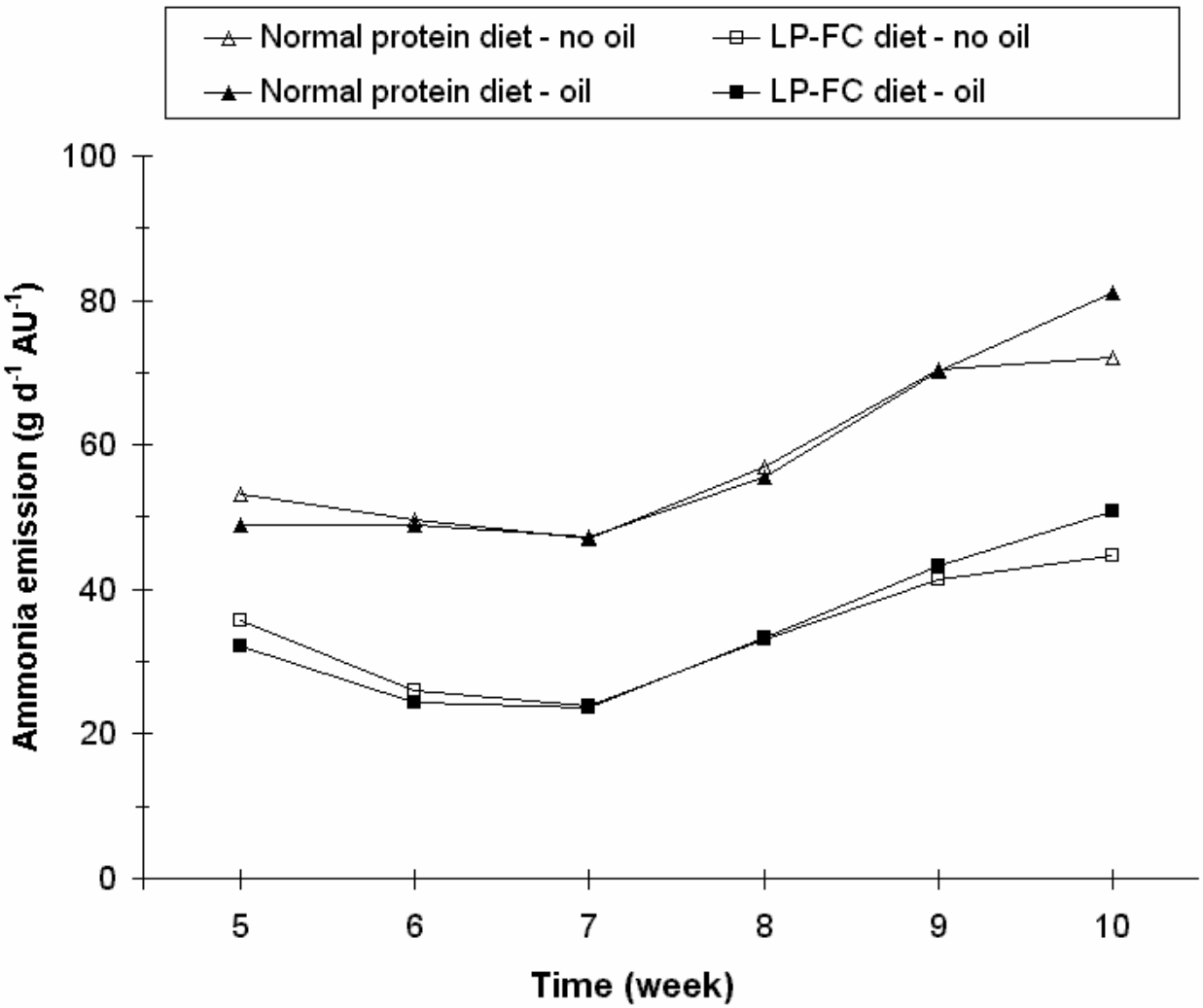
Zervas and Zijlstra, 2002b

Total and Fermentable Fibre



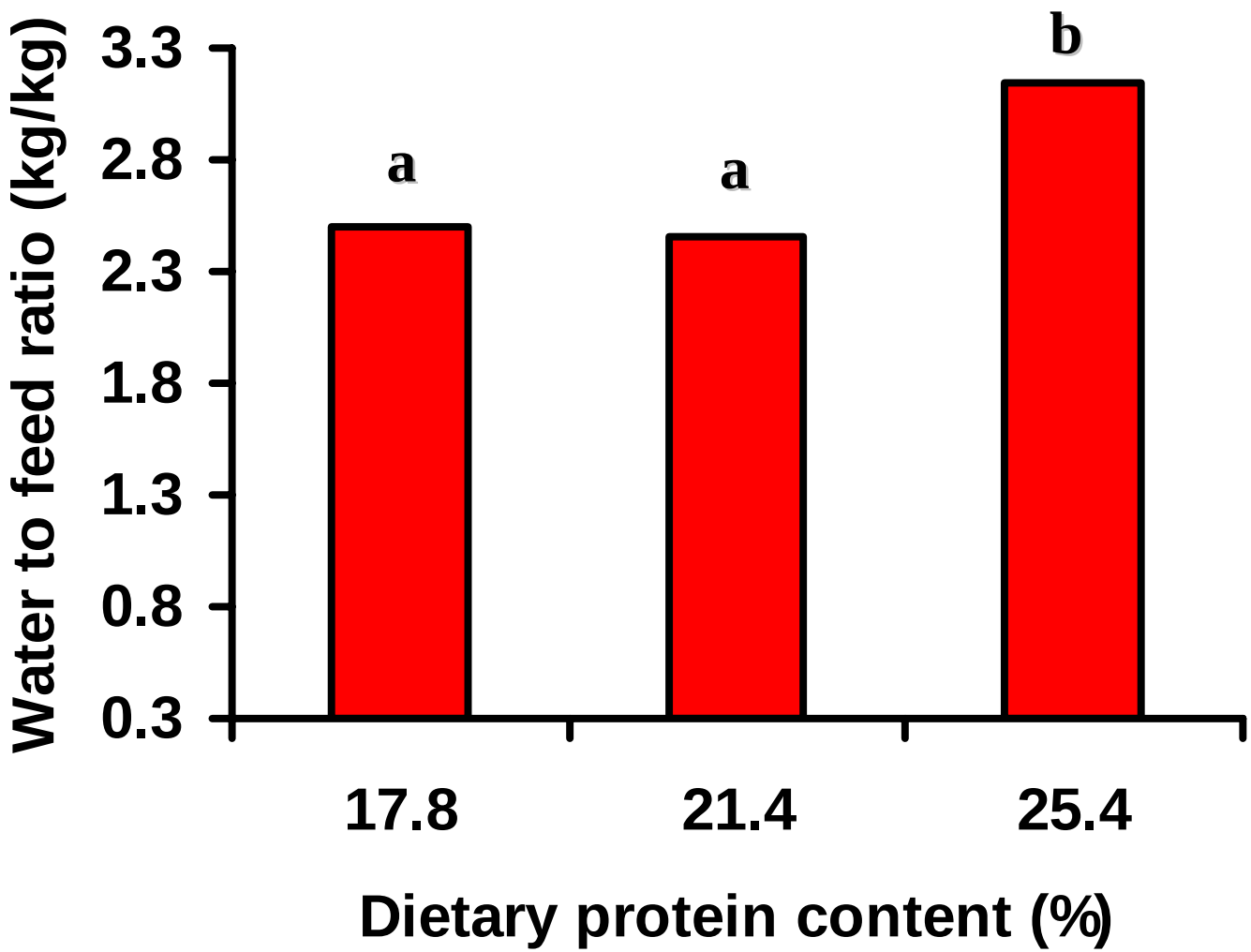
(CVB, 2004)

LP + FF – Ammonia Emission



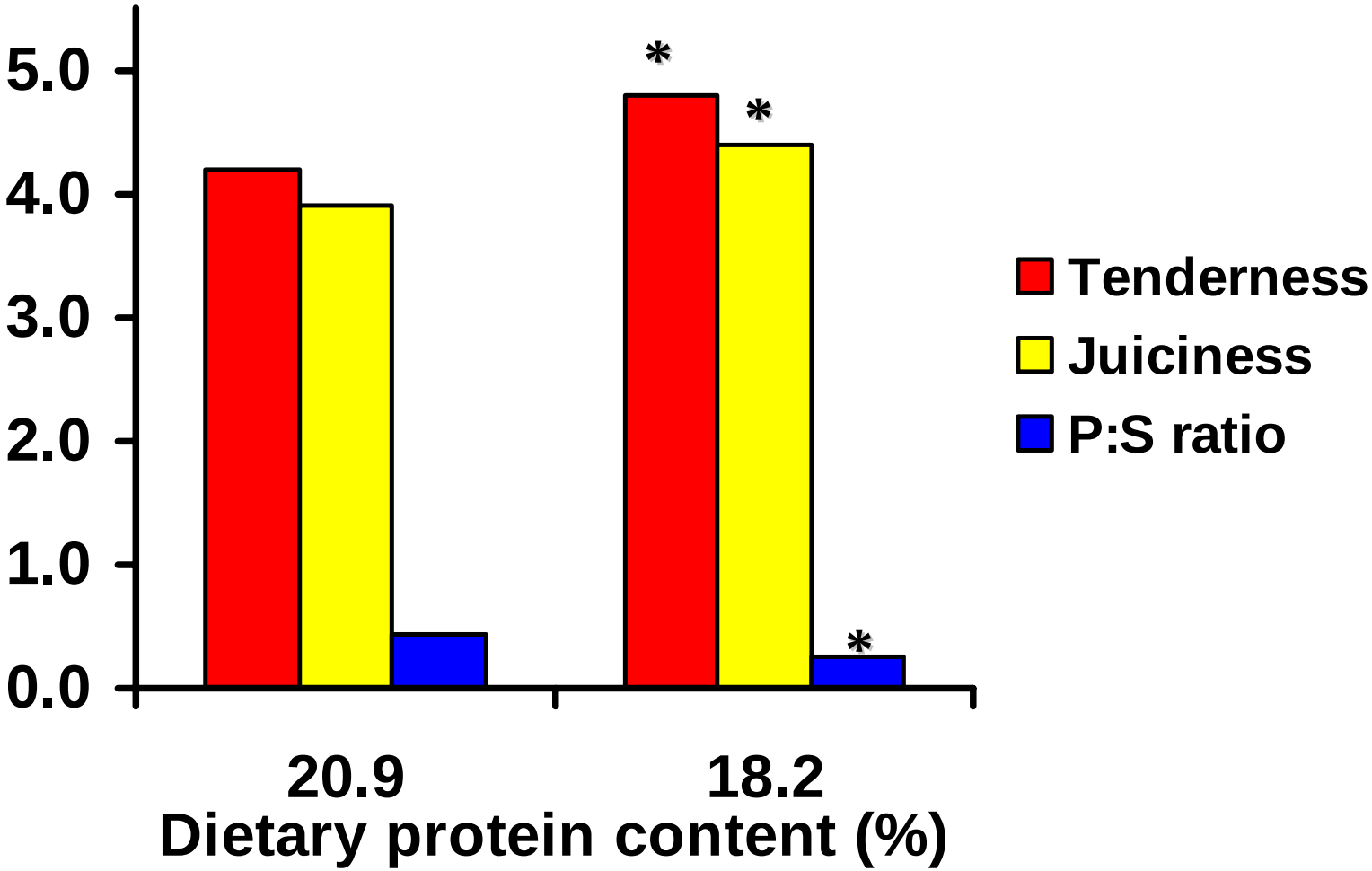
Payeur et al., 2002

Inputs



Shaw et al., 2006

Implication 5 – Pork Q



Teye et al., 2006

Feeding protein or amino acid deficient diets increases marbling (Dugan 2004)

Summary

- Changes in dietary protein content should not affect ADG and carcass quality within the studied range, provided proper energy and AA evaluation system have been used
  - Will extreme levels of protein content be reached?
- Impact on nutrient management can be predicted
- Will normal range of undigested protein, intestine health might not be affected much under clean conditions
  - What about larger levels of undigested plant-based protein and fiber?