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THE ROLE OF NUTRITION TO PREVENT INJURIOUS BEHAVIOURS IN PIGS

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Injurious behaviours in pigs

- Aggression

Establishment of rank
Competition for resources
“Irritability”

Injurious behaviours in pigs

- Penmate directed behaviours

High levels of repetitive oral behaviour

tail, ear and flank biting in growing pigs (belly nosing)

The Evolutionary Background of the Pig

- Omniverous forest dwellers
- Spend most of their active time in foraging for food

A major contrast with modern production systems

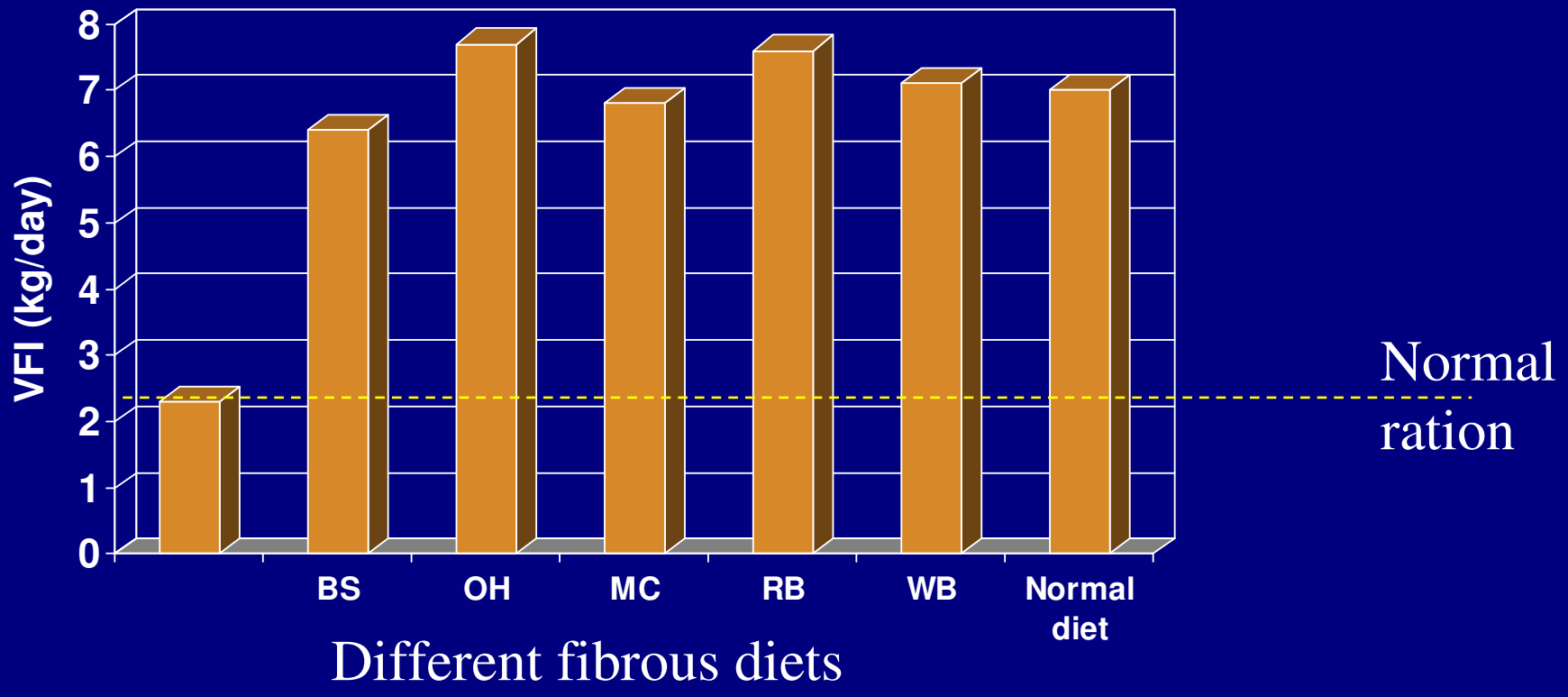
Nutrition and Aggression in the Breeding Sow

The Problem:

Limited food resources when animals are highly food motivated

Voluntary intake in the pregnant sow

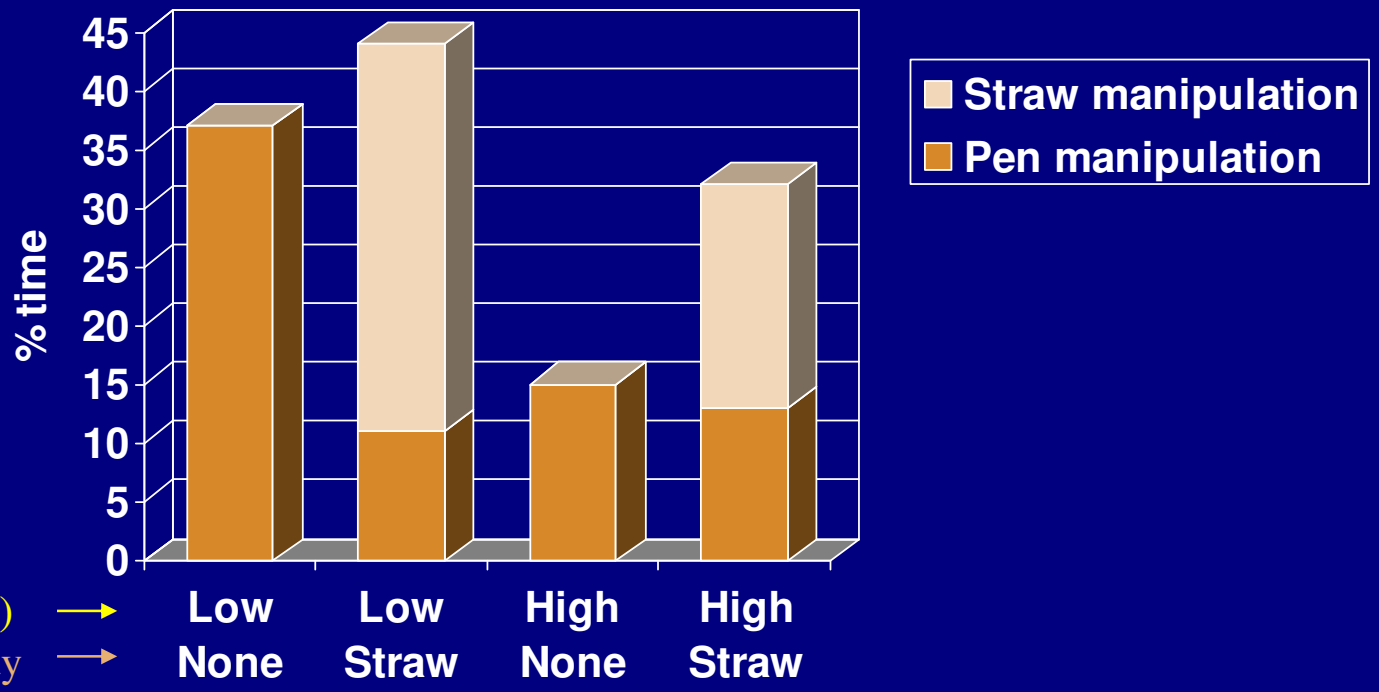
- Normal concentrate ration is far below appetite



(Brouns et al., 1995)

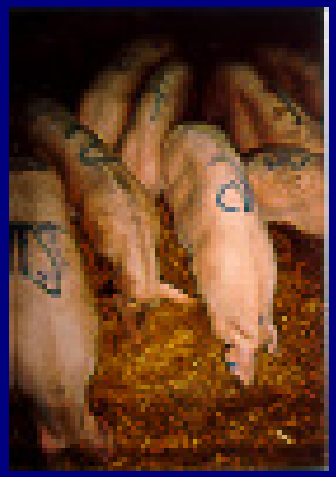
Hunger and its expression

- Stereotyped behaviour arises because of chronic hunger in an environment where foraging cannot be functionally expressed



(Spoolder et al 1995)

Aggression is increased by feed competition



	Group fed	Individually fed	sed
Fat gain variation (mm P2)	0.04	0.03	0.004 *
Skin lesion score	9.3	5.9	1.12 **
Litter size	10.3	11.9	1.00

And production may be adversely affected!

(Edwards et al 1993)

Good management can avoid aggression despite low feed levels

	20 MJ DE/d (1.6 kg)	38 MJ DE/d (3.0 kg)	
% Active	41	31	P<0.05
% Straw manipulation	17	10	P<0.001
Aggression/sow/day	3.6	3.8	ns
Skin lesion score	0.24	0.28	ns

Protected feeding
Foraging substrate

(Spoolder et al 1997)

Vulva Biting in sows

- Prevalence can be high
  - 15% in Swedish survey
  - 50% in Dutch report
- Vulva biting increased by:
  - Poor body condition
  - Concentrate feeding (no roughage)
  - Unbedded housing
  - ESF systems (sequential feeding)

(Bure 1991; Gjein & Larssen 1995, Scott et al 2009)

Why does vulva biting occur?

- NOT occurring as animals competed for feed station access
- Occurred when animals left the station after consuming a small meal

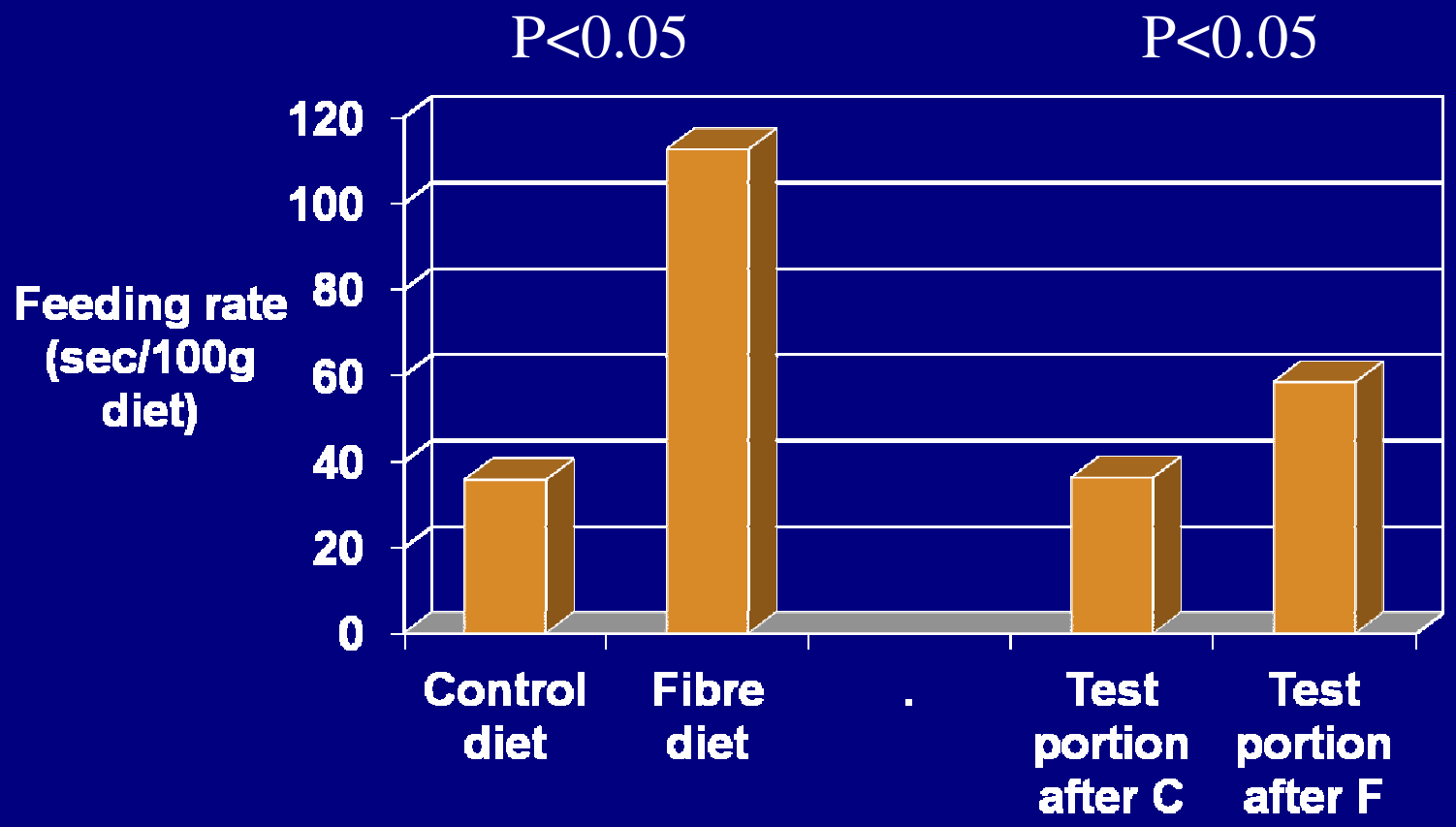
(Bure 1991)

Frustrated feeding motivation

A small amount of food increases feeding motivation compared to no food, but cannot satisfy it

(Terlouw et al 1993)

Can we reduce hunger without increasing calorie intake? [obesity is undesirable]

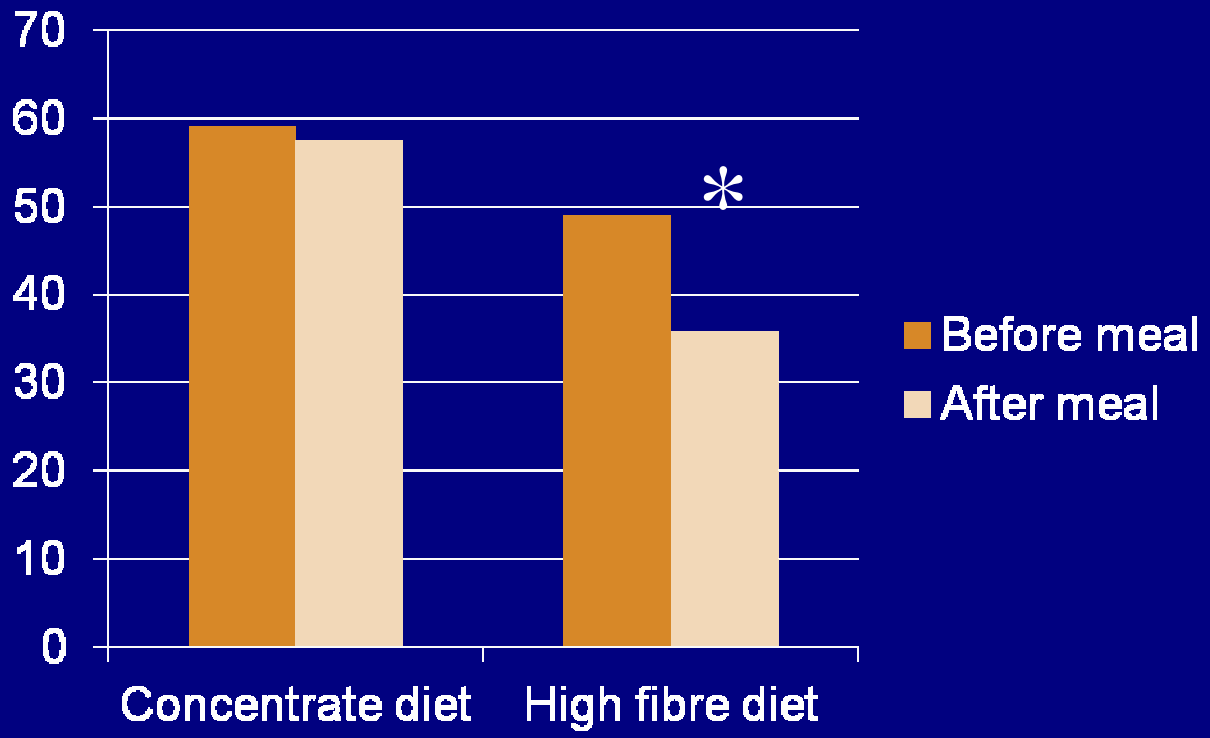


Test portion the same for both treatments

(Brouns et al., 1997)

Do high fibre diets reduce hunger ?

No of rewards in operant test



(Robert et al, 1997)

How does fibre induce satiety ?

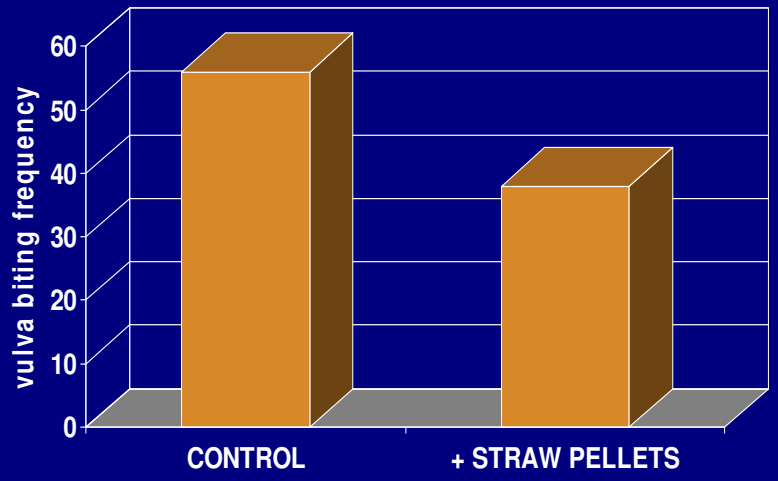
- Short term effect = physical
  - Increased chewing, gut distention
- Long term effect = metabolic
  - Reduced initial postprandial rise in glucose and insulin
  - Longer persistence of VFA & insulin

(Danielsen & Vestergaard 2001; de Leeuw et al 2004)

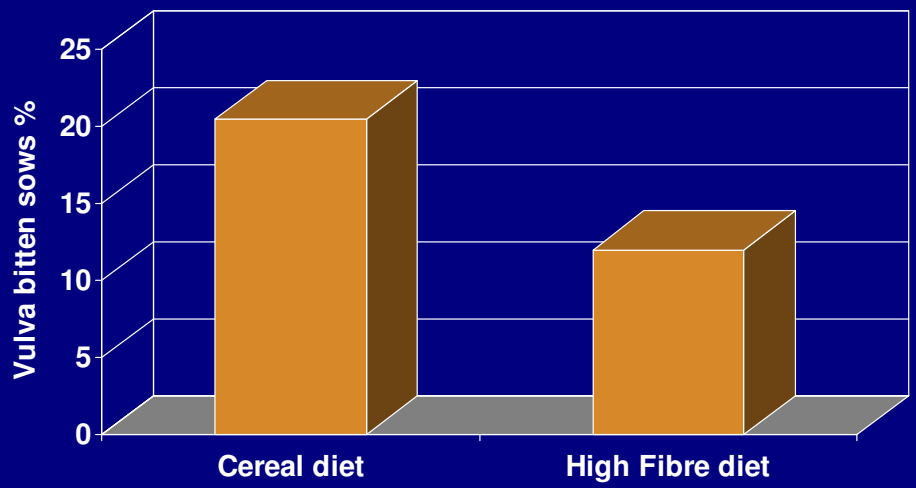
- Most effective fibres:
  - High water holding capacity
  - Delayed gastric emptying
  - High fermentation

e.g. Sugar beet pulp

High Fibre diets reduce vulva biting



Bure 1991
ESF system



Whittaker et al 1995
Floor feeding

Win-Win

HF diets can increase litter size, reduce MMA

HF diets use by-products so reduce carbon footprint

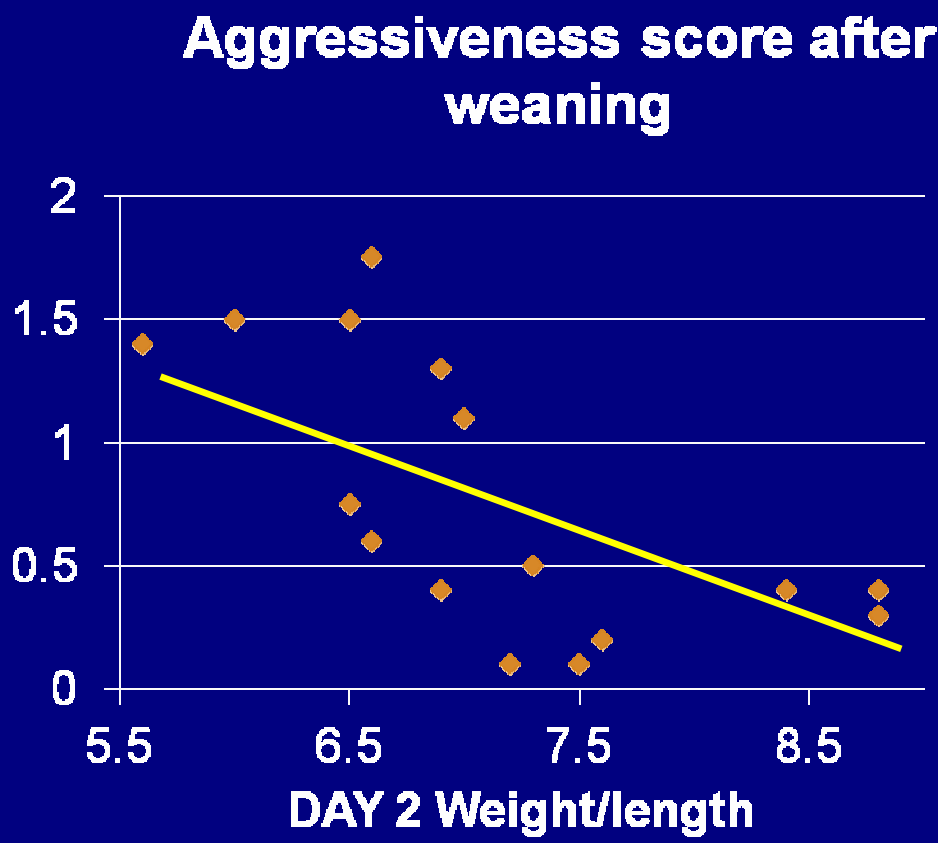
BUT: reduce digestive efficiency

Aggression in food competition starts early

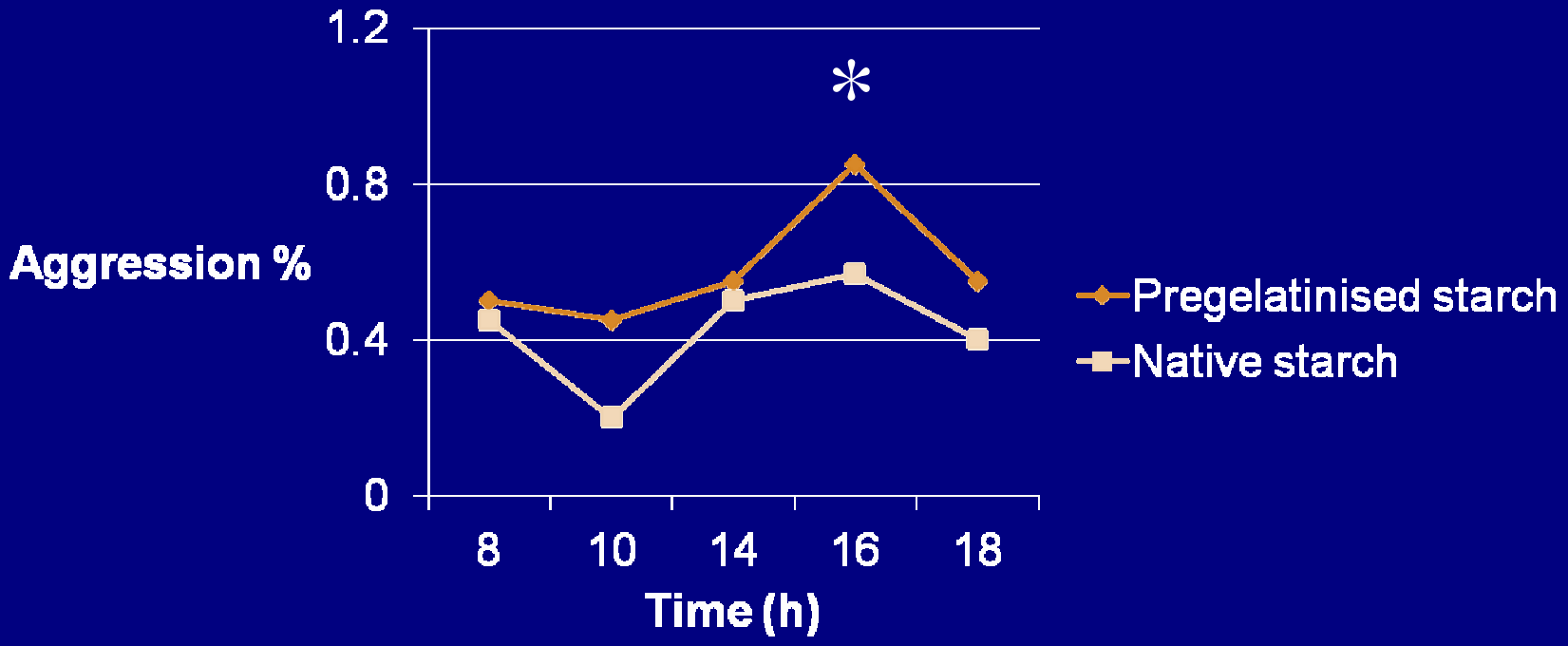
Intact canine teeth can cause serious facial damage

(D'Eath & Lawrence 2004)

And may have long term effects



Fermentable diets can also reduce aggression in growing pigs



Effects more pronounced in unbedded pens

(Bolhuis et al 2010)

Nutrition to modify Behaviour

- Neural pathways controlling aggression
  - Reduced serotonin and increased dopamine activity associated with aggression

(Nelson & Chiavegatto 2001)

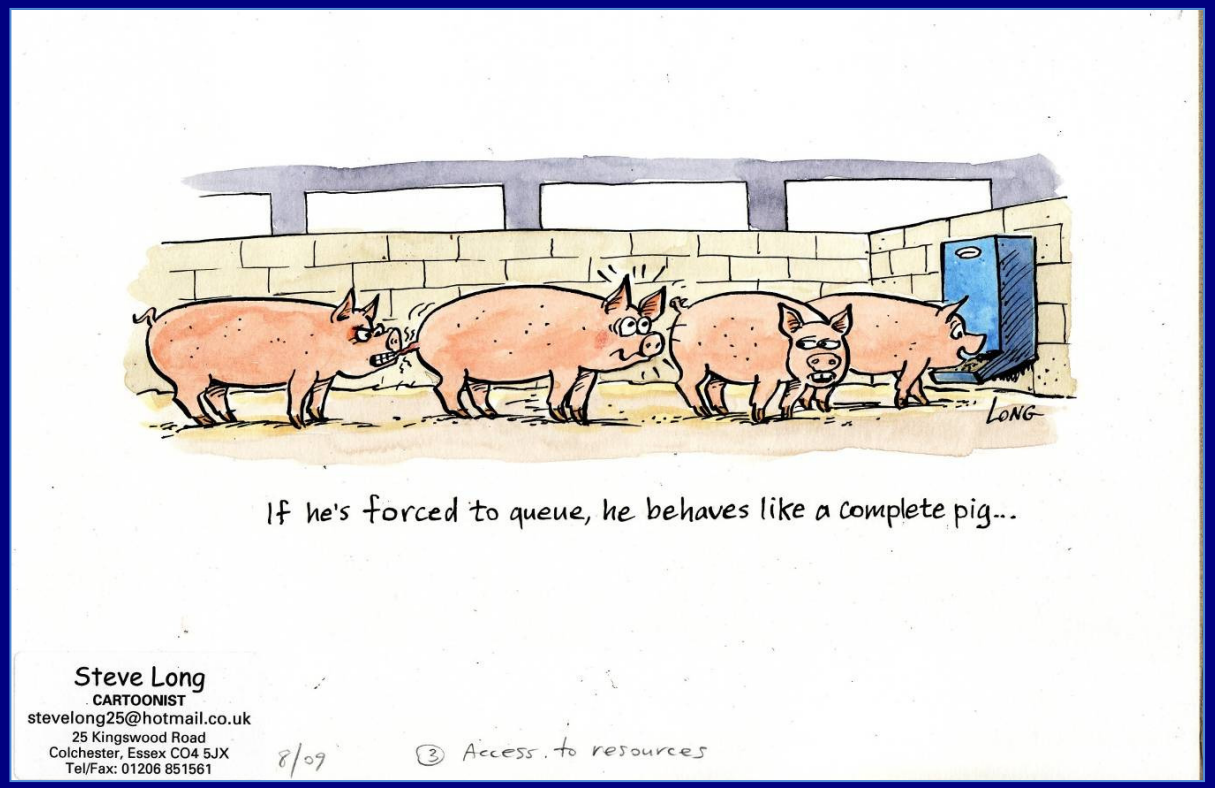
- Tryptophan (serotonin precursor) dietary supplementation reduced aggression:
  - in weaned piglets (Koopmans et al 2006)
  - in grow-finish pigs (Lee et al., 2006)
  - in replacement gilts (Poletto et al 2010)

Nutrition and Tail Biting in growing pigs

Prevalence ~5% worldwide

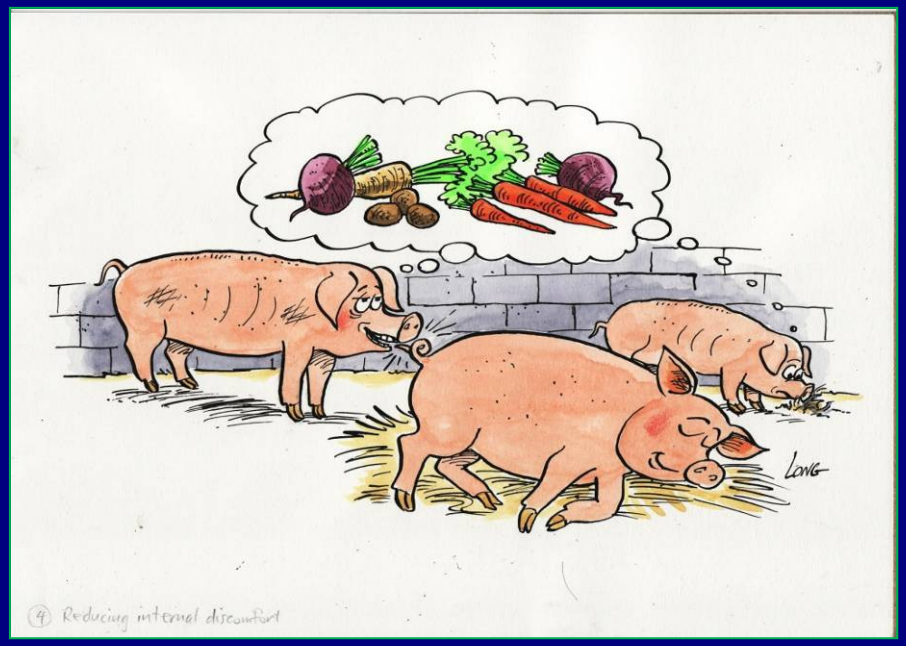
Review of scientific and technical literature yielded >100 different possible current and developmental causal factors

Sudden forceful biting (frustration e.g. competition for food)



(Hansen & Hagelso 1980; Hansen et al 1992)

Two-stage biting (redirected foraging behaviour)



Hunger increases foraging behaviours
Directed to penmates in a barren environment

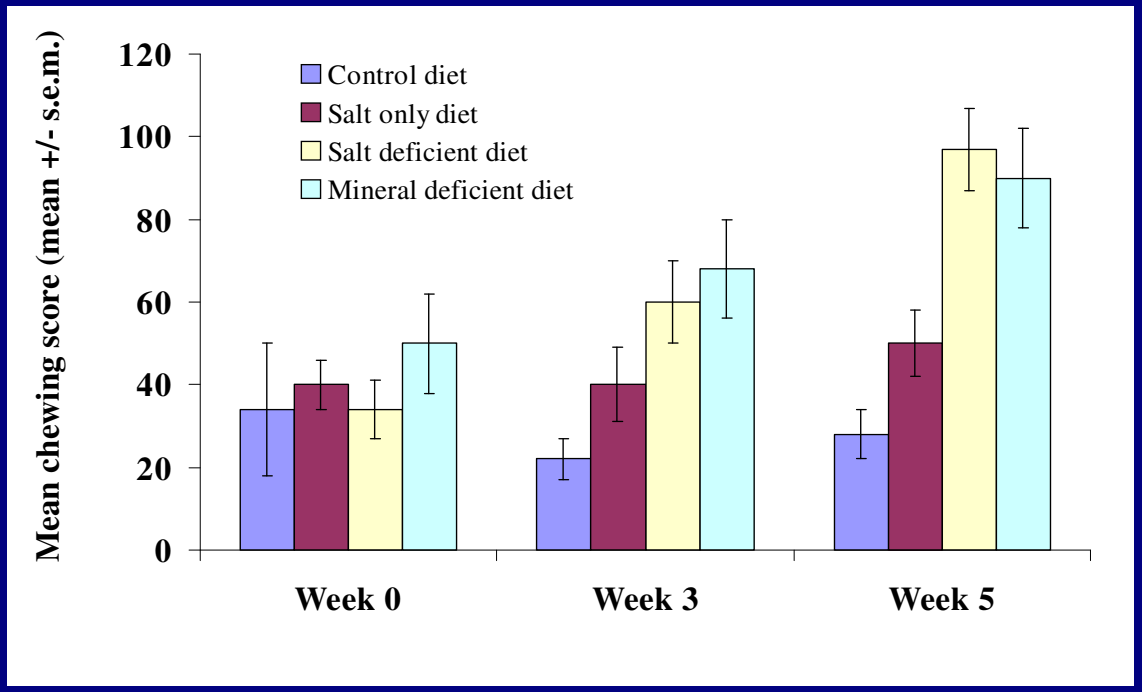
Hunger may be for specific nutrients in imbalanced diets fed ad libitum

Cr. protein in diet	12	20	24
DLWG (g/d)	616	865	1020
% time:			
Standing	37	28	24
Rooting straw	8	5	5

(Jensen et al., 1993)

Effect of mineral deficiency on scores for chewing on a blood saturated tail model

(Fraser, 1987)



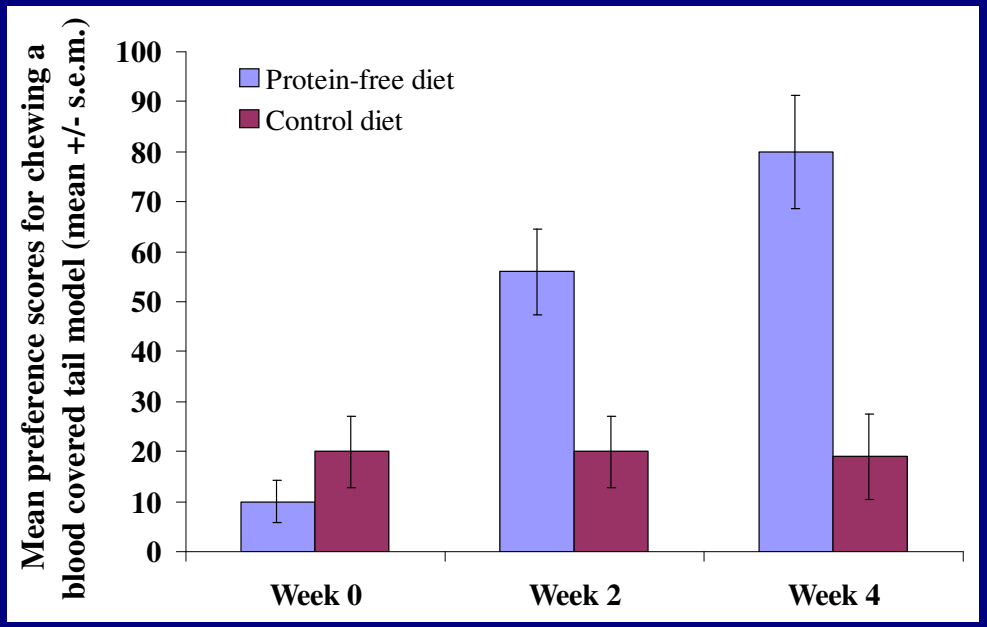
? Tail biting caused by stress induced "sodium hunger"

cortisol increases Na clearance rate (in rats)

but experimental evidence in pigs not supportive

(Beattie et al 2001; Jankevicius & Widowski 2004)

Effect of protein deficiency on scores for chewing a blood saturated tail model



(Fraser *et al.*, 1991)

? Tail biting caused by reduced brain serotonin

low / imbalanced protein diets increase tail biting

predisposition genetically linked to high lean tissue growth

tryptophan supplementation reduces biting

(BPEX 2004, 2005; Breuer et al 2005; McIntyre & Edwards 2002)

Conclusions

- Directive 91/639/EEC

"All pigs must be provided with a diet appropriate to their age, weight and behavioural and physiological needs, to promote a positive state of health and well being"

- Both quantitative and qualitative feed deficiency engender foraging motivation
  - frustration causes aggression
  - redirection (in barren environments) causes injurious behaviour