

Pork quality related to the diet content of fermentable fibre-rich feedstuffs (chicory and lupine) with special emphasis on the effect on boar taint and meat quality

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The effect of feeding 10% dried chicory roots (*Cichorium intybus* L.) or 25% Blue lupine (*Lupinus angustifolius*) for 7 or 14 days prior to slaughter on boar taint and meat quality characteristics of organic entire male and female pigs



Utilization of entire males

Advantages

- Leaner meat
- Lower production costs
- Animal welfare
- Environmental issues

Disadvantages

- Boar taint

5-10% of the entire males



Boar taint

- **Androstenone**

- Testicular steroid

Urinary odour

- **Skatole**

- Microbial break down of tryptophane

Faecal odour

Both compounds accumulate in the adipose tissue and give unpleasant odour and flavour in cooked pork meat



Reduction of skatole in blood and backfat

- **Inclusion of high fermentable carbohydrates in the diet: potato starch, inulin (chicory root) or lupine seed**



Chicory roots (crude or dried)

- **High content of inulin and oligofructose**
- **Available for microbial fermentation in the large intestine**
- **Increase the potential health promoting bacteria in expense of harmful species in the large intestine**
- **Reduce skatole in blood and backfat effectively**
- **Improve odour and flavour in cooked meat from both males and females**
- **Decrease parasites in the large intestine**

Lupine seed

- **Unique carbohydrate properties**
 - Negligible levels of starch
 - High levels of soluble and insoluble NSP and oligosaccharides
 - Rafinose oligosaccharides
 - High content of dietary fibres
- **High protein content**
- **Alternative protein source to soya meal in organic pig production**
- **Reduce skatole in backfat**

Objective

The inclusion of 10% dried chicory or 25% Blue lupine for 7 or 14 days prior to slaughter and their effects on:

- **Skatole levels in blood and backfat**
- **Sensory boar taint and eating quality on *M. Longissimus dorsi* (LD)**
- **Technological meat quality characteristics on *M. Longissimus dorsi* (LD)**
- **Performance**
- **Campylobacter in the large intestine**



Material and methods

Table 1. Experimental design for the finishing feeding period (1 or 2 weeks) of the three treatments with organic concentrate, dried chicory and blue lupine from avg. 90 kg until slaughter at avg. 103 kg live weight

Replicate	Treatment	No. of pigs	Feed composition
1	Control	8 4 female + 4 male	100% Organic Concentrate (Control feed)
	Chicory	8 4 female + 4 male	10% Dried Chicory + 90% Control feed
	Lupine	8 4 female + 4 male	25% Blue Lupine + 75% Organic Concentrate
2	Control	8 4 female + 4 male	100% Organic Concentrate (Control feed)
	Chicory	8 4 female + 4 male	13.3% Dried Chicory + 86.7% Control feed
	Lupine	8 4 female + 4 male	25% Blue Lupine + 75% Organic Concentrate

Sampling

- **Skatole**
 - Blood samples from *Vena jugularis* (day 0 and before slaughter)
 - Backfat
- **Sensory analysis on Longissimus dorsi (LD)**
- **Performance**
 - Daily weight gain
 - FUp per kg gain
 - Lean Meat (%)
- **Meat quality attributes on *Longissimus dorsi* (LD)**
 - pH45min and pH24h
 - T45min and T24h
 - Glycogen 45 min and 24 hours
 - Colour (L^* , a^* , and b^* values)
 - Drip loss
- ***Campylobacter* in the large intestine (not yet finished)**

Performance and technological meat quality results



- Production results decreased by inclusion of 25% of lupines
- Lupines may decrease driploss and increase the glycogen concentration in LD?

Table 1. Skatole in blood and backfat initial and at slaughter



	Control		Chicory		Lupine		Significance ¹	
	LSM	s.e.	LSM	s.e.	LSM	s.e.	Treatm.	Sex
Skatole in blood initial	1.87	± 0.20	1.95	± 0.20	2.00	± 0.20	ns	*
Skatole in blood at slaughter	2.39 ^a	± 0.27	1.95 ^a	± 0.27	0.46 ^b	± 0.27	***	**
Skatole in backfat at slaughter	0.13 ^a	± 0.01	0.11 ^a	± 0.01	0.03 ^b	± 0.01	***	*

a, b Within rows, LMS not sharing a common superscript letter differ significantly (P<0.001). 1) No interactions between treatments and experimental factors: replicate, sex and feeding time (1 or 2 weeks)

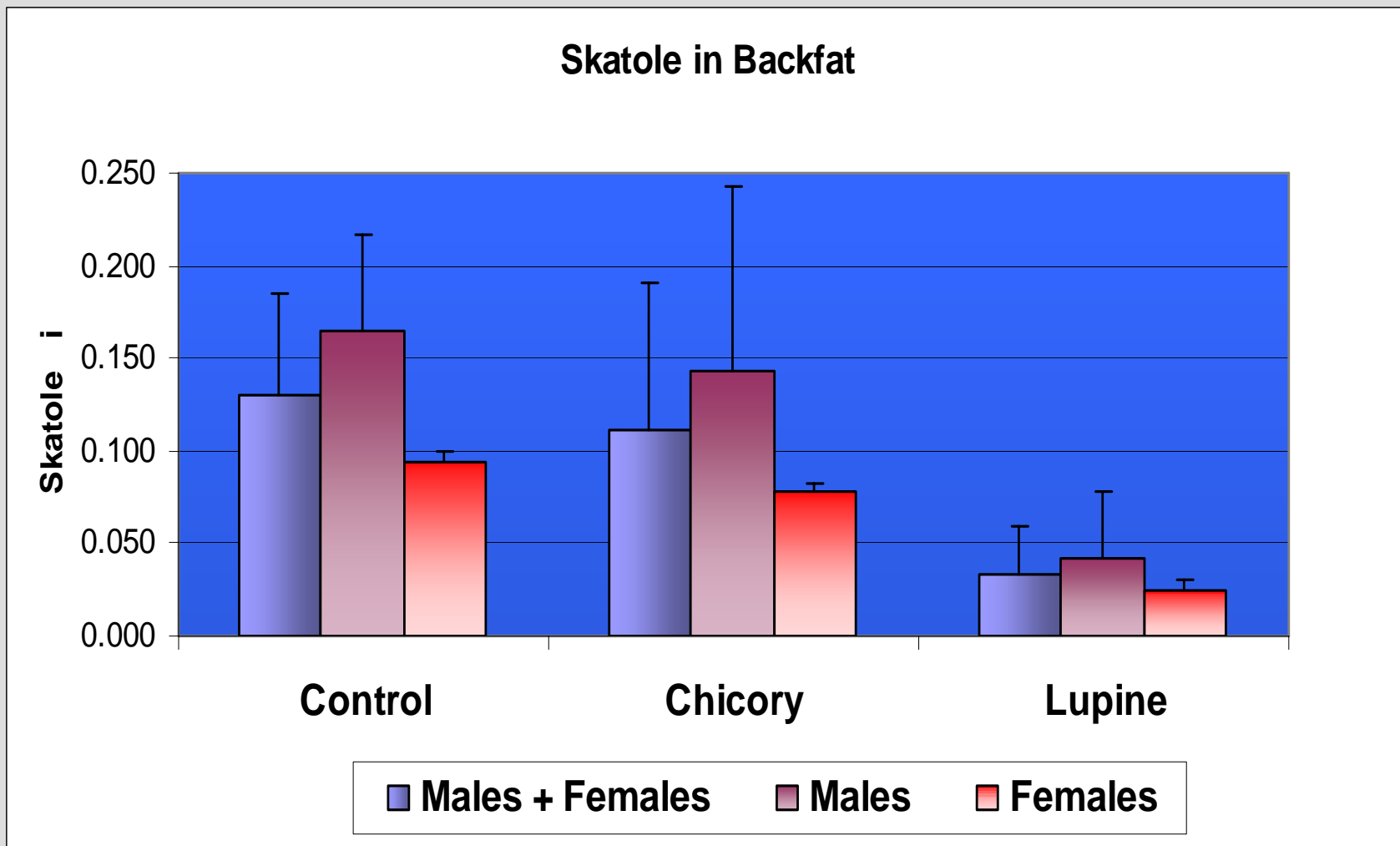


Figure 1: Skatole equivalents in backfat ($\mu\text{g/g}$ fat) of Males+Females, Males and Females for the three treatments

Skatole in backfat after feeding 7 or 14 days in entire males

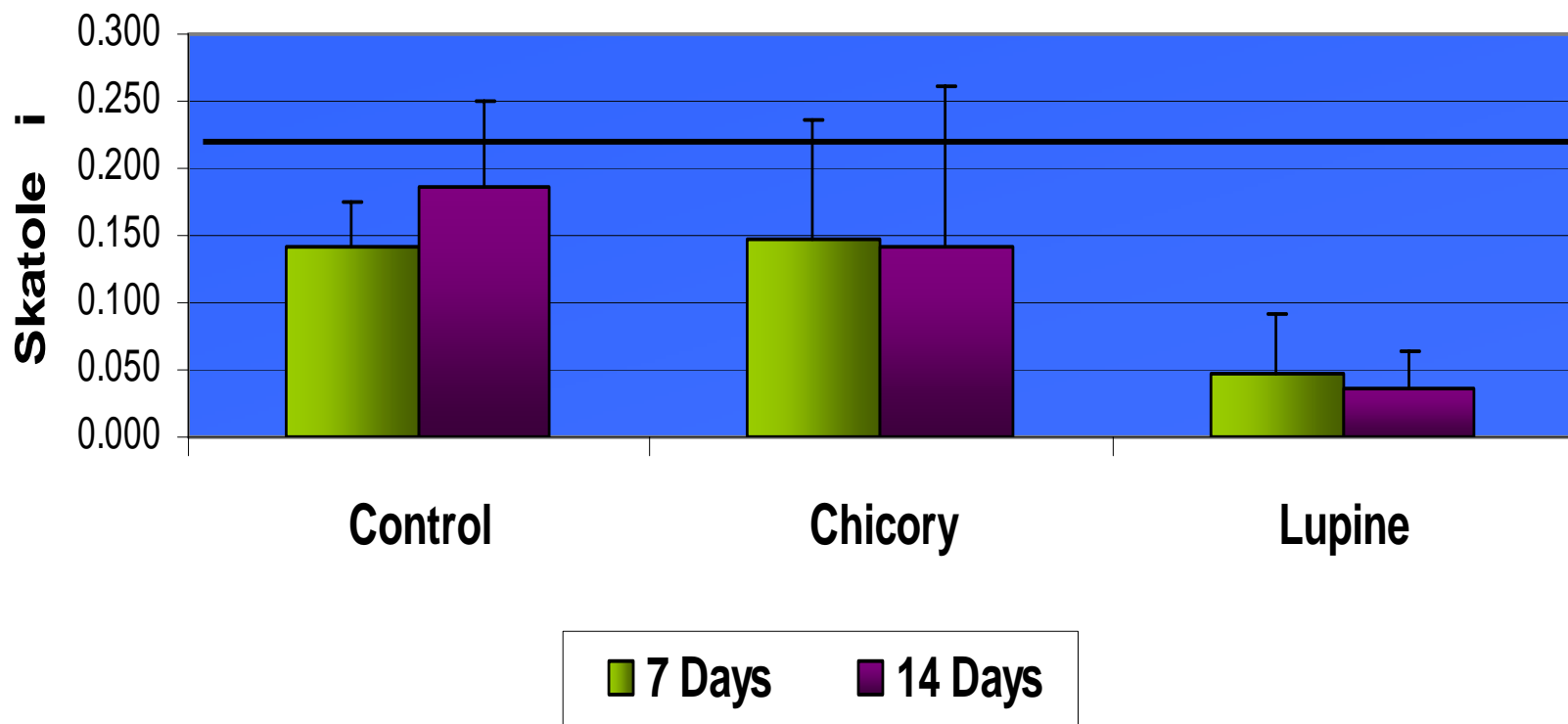


Figure 3: Skatole in backfat from entire males after feeding 7 or 14 days the experimental diets

Sensory results of the male pigs

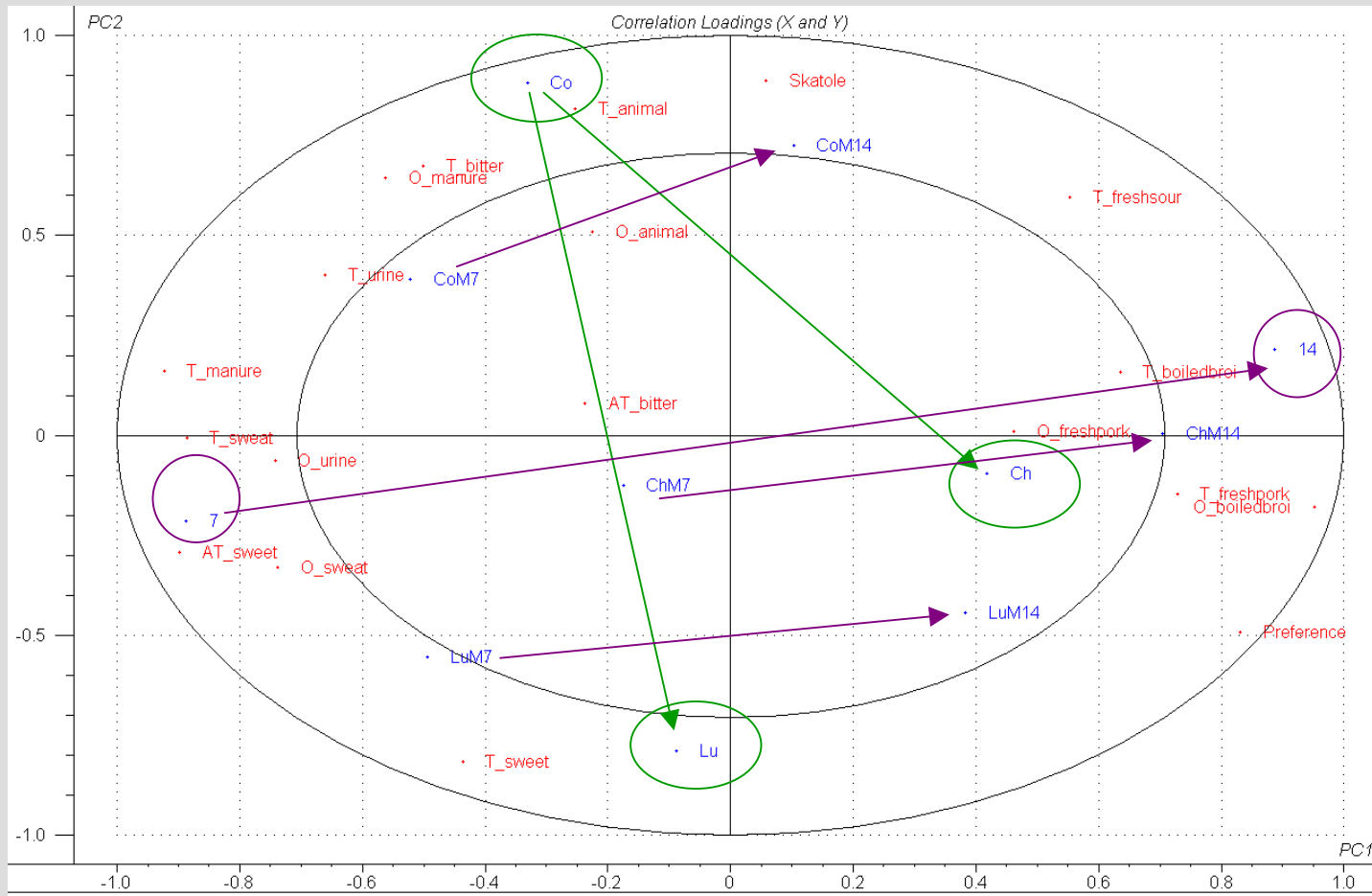


Figure 4: APLSR correlation loadings plot of the two first Principal Components (PCs). The design variables: feedings; control (Co), chicory (Ch) and lupine (Lu), and feeding days prior to slaughtering; 7 and 14 in the X-matrix and the sensory terms in the Y matrix

Conclusions

- The main variation is described by the feeding days prior to slaughtering.
- 14 days of feeding minimise boar taint more efficient than 7 days of feeding prior to slaughtering.
- Chicory and lupine reduce boar taint - lupine has stronger effect than chicory

Conclusion

- Addition of 25% Blue lupines reduce skatole in blood and backfat to low levels after one and two weeks feeding in both sexes
- Inclusion of 10% in first replicate and 13.3% in second replicate of dried chicory did not affect skatole level in blood and backfat from entire male and female pigs opposite to an earlier experiment possibly due to wrong drying procedure or too high temperature?
- Lupine and chicory reduce sensory boar taint, however, 14 days of feeding lupine and chicory minimise sensory boar taint more efficient than 7 days of feeding prior to slaughtering.
- Lupine has stronger effect than chicory on sensory boar taint
- Lupines may decrease driploss and increase the glycogen concentration in LD?
- Production results decreased by inclusion of 25% of lupines

Future studies

- Influence of drying procedure and temperature on fructan quantity and quality (inulin) of dried chicory roots needs further investigation.
- Lupines may replace soyabean meal as a protein source, however, not more than 12.5 to 15% must be used if production is considered.
- Combined use of dried chicory roots and blue lupines (no more than 12-15%) may affect the total fermentation pattern in the intestine in a positive way and by that decrease infections more effectively and give better production and meat quality results?
- Influence of feeding time with fibre-rich fermentable carbohydrates (chicory + lupine) before slaughter on urine odour and taste (androstenone) needs further investigation.