Feeding with chicory roots reduces the amount of odorous compounds in colon contents of pigs

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Chicory

Cichorium intybus L.

A versatile plant product in the pig production with positive effects on meat quality, environment, parasite and bacterial infections

The Danish Institute of Agricultural Sciences &

The Royal Veterinary and Agricultural University

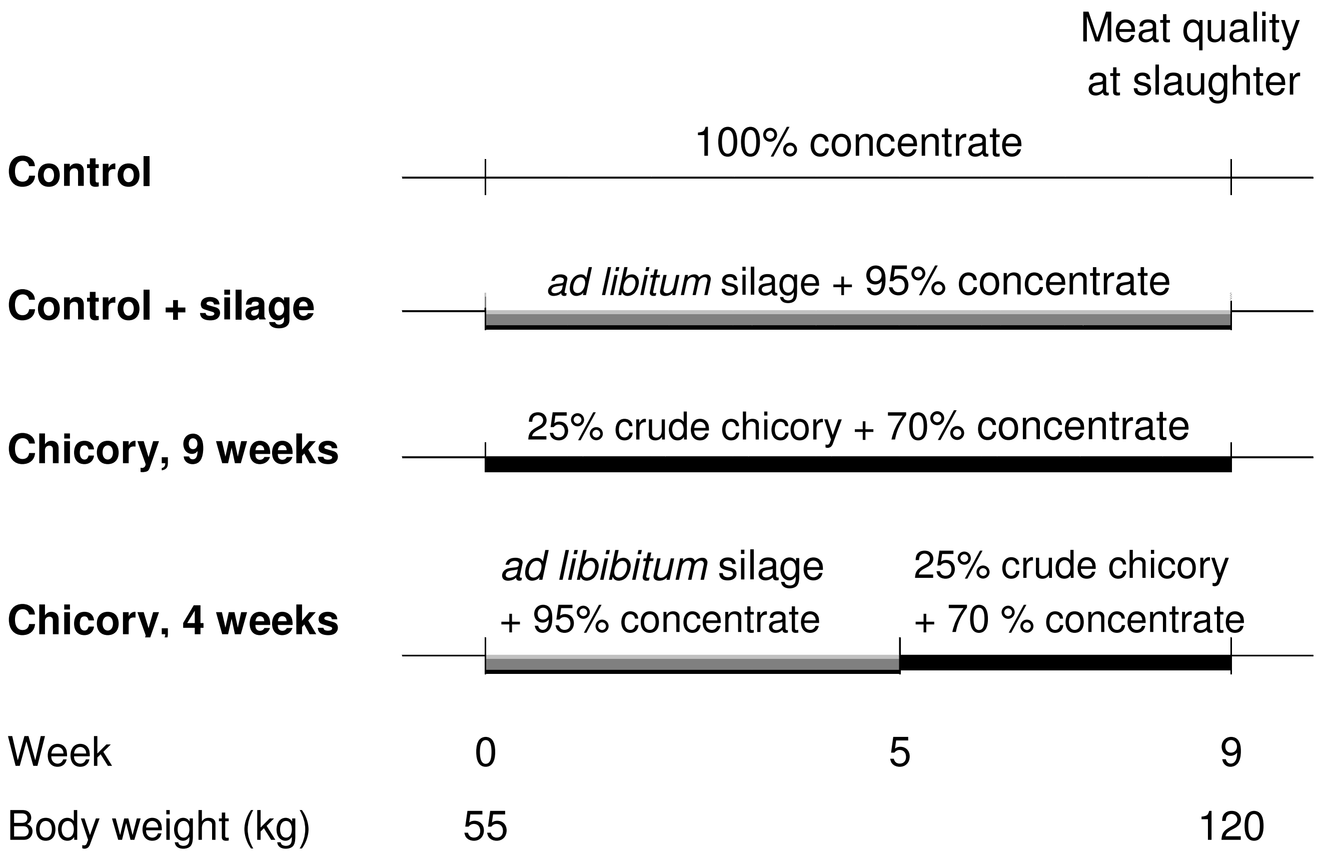
Background

- It is known that pure inulin a fructooligosaccharide extracted from chicory roots can:
  - reduce boar taint (skatole in backfat and blood)
  - reduce parasite infection levels when added to specially composed experimental diets
- However, the entire chicory roots may, in comparison to inulin:
  - reduce boar taint more effectively
  - improve the taste of cooked meat from both male and female pigs
  - be more effective against parasites when added to normal diet types
- Improved stable environment due to:
  - the reduced malodour coming from pig stables and manure may possibly lead to environmental benefits for the farmer and the public?

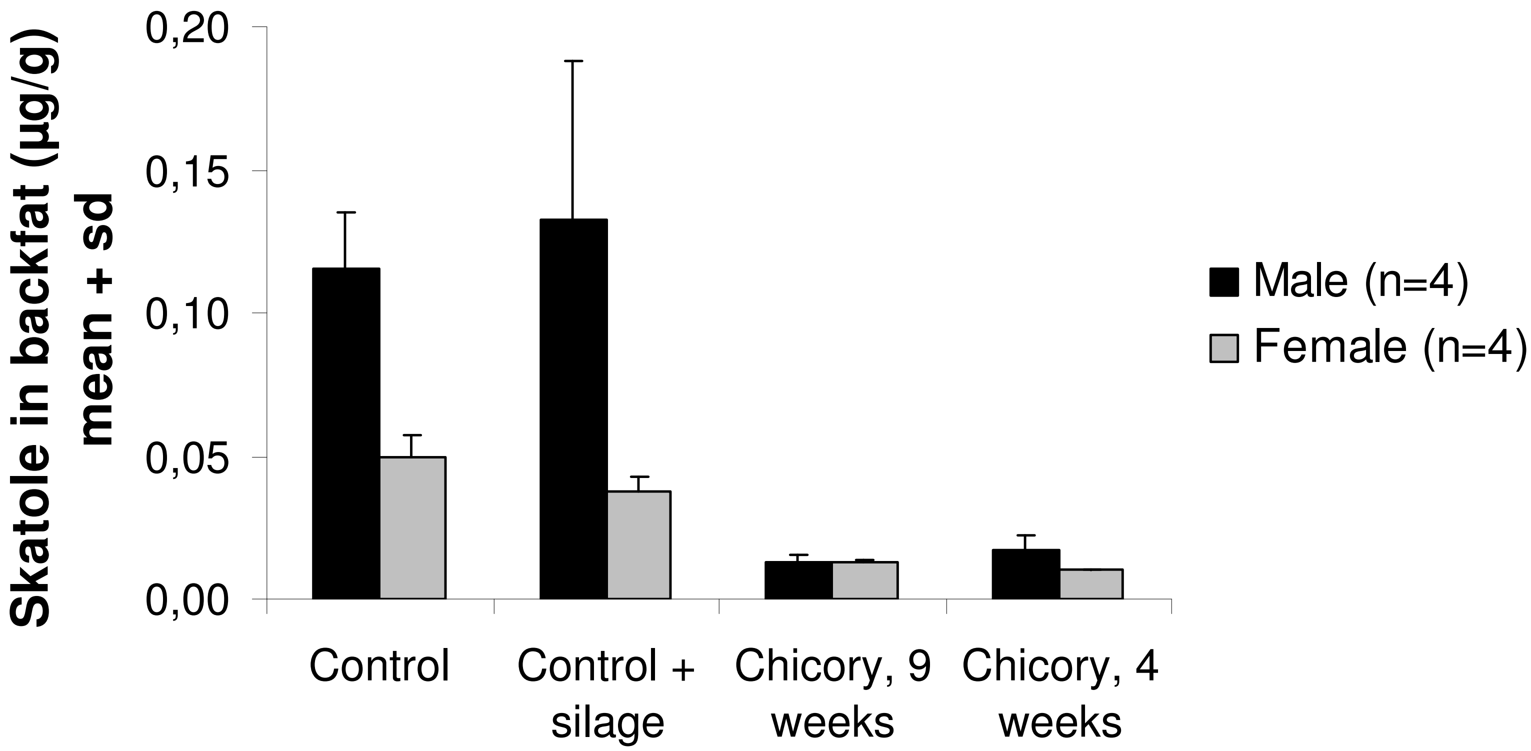
Design

All pigs were given a basal diet of organic concentrate (given as % of total energy intake)

4 female & 4 entire male pigs per treatment



Skatole in backfat at slaughter



Experimental design for the finishing feeding period of the 2 treatments feeding with or without the chicory roots from 55 kg live weight until slaughter (9 weeks)

Treat-ment	No. of pigs	Food composition and energy level compared with 100 energy % according to scale1)	Roughage
1	8 4 female + 4 male	100% organic concentrate from 55–123 kg live weight	None
2	8 4 female + 4 male	70% organic concentrate+ 25% chicory roots from 55–115 kg live weight	Chicory roots (2.1-3.0 kg per day) from 55 kg until slaughter

1) Madsen et al., (1990)

Compound	**Control** (n=8)		**Chicory, 9 weeks** (n=7)			
GC-MS areas	**LSMEAN**	**Std.err.**	**LSMEAN**	**Std.err.**	**Significant difference**	**Factorial difference**
Dimethylsulfide	83736	6827	48145	8078	NS	1.74
2-Butanon	54274	7681	59512	9088	NS	0.91
Acetic acid	252338	42504	286741	50292	NS	0.88
2-Pentanon	***22742***	***7513***	***48500***	***8889***	*******	***0.47***
Dimethyldisulfide	132354	52309	128911	61893	NS	1.03
1-Pentanol	29277	6201	47543	7337	NS	0.62
2-Methylpropanoic acid	43571	9416	29886	11141	NS	1.46
Ethylbutyrate (ester)	***5026***	***28026***	***48440***	***33161***	***NS***	***0.10***
Propylpropionate (ester)	***23718***	***40419***	***174429***	***47824***	***(*)***	***0.14***
Butyric acid	***935596***	***118921***	***878861***	***140710***	***NS***	***1.06***
Butanoic acid, 2-methyl-ethylester	***2663***	***1599***	***8679***	***1892***	*******	***0.31***
Propylbutyrat (ester)	***3208***	***1145***	***7760***	***1355***	*******	***0.41***
3-Methylbutanoic acid	96309	12822	64413	15171	NS	1.50
Dimethyltrisulfide	7196	2755	6252	3260	NS	1.15
p-Cresol	**347725**	**27566**	**72516**	**32616**	**	**4.8**
Indole	**19943**	**2487**	**6690**	**2942**	(*)	**3.0**
3-methylindole (skatole)	**25322**	**4954**	**3740**	**5862**	**	**6.8**

Large intestinal content of selected odorous compounds at slaughter

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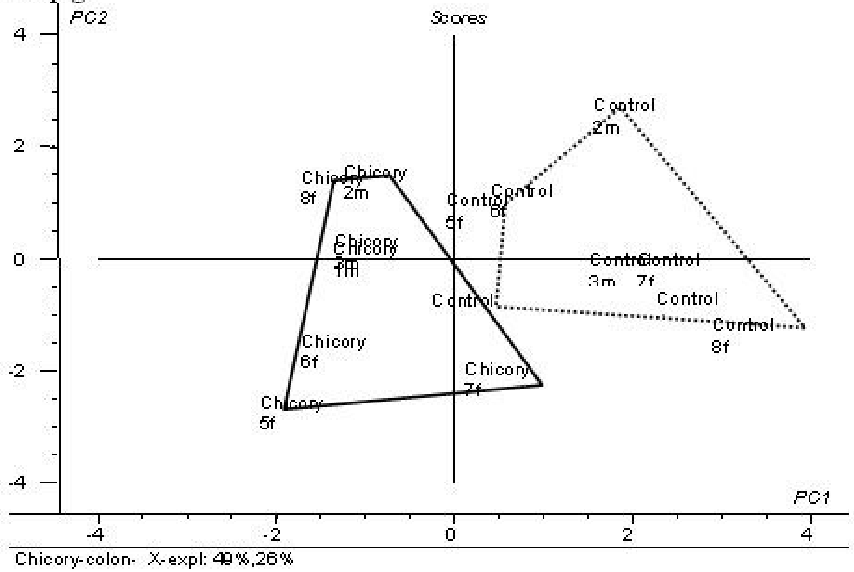
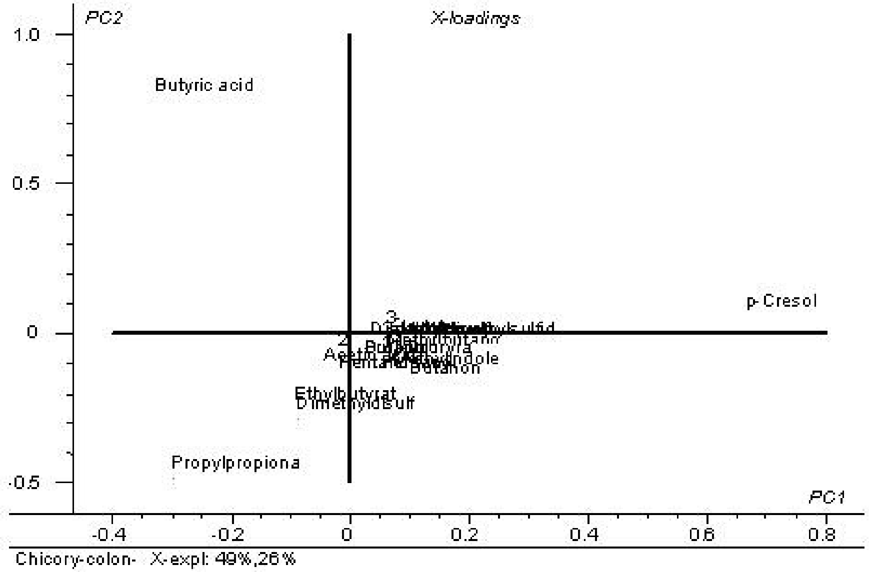
Figure 1. (a) The scores of odorous compounds of raw data from colon contents of control-fed and chicory-fed pigs. (b) The loadings of the odorous compounds of control-fed and chicory-fed pigs.



(a)



(b)

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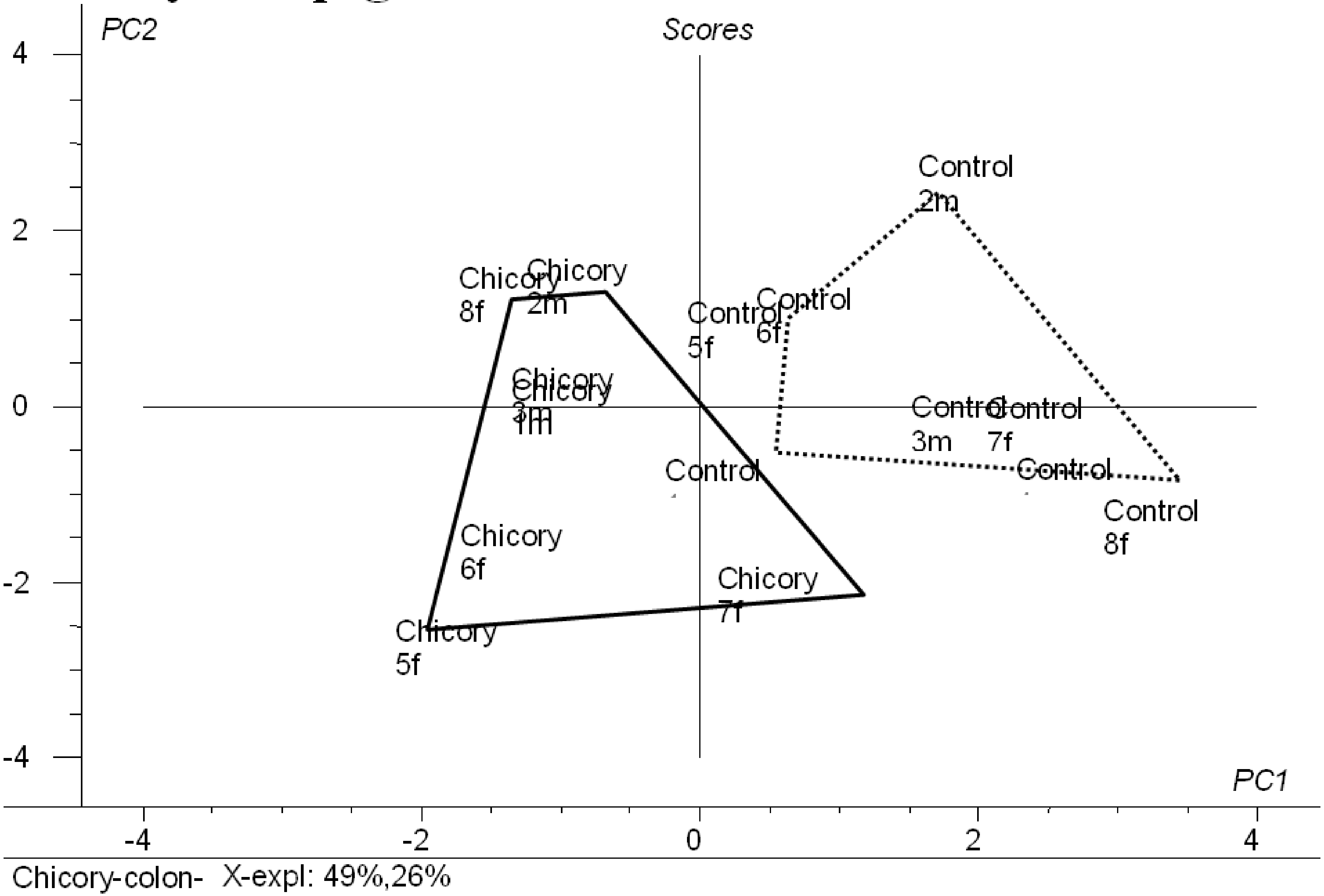

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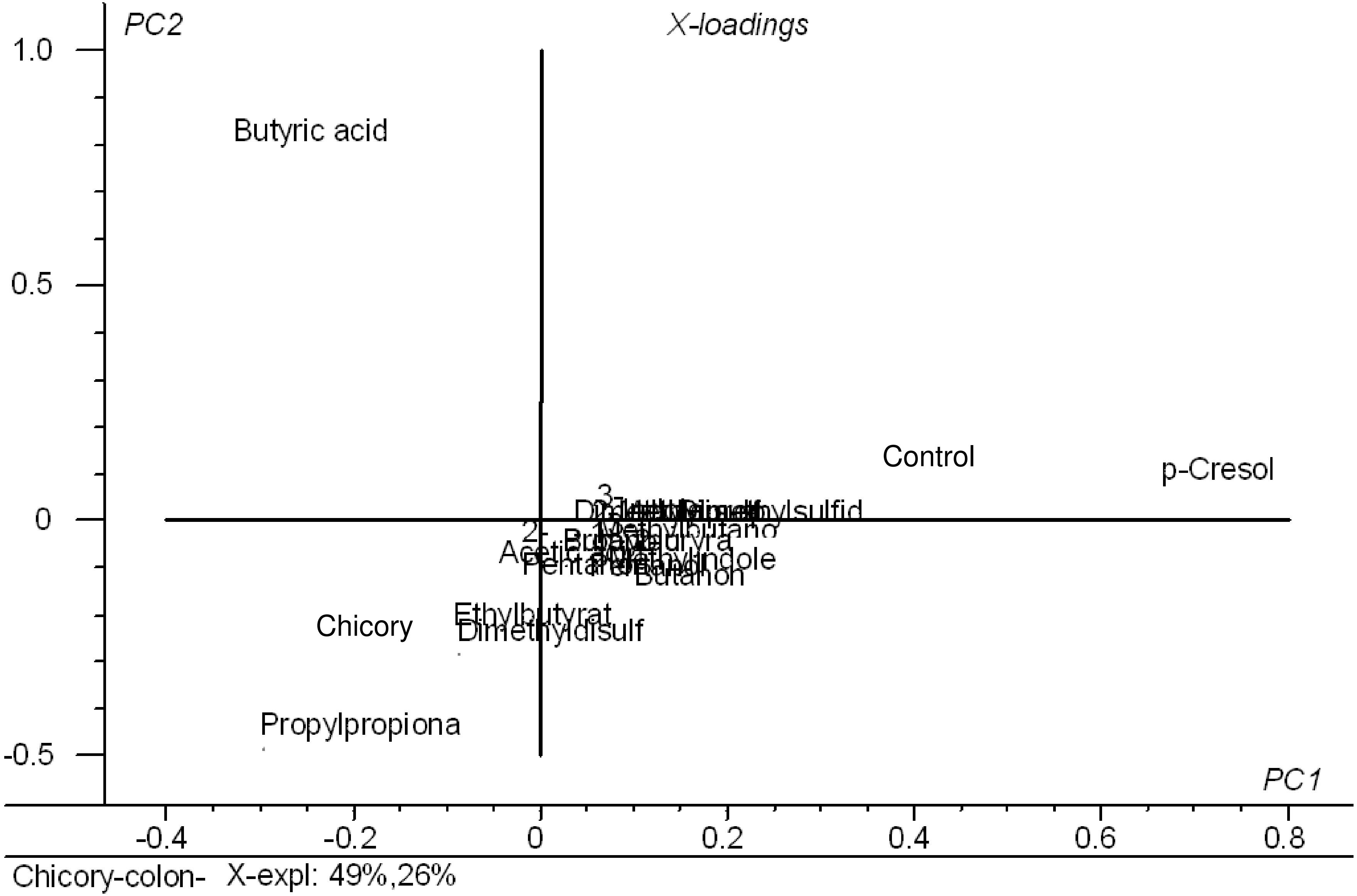
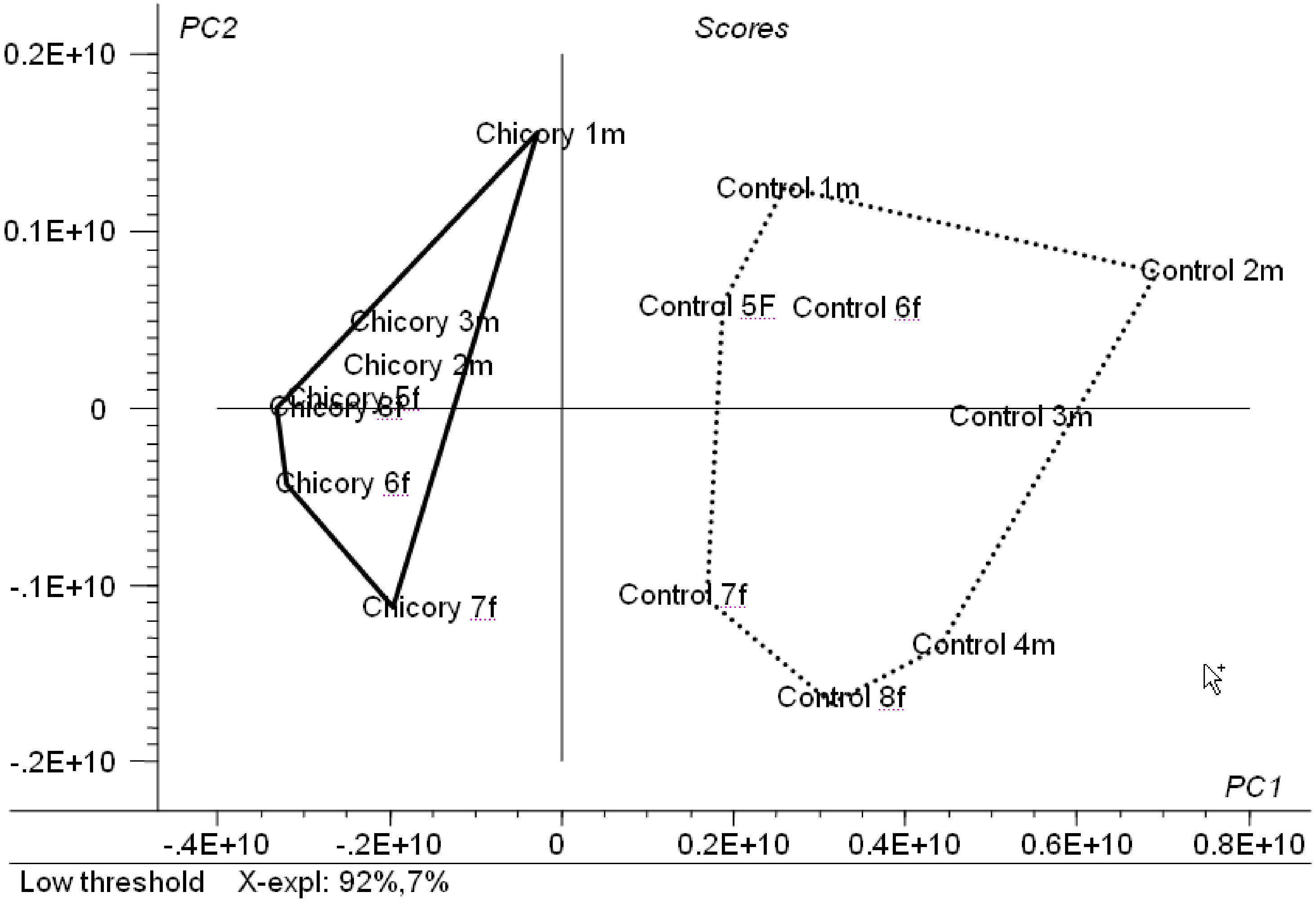


Figure 2. (a) The scores of raw GC-MS data corrected by dividing with low threshold values of odorous compounds from colon contents of control-fed and chicory-fed pigs.



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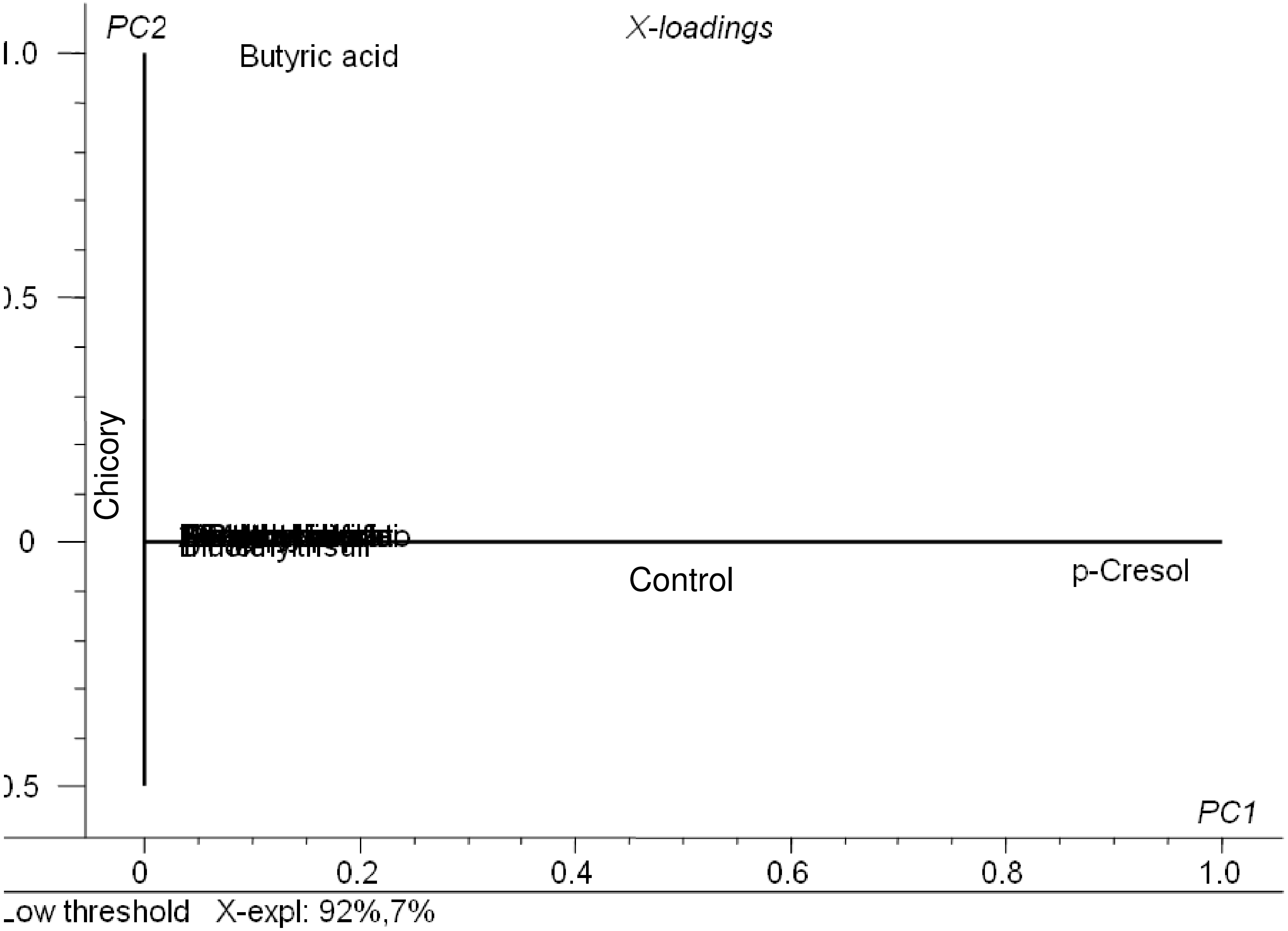

Odorous compounds - conclusions

- Feeding crude chicory roots to the pigs shifted the fermentation pattern in the large intestine from protein to carbohydrate fermentation

- It is shown that chicory roots change the composition of odour impact compounds. The esters, which have relatively pleasant, and often fruity, odours, are increased in the chicory fed pigs, whereas the malodorous compounds, p-cresol, indole and skatole were decreased

- p-Cresol seems to be the most smelling compound together with skatole and indole. However butyric acid also has some minor influence.

Research has revealed the following diverse properties of the chicory root in pig feed:

- Decreasing concentration of the boar taint compound skatole with increasing chicory percent in the feed
- Increased meat quality and decreased boar odour with increasing chicory content in the feed
- Deodorizing effect on the colon contents with relevance to environment in the stable
- Decreased parasite transmission
- Pronounced protective effect against swine dysentery

Perspectives of feeding chicory to pigs

- Improved animal welfare as:
  - male pigs do not need to be castrated
  - production diseases caused by intestinal parasites and bacteria can be reduced or eliminated
- Increased meat quality because:
  - boar taint is eliminated in both male and female pigs
  - the odour, flavour, taste and aftertaste is improved for meat from both male and female pigs
  - the use of antibiotics and deworming drugs is reduced
- Improved stable environment due to:
  - the reduced malodour coming from pig stables and manure may possibly lead to environmental benefits for the farmer and the public?

The chicory root product, how does it fit in production systems?

- On the farm level the chicory can be handled with the same equipment as sugar beets – hardly no or only minor need for new expertise or machines
- On the factory level the chicory roots can be dried and manufactured with existing equipment – no need for new investments
- The product can be dried and used in feed mixtures all-year round
- High biomass yield by area (e.g. 60 ton per ha)
- Can improve the soil quality and decrease the loss of N from soils by deep roots